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Integrative taxonomy and evolution of the hyperdiverse weevil genus *Trigonopterus*

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I Eidesstattliche Erklärung

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II Summary

Weevils are one of the most successful groups of organisms, comprising more than 62,000 described species (Oberprieler 2007) with numbers of discovered species rising rapidly. Since the first weevil descriptions by Carolus Linnaeus (1758) 250 years ago, the number of described species has increased by a 1000-fold. Cryptorhynchinae are one of the major subfamilies within the Curculionoidea to which *Trigonopterus* belongs to. *Trigonopterus* is a genus of flightless and usually small weevils. Nevertheless, this genus exhibits a broad distribution ranging from Taiwan to New Caledonia and from Sumatra to Samoa. Its center of diversity is in New Guinea.

At the start of this project, 90 species of *Trigonopterus* were described (Riedel 2010). Species delineation using DNA based methods was demonstrated to be an effective tool based on the 48 new species described from the Cyclops Mountains of New Guinea (Riedel et al. 2010). In my first publication 1,002 specimens were selected out of 6,500 specimens collected and examined with molecular and morphological methods. The latter method yielded 270 morphospecies. Cox1 sequences were used for delimitating species with two different methods; “Objective Clustering” and the “Generalized Mixed Yule Coalescent” (GMYC) method. Out of the 279 morphospecies both methods perfectly assigned 258, and 239 species respectively. Taxonomic accuracy (the proportion of DNA groups that agree with morphology-based species hypotheses) for both methods was 93.1%, and 86.4%respectively. Additionally both methods outperformed the parataxonomist (31.6% taxonomic accuracy). Furthermore, nine cryptic species were found for which additional nuclear markers showed congruent results with the mitochondrial data. This demonstrates that integrative taxonomy facilitates a fast and reliable species identification method even for largely unexplored and hyperdiverse groups. *Trigonopterus* weevils are an important part of biodiversity, both in number of species and in terms of being a sensitive bioindicator of forest health.

An inventory of species makes it possible to find hotspots of biodiversity that can be prioritized for conservation. Describing the vast number of species found in tropical regions with traditional taxonomic methods would not be efficient enough, given the pace at which their habitats are being destroyed. As a result of the rapid destruction of living environments it is necessary to develop new techniques that allow for faster but still sound identification of species. Publication II and III demonstrate how to determine and to describe a large number of species. The results confirm that mitochondrial cox1 data is ideal for identification of *Trigonopterus* species. Out of the 279 species (Tänzler et al. 2012) 101 were selected and described. Owing to the high number of species, descriptions were kept to a minimum and illustrations restricted to the dorsal aspect of habitus and male genital. Additionally DNA-

barcodes were used to replace an identification key which would be difficult to use in such a large genus with many undescribed species.

DNA Barcoding is a tool that will help delimit species in many hyperdiverse groups and will pave the road to additional comparative studies, e.g. in community ecology, phylogeography and large scale biogeographic studies. In publication IV, eight species of *Trigonopterus* occurring on Bali have been investigated. Bali is located west of Wallace´s Line which separates Orientalis and Australis. Bali and islands west of it have been connected to mainland Asia repeatedly, as a result of the lower sea levels during the Pleistocene. This facilitated an exchange of species. In contrast, the deep ocean trench that separates Bali from the Australis towards the east has not seen a great interchange of Australian fauna. These circumstances should have resulted in a stronger influence of the Javanese fauna in Bali and a lesser influence of the fauna of the Australis (Braby et al. 2007, Hendrich & Balke 1995, MacKinnon 1993, McKay 2006). However, most of the previous studies focused on vertebrates and were not based on robust phylogenetic data (Rensch 1936). By using molecular phylogenetics and ancestral area reconstruction it was demonstrated that *Trigonopterus* dispersed from the east and passed Wallace´s Line repeatedly. On Bali a radiation with eight species of *Trigonopterus* took place. The crossing of Wallace´s Line is even more surprising considering the small body size and winglessness of this genus, resulting in many narrowly endemic species. This highlights the importance of detailed and comprehensive surveys in this highly complex biogeographic region.

Future research on *Trigonopterus* will need to focus on reconstructing and dating their geographical expansion as well as pinpointing the group´s center of origin. Another aim is to establish *Trigonopterus* as an indicator organism in terms of biodiversity conservation. These investigations will bring further valuable insights into evolutionary processes and patterns of biodiversity.

III Zusammenfassung

Rüsselkäfer und deren nächste Verwandte (Curculionoidea) stellen mit über 62000 bekannten Arten eine der erfolgreichsten Gruppen im Tierreich dar (Oberprieler 2007). Seit der ersten Beschreibung von Carolus Linnaeus (1758) vor über 250 Jahren hat sich deren Anzahl um den Faktor 1000 erhöht. Mit ca. 6000 Arten sind die Cryptorhynchinae, zu denen auch die Gattung *Trigonopterus* gehört, eine der größten Unterfamilien. *Trigonopterus* ist eine Gattung kleiner, flugunfähiger Käfer, welche dennoch eine extrem weite Verbreitung aufweisen. Neben dem Hauptverbreitungsgebiet Neu Guinea reicht die Verbreitung in Nord-Süd Richtung von Taiwan bis Neukaledonien und von Samoa bis Sumatra in Ost-West Richtung.

Zu Beginn des Projekts waren lediglich 90 Arten der Gattung *Trigonopterus* beschrieben. Nachdem bereits für 48 neue, in den Cyclops Mountains von Neuguinea vorkommende Arten gezeigt wurde, dass mittels DNA basierter Methoden eine Artabgrenzung möglich ist (Riedel et al. 2010), wurden für die erste Publikation meiner Arbeit über 6500 Exemplare an sieben Fundorten auf Neu Guinea gesammelt. 1002 ausgewählte Exemplare wurden 270 Morphospezies zugeordnet und anschließend molekularbiologisch untersucht. Dabei wurden cox1 Sequenzen genutzt und mittels “Objective Clustering” und dem “Generalized Mixed Yule Coalescent (GMYC)“ Verfahren Arten abgegrenzt. Beide Methoden ordneten jeweils 258 bzw. 239 von 279 Morphospezies perfekt zu. Die taxonomische Genauigkeit (Prozentsatz an Übereinstimmung zwischen molekularen und morphologischen Arthypothesen) betrug bei beiden Methoden jeweils 93,1% und 86,4% womit beide besser als ein (gebietsfremder) Taxonom arbeiteten (31,6% taxonomische Genauigkeit). Zudem wurden neun kryptische Arten gefunden und mittels Kerngenen bestätigt. Dies zeigt, dass die Kombination aus taxonomischem Expertenwissen und DNA Sequenzierung eine schnelle und zuverlässige Artidentifikation auch bei großteils unerforschten und extrem artenreichen Tiergruppen ermöglicht. Zudem stellt sich *Trigonopterus* aufgrund seiner Diversität (ein Großteil der Arten ist endemisch und zeigt eine hohe α - und β-Diversität), der weiten Verbreitung und der leichten Identifizierbarkeit als eine nützliche Indikatorart für die Ausweisung von Naturschutzgebieten dar.

Solch große Artenvielfalt ist mittels klassischer Methoden nur unter großem Zeitaufwand zu beschreiben. Aufgrund der voranschreitenden Lebensraumzerstörung ist es nötig, Methoden zu finden, um Arten schneller und trotzdem sicher zu bestimmen. Nur anhand exakter Artenaufstellungen sind Biodiversitätshotspots auffindbar und zu schützen. In den Publikationen II und III wurde gezeigt wie eine große Artenanzahl mit Hilfe von DNA-Sequenzen bestimmt und beschrieben werden kann. Aus 279 Arten (Tänzler et al. 2012) wurden insgesamt 101 ausgewählt und neu beschrieben. Aufgrund der hohen Anzahl an

Arten wurden lediglich dorsale Habitus- und Genitalabbildungen sowie eine kurze Artbeschreibung angefertigt. Zusätzlich wurden DNA Barcodes zur eindeutigen Artbestimmung hinzugefügt, welche zudem einen, in diesem Fall ohnehin nur sehr schwer einsetzbaren, Bestimmungsschlüssel ersetzen.

Erst durch eine sichere Artbestimmung ist es möglich, auch in anderen Gebieten der Biologie, wie der Systematik, Ökologie und nicht zuletzt der Biogeographie neue Erkenntnisse zu erlangen. In Publikation IV wurden acht Arten der Gattung *Trigonopterus* auf Bali, der „Insel der Götter", untersucht. Bali liegt westlich der Wallace-Linie, welche die zoogeographischen Regionen Orientalis und Australis trennt. Aufgrund des, bedingt durch die Eiszeiten, gesunkenen Meeresspiegels waren Bali und alle Inseln westlich davon mit dem Kontinentalschelf verbunden. Nach Osten hingegen war Bali immer durch einen Tiefseegraben von der Region Australis getrennt. Nach allgemeiner Lehrmeinung hatte dies zur Folge, dass die balinesische Fauna vom nur rund 2 km entfernten Java stark beeinflusst ist. Bisherige Studien bezogen sich jedoch zumeist auf Vertebraten (Braby 2007, Hendrich 1995, Rensch 1936, MacKinnon 1993, McKay 2006). Für *Trigonopterus* konnte mittels molekularer Phylogenie und der Rekonstruktion früherer Verbreitungsgebiete gezeigt werden, dass sich diese von Osten kommend verbreiteten und dabei die Wallace-Linie mehrfach überschritten. Auf Bali differenzierten sich die Neuankömmlinge zu insgesamt acht nur dort vorkommenden Arten. Das Übertreten der Wallace-Linie von Osten überrascht umso mehr, berücksichtigt man, welch geringen Aktionsradius solch kleine und zudem flugunfähige Organismen haben. Es hebt die Bedeutung von detaillierten und umfassenden Studien in dieser biogeographisch hoch komplexen Region hervor.

Die Beantwortung der Frage zur genauen Herkunft der Gattung *Trigonopterus*, die Erstellung von Verbreitungsmustern im gesamten südostasiatischen Raum sowie eine Datierung mithilfe neuer Kalibrierungspunkte werden in Zukunft weitere Ziele bei der Arbeit mit dieser Gruppe sein. Desweitern steht die Etablierung von *Trigonopterus* als Indikatororganismus in Sachen des Naturschutzes im Vordergrund. Dies alles wird weitere wichtige Erkenntnisse über evolutionäre Abläufe und Muster innerhalb der Rüsselkäfer als auch im Allgemeinen hervorbringen.

IV List of publications

Publication I

Tänzler R , Sagata K , Surbakti S , Balke M , Riedel A (2012) DNA Barcoding for Community Ecology - How to Tackle a Hyperdiverse, Mostly Undescribed Melanesian Fauna. PLoS ONE 7(1): e28832. doi:10.1371/journal.pone.0028832

Publication II

Riedel A , Sagata K , Suhardjono Yayuk R , **Tänzler R** , Balke M (2013) One hundred new species of Trigonopterus weevils from New Guinea. ZooKeys 280: 1–150.

Publication III

Riedel A , Sagata K , Suhardjono Yayuk R , **Tänzler R** , Balke M (2013) Integrative taxonomy on the fast track. Frontiers in Zoology 2013, 10:15.

Publication IV

Tänzler R, Toussaint EFA, Suhardjono YR, Balke M & Riedel A (2014) Multiple transgressions of Wallace´s Line explain diversity of flightless Trigonopterus weevils on Bali. Proceedings of the Royal Society B

V Contributions

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Michael Balke - MB
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Suriani Surbakti - SS
Yayuk Suhardjono - YS
Emmanuel Toussaint - ET

Publication I

MB, AR and RT designed the study. AR, KS and SS performed fieldwork. RT performed the molecular work, analyzed sequences, computed all statistics and bioinformatics and made the illustrations. All authors participated in manuscript preparation; all have read and approved the final manuscript.

Publication II

MB and AR designed the study. AR, KS and SS performed fieldwork. RT performed the molecular work and analyzed sequences. AR defined the morphospecies and prepared descriptions. All authors participated in manuscript preparation; all have read and approved the final manuscript.

Publication III

MB and AR designed the study. AR, YS and KS performed fieldwork. RT performed the molecular work and analyzed sequences; AR defined the morphospecies and prepared descriptions. All authors participated in manuscript preparation; all have read and approved the final manuscript.

Publication IV

MB, AR and RT designed the study. AR and KS performed fieldwork. RT performed the molecular work. RT and ET analyzed sequences, performed bioinformatics and made the illustrations. All authors participated in manuscript preparation; all have read and approved the final manuscript.

1. Introduction

1.1 The genus *Trigonopterus* Fauvel 1862

Although being a highly diverse group little is known on the biology of *Trigonopterus*. Most species are found on the foliage or in the leaf litter of primary tropical rainforest. The substrate of the larvae and the food plant of the adults are still unknown. Even the morphology of the larva has not been described yet. In *Trigonopterus* a biological screw joint has been revealed for the first time (van de Kamp et al. 2011) which allows a better articulation of the leg and helps to lock the legs in a strong defensive position. *Trigonopterus* species are also involved in a mimicry complex which reflects their evolutionary success. The Salticidae genus *Coccorchestes* Thorell 1881 mimics the weevils, presumably because they are not palatable. Apomorphic characters of *Trigonopterus* are the complete loss of the metanepisternum, minute tarsal claws, a deeply incavated articulation of the fourth tarsomere, and the translocation of the metathoracic spiracle to the side of the metaventrite (van de Kamp et al. 2015a). They can take a typical defense position, thanatosis, by folding the legs over the ventral side of the body (van de Kamp et al. 2014). This and the fact that the elytra are fused with each other and the thorax combined with one of the thickest cuticle of all insects (compared to the body size) makes *Trigonopterus* remarkably robust against external pressure (van de Kamp et al. 2015a, 2015b). This could be one reason for the group´s extraordinary success.

At the start of my project on the evolution of *Trigonopterus* in 2009, only 90 species had been formally described. Now, in 2015 almost 300 species are described and several hundred additional ones are already discovered and awaiting their formal description. Presumably, more than 1,000 species belong to this genus. Describing this vast number of mostly very similar species with traditional taxonomy would not be possible within the near future. Other tools are necessary to describe and identify all the species in a hyperdiverse genus like *Trigonopterus*.

1.2 The Southeast Asian region

The region of south east (SE) Asia is geologically one of the most complex regions on earth. Here, four tectonic plates are colliding, i.e. the Australian, Eurasian, Pacific and Filipino plates. The resulting strong volcanism produced an exceedingly complex archipelago comprising thousands of islands. This geological diversity is a driving factor for the biological diversity in SE Asia. It is also an area of interchange between the two zoogeographic regions Australis and Orientalis. Several faunal boundaries have been drawn with Wallace´s Line as the most famous one (Fig. 1). It is located east of the Sunda Shelf and separates the Asian from the Australian fauna with Wallacea between them. Besides the different faunas caused by trenches precluding a land connection between Australis and Orientalis during glacial low sea levels, the faunas which were able to cross Wallace´s Line mostly dispersed from the west. Most studies are limited to the larger islands of Indo-Australia (Hall 1998, Klaus et al. 2013, Stelbrink et al. 2012, Whitemore 1981). Even for Bali, one of the most famous islands in this area, studies are scarce despite its critical biogeographic position. Furthermore, most relevant studies are based on vertebrates (McKay 2006, MacKinnon & Phillipps 1993, Rensch 1936, Whitten et al. 1996) and just few refer to invertebrates (Braby & Pierce 2007, Hendrich & Balke 1995, Vemeulen & Whitten 1998).

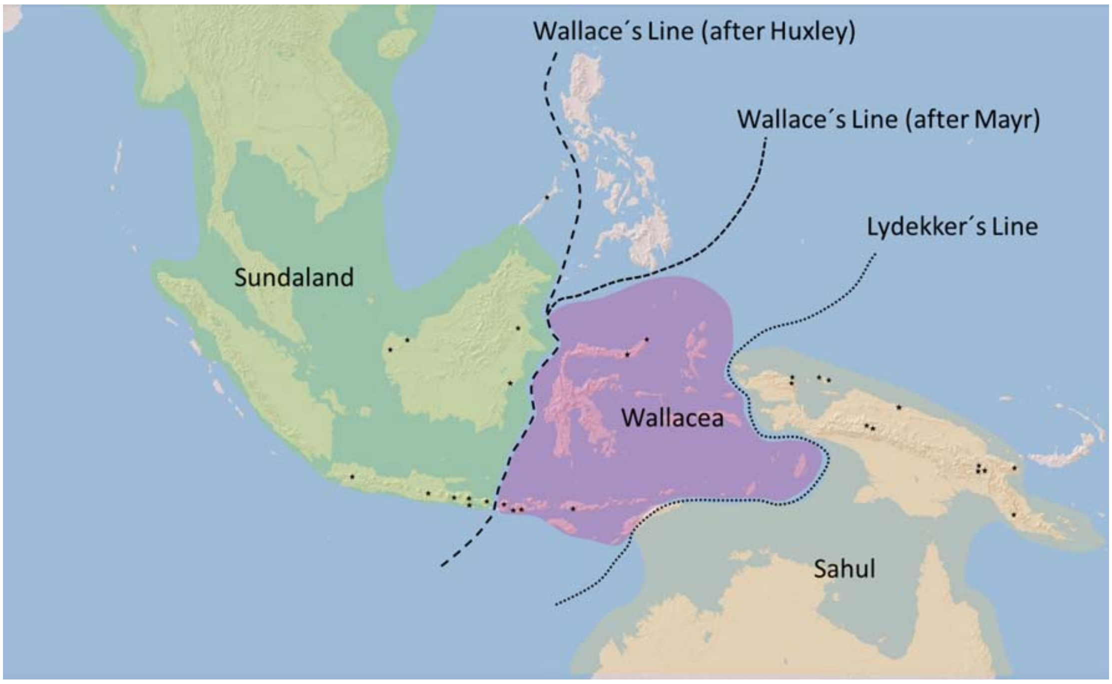

Fig. 1 Map of SE Asia with the zoogeographic boundaries Wallace´s Line, Lydekker´s Line and the regions of Sundaland, Wallacea and Sahul. Sampling sites of *Trigonopterus* specimens included in this thesis are marked by asterisks. Nearby sites were partly merged.

Also molecular phylogenetic reconstructions of the Balinese fauna investigating phylogeographic patterns are missing completely. Bali is located only 2km east of Java and both islands have been connected repeatedly during sea level lows of the Pleistocene. Bali is not famous for its endemic fauna yet. In my last publication of this thesis a robust phylogeny including six endemic *Trigonopterus* species is provided which is the first time for any Balinese taxon. Their biogeographical trends have been well documented: the genus is 1) hyperdiverse (especially in New Guinea) with a 2) wide range of distribution but also shows 3) high local endemism and 4) a very low potential to disperse, caused by their edaphic life and the inability to fly. The highly unexpected distribution pattern for *Trigonopterus* on Bali shows that further comprehensive phylogenetic studies are necessary to reveal the complex evolutionary history in this equally complex region. It would not be surprising if there are even more groups transgressing the traditional biogeographical boundary lines. Within the island of Bali *Trigonopterus* shows a clear geographical structure as is expected for organisms with very limited dispersal abilities. This brings up the question of how these beetles dispersed throughout the archipelago and overcame the dispersal barrier of the open ocean. Examinations of other taxa with little dispersal abilities are necessary to arrive at a more precise picture of how zoogeographic history proceeded in times when land connections and ocean currents were different from today. Wallace´s Line has been drawn mainly based on the relatively recent Pleistocene processes of faunal exchange between Bali and Java, part of the Sunda shelf. For lineages presumably of an older age, the geological age of terranes are even more important as many islands emerged at very different times from the sea. Further studies of taxa with poor dispersal abilities could give new insights on the geological evolution of this seemingly uniform chain of islands besides helping to reveal processes of faunal evolution in the Indo-Australian Archipelago.

1.3 Sampling

To date this project included six fieldtrips to SE Asia. In average one trip lasted 6-8 weeks. All have been undertaken by Alexander Riedel. At the last fieldtrip to Australia the author participated as well but the collected specimens will not be used in this thesis. For collecting *Trigonopterus* in the tropical rainforest, two different collecting techniques are applied (Fig. 2). Species occurring on foliage can be collected by beating. The weevils will fall down caused by a drop-off reflex and can be collected easily from the white beating-sheet. Sometimes *Trigonopterus* can also be spotted sitting on the foliage in bright daylight. Finding the edaphic species is much more time consuming. The first step is to sift organic debris like leaf litter, twigs, pieces of wood etc., by using a sieve with a mesh width of approximately 1cm which most arthropods will pass through. The sifted material is collected in bags and has to be brought back from the rain forest. For extracting specimens mainly Winkler-funnels are used overnight. Sorting the samples by hand is possible as well but more time-consuming. For sifting the leave litter the right weather conditions are essential. If it is too dry the weevils retreat deeply into the soil; if it is too wet the leave litter is too sticky for efficient sifting. Therefore, traveling at the peak of the rainy or the dry season should be avoided. Also the local weather has to be taken into account and the traveling route may need to be changed according to local conditions. All specimens are preserved in 96-100% ethanol to allow subsequent molecular work. Out of several thousand specimens collected, a selection of 1064 specimens has been used for this thesis.

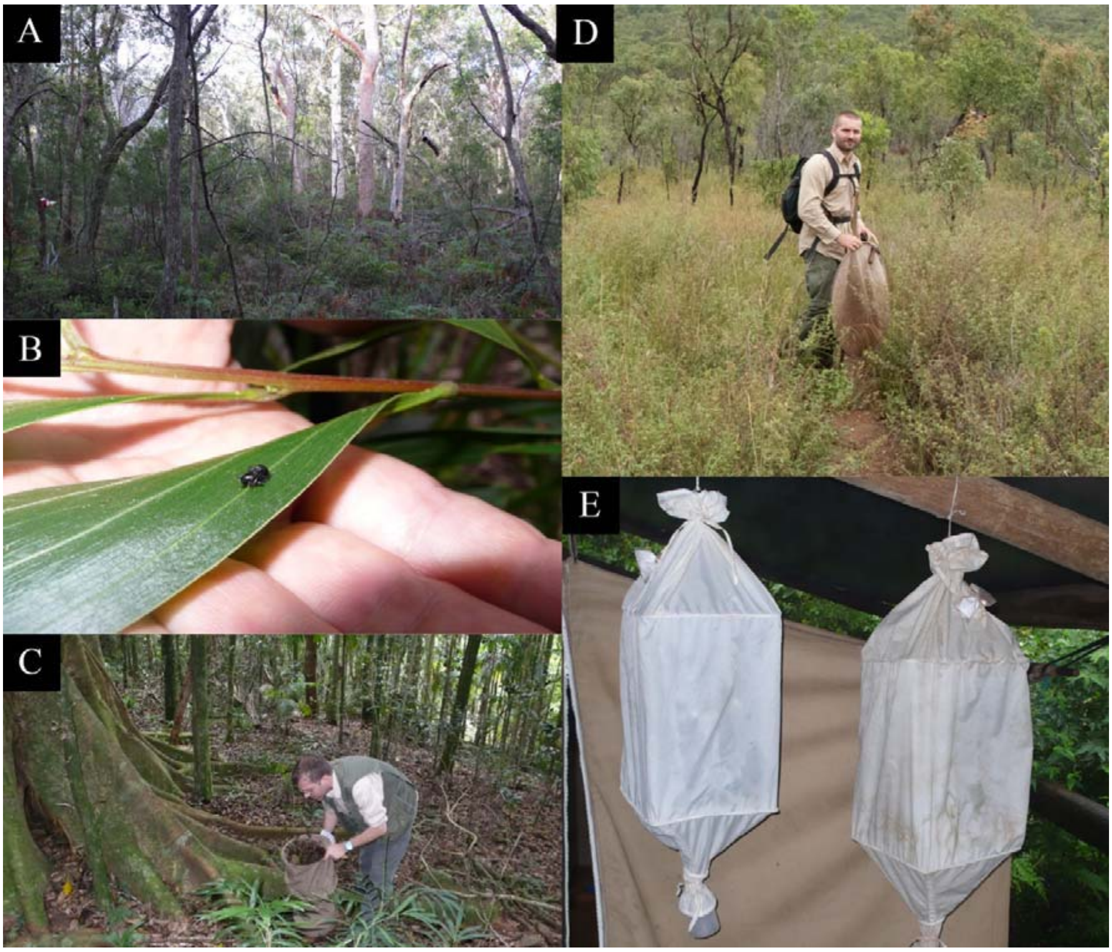

Fig. 2 Collecting of *Trigonopterus* weevils. A locality of *Trigonopterus* in Australia (A) and a mating couple of *Trigonopterus* in its habitat (B). The Cryptorhynchinae of the leaf litter are collected with a sieve (C) whereas the species from the foliage are collected with a beating sheet (D). Winkler-ecclectors (E) are used to extract specimens from the sifted material.

1.4 Morphological work

To ensure an ideal workflow morphological and molecular work has been split between Alexander Riedel and the author. Alexander Riedel did all the morphological work whereas the author performed all the lab work.

All samples have been pre-sorted to avoid excessive sequencing of the same species. Therefore external characters (i.e. size, surface sculpture, dorsal outline and colour) were used. Male genital characters could not be used at this stage. For DNA extraction the specimens have been split between prothorax and mesothorax. The latter forms a distinct anterior neck which fits into the prothorax, forming a natural plug connection. After DNA extraction both parts could be put back together without any obvious damage. Thus, this is a non-destructive technique leaving the specimens intact and available as type material without any problems. As all muscles have been dissolved the beetles are easy to mount.

Also preparation of the genitalia could be done at this stage. The genitalia of the extracted specimens were macerated in 10% KOH if necessary, rinsed in diluted acetic acid, stained with an alcoholic Chlorazol Black solution and stored in microvials filled with glycerol. These are attached to the pin of the specimens.

Great efforts were made to obtain high quality images of all specimens. An automated Leica Z6 APO (Leica Microsystems, Wetzlar, Germany) was used in combination with a JVC KY70 camera (JVC Professional Products). Stacks of images were taken and combined into one picture with a perfect depth of focus using Automontage© software (Syncroscopy, Cambridge, UK).

1.5 Molecular work and sequence data analysis

1,140 specimens have been extracted for this thesis (in total > 3000 specimens but results are not published yet) mainly by using two different plate extraction kits, i.e. DNeasy tissue kit (Qiagen, Hilden, Germany) and NucleoSpin 96 Tissue kit (Machery & Nagel, Düren, Germany). Some specimens have been extracted individually using single extraction kits from Qiagen. As entire beetles were digested DNA concentrations were high enough to allow 2x 200µl of elution. The first elution was used for the general workflow, the 200µl remaining were stored at -70°C. For PCRs standard protocols with different annealing temperatures for the respective genes were used. For most samples Mango TAQ (Bioline) was sufficient. For the sequencing reaction Big Dye 1.1 (ABI) was used. An ABI 3730 capillary sequencer was used at the Biocenter of the LMU (Munich). Depending on the requirements of the project different genes were sequenced. For species delineation both fragments of cox1 were used. For deeper phylogenetic resolution additional nuclear markers were necessary. In total 12 markers were used namely: cox1 (3' and 5' end), 16S, 18S, 28S, Arginine kinase, CAD (3 fragments), Elongation factor 1α, Enolase and Histone 4 (see Appendix Table 1). Sequences were edited using Sequencher 4.x (GeneCodes Corp., Ann Arbor, MI, USA) (Versions changed through the years). For aligning sequences MEGA version 4-6 (Tamura et al. 2007) was used as well as for quality control of the alignment. For the alignment of noncoding genes MAFFT version 7 (Katoh et al. 2007) has been used.

1.6 Species delineation – tools for determining and describing new species

Eukaryotes contain both mitochondrial and nuclear DNA. Mitochondria are hypothesized to be immigrated bacteria which explains the possession of their own DNA plasmid and a doubled membrane (Schimper 1883, Mereschkowsky 1905, Sagan 1967). With around 16 KBp the mtDNA comprises just a very small portion of the genome. The majority of genes are found in the nuclear DNA. For phylogenetics both are used. Typically, mtDNA evolves much faster making it suitable for more recent diversifications. In contrast nDNA genes are more conserved hence they can resolve more ancient events. The number of copies is much bigger for mitochondrial genes as there are several thousands of mitochondria in one cell which makes sequencing much easier compared to nuclear genes. Both factors, fast evolution and large number of copies makes mitochondrial markers more suitable for species delineation.

Different methods for analyzing species boundaries are available. The two that were used in this thesis are objective clustering and the generalized mixed Yule-coalescent method (GMYC method). The former runs in SpeciesIdentifier (Meier et al. 2006) and uses uncorrected p-distances to cluster sequences at different thresholds which were preset to values between 1% and 10%. For each threshold SpeciesIdentifier can distinguish which sequence belongs to which a priori-identified morphospecies. Moreover, it calculates the number of clusters in agreement with existing taxonomy, as well as numbers of lumped or split clusters. The GMYC approach does not rely on preset thresholds but on information contained in the data itself. It delimits independently evolving species using single locus data and it is based on the assumption that independently evolving lineages result in distinct genetic clusters which are separated by longer internal branches (Acinas et al. 2004, Barraclough et al. 2003). These genetic clusters are delimited by optimizing the set of nodes that define the transitions between inter- and intraspecific processes. It is optimized by finding the maximum likelihood solution for a model that combines diversification between species and genealogical branching within species. The likelihood framework also allows statistical inference and hypothesis testing across the entire sampled clade. For both methods agreement and taxonomic accuracy were calculated. Agreement is “the number of clusters found relative to the number of morphospecies” whereas the latter represents “the number of perfect clusters relative to the number of morphospecies”.

1.7 Phylogenetics and ancestral area reconstruction

Defining species boundaries is the first step in the study of a mostly unknown group. For a better understanding of their evolution more complex analyses are necessary. With the help of phylogenetics and ancestral area reconstructions evolutionary relationships and distribution patterns among groups of organisms can be reconstructed over time. In general, both morphological and molecular data can be used, but within this thesis exclusively molecular data has been used for phylogenetic analyses. Morphological characters have been used for the preliminary sorting specimens. Species boundaries were largely based on the examination of genital characters after the extraction of DNA. For the reconstruction of a phylogenetic tree, three different statistical approaches are used namely Maximum parsimony (MP), maximum likelihood (ML) and Bayesian inference (BI). The latter two have been used in this thesis.

MP is based on the parsimony principle. As the minimalistic principal of economy, according to which a simple model is preferred over a more complex one, it is also known as “Ockham´s razor”. For phylogenetics it means that the phylogeny with the least changes in character states is preferred. Comparing each possible tree to find the most parsimonious one is usually too time consuming, so a heuristic search approach is used. To avoid a local optimum and to increase the chance to find the global optimum branch-swapping can be used. This method was occasionally used for obtaining fast preliminary trees but not used for publication.

The second method for reconstructing phylogenetic trees relies on the likelihood of a phylogenetic hypothesis. The aim of ML is to calculate the tree which fulfills the optima criterion best. The optima criterion is to search for the tree which makes the data appear the most likely. Unlike in MP analyses, models of sequence evolution can be taken into account as well.

BI had the biggest influence into phylogenetics with the appearance of the program MrBayes (Huelsenbeck & Ronquist 2001). It unites two advantages of the former methods: thoroughly searching tree space and the ability to incorporate models of sequence evolution. Instead of using likelihood, Bayesian statistics use Posterior Probabilities. These are calculated based on an initial model and new insights after an experiment. The aim is to find the posterior distribution which is the probability of a hypothesis given by a dataset. Similar to the previous methods analytical calculating of the posterior probabilities is too time-consuming which makes the use of an algorithm necessary. The Markov Chain Monte Carlo algorithm (MCMC) with the Metropolis-Hastings implementation (Metropolis 1953, Hastings 1970) is used in MrBayes as follows: starting from an initial tree a new tree is proposed repeatedly according to certain rules. Based on additional rules it is decided if the new tree is accepted and forms the next chain link. The process runs indefinitely and is determined by the number of generations defined by the user. Speed can be increased up by the use of several simultaneous chains, a cold one which samples from the posterior distribution and several hot chains which are not sampled. Heated chains allow the cold chain to jump from one hilltop (local optimum) to another and to skip all the intermediate steps between.

To interpret trees it is necessary to know how likely the occurrence of a node is. For BI posterior probabilities are given at each node that show the frequency in which this node occurs in the sampled trees (e.g. 0.99 means in 99 out of 100 trees). For MP and ML analyses methods with the higher designation “resampling plans” are used, namely “boostrap” and “jackknife”. Both are very similar to each other as both take multiple, random and independent samples out of a given dataset. Each character in the data matrix can be duplicated or deleted. With the bootstrapping method the extent of the dataset remains always the same whereas with the jackknifing a certain amount of the data is deleted. Both methods result in certain values at the tree nodes comparable to the posterior probabilities.

But ultimately, all the trees remain hypotheses unless the true relationships among the taxa are already known (which only possible for bacteria or viruses under laboratory conditions). Thus well supported trees are desirable but there are still some pitfalls e.g. homoplasy, horizontal gene transfer, density of taxon sampling or the amount of missing data which could lead to the wrong conclusions. The dataset should be tested for these problems if possible.

The branch lengths of a phylogenetic reconstruction indicate the genetic distances between the taxa but not at what time a certain split occurred. Trees need to be dated for this purpose. The first molecular clock hypothesis presupposes that molecular evolution occurs at a constant rate over time (Zuckerkandl and Pauling 1962, 1965). However, evolutionary rate over time differs between different taxa and also through evolutionary history. Therefore different models with a variable molecular clock have been proposed. Fossils and geological data can be used as calibration points as well as rates obtained from other analyses. For the calibration in publication IV, I used the Bayesian method implemented in BEAST (Drummond and Rambaut 2007) with a geological calibration point. Fossils are scarce in weevils, and no fossil *Trigonopterus* is known. The calibration using a standard rate resulted in a phylogeny which was much too old.

Usually organisms do not disperse by chance. Depending on the group its dispersal abilities are influenced by many biotic and abiotic elements. One major factor are geographical boundaries, which can be climatic or geological. With phylogenetic trees and an ancestral area reconstruction it is possible to test hypothesis on the patterns of dispersal through time. In publication IV I used a dispersal-extinction-cladogenesis (DEC) Model implemented in Lagrange (Ree et al. 2005, 2006). In this maximum likelihood based model geographic range evolution is modeled in detail along all branches during cladogenesis. For specific biogeographic scenarios, time slices are prepared to take into account plate tectonic movements possibly influencing dispersal rates over time.

2 Aims

Previous studied on *Trigonopterus* found 48 undescribed species at a single locality (Riedel et al. 2009) in the Cyclops Mountains. This brought up the question of how many species could be expected in this genus, especially in their center of diversity New Guinea. Delimitation of the species by using DNA barcodes already worked excellent within this single locality. Therefore the first aim was to collect specimens at different localities in New Guinea and to produce a robust phylogeny of *Trigonopterus.* By using various molecular techniques species were successfully delimitated in publication I.

After finding numerous new undescribed species in New Guinea the next aim was to describe this huge number. For this purpose integrative taxonomy seemed to be the right tool. By the use of short species descriptions combined with DNA Barcodes describing a large number of new species within a short time seemed to be possible (publications II + III).

Besides delimiting and describing new species the aim was to reveal distribution patterns of the genus *Trigonopterus*. As these weevils are flightless and often occur in the leaf litter it is very interesting to find them scattered all over the Indo-Australian region. For a first attempt, in publication IV a considerable number of species of the Sunda arc have been investigated with a focus on Bali. To date comprehensive phylogenetic analyses were lacking completely from Bali.

Manuscripts are in preparation which will deal with the large-scale distribution patters of *Trigonopterus* but these are outside the scope of my thesis.

3 Publication I

DNA Barcoding for Community Ecology - How to Tackle a Hyperdiverse, Mostly Undescribed Melanesian Fauna

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Abstract

Background: *Trigonopterus* weevils are widely distributed throughout Melanesia and hyperdiverse in New Guinea. They are a dominant feature in natural forests, with narrow altitudinal zonation. Their use in community ecology has been precluded by the "taxonomic impediment".

Methodology/Principal Findings: We sampled >6,500 specimens from seven areas across New Guinea; 1,002 specimens assigned to 270 morphospecies were DNA sequenced. Objective clustering of a refined dataset (excluding nine cryptic species) at 3% threshold revealed 324 genetic clusters (DNA group count relative to number of morphospecies = 20.0% overestimation of species diversity, or 120.0% agreement) and 85.6% taxonomic accuracy (the proportion of DNA groups that "perfectly" agree with morphology-based species hypotheses). Agreement and accuracy were best at an 8% threshold. GMYC analysis revealed 328 entities (21.5% overestimation) with 227 perfect GMYC entities (84.1% taxonomic accuracy). Both methods outperform the parataxonomist (19% underestimation; 31.6% taxonomic accuracy). The number of species found in more than one sampling area was highest in the Eastern Highlands and Huon (Sørensen similarity index 0.07, 4 shared species); ⅓ of all areas had no species overlap. Success rates of DNA barcoding methods were lowest when species showed a pronounced geographical structure. In general, *Trigonopterus* show high α and β-diversity across New Guinea.

Conclusions/Significance: DNA barcoding is an excellent tool for biodiversity surveys but success rates might drop when closer localities are included. Hyperdiverse *Trigonopterus* are a useful taxon for evaluating forest remnants in Melanesia, allowing finer-grained analyses than would be possible with vertebrate taxa commonly used to date. Our protocol should help establish other groups of hyperdiverse fauna as target taxa for community ecology. Sequencing delivers objective data on taxa of incredible diversity but mostly without a solid taxonomic foundation and should help pave the road for the eventual formal naming of new species.

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Introduction

Community ecology and conservation biology are highly relevant in these times of global climate change and biodiversity crisis. They rely heavily on species-based hypotheses as their basic currency. Ecologists are increasingly aware of the great importance and added value of "good" taxonomy, e.g., in studies of local species richness, large-scale patterns of biodiversity and regional / global species estimation (α-, β- and γ-diversity) [1]. In particular, comparative studies with large numbers of species would benefit from deeper involvement of taxonomists [2] or from the application of sound taxonomic resources [1]; however, the lack of the latter and the steady decrease of the former hamper species-based research, especially in studies of hyperdiverse arthropods in tropical ecosystems [3]. These highly diverse groups are thus neglected by those setting conservation priorities [4].

Here, we provide a working example using hyperdiverse Melanesian fauna, with a focus on the island of New Guinea. Many great naturalists have studied Melanesian fauna and have sought to explain its extraordinary diversity (e.g., [5], [6], [7]). Recently, community ecologists have established one of the most extensive research programs on large-scale patterns of arthropod diversity, with extensive involvement of taxonomists and parataxonomists and university training of in-country partners [8]. To uncover general patterns in such studies, as many taxonomic groups as possible should be considered. Even when relying on taxonomic expertise, the potentially large number of species poses the question of how to substantiate species-level data. Here, we summarise the first steps necessary for establishing a new taxon in a community ecology research program, building on both DNA sequencing and taxonomic expertise.

We have previously shown that the New Guinea weevils in the genus *Trigonopterus* are locally very diverse, with more than 50 species in a single small mountain range. These species exhibit strong altitudinal zonation and are well characterised by deep divergences in the DNA barcoding fragment of the *cox1* gene [9]. Literature data indicate a wider geographic distribution of *Trigonopterus* in the region; the group can thus potentially serve as an indicator in community ecology research, particularly if (1) species diversity is high across a wider area, (2) there are good morphological characters that can be used to identify specimens by genus and species for future taxonomic work, and (3) the species have generally clear genetic signatures, even when sampling density is very high. One criticism of DNA sequence-based approaches is that genetic signatures might become obscured when sampling is expanded such that it introduces both higher intraspecific variation and sister species, especially recent ones [10], [11]. Most studies on rich tropical fauna were conducted at local scales [9], [12], [13], thus avoiding this problem. Relatively few studies have included the effects of β-diversity and studied a given taxon over a wider geographic range, e.g. [14], [15], [16], [17], [18].

We conducted an extensive sampling program at seven sites across the island of New Guinea to investigate the effects of sampling on species diversity patterns. Three different geographical scales were examined: local (0–5 km), mid-range (7–107 km), and distant (160–1700 km, average 850 km) across distinct geological terranes. (Fig. 1). This is also the first study to contrast the error rates of taxonomic sorting, sorting by parataxonomists, and various approaches to DNA-based species delineation. The usefulness of *cox1* sequence data for sustainably enhancing community ecology studies is discussed.

Materials and Methods

Diagnostic characters of *Trigonopterus*

For morphological characterisation and the taxonomic background, see http://species-id.net/wiki/Trigonopterus. The apomorphic characters for diagnosis were as follows: 1) complete loss of the metanepisternum, 2) minute tarsal claws, 3) articulation of fourth tarsomere deeply incavated.

Field methods

The methods for collection and preparation of specimens were previously described by Riedel et al. [9]. The specimens were collected during 2006 and 2010 in seven areas of New Guinea, each of which represents a distinct geological terrane [19] (Fig. 1). As many localities as possible were sampled in each area by collecting along elevational transects and applying different collecting techniques, such as beating (for foliage-frequenting species) and sifting (for edaphic species). The time spent and the number of litter samples taken in each area were recorded (see Table S1). Approximately 6,500 specimens of *Trigonopterus* were collected and screened for this study.

Selection of specimens and the initial morphospecies hypotheses

Specimens from each sampling area were pre-sorted wet in ethanol-filled petri dishes by an expert taxonomist (A. Riedel) to prevent excessive sequencing of the same species. When possible, three to four specimens of each morphospecies were included. External characters such as size, surface sculpture, dorsal outline, and colour were used for the pre-selection (Figs. 2A–C), with the underlying species concept being biological, and a certain degree of morphological difference a (subjective) indicator of potential reproductive isolation. Where possible, specimens were chosen from the most distant localities, e.g., the lowest and highest elevation in the area. Single specimens of uncertain morphospecies assignment were also selected for extraction. No attempt was made to identify identical species across different sampling areas. Male

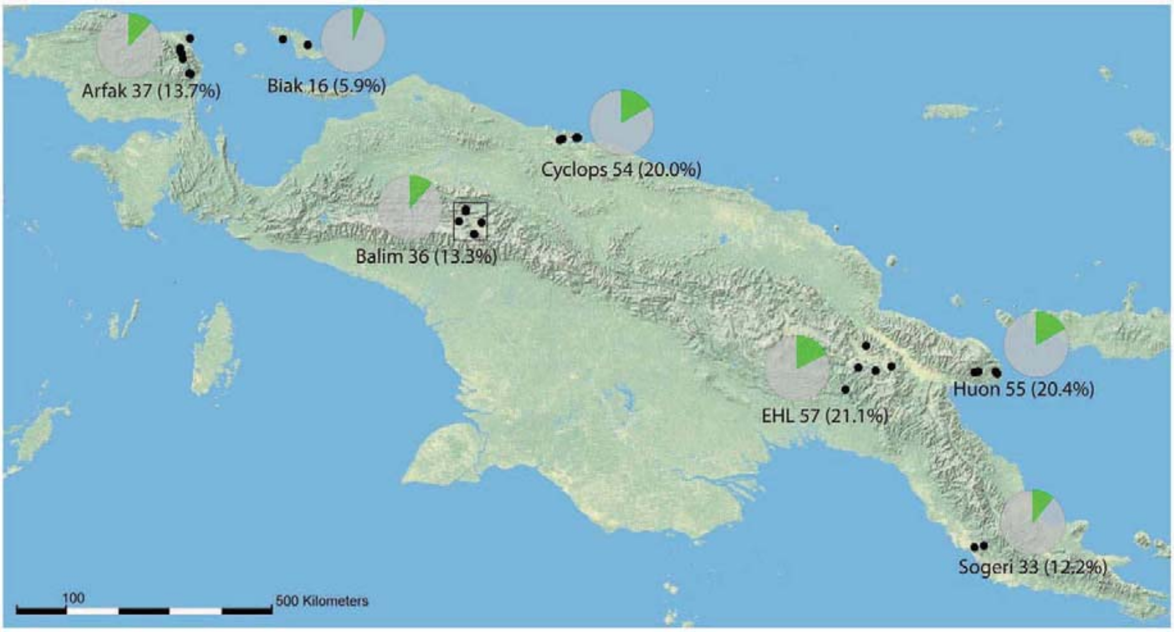

Figure 1. The seven sampling areas across New Guinea. The number of species found at each area is given, with percentage of the total species number in parentheses. Pie charts show the number of species found in the area (green) in relation to New Guinea γ diversity (grey). The results rely on the refined dataset (989 individuals and 270 morphospecies). EHL = Eastern Highlands. The frame in Balim outlines the area shown in the detailed map (see Additional Fig. S1).
doi:10.1371/journal.pone.0028832.g001

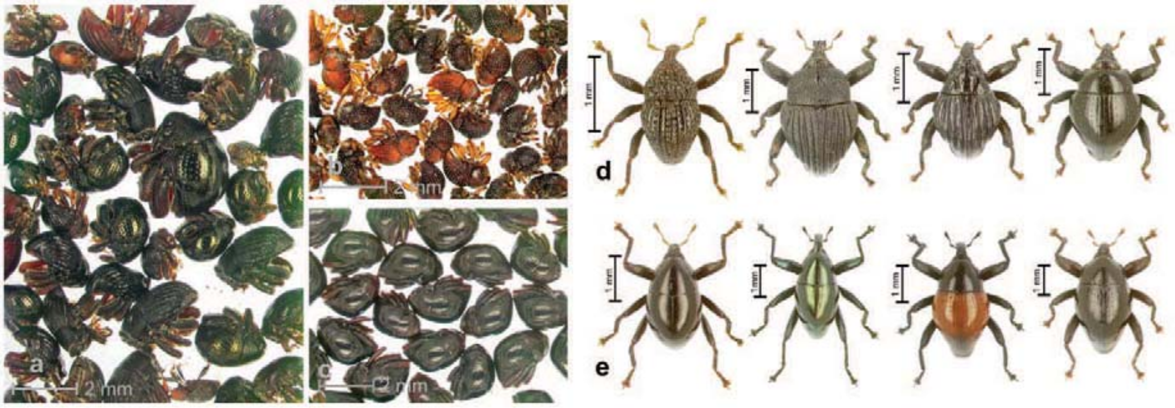

Figure 2. Process of sorting specimens. a) unsorted sample of edaphic weevils including *Trigonopterus* and other genera in ethanol. b–c) sorted samples containing each ''initial morphospecies'' of *Trigonopterus*. d–e) Dry-mounted specimens of *Trigonopterus* after DNA extraction and the preparation of genitalia; ''refined morphospecies''; examples of four characteristic edaphic species (d) and foliage-frequenting species (e).
doi:10.1371/journal.pone.0028832.g002

genital characters could not be referred to at this stage. Only unique female specimens that could be identified based on their distinct external morphological characters were included in the final analysis. Altogether, 1,002 *Trigonopterus* were selected for DNA extraction, plus seven outgroup representatives. The initial morphospecies identifications were used in a separate dataset.

Refined morphospecies hypotheses

After extraction, the preliminary morphospecies hypotheses were revised based on examinations of the male genital characters and dry-mounted specimens (Figs. 2D–E). The judgement of species status was based exclusively on morphological evidence. These refined morphospecies were used in a separate dataset and formed the basis for most subsequent analyses of morphospecies. Our null hypothesis of species was based on morphology.

Parataxonomist sorting

We made an attempt to contrast the taxonomist's species hypotheses with those of a trained layman, i.e., the parataxonomist. For that purpose, we used our dry-mounted voucher-specimens, genital dissections and attached identification labels hidden. Michael Balke, a water beetle taxonomist who was unfamiliar with weevil classification, was the ''highly trained'' parataxonomist. Sorting was conducted under highly favourable conditions, as sorting through wet samples in ethanol would be much more difficult; replication of the sorting by other parataxonomists was beyond the scope of this work.

DNA sequencing

Whole beetles were non-destructively extracted with DNeasy (Qiagen, Hilden, Germany) and NucleoSpin 96 Tissue Kits (Macherey-Nagel, Düren, Germany). We amplified the 5′ end of cytochrome *c* oxidase 1 (*cox1*) for all specimens using primers adjusted for Cryptorhynchinae [20] (see Table S2). For PCR (Mango-Taq, Bioline), we used a two-stage protocol (5 cycles at a 47°C annealing temperature followed by 30 cycles at 52°C [21]. For a few presumably cryptic species and for comparative purposes with few other species, the additional nuclear protein-coding genes arginine kinase [22], histone 4 [23] and elongation factor 1α [24], [25] were amplified and sequenced (see Table S2). The sequences were edited using Sequencher 4.10.1 (GeneCodes Corp., Ann Arbor, MI, USA) and submitted to ENA, European Nucleotide Archive [HE613858–613921; 615156–616164].

Sequence data analysis, molecular species hypotheses

Sequences were aligned with ClustalW (reference), and maximum likelihood (ML) trees were inferred using raxmlGUI 0.93 [26], [27] with default settings (ML+rapid bootstrap, 200 bootstrap replicates and model GTR+GAMMA). For species delineation, we used two methods: objective clustering [10] and the general mixed Yule coalescent (GMYC) model-based method [28] (see [17]). Objective clustering in SpeciesIdentifier [10] uses uncorrected p-distances to cluster sequences at different thresholds that are preset by the user. SpeciesIdentifier can distinguish which sequences belong to which *a priori*-identified morphospecies, and can provide outputs that allow the calculation of the number of clusters in agreement with existing taxonomy, as well as numbers of lumped and split clusters (see [17]). Neither the use of mean interspecific distances, nor K2P distances are appropriate in barcoding studies [29], [30]. The GMYC [28], [31] approach does not rely on preset thresholds but on information contained in the data itself. GMYC analyses were conducted with ''SPLITS'' (Species Limits by Threshold Statistics) (http://r-forge.r-project.org/projects/splits) in R Version 2.12.1 [32]. As identical haplotypes included in the dataset are problematic for GMYC, they were removed using Collapse 1.2 [33], resulting in a dataset of 824 658-bp sequences. GMYC requires the calculation of an ultrametric tree, but the tree does not have to be time calibrated. The ultrametric tree was obtained in BEAST version 1.4.7 [34]. The model that best fit the data was GTR+I+G, but as there are concerns relating to the simultaneous use of invariants and gamma distributions in evolutionary models [27], we decided to use the GTR+G model; GRT+G was the second-best model in jModeltest [35]. The Likelihood Ratio Test in DAMBE [36] demonstrated a $p<0.001$ suggesting the rejection of the null hypotheses (strict clock constraint) and use of the relaxed (uncorrelated log-normal) clock constraint. A coalescent model with a constant population size has been implemented. We obtained 36 M generations by merging nine separate runs and sampling every 1,000th in LogCombiner 1.4.7. After the removal of 1.5 M generations of burnin in each run, the remaining 22,509 trees were analysed with TreeAnnotater version 1.4.7 (http://beast.bio.ed.ac.uk). For the GMYC analysis, we used the single method with standard parameters (interval = c(0,10)) because changing the upper and lower limit of scaling parameters had no noticeable effect on our results (see the SPLITS help manual).

To demonstrate the differences between clustering localities separately and clustering the combined localities of an entire area we used a 95% confidence interval obtained from the seven values for the localities at each clustering threshold to check whether the number of clusters found by SpeciesIdentifier differed significantly from that found for the complete dataset, i.e., whether they fell within the 95% confidence interval. For comparison, we used relative values, calculating percentages out of the absolute number of clusters found for each of the 12 clustering thresholds.

Final species hypotheses

These were arrived at by studying the distribution of refined morphospecies hypotheses among the molecular entities (Fig. 3; Table 1). Morphospecies with high *cox1* divergence were examined morphologically a second time (see Table S3), and nuclear DNA markers were sequenced to discover potentially diagnostic nDNA characteristics that suggest the existence of "cryptic" species or reveal overlooked species. The final hypotheses incorporate evidence from both morphology and molecules. To avoid circularity, the final species hypotheses were used only for comparison with data derived from the "refined morphospecies".

β-diversity

To quantify between-site (β) diversity, the Sørensen similarity index [37] was calculated for each pair among the seven locations as QS = 2 C/A+B, where A and B were the number of species in the two compared localities and C was the number of species shared by the two compared locations.

Objective Clustering

As performance metrics, we calculated the "number of clusters found relative to the number of morphospecies in the dataset (agreement)" and "the number of perfect clusters relative to the number of morphospecies in the dataset (taxonomic accuracy)" [17]. "Agreement" thus compares *numbers* of molecular and traditional taxonomic units, but not their *contents*. That means that in an agreement of 100%, the number of split morphospecies may be balanced by an equivalent number of lumped morphospecies. However, a taxonomic accuracy of 100% is achieved only when all morphospecies are fully congruent with the molecular groups and vice versa. In practice, high agreement means that the number of cox1 clusters or entities reflects species diversity as defined by an expert taxonomist well, and cox1 sequencing delivers a reasonable proxy for a fast, initial measure of diversity in a sample. High agreement does not neccesarily mean that most or all molecular units directly translate into species. Agreement-values exceeding 100% signal overestimation of species numbers, e.g. 120% agreement equals 20% overestimation, whereas 80% agreement equals 20% underestimation.

Results

The *cox1* (658 bp), AK (662 bp), EF1α (404 bp) and H4 (209 bp) sequences had no indels after alignment. Amino acid translation detected no stop codons or suspiciously common non-synonymous substitutions that could suggest the presence of pseudogenes. EF1α contained one intron, which was removed prior to further analysis.

Maximum likelihood analyses of *cox1* data included 1,002 *Trigonopterus cox1* sequences and seven outgroups. The resulting

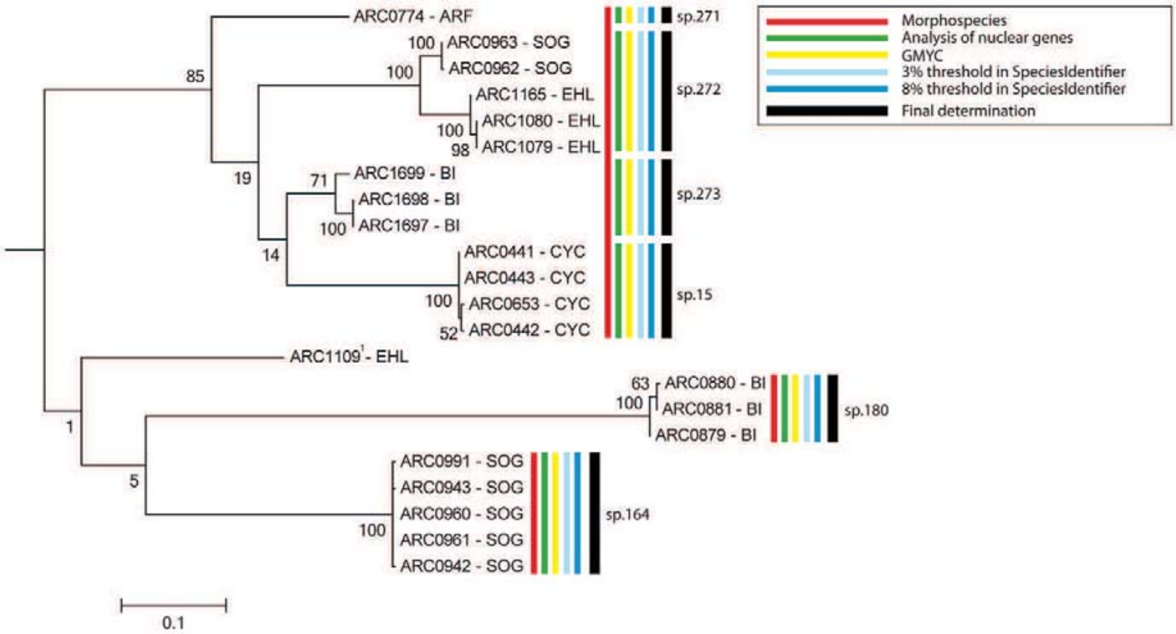

Figure 3. Cox1-based RaxML subtree including three morphospecies for which we sequenced nDNA markers. Red bar = initial morphospecies hypotheses. Additional bars are species delineation based on nDNA markers (green), GMYC analysis (yellow), clustering at different thresholds using SpeciesIdentifier (blue bars) and the final identification based both on morphological and molecular data (black). Bootstrap values at the nodes are based on 200 replicates. In tip labels, areas where specimens were found are indicated: ARF = Arfak, SOG = Sogeri, EHL = Eastern highlands, BI = Biak, CYC = Cyclops. [1] ARC1109: single female not included in the analyses.
doi:10.1371/journal.pone.0028832.g003

Table 1. *p*-distances of 40 specimens, partly representing cryptic species.

refined morphospecies hypotheses	% *p*-distance mtDNA	% p-distance nDNA	final morphospecies hypotheses	% *p*-distance mtDNA	% *p*-distance nDNA	Area
sp. 1, *T.* cf. *illex*	20.00 (21.61)	1.17 (9.70)	sp. 1 (N = 5)	0.76 (19.66)	0.07 (8.90)	Cyclops
sp. 1, *T.* cf. *illex*			*sp. 270 (N = 3)	4.86 (21.95)	n/a	Huon
sp. 1, *T.* cf. *illex*			*sp. 275 (N = 1)	n/a (19.49)	n/a (9.04)	EHL
sp. 1, *T.* cf. *illex*			*sp. 276 (N = 3)	0.99 (21.29)	0.73 (4.35)	EHL
sp. 15	8.80 (18.07)	1.80 (10.69)	sp. 15 (N = 4)	0.30 (16.60)	0.62 (7.98)	Cyclops
sp. 15			*sp. 271 (N = 1)	n/a (16.81)	n/a (10.95)	Arfak
sp. 15			*sp. 272 (N = 4)	2.47 (18.69)	0.20 (6.35)	Sogeri & EHL
sp. 15			*sp. 273 (N = 3)	1.98 (16.43)	0.05 (7.08)	Biak
sp. 86	14.21(18.69)	n/a	sp. 86 (N = 3)	0.15 (19.84)	n/a	Balim
sp. 86			*sp. 274 (N = 1)	n/a (18.46)	n/a	Balim
sp. 150	11.96 (19.68)	n/a	sp. 150 (N = 7)	4.21 (18.27)	n/a	Sogeri & Huon
sp. 150			*sp. 269 (N = 1)	n/a (18.29)	n/a	Huon
sp. 247	7.09 (20.42)	n/a	sp.247 (N = 3)	0.30 (21.15)	n/a	Arfak
sp. 247			*sp.279 (N = 1)	n/a (19.40)	n/a	Arfak

Average intraspecific and interspecific (in parentheses) p-distances for mitochondrial and nuclear DNA. All codon positions are included. All positions containing missing data were eliminated for pairwise sequence comparisons (pairwise deletion option). There were a total of 1275 positions (AK, EF1a and H4) in the nuclear dataset and 658 positions in the mitochondrial dataset. The presence of n/a in the results denotes cases in which it was not possible to estimate evolutionary distances.
*Finally accepted cryptic species. EHL = Eastern Highlands.

doi:10.1371/journal.pone.0028832.t001

cox1 tree (see Fig. S1) revealed 13 singleton clades that contained females without diagnostic morphological characteristics. These females were excluded from the downstream cluster and GMYC analyses as they cannot reliably be diagnosed morphologically. The resulting alignment of 989 *Trigonopterus* sequences contained 274 morphospecies according to the initial morphospecies hypothesis (without male genitalia data), 270 morphospecies according to the refined morphospecies hypothesis (based on dry-mounted specimens and genital characters, but without input from molecular data) and 279 species according to the final hypotheses (including cryptic species). Along with the full datasets (γ-diversity), we also used the refined hypotheses to count species in each of the seven localities (α-diversity).

Although interspecific divergences in the genus (average 19.80%, between 12.06–23.86%) are much deeper than the intraspecific divergences (average 1.28%, between 0.00–19.49%), some species showed conspicuously high intraspecific divergence (see Table S3). Twenty-five of the refined morphospecies showed a divergence above 3%; these species were subjected to additional scrutiny (see [17]). All of these 25 species were re-investigated morphologically, and for some, we aimed to add nuclear markers.

Five of the above species combined high divergence with partial sympatry or, at least, patterns in which genetic distance was negatively correlated with geographic distance (as in sp. 015, see below). One species was polyphyletic (sp. 001 - *T.* cf. *illex*), i.e., split into two clades that were placed at distant positions on the tree and consisted of four divergent clusters (spp. 001, 275, 276, and sp. 270; the latter associated with sp. 263 - *T.* cf. *densatus*). Two others were paraphyletic; sp. 150 - *T.* cf. *vanus* turned out to be the sister of a clade comprising sp. 014 and sp. 269 - *T.* cf. *vanus*, and sp. 002, sp. 086, and sp. 274 formed a triad. One species was monophyletic but was divided into four highly divergent clusters (spp. 015, 271, 271, 273) that showed an unexpected geographic pattern: sp. 015 from Cyclops Mountains and sp. 273 from Biak Island were closely related to sp. 272 from Sogeri and EHL but not to sp. 271 from the Arfak mountains, which are geographically closer to Biak. Finally, specimen ARC0854 showed a divergence of 7.09% from the sympatric specimens of species 247.

For two of the questionable refined morphospecies (spp. 001, 015), the nuclear markers AK, EF1α and H4 were sequenced and compared with the mtDNA clusters (Fig. 3). In all cases, the mtDNA and nDNA clusters were fully congruent. Sequence divergence and/or morphological differences found by re-examination of the specimens suggested the presence of six cryptic species within these two morphospecies (see Table S3), with a mean interspecific nDNA *p*-distance of 7.31% (smallest: 4.35%). For the remaining three questionable species (spp. 086, 150, 247), with distances of 14.21%, 5.41% and 7.09%, respectively, we conducted only morphological re-examination of the specimens, which confirmed three additional cryptic species (*spp. 269, 274, 279) based on inconspicuous differences in the male genitalia. Some of the suggested cryptic species are allopatric, but *sp. 275 and *sp. 276 occur sympatrically in Haia in the EHL area, as do sp. 086 and *sp. 274 in Bokondini in the Balim area, sp. 247 and *sp. 279 in Mokwam in the Arfak area, and sp. 150 and *sp. 269 in Sattelberg and Pindiu, two localities in the Huon area that are separated by less than 30 km. As sp. 150 has a relatively wide distribution, occurring both in the Huon area and in Sogeri, the two species must be considered sympatric in the Huon area.

Trigonopterus nasutus (Cyclops Mts.) and *T.* sp. 018 (Arfak Mts.) were initially classified as two species from two geographical areas. *Cox1* divergence is high, averaging 7.46% between our single *T. nasutus* and the specimens of *T.* sp. 018. Nuclear markers were less divergent (average *p*-distance: 0.36%), and in the absence of marked morphological differences, we opted to consider all specimens as representing one species, *Trigonopterus nasutus*, with a range over two geographical terranes and with pronounced geographical haplotype structure.

After recognition of the cryptic species, the final dataset, with 279 species, showed an average intraspecific divergence of 1.04% (refined dataset before 1.28%) ranging from 0.00–11.40%. Interspecific divergence was unchanged.

Parataxonomist sorting

Lumping species resulted in 27% error between parataxonomist sorting and our final species hypothesis.

Objective Clustering

First, we clustered the initial dataset with 274 morphospecies at a 3% cutoff. We found 324 clusters (120% agreement, with a 20% overestimation relative to the 274 morphospecies of the dataset) and 145 perfect clusters (53.7% taxonomic accuracy). The best taxonomic accuracy was found at a 4% threshold, with 146 perfect clusters (54.1%), and the best agreement was found at a 9% threshold, with 269 clusters (99.6%).

Second, we clustered the refined dataset (270 morphospecies) at a 3% cutoff. A total of 947 (95.75%) sequences had at least one conspecific sequence, which equates to 42 singletons; 228 (84.44%) morphospecies had valid conspecifics. We found 324 clusters (120% agreement, or 20% overestimation); of these clusters, 231 were perfect (85.56% taxonomic accuracy) (Table 2). The best taxonomic accuracy was found at an 8% threshold, with 247 perfect clusters (91.48%), and the best agreement at a 9% threshold, with 269 clusters (99.63%). In addition, each locality was clustered separately, resulting in 80.6–100% taxonomic accuracy and 100–125.0% agreement at a 3% threshold (Table 2). The overall success rate was lowest within the Balim area (80.6% taxonomic accuracy; 125% agreement). This finding was likely caused by the strongly structured landscape of the sampling area and a critical 7–52 km distance between the localities, which supposedly allows both high species overlap and marked local differentiation. To test this hypothesis, the four main localities sampled in the Balim area were examined individually, resulting in local success rates of 90.9–100% at a 3% threshold; these results corresponded with the values obtained for the other areas (see Table S4).

Finally, we clustered the final dataset with 279 species at a 3% threshold. As the sequences of the final dataset are identical to the initial and refined datasets, the total number of clusters was the same. We found 242 perfect clusters (86.74% taxonomic accuracy), with 116.1% agreement. The best taxonomic accuracy and agreement were found at an 8% threshold, with 258 perfect clusters (92.47%) and 278 total clusters (99.64%).

GMYC

GMYC analysis was used to evaluate clustering outcomes using dataset-intrinsic factors rather than arbitrary preset thresholds for the delineation of molecular entities or species. GMYC analyses used the refined 270-species dataset without the resolved cryptic species. The single-threshold GMYC approach was applied to a chronogram constructed with a relaxed lognormal clock and a coalescent prior. This analysis revealed 328 GMYC entities, including 90 singletons, within a 95% confidence interval of 322–335, for an agreement of 121.48% or a 21.48% overestimation of species diversity. A total of 227 GMYC entities were perfect (taxonomic accuracy = 84.07%), and 101 entities (37.41%) belonging to 41 morphospecies were split.

Neither clustering of the refined dataset at 1–4% and final datasets at 1–5% nor GMYC analysis lumped the morphospecies. Hence, interspecific divergences were always higher than intraspecific ones, a prerequisite for molecular biodiversity assessment that is sometimes referred to as the "DNA barcoding gap" (see Fig. S2) [38], [14]. Inconsistencies between molecular entities and morphospecies were entirely due to oversplitting.

Different species hypotheses have been visualised on a subtree that also summarises the progress from morphospecies hypotheses (red bars), the analysis of nDNA (green), clustering GMYC of mtDNA (yellow / blue) and the final species hypotheses (Fig. 3). Analysis of the nDNA used a RaxML tree based on the three nuclear genes (AK, EF1α and H4). Its topology was entirely congruent to the mtDNA-based tree. The final determination was based on the relative degree of divergence and the geographical distribution pattern. The relatively shallow divergence within

Table 2. Regional and local clustering at a 3% threshold and GMYC of the final dataset.

analyzed dataset	number morpho-species	number cluster/entities	agreement [%]	number perfect fit	taxonomic accuracy [%]	lumped cluster	split cluster
PT sorting	270	226	81.0	88	31.6	79	59
initial	274	324	120	145	53.7	49	130
refined	270	324	120.0	231	85.6	0	93
refined 8%	270	278	103.0	247	91.5	4	27
refined GMYC	270	328	121.5	227	84.1	0	101
Arfak (ref.)	37	40	108.1	34	91.9	0	6
Biak (ref.)	16	16	100.0	16	100.0	0	0
Balim (ref.)	36	45	125.0	29	80.6	0	16
Cyclops (ref.)	54	61	113.0	49	90.7	0	12
Sogeri (ref.)	33	40	121.2	27	81.8	0	13
Huon (ref.)	55	59	107.3	51	92.7	0	8
EHL (ref.)	57	63	110.5	51	89.5	0	12
final 3%	279	324	116.1	242	86.7	0	82
final 8%	279	278	99.6	258	93.1	5	15
final GMYC	279	328	117.6	239	86.4	0	89

Columns from left to right: (1) name of the dataset used; (2) number of morphospecies that each dataset includes; (3) number of clusters / entities found for each dataset; (4) number of clusters found relative to the number of morphospecies (agreement); (5) number of clusters containing all individuals of one species and none of other species; (6) percentage of perfect clusters relative to morphospecies (taxonomic accuracy); (7) number of clusters containing more than one species; (8) number of clusters containing not all individuals of a species. ref. = refined dataset; PT sorting = parataxonomist sorting.

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species 272 was interpreted as an intraspecific allopatry between two neighbouring areas. The decision to separate three cryptic species from "sp. 015 sensu lato" was based on the deep divergences between sp. 015, sp. 271, sp. 272, and sp. 273, which were furthermore negatively correlated with geographic distance.

GMYC and objective clustering of the final dataset

The cases in which our 279 final species were not compatible with the results of the computer-based methods were examined in detail to clarify the circumstances of these "failures". Clustering achieved its highest taxonomic accuracy at an 8% threshold, with 258 perfect clusters. At this setting, six species (spp. 041, 098, 101, 192, 229, 263) were split into two, and one species (sp. 081) was split into three; twelve species, meanwhile, were lumped. In GMYC, no lumping occurred, but 31 species (spp. 008, 011, 018, 028, 030, 041, 048, 049, 051, 081, 094, 098, 101, 114, 123, 132, 133, 150, 153, 161, 171, 172, 175, 192, 205, 225, 226, 228, 229, 240, 244, 246, 259, 261, 263, 264, 270, 272) were split into two, five species (spp. 008, 028, 051, 133, 264) into three and three species (spp. 012, 081, 205) into four. Of these split entities, 74.4% contain allopatric subclades; i.e., they represent species with geographically structured haplotype pools, where higher intraspecific divergences induce GMYC to oversplit. It is likely that denser sampling to bridge the gaps between these allopatric populations could cause the results of the final species count and GMYC to converge. Ten species (25.6%) (spp. 008, 011, 012, 030, 048, 051, 175, 225, 246, 259) contained only specimens from the same locality, and the reasons for their divergence are not always clear. There is a chance that some contain additional cryptic species, but with the available data, such a possibility is impossible to demonstrate. An example of such a doubtful species is sp. 246: a single specimen (ARC0852) diverges 7.7–9.2% from a morphologically identical cluster possessing a maximum divergence of 1.4% (average 0.6%). In other cases, however, as with sp. 259, GMYC appears to have been too sensitive and shows a tendency towards oversplitting. The species split by clustering at an 8% threshold appeared to be better justified, as they belong to allopatric populations that could be classified as "subspecies" (spp. 041, 081), are potential candidates of cryptic species (spp. 098, 263), or belong to distant allopatric populations, with no morphological differences (spp. 101, 192, 229). The species lumped by clustering at the 8% threshold usually belong to closely related sympatric species: sp. 039+sp. 109+sp. 278 from the Cyclops Mountains or sp. 115+sp. 116 from the Arfak Mountains and sp. 221+sp. 223 from Biak Island. The species in the group sp. 121+sp. 122+sp. 123 come from the Balim area but are lumped together with sp. 029, an obviously closely related species from the Cyclops Mountains.

Success rates regional *versus* local sampling

To test whether there are significant differences between clustering of the regional *versus* local datasets, we calculated the 95% confidence interval of the 7 areas and checked whether the value for the complete dataset was within the 95% confidence interval; e.g., at the 1% threshold, we took the percentage value of the perfect clusters for the entire dataset and compared it with the values for each of the seven areas. We plotted the 95% confidence interval of agreement and taxonomic accuracy (Fig. 4). Values fell

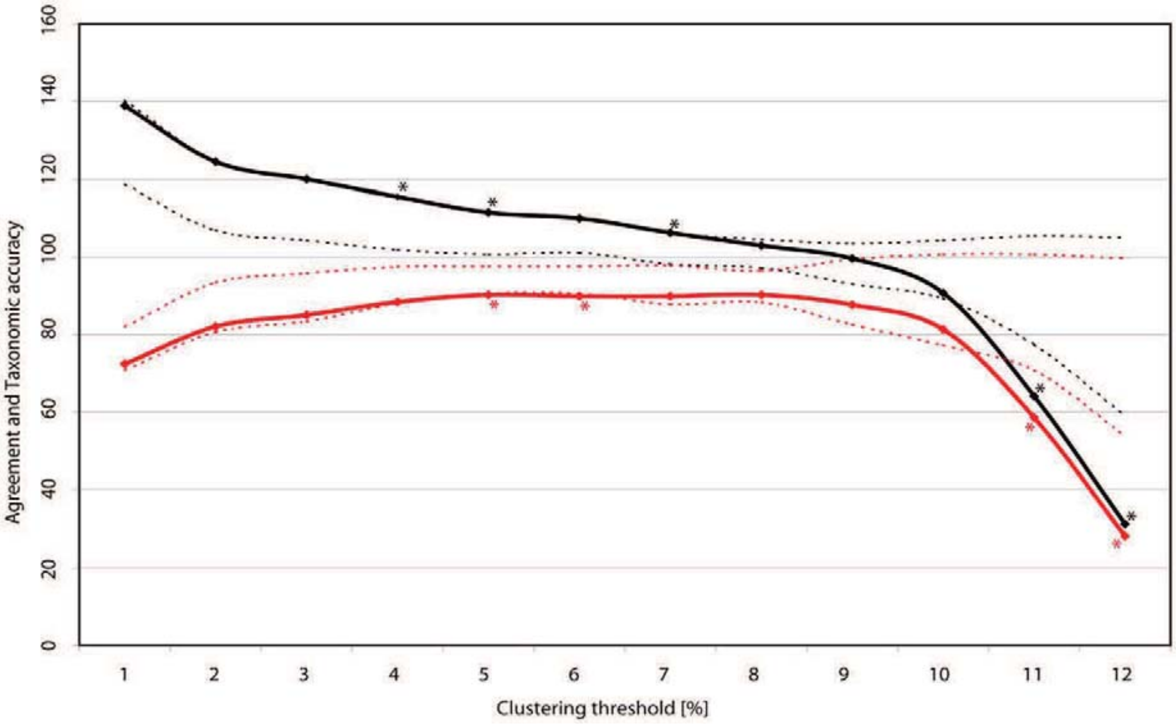

Figure 4. Agreement (black) and taxonomic accuracy (red) at thresholds from 1–12%. Numbers derived from the refined dataset, including 270 morphospecies. Dotted lines define 95% confidence interval of the seven areas. * = Thresholds at which clustering of the complete dataset differs statistically significant from the clustering of the areas.
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outside the 95% confidence interval at the 4%, 5%, 7%, 11% and 12% values for agreement and at the 5%, 6%, 11% and 12% values for taxonomic accuracy. At these thresholds, clustering of the complete dataset induced significantly different values compared with the clustering of the areas. For all other cases, this result means that there is no significant difference between the clustering of the complete dataset and the clustering of the single areas.

ß-diversity

For the refined dataset, 259 (95.93%) species were found in just one of the seven sampling areas (Table S5). Ten species were found in two areas (spp. 018, 133, 150, 161, 192, 205, 228, 229, 244, 261), two species in three areas (spp. 001, 028) and one species in five areas (sp. 015). Out of the 279 species that were finally identified (including cryptic species), 270 (96.77%) were found in just one sampling area. Ten species were found in two areas, and one species was found in three areas. No species was found in more than three areas.

A Sørensen similarity index of 1 means that all species are shared across all areas, while an index of 0 means that no species are shared among the areas compared. The average Sørensen similarity indices for the refined and final datasets were 0.029 and 0.013, respectively, reflecting the low level of species sharing among the sampling areas. Huon, Sogeri and the Eastern Highlands had the highest values for the Sørensen similarity index, whereas Balim shared no species with any other area (Table 3). Furthermore, Sørensen similarity indices were calculated for the four localities in the Balim area (average 0.27) (Table 3) and the six localities of the Eastern Highlands (average 0.05) (Table 4).

At present, 44 species of *Trigonopterus* from New Guinea have been formally described [9], [39]. In our current dataset, three of those species (*T. nasutus*, *T. vandekampi*, *T. micros*) could be identified with confidence, while 19 others (*T. anthracinus*, *T. cribratus*, *T. curtus*, *T. densatus*, *T. dilaticollis*, *T. ephippiatus*, *T. femoralis*, *T. flavomaculatus*, *T. gibbirostris*, *T. globatus*, *T. illex*, *T. illitus*, *T. neglectus*, *T. oblongus*, *T. obnixus*, *T. pulchellus*, *T. pusillus*, *T. sejunctus*, *T. vanus*) were only tentatively named, pending a thorough taxonomic revision to include the designation of lectotypes. A final taxonomic clarification will be difficult in morphospecies that include cryptic species (e.g., *T. illex*, *T. vanus*), as the type specimens lack the necessary diagnostic characters. Most of the remaining 257 species marked by numbers here are presumably new to science.

Discussion

Trigonopterus weevils are hyperdiverse across the island of New Guinea, with high α- and γ-diversity. Their ß-diversity is very high, as expected from samples that mainly originate from different mountain ranges. Despite denser sampling across the island, we still find comparably deep branching patterns between species, with an average interspecific *cox1* divergence of approximately 20% (range 12–24%). Molecular biodiversity assessment using *cox1* data is feasible, with error rates of approximately 15–20% when the number of molecular entities is compared to the number of morphospecies (refined & final dataset). Outcomes of the clustering of local *versus* regional datasets might differ with slight significance, depending on the threshold chosen. When geographically proximate localities (distance of approximately 7–52 km) were merged into one collection area, the agreement and taxonomic accuracy were lower (125%, error = 25% overestimation / 80.6%, error = 19.4% overestimation) because of the pronounced geographical genetic structure in some species. Otherwise, the performance of local and regional clustering showed mostly agreement and taxonomic accuracy using both 3% threshold clustering and GMYC (Table 2). In practice, this finding means that ß-diversity studies will probably suffer from slightly higher error rates when closer localities are studied, compared to studies of larger-scale patterns of diversity.

Table 3. Summary of the ß-diversity between the four localities of the Balim area.

	# species	Bokondini	Habbema	Jiwika	Poga
Bokondini	11 (12)		1	3	2
Habbema	6 (6)	0.12 (0.11)		3	4
Jiwika	13 (13)	0.25 (0.24)	0.32 (0.32)		6
Poga	19 (19)	0.13 (0.13)	0.32 (0.32)	0.38 (0.38)	

Data are derived from the refined and the final (in parentheses) datasets. The upper right shows shared species, and the lower left shows the Sørensen similarity index.

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Table 4. Summary of the ß-diversity between the six localities of the Eastern Highlands area.

	# species	Aiyura	Goroka	Haia	Mt. Michael	Okapa	Supa
Aiyura	8		2	0	0	5	0
Goroka	3	0.36		0	0	2	0
Haia	31	0.00	0.00		0	0	10
Mt. Michael	3	0.00	0.00	0.00		0	0
Okapa	13	0.24	0.25	0.00	0.00		0
Supa	17	0.00	0.00	0.21	0.00	0.00	

Data are derived from the refined dataset. The upper right shows the shared species, and the lower left shows the Sørensen similarity index.

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Distances between the localities within the Balim and Eastern Highlands areas are comparable, so the differences in their β-diversity (Tables 3 and 4) require an explanation. One possible factor might be the different geographical structure of the areas; another possibility is that differences in vegetation, or both geography and vegetation in combination, mediate the difference in ß-diversity. The mountain ranges bordering the Balim Valley (see Fig. S3) are largely covered with montane forests dominated by *Nothofagus*. The valley bottom could promote isolation but still allow colonisation of the localities that have a similar set of species. In the Eastern Highlands, the mountain structure is more complex, and most localities are located north of the watershed (except two, Haia and Supa, which are south of it). Haia and Supa support lower and mid-montane forests, while mid- and upper montane forests dominate the localities in the North. Aiyura, Goroka, and Okapa have Sørensen indices similar to the localities in the Balim area. Only two of the seven species shared between them, had intraspecific *p*-distances above 2%. However, five of the eight allopatric species in Balim had high intraspecific *p*-distances (2.05–8.79%), resulting in a lower success rate from clustering (see above). The ecology of the species collected could be an important factor as well; the mountains bordering the Balim Valley were largely untouched by human activities until quite recently, while the primary forests around Aiyura, Okapa and Goroka were reduced to patches surrounded by dominant grasslands and gardens long before the arrival of Western civilisation. Species that were somewhat adapted to these conditions could be promoted and also retain the potential for relatively recent dispersal, resulting in a lower degree of genetic structure. Additional investigations, including the study of the species' ecology and population genetics, coupled with GIS modelling, would be needed for a detailed explanation of the observed differences.

The 13 species found in more than one terrane are hardly enough to study generalities of their distribution patterns. Two of them (spp. 1, 15) had to be split into cryptic species, so their areas of distributions were markedly reduced. Of the remaining, the majority (spp. 133, 150, 161, 205, 228, 229, 244, 261) are restricted to the three areas in Papua New Guinea and include a number of montane species. Others, shared with / between the more distant areas in West New Guinea rather belong to "lowland species", such as sp. 018, sp. 028, and sp. 192. It would be tempting to investigate the ß-diversity of localities in lowland forests, either in the Mamberamo-Sepik basin, or the Southern platform. Presumably, ß-diversity would be higher compared to the highlands.

Cox1 sequencing to aid taxonomy

The morphospecies count changed from the initial sorting, via a refined morphological concept, to the final species hypotheses, which combined morphological and molecular evidence. Although the absolute numbers from the initial sorting and the refined morphospecies count changed only slightly (from 274 to 270 morphospecies), the taxonomic changes were substantial. A number of species were oversplit (i.e., contained "synonyms"), but this inflation of the species count was almost exactly compensated by a failure to recognise superficially similar species. In the final step, analysis of *cox1* data stimulated the taxonomist to rethink species boundaries, accepting the existence of nine cryptic species that raised the total number to 279 species.

Because of the high number of morphologically similar species, sorting morphospecies across different localities is very difficult, even for highly trained experts. This difficulty can be clearly seen from the errors in our initial morphospecies hypotheses; the samples that were sorted at different times or came from different areas had a large number of "synonyms", i.e., different species designation numbers were mistakenly assigned to conspecific specimens collected at different times or locations more frequently than they would be assigned to an equal number of specimens taken from the same locality and sorted at the same time. The likelihood of mistakes increased with the number of specimens as well, which was largely the result of human error and / or the occurrence of "aberrant" specimens, i.e., relatively rare individuals on the fringes of a trait range. The approach applying DNA sequence data and morphology is more reliable when large volumes of material need to be sorted, as suggested for beetles [40] and for tropical trees [41].

The current inventory of 279 species is far from complete; even for the localities sampled, not all species have been discovered. Old museum specimens representing additional species from the Cyclops Mountains and the Balim Valley are already on hand, and most of the 13 divergent clades represented by females could probably be added to the species count after males with their diagnostic characters are found (and can easily be assigned to their females using *cox1* sequences). Thus, the number of species is likely to increase with additional sampling efforts, even in the same localities. Adding more areas will further increase species discovery, and a total of more than 1000 *Trigonopterus* species is likely, as anticipated [42]. Comparing specimens side by side under the microscope or preparing provisional identification keys is not efficient when dealing with so many superficially similar species. In fact, the possibility of locating supposedly close relatives of a new specimen using DNA barcodes becomes most compelling in very large data sets. The advantages of molecular species diagnosis *versus* morphological identification also became apparent in the hyperdiverse weevil genus *Conotrachelus* [43], in a survey of ants on Madagascar [44] and in Chironomidae [45].

In addition to its use in species identification, *cox1* also contains valuable phylogenetic information. Because of its high divergence, this use is somewhat limited in *Trigonopterus*, as saturation is usually reached in groups of more than four to five closely related species. We are still confident that this effect did not affect the results of the GMYC analysis, as this program relies on the topologies and branch lengths of closely related species and their intraspecific patterns; an incorrect node at the basal position is irrelevant. At present, there are some indications for a high degree of *in situ* diversification: the clade of species 210–214 (bootstrap, BS, 86%) is endemic to the Balim area, while species 231–233 (BS 95%) are endemic to the Arfak Mountains, and the clade of species 039, 109 and 278 (BS 94%) are endemic to the Cyclops Mountains. In some cases, as with the clade of species 147–149 (BS 97%), dispersal between separate terranes seems to be involved; the species occur in the Eastern Highlands area and on the Huon peninsula. Additional, slightly more conservative markers would have to be included in a dataset to obtain a phylogeny that can resolve deeper nodes. With these data, a study investigating the extent of endemism in geological terranes could provide important insights into the evolution of a hyperdiverse group in New Guinea.

Cox1 sequencing for community ecology

In *Trigonopterus*, it is possible to merely rely on *cox1* sequence data to arrive at a solid starting hypothesis for comparative studies on patterns of diversity, for example ß-diversity assessment [46]. Both clustering at a 3% threshold and GMYC analyses would overestimate species diversity by 16–17%, and taxonomic error with respect to the molecular entities is approximately 14%. These data assume that the final species hypotheses are correct; however, an overestimation of species diversity, mainly involving allopatric populations, might also suggest that there are more *Trigonopterus* species in the dataset than we finally recognised. Here, more sampling and a research program focused on population genetic processes and other lines of evidence would be needed to arrive at sound taxonomic conclusions.

In any case, as soon as fifty or more *Trigonopterus* species become involved, species counts and diagnoses based on DNA barcoding become more accurate than the numbers obtained by either parataxonomists or traditional taxonomists.

Conclusions

The present study summarises the first steps necessary to establish a new taxon for a research program on a largely unexplored fauna, building on DNA sequencing and expert taxonomic knowledge. A diverse, widespread and easy to diagnose study group prominent in all major terrestrial habitats of the Melanesian region was identified. The majority of species possess clear morphological characters and only a minor proportion (3.3%) had to be classified as cryptic species at a later stage. Both objective clustering at variable thresholds (3% to 8%) and a GMYC analysis outperform the parataxonomist. DNA barcoding proves to be an excellent tool for surveying both locally and supraregionally but may exhibit a slight drop in performance when localities 7–52 km away are included.

The tools available to identify *Trigonopterus* weevils thus allow researchers to overcome the taxonomic impediment. The advantages of weevils over butterflies or vertebrates commonly used in rapid biodiversity assessment (RAP) surveys should be apparent; collecting is relatively easy, and weevils are present in most primary forests of Melanesia from sea level to subalpine grasslands. Even forest remnants of limited size likely harbour a large number of species. As shown above, endemism is high, and the chance that an isolated forested hill has its own set of endemic species is good. If it is our purpose to protect the biodiversity of Melanesia, *Trigonopterus* weevils are surely a valuable part of that biodiversity, both in the numbers of species and in terms of quality as an indicator. The tools are ready; it is now up to conservationists to use them.

Supporting Information

Figure S1 Maximum likelihood tree based on *cox1* sequences of 1,002 specimens of *Trigonopterus*. Seven outgroup representatives are included. Specimens come from seven areas of New Guinea. Clusters correlate with the assignment of 270 morphospecies given to the right and nine additional cryptic species marked in red. The dataset in nexus format is available from the authors.
(TIF)

Figure S2 Distribution of all average intra- and interspecific distances based on the refined dataset.
(TIF)

Figure S3 Balim area showing all sampling points at the four localities.
(TIF)

Table S1 Overview of field work in each collecting area. ^{1} = sampling points with a minimum distance of 7 km are counted as separate localities.
(DOC)

Table S2 Primers used in this study.
(DOC)

Table S3 Average intraspecific p-distances of *Trigonopterus* that are higher than 3%. Based on the entire refined dataset. EHL = Eastern Highlands. The term "subspecies" describes allopatric populations with distinct but minor morphological differences.
(DOC)

Table S4 Clustering of four localities in the Balim area.
(DOC)

Table S5 Summary of the ß-diversity between the seven sampled areas in New Guinea. Data are derived from the refined dataset (final dataset in parentheses). The upper right shows species shared between areas; the lower left shows the Sørensen similarity index. Numbers following area names indicate the number of species encountered.
(DOC)

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Author Contributions

Conceived and designed the experiments: RT MB AR. Performed the experiments: RT KS SS AR. Analyzed the data: RT MB AR. Contributed reagents/materials/analysis tools: KS SS AR. Wrote the paper: RT MB AR.

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RESEARCH ARTICLE

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One hundred and one new species of *Trigonopterus* weevils from New Guinea

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Abstract

A species discovery and description pipeline to accelerate and improve taxonomy is outlined, relying on concise expert descriptions, combined with DNA sequencing, digital imaging, and automated wiki species page creation from the journal. One hundred and one new species of *Trigonopterus* Fauvel, 1862 are described to demonstrate the feasibility of this approach: *T. aeneipennis* **sp. n.**, *T. aeneus* **sp. n.**, *T. agathis* **sp. n.**, *T. agilis* **sp. n.**, *T. amplipennis* **sp. n.**, *T. ancoruncus* **sp. n.**, *T. angulatus* **sp. n.**, *T. angustus* **sp. n.**, *T. apicalis* **sp. n.**, *T. armatus* **sp. n.**, *T. ascendens* **sp. n.**, *T. augur* **sp. n.**, *T. balimensis* **sp. n.**, *T. basalis* **sp. n.**, *T. conformis* **sp. n.**, *T. constrictus* **sp. n.**, *T. costatus* **sp. n.**, *T. costicollis* **sp. n.**, *T. crassicornis* **sp. n.**, *T. cuneipennis* **sp. n.**, *T. cyclopensis* **sp. n.**, *T. dentirostris* **sp. n.**, *T. discoidalis* **sp. n.**, *T. dromedarius* **sp. n.**, *T. durus* **sp. n.**, *T. echinus* **sp. n.**, *T. edaphus* **sp. n.**, *T. eremitus* **sp. n.**, *T. euops* **sp. n.**, *T. ferrugineus* **sp. n.**, *T. fusiformis* **sp. n.**, *T. glaber* **sp. n.**, *T. gonatoceros* **sp. n.**, *T. granum* **sp. n.**, *T. helios* **sp. n.**, *T. hitoloorum*

sp. n., *T. imitatus* **sp. n.**, *T. inflatus* **sp. n.**, *T. insularis* **sp. n.**, *T. irregularis* **sp. n.**, *T. ixodiformis* **sp. n.**, *T. kanawiorum* **sp. n.**, *T. katayoi* **sp. n.**, *T. koveorum* **sp. n.**, *T. kurulu* **sp. n.**, *T. lekiorum* **sp. n.**, *T. lineatus* **sp. n.**, *T. lineellus* **sp. n.**, *T. maculatus* **sp. n.**, *T. mimicus* **sp. n.**, *T. monticola* **sp. n.**, *T. montivagus* **sp. n.**, *T. moreaorum* **sp. n.**, *T. myops* **sp. n.**, *T. nangiorum* **sp. n.**, *T. nothofagorum* **sp. n.**, *T. ovatus* **sp. n.**, *T. oviformis* **sp. n.**, *T. parumsquamosus* **sp. n.**, *T. parvulus* **sp. n.**, *T. phoenix* **sp. n.**, *T. plicicollis* **sp. n.**, *T. politoides* **sp. n.**, *T. pseudogranum* **sp. n.**, *T. pseudonasutus* **sp. n.**, *T. ptolycoides* **sp. n.**, *T. punctulatus* **sp. n.**, *T. ragaorum* **sp. n.**, *T. rhinoceros* **sp. n.**, *T. rhomboidalis* **sp. n.**, *T. rubiginosus* **sp. n.**, *T. rubripennis* **sp. n.**, *T. rufibasis* **sp. n.**, *T. scabrosus* **sp. n.**, *T. scissops* **sp. n.**, *T. scharfi* **sp. n.**, *T. signicollis* **sp. n.**, *T. simulans* **sp. n.**, *T. soiorum* **sp. n.**, *T sordidus* **sp. n.**, *T. squamirostris* **sp. n.**, *T. striatus* **sp. n.**, *T. strigatus* **sp. n.**, *T. strombosceroides* **sp. n.**, *T. subglabratus* **sp. n.**, *T. sulcatus* **sp. n.**, *T. taenzleri* **sp. n.**, *T. talpa* **sp. n.**, *T. taurekaorum* **sp. n.**, *T. tialeorum* **sp. n.**, *T. tibialis* **sp. n.**, *T. tridentatus* **sp. n.**, *T. uniformis* **sp. n.**, *T. variabilis* **sp. n.**, *T. velaris* **sp. n.**, *T. verrucosus* **sp. n.**, *T. violaceus* **sp. n.**, *T. viridescens* **sp. n.**, *T. wamenaensis* **sp. n.**, *T. wariorum* **sp. n.**, *T. zygops* **sp. n.**. All new species are authored by the taxonomist-in-charge, Alexander Riedel.

Keywords
Melanesia, integrative taxonomy, turbo-taxonomy, weevils, hyperdiverse, morphology, nuclear DNA, *cox1*, DNA barcoding, Coleoptera, Curculionidae, Cryptorhynchinae

Introduction

The number of undescribed species on Earth is immense (Scheffers et al. 2012). Large scale studies on morphology, functional biology, community ecology, and phylogeny lead to the discovery of large numbers of new species, but suffer from the lack of a sound taxonomic foundation. DNA barcoding and molecular biodiversity assessment studies do indeed suffer from the same issue. The reason is apparent – it is comparably easy to collect many species and create large datasets, but it is not so easy to identify them, especially if numerous samples from tropical localities are involved. It is easy to obtain hundreds or thousands of DNA sequences or insect samples for a beta diversity study, even for a student project. Identification of samples from moderately to poorly studied regions, and more specifically the recognition and formal scientific description of new species however require taxonomic expertise.

Here, we will not review the significant body of literature addressing the various suggestions how to overcome the "taxonomic impediment". Rather we report a species discovery and description pipeline (Riedel et al. 2013) that accelerates and improves the way taxonomy flanks research in related disciplines such as biogeography, phylogenetics and not the least community ecology. The term "turbo-taxonomy" was coined for a similar procedure describing 178 new species of parasitic wasps (Butcher et al. 2012) and is discussed below. When faced with a large number of morphologically similar, undescribed species, it is not an option to carry on "business as usual" and prepare very detailed descriptions with an output of only few species per year. Such a strategy will not achieve a sustained success within this century.

The first step is to select a suitable study group (see also Riedel et al. 2013 for a process chart). After an initial taxon screening, we have selected the hyperdiverse weevil genus *Trigonopterus* Fauvel for our research on biodiversity patterns and biogeography across the Indomalayan Archipelago and Melanesia. *Trigonopterus* are flightless weevils placed in the subfamily Cryptorhynchinae of Curculionidae (Alonso-Zarazaga and Lyal 1999). It contains 91 described species ranging from Sumatra to Samoa, and from the Philippines to New Caledonia. To date, 50 species of *Trigonopterus* have formally been described from New Guinea, the center of its diversity. The majority of these species were described from the Papuan peninsula (Faust 1898, 1899) and from the Sattelberg area of the Huon peninsula (Voss 1960), both in present day Papua New Guinea.

We have previously established that *Trigonopterus* are suitable for accelerated taxonomic study combining morphology and the DNA barcoding approach using mitochondrial *cox1* data (Riedel et al. 2010; Tänzler et al. 2012). *Trigonopterus* species were clearly delineated by both molecular data (nuclear as well as mitochondrial sequences) and morphology, and both data sets were fully compatible. These preliminary surveys already resulted in the recognition of 279 *Trigonopterus* species from seven localities across New Guinea. Most of these were undescribed. DNA barcoding is recommended as an identification tool for *Trigonopterus* since the sequence data in a dynamic identification engine represent an efficient substitute for a traditional species-level key. Considering the high proportion of unknown and usually morphologically similar species both traditional dichotomous keys and computer-based interactive keys would be of very limited use. In the following we provide short diagnostic descriptions with photographs of habitus and male genitalia. In keeping these descriptions concise, it is possible to increase the number of species treated dramatically. This study demonstrates that the taxonomy of hyperdiverse groups can be tackled with the combination of DNA-barcoding and taxonomic expertise. Such work does neither proceed at lightning speed, nor can it be fully automated. However, fully embracing technological development, work can be sped up and results are more sustainable. Significant workloads can be trusted to technicians and students, while the taxonomist can focus on the actual comparative taxonomic work.

Some of the historic *Trigonopterus* species from New Guinea were revised by Riedel (2011). Types of all relevant Papuan species have been examined and additional revisions of the previously described species are in preparation. In the following, we concentrate on species which are not closely related to the ones already known to science. A selection of 101 species covering the morphological diversity of Papuan *Trigonopterus* is described below providing a scaffold for ongoing, future work on this genus.

Materials and methods

This study is based on a selection of 101 out of 279 species recognized by Tänzler et al. (2012). The number of 101 species was chosen as large enough to cover a major portion of diversity and small enough to complete the task within the scheduled time frame in 2012. Species represented only by females were not included in this selection. Care was taken that all major groups are represented, based on our unpublished phylogenetic analysis. Moreover, we describe some clades of closely related species to demonstrate that our technique also works well for these. Four cryptic species (*T. granum* sp. n., *T. imitatus* sp. n., *T. pseudogranum* sp. n., and *T. velaris* sp. n.) are here described; they differ only in minor morphological characters but exhibit a marked genetic divergence (9.9–13.9 % uncorrected *p*-distance in our *cox1* fragment). In all, 50 species of *Trigonopterus* were previously known from the Papuan region, and three of these species could be identified with confidence in our full dataset. Many of the other previously described species have type series of mixed species which requires additional taxonomic work. This will be done in the near future after the completion of ongoing field campaigns might reveal fresh specimens for study. Species resembling the historic described species were excluded to avoid the risk of creating synonyms. Therefore, species from the Papuan and the Huon peninsula are somewhat underrepresented here.

Holotypes were selected from the sequenced specimens of Tänzler et al. (2012); their DNA had been extracted nondestructively as described by Riedel et al. (2010) and in our laboratory wiki (http://zsm-entomology.de/wiki/The_Beetle_D_N_A_Lab). The genitalia of most specimens did not require maceration after DNA-extraction; they could be directly stained with an alcoholic Chlorazol Black solution and stored in glycerol in microvials attached to the pin of the specimens. Genitalia of collection specimens or specimens whose abdominal muscle tissue was not sufficiently digested after DNA extraction were macerated with 10% KOH and rinsed in diluted acetic acid before staining. Illustrations of habitus and genitalia were prepared from holotypes. Finally, type series were supplemented with specimens stored in ethanol and older material from the dry collection. As always the case in paratypes, there is a chance that some of these are incorrectly assigned; this is especially true for specimens without sequence-data as an identification based on external morphological characters is more prone to error than an identification based on a *cox1* sequence (Tänzler et al. 2012). Altogether, the selection of 101 species herein is represented by 4,624 specimens. Type depositories are cited using the following codens:

ARC	Alexander Riedel Collection, stored in SMNK, Germany.
MZB	LIPI Research Center of Biology, Division of Zoology, Museum Zoologicum Bogoriense, Widyasatwaloka, Cibinong, Indonesia.
NAIC	National Agriculture Insect Collection, Kilakila, Port Moresby, Papua New Guinea.
NHMB	Naturhistorisches Museum Basel, Switzerland.
NKME	Naturkundemuseum Erfurt, Germany.
SMNK	Staatliches Museum für Naturkunde, Karlsruhe, Germany.
ZSM	Zoologische Staatssammlung, München, Germany.

The methods applied for DNA sequencing and sequence analysis are described by Riedel et al. (2010) and Tänzler et al. (2012).

Morphological descriptions are limited to major diagnostic characters. For example, the aedeagus often bears characters suitable to separate closely related species and is therefore illustrated and briefly described. Tegmen and sternite VIII of males show peculiar characters in some species, but these are usually not species-specific. Therefore, they are omitted from the diagnostic descriptions. Measurements such as length / width ratio of elytra or pronotum are avoided and can be taken from the photographs if needed. Identification of females is difficult and is best done based on *cox1*-sequences. Illustrations of female genitalia would alleviate this situation only marginally and the time required to prepare the relevant illustrations did not appear justified. Negative character states (i.e. the absence of a character) are only mentioned explicitly where it appears appropriate. For example, there are few species with swollen or denticulate epistome. In these cases the character state is described, but for the majority of species with simple epistome it is not mentioned. Common practice would require to state explicitly "epistome simple". Although formally accurate, in groups comprising hundreds of species this leads to inflated descriptions that distract the reader from the important information by enumerating the absence of rare character states. Except in the case of cryptic species no mention is made of "closely related species", as their choice is highly subjective. The data provided by the *cox1*-sequences should be sufficient at the moment. At a later stage a phylogeny will be published based on several markers and then suitable subgroups may be formally named as subgenera.

Describing large numbers of new species belonging to the same genus makes the invention of suitable species epithets increasingly difficult. We propose a solution by naming ten species based on family names found in the phonebook of Papua New Guinea.

As proposed by Beutel and Leschen (2005) the terms "mesoventrite" / "metaventrite" are used instead of "mesosternite" / "metasternite", and "mesanepisternum" / "metanepisternum" instead of "mesepisternum" / "metepisternum". Descriptions were prepared using a Leica MZ16 dissecting microscope and a fluorescent desk lamp for illumination. Measurements were taken with the help of an ocular grid. The length of the body was measured in dorsal aspect from the elytral apex to the front of the pronotum. Legs were described in an idealized laterally extended position; there is a dorsal / ventral and an anterior / posterior surface. Habitus illustrations were compiled using the Automontage© software (Syncroscopy, Cambridge, UK) with a JVC KY70 camera (JVC Professional Products) adapted to a Leica Z6 APO (Leica Microsystems, Wetzlar, Germany). Photographic illustrations of genitalia were made using the same software / camera combination adapted to a Leica Diaplan, and for this purpose the genitalia were embedded in glycerol gelatin as described by Riedel (2005). Genitalia were photographed with their longitudinal axis somewhat lifted anteriorly, to adequately illustrate structures of the curved down apex. All photographs were enhanced using Adobe Photoshop CS2. However, care was taken not to obscure or alter any features of the specimens illustrated. Sequence data were submitted to the European Molecular Biology Laboratory (EMBL), and the accession numbers are provided under each species e.g. as "(EMBL # FN429236)".

Taxonomy

Trigonopterus Fauvel, 1862

http://species-id.net/wiki/Trigonopterus\according_to_Riedel_et_al_2013

Type-species: *Trigonopterus insignis* Fauvel, 1862, by monotypy.

Diagnosis. Fully apterous genus of Cryptorhynchinae. Length 1.5–6.0 mm. Rostrum in repose not reaching center of mesocoxa. Scutellum completely absent externally. Mesothoracic receptacle deep, posteriorly closed. Metanepisternum completely absent externally. Elytra with 9 striae (sometimes superficially effaced). Tarsal claws minute. Usually body largely unclothed, without dense vestiture. For additional information see http://species-id.net/wiki/Trigonopterus

Descriptions of the species

1. *Trigonopterus aeneipennis* Riedel, sp. n.

urn:lsid:zoobank.org:act:7746E1DE-0AFD-443A-A8D5-FBD6DD369F43
http://species-id.net/wiki/Trigonopterus_aeneipennis

Diagnostic description. Holotype, male (Fig. 1a). Length 1.74 mm. Color black; elytra and pronotum with greenish-bronze lustre; antenna and tarsi ferruginous. Body subovate; in dorsal aspect and in profile with weak constriction between pronotum and elytron. Rostrum with indistinct, irregular, longitudinal ridges. Pronotum with weak subapical constriction; densely punctate. Elytra with striae deeply impressed, intervals weakly costate, subglabrous. Meso- and metafemur ventrally weakly dentate. Metafemur subapically without stridulatory patch. Aedeagus (Fig. 1b) with apex extended, pointed; body in profile at middle with marked depression; transfer apparatus relatively complex, symmetrical; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 1.50–1.74 mm. Female rostrum dorsally subglabrous.

Material examined. Holotype (MZB): ARC0530 (EMBL # FN429236), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 3 exx, ARC0531 (EMBL # FN429237), same data as holotype; 2 exx, ARC0550 (EMBL # FN429256), S02°31.776', E140°30.215', 945 m, 21-XI-2007, sifted; 4 exx, ARC0564 (EMBL # FN429270), S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 785–945 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on a combination of the Latin adjective *aeneus* (of bronze) and the noun *penna* (wing, elytron) and refers to its coloration.

Notes. *Trigonopterus aeneipennis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 50" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spax" in the EMBL/GenBank/DDBJ databases.

2. *Trigonopterus aeneus* Riedel, sp. n.

urn:lsid:zoobank.org:act:469B5A6C-6773-4E35-8F0D-5CF4EE85D658
http://species-id.net/wiki/Trigonopterus_aeneus

Diagnostic description. Holotype, male (Fig. 2a). Length 1.91 mm. Color black with greenish-bronze lustre; antenna and tarsi ferruginous. Body subrhomboid; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum with weak median wrinkle; epistome simple. Eyes small. Pronotum with weak subapical constriction; disk sparsely punctate. Elytra with strial punctures distinct; intervals flat, subglabrous; interval 7 subapically costate, forming angulate ridge; sutural interval apically with knob. Meso- and metafemur ventrally weakly dentate. Metafemur subapically without stridulatory patch. Onychium ca. 1.8× longer than tarsomere 3. Aedeagus (Fig. 2b) with apex weakly asymmetrical; long median extension somewhat shifted to the left; transfer apparatus hook-shaped; ductus ejaculatorius with indistinct bulbus, torn off in holotype. **Intraspecific variation**. Length 1.63–1.91 mm. Female rostrum dorsally subglabrous, sparsely punctate.

Material examined. Holotype (SMNK): ARC1089 (EMBL # HE615719), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, S06°43.948', E144°59.856', 915 m, 26-IX-2009. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Simbu Prov.: 12 exx, ARC1090 (EMBL # HE615720), ARC1091 (EMBL # HE615721), same data as holotype; 1 ex, Haia, S06°41.624', E145°00.728', 960 m, 25-IX-2009, sifted; 1 ex, ARC1105 (EMBL # HE615734, Haia, S06°41.018', E145°00.995', 1090 m, 04-X-2009.

Distribution. Simbu Prov. (Haia). Elevation: 915–1090 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin adjective *aeneus* (of bronze) and refers to its coloration.

Notes. *Trigonopterus aeneus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 267" by Tänzler et al. (2012).

3. *Trigonopterus agathis* Riedel, sp. n.

urn:lsid:zoobank.org:act:C893B010-52FB-4D88-8049-5F688480488B
http://species-id.net/wiki/Trigonopterus_agathis

Diagnostic description. Holotype, male (Fig. 3a). Length 2.04 mm. Color black; legs and antenna ferruginous. Body subglobose; in dorsal aspect with weak constriction between pronotum and elytron; with more distinct constriction in profile. Rostrum in basal half with 3 ridges posteriorly continued to and uniting on forehead; apical half scabrous; epistome smooth, forming indistinct transverse ridge. Pronotum punctate-rugose, interspaces between punctures forming longitudinal wrinkles; with distinct subapical constriction. Elytra subglabrous, striae deeply impressed, intervals costate; apex extended ventrad, beak-shaped. Femora edentate. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Abdominal venter steeply flexed dorsad, concealed in elytral capsule. Aedeagus (Fig. 3b) with apex medially pointed; body in apical half with broad depression visible in lateral aspect; in basal half with x-shaped sclerite; subglabrous, with sparse indistinct setae; transfer apparatus markedly flagelliform, longer than body, curled, pointing apicad. **Intraspecific variation**. Length 1.86–2.04 mm.

Material examined. Holotype (MZB): ARC1688 (EMBL # HE615975), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Angkasa indah, S02°30.346', E140°42.087', 490 m, 28-VI-2010, sifted. Paratypes (SMNK): 4 exx, ARC1689 (EMBL # HE615976), same data as holotype.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 490 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Greek noun *agathis* (ball, globe) in apposition and refers to the species' habitus.

Notes. *Trigonopterus agathis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 109" by Tänzler et al. (2012).

4. *Trigonopterus agilis* Riedel, sp. n.

urn:lsid:zoobank.org:act:5CADDA0B-E91B-4A91-8140-44D3137E69EB
http://species-id.net/wiki/Trigonopterus_agilis

Diagnostic description. Holotype, male (Fig. 4a). Length 2.55 mm. Color black with slight bluish lustre; legs deep ferruginous, antenna light ferruginous. Body ovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally in basal half with median ridge, coarsely punctate and with sparse cream-colored scales; apically smooth, with small punctures. Eyes large. Pronotum dorsally densely punctate with minute punctures; laterally with larger punctures, anteriorly above procoxa squamose with subtriangular cream-colored scales. Elytra dorsally subglabrous, punctures minute, striae hardly visible; laterally strial punctures deep, lateral 5 striae distinct. Femora elongate, edentate. Profemur converging from base to apex. Metafemur with simple dorsoposterior edge; subapically without stridulatory patch. Tibiae simple, without rows or brushes of long setae. Metathoracic and abdominal venter with sparse cream-colored scales. Aedeagus (Fig. 4b) symmetrical, apically pointed; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.54–2.84 mm. Female rostrum dorsally subglabrous, in apical half with minute punctures.

Material examined. Holotype (MZB): ARC0488 (EMBL # FN429195), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.7', E140°30.3', 850–1000 m, 30-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 4 exx, ARC0489 (EMBL # FN429196), ARC0490 (EMBL # FN429197), same data as holotype; 2 exx, S02°31.7', E140°30.3', 860–1150 m, 21-XI-2007, beaten; 3 exx, S02°31.6', E140°30.4', 900–1100 m, 28-XI-2007, beaten; 5 exx, S02°31.6', E140°30.4', 1000–1200 m, 30-XI-2007, beaten;

5 exx, 950–1450 m, 03-X-1992; 1 ex, 1100–1600 m, 05-X-1991; 1 ex, 700–1400 m, 23-XII-2004; 5 exx, 300–1400 m, 10-VIII-1991.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 700–1100 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin adjective *agilis* (quick) and refers to the behavior of this species and its close relatives.

Notes. *Trigonopterus agilis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 14" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spm" in the EMBL/GenBank/DDBJ databases.

5. *Trigonopterus amplipennis* Riedel, sp. n.

urn:lsid:zoobank.org:act:7871593A-F435-4CFC-99C5-4A68F2BB589D
http://species-id.net/wiki/Trigonopterus_amplipennis

Diagnostic description. Holotype, male (Fig. 5a). Length 2.26 mm. Color black; tarsi and antenna ferruginous. Body subrhomboid; in dorsal aspect with marked constriction between pronotum and elytron; in profile with shallow constriction. Rostrum dorsally dull, with 3 irregular ridges, with rows of erect setae; epistome forming angulate ridge and median denticle. Pronotum with distinct subapical constriction, sparsely punctate with small setiferous punctures, behind subapical constriction scales larger, subclavate, yellowish. Elytra subglabrous, striae weakly impressed, with minute punctures, each puncture with minute seta; apex bordered by curved ridge, median suture incised. Femora edentate. Meso- and metatibia in basal half widened, subapically narrowed. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 5b) widening towards subtruncate, medially pointed apex; transfer apparatus flagelliform, curved, shorter than body; ductus ejaculatorius basally swollen, without bulbus. **Intraspecific variation**. Length 2.00–2.28 mm. Color of elytra and legs black or ferruginous. Female rostrum dorsally punctate-rugose, in apical half without setae; epistome simple.

Material examined. Holotype (MZB): ARC0556 (EMBL # FN429262), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.182', E140°30.542', 1510 m, 30-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 34 exx, ARC0557 (EMBL # FN429263), ARC0558 (EMBL # FN429264), ARC0559 (EMBL # HE615318), same data as holotype; 14 exx, S02°31.281', E140°30.535', 1420 m, 30-XI-2007, sifted; 7 exx (1 marked ARC0094), 1320 m, 23-XII-2004, sifted; 5 exx, 300–1400 m, 10-VIII-1991.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1320–1510 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on a combination of the Latin adjective *amplus* (wide) and the noun *penna* (wing, elytron) and refers to the basally widened elytra.

Notes. *Trigonopterus amplipennis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 40" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* span" in the EMBL/GenBank/DDBJ databases.

6. *Trigonopterus ancoruncus* Riedel, sp. n.

urn:lsid:zoobank.org:act:09FC1006-E9A6-41F7-B345-C97D58ECE178
http://species-id.net/wiki/Trigonopterus_ancoruncus

Diagnostic description. Holotype, male (Fig. 6a). Length 2.49 mm. Color black; antenna and tarsi ferruginous. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Eyes large. Rostrum medially with two rows of course squamiferous punctures; pair of lateral furrows with row of larger overlapping almond-shaped white scales. Pronotum densely punctate; dorsally punctures containing inconspicuous setae, anterolaterally with scattered white scales. Elytra with striae distinct; intervals flat, subglabrous, each with one row of minute punctures. Femora ventrally with acute tooth. Mesofemur and metafemur dorsally sparsely squamose with white scales. Metafemur subapically with stridulatory patch. Metatibia at middle curved ventrad, subapically with brush of long setae; uncus hook-like extended, curved ventrobasad. Aedeagus (Fig. 6b) with apodemes 2.5 × as long as body; sides of body weakly bisinuate, converging; apex extended, pointed, markedly curved ventrad, sinuate in profile; transfer apparatus flagelliform, subequal to body of aedeagus; ductus ejaculatorius without bulbus.

Material examined. Holotype (SMNK): ARC1115 (EMBL # HE615744), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009.

Distribution. Simbu Prov. (Haia). Elevation: ca. 1220–1450 m.

Biology. Collected by beating foliage in montane forest.

Etymology. This epithet is based on a combination of the Latin nouns *ancora* (anchor) and *uncus* (hook; tibial uncus) in apposition and refers to the species´ remarkable metatibia.

Notes. *Trigonopterus ancoruncus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 78" by Tänzler et al. (2012).

7. *Trigonopterus angulatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:08E94D6F-0D25-4ABD-AEF0-DA8726D4137E
http://species-id.net/wiki/Trigonopterus_angulatus

Diagnostic description. Holotype, male (Fig. 7a). Length 2.63 mm. Color black; antenna light ferruginous; tarsi and tibiae deep ferruginous. Body subovate-hexagoniform; in dorsal aspect with shallow constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with median and pair of submedian carinae; laterally somewhat flattened; with sparse suberect scales; epistome with transverse, angulate ridge. Pronotum with anterior margin curved dorsad, forming lateral angles; disk subglabrous, anteriorly densely coarsely punctate, towards sides forming edges; laterally in front and behind procoxa with cavity. Elytra subglabrous; intervals flat, with minute punctures; striae weakly incised on disk, towards glabrous sides forming edges; interval 7 subapically forming edge, apex angulate. Femora edentate.

Metafemur dorsally squamose with indistinct suberect scales; in apical third without transverse row of setae, subapically with stridulatory patch. Aedeagus (Fig. 7b) apically subangulate, median tip truncate; with complex, symmetrical transfer apparatus; ductus ejaculatorius with indistinct bulbus. **Intraspecific variation**. Length 2.60–2.63 mm. No female specimen available.

Material examined. Holotype (SMNK): ARC1088 (EMBL # HE615718), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, S06°41.216', E145°00.945', 965 m, 27-IX-2009, sifted. Paratype (NAIC): 1 ex, ARC1098 (EMBL # HE615727): PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, S06°40.976', E145°00.979', 1135 m, 27-IX-2009, sifted.

Distribution. Simbu Prov. (Haia). Elevation: 965–1135 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin adjective *angulatus* (with angles) and refers to the outline of its body in dorsal aspect.

Notes. *Trigonopterus angulatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 194" by Tänzler et al. (2012).

8. *Trigonopterus angustus* Riedel, sp. n.

urn:lsid:zoobank.org:act:0235E0EC-2D2D-4857-9720-33CA745EFB42
http://species-id.net/wiki/Trigonopterus_angustus

Diagnostic description. Holotype, male (Fig. 8a). Length 2.83 mm. Color black; legs and antenna ferruginous. Body elongate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum basally with distinct median and pair of submedian carinae, in apical ¼ relatively smooth, basally sparsely squamose. Pronotum densely punctate with large punctures except small glabrous area at center; interspaces smaller than puncture´s diameter. Elytra dorsally punctate with deep punctures; near base and along suture more densely punctate, punctation confuse; basal margin near elytral suture somewhat swollen and glabrous; striae impressed as fine lines; laterally punctation relatively sparse, behind humerus with row of deep punctures. Femora edentate. Profemur in basal third posteriorly with callus. Metafemur subapically without stridulatory patch. Aedeagus (Fig. 8b) apically subangulate, medially truncate, with pair of stout setae; body flattened, sides subparallel; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.24–2.83 mm. Body of females more slender. Female rostrum dorsally subglabrous, punctate, basally sparsely squamose. Female abdominal ventrites 1–2 flat.

Material examined. Holotype (MZB): ARC0626 (EMBL # FN429283), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.3', E140°30.4', 350–620 m, 19-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts: 4 exx, Sentani, ARC0455 (EMBL # FN429166), ARC0456 (EMBL # FN429167), ARC0479 (EMBL # FN429186), ARC0631 (EMBL # FN429286), S02°31.3', E140°30.5', 1200–1420 m, 30.XI.2007; 2 exx,

ARC0627 (EMBL # FN429284), ARC0630 (EMBL # FN429285), same data as holotype; 1 ex, Cyclops Mts, Angkasa indah ARC1693 (EMBL # HE615980), S02°30.355', E140°42.103' to S02°30.346', E140°42.087', 450–520 m, 28-VI-2010; 5 exx (1 marked as "ARC0046"), 950–1450 m, 03-X-1992; 3 exx, 400–800 m, 07-VIII-1992; 1 ex, 1100–1600 m, 05-X-1991; 2 exx, 300–1400 m, 10-VIII-1991; 6 exx, 1200–1400 m, 09-VIII-1992; 3 exx, Lereh, 500–1000 m, 26-I-1996.

Distribution. Jayapura Reg. (Cyclops Mts; Lereh). Elevation: 520–1200 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin adjective *angustus* (narrow) and refers to its habitus.

Notes. *Trigonopterus angustus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 12" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spl" in the EMBL/GenBank/DDBJ databases.

9. *Trigonopterus apicalis* Riedel, sp. n.

urn:lsid:zoobank.org:act:3071BA70-6556-4D6B-84D0-834C3CB54B99
http://species-id.net/wiki/Trigonopterus_apicalis

Diagnostic description. Holotype, male (Fig. 9a). Length 4.90 mm. Color black except basal half of elytron bright orange; tarsi and antenna ferruginous. Body elongate; in dorsal aspect with distinct constriction between pronotum and elytron. Rostrum slender, basally scabrous with distinct median ridge and pair of irregular submedian ridges, in apical 1/3 punctate. Pronotum large, subquadrate, densely punctate. Elytra densely punctate with small irregular punctures; striae partly impressed as fine lines, partly indistinct. Femora dentate with acute tooth. Profemur enlarged, subovate, posteriorly concave and polished, in basal third with callus. Metafemur subapically with stridulatory patch. Thoracic and abdominal venter concave, densely punctate, sparsely setose with thin erect setae. Aedeagus (Fig. 9b) with apodemes 3.0 × as long as body; apex rounded, at middle subtruncate; transfer apparatus flagelliform, stout, more than 2 × as long as body; ductus ejaculatorius basally swollen, without bulbus. **Intraspecific variation**. Length 4.08–4.90 mm. Female rostrum dorsally subglabrous, sparsely punctate, at base coarsely punctate. Male pronotum larger, with sides posteriorly almost straight; female pronotum smaller, with sides rather convex. Male elytra narrower, converging apicad; female elytra wider, lateral contour convex. Female abdominal venter flat, subglabrous, punctate, with sparse short recumbent setae.

Material examined. Holotype (SMNK): ARC1136 (EMBL # HE615765), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°39.905', E145°03.880' to S06°39.796', E145°03.873', 1220–1320 m, 01-X-2009. Paratypes (NAIC, SMNK, ZSM): Simbu Prov., Karimui Dist., Haia, Supa: 2 exx, ARC1137 (EMBL # HE615766), ARC1138 (EMBL # HE615767), same data as holotype; 1 ex, Haia, Supa station, S06°40.047', E145°03.464' to S06°39.905', E145°03.880', 1075–

1220 m, 01-X-2009, beaten; 1 ex, Haia, Supa station, S06°39.815', E145°03.169' to S06°39.609', E145°03.012', 1240–1450 m, 30-IX-2009, beaten.

Distribution. Simbu Prov. (Haia). Elevation: 1220–1240 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin adjective *apicalis* (pertaining to the apex) and refers to the species´ contrasting elytral coloration.

Notes. *Trigonopterus apicalis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 259" by Tänzler et al. (2012).

10. *Trigonopterus armatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:FF48AA13-61F6-40DA-A5E3-918590A8212B
http://species-id.net/wiki/Trigonopterus_armatus

Diagnostic description. Holotype, male (Fig. 10a). Length 3.53 mm. Color black; tarsi and antenna ferruginous. Body ovate; almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal third swollen, dorsally coarsely punctate and with indistinct median carina; apically shining, punctures more shallow, with longitudinal furrows. Pronotum densely punctate except along impunctate midline. Elytra punctate with small punctures, along basal margin with transverse row of deeper and denser punctures; striae impressed as fine lines; lateral stria behind humeri simple, not deepened. Profemur and mesofemur with anteroventral ridge ending abruptly 1/3 before apex. Metafemur with anteroventral ridge ending with bluntly angled tooth 1/3 before apex; with denticulate dorsoposterior edge; subapically with stridulatory patch. Mesotibia ventrally with spine in subapical 1/3, apically with premucro. Metatibia apically with uncus and larger subtriangular premucro. Aedeagus (Fig. 10b) with distinct, symmetrical transfer-apparatus; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.63–3.59 mm. Female rostrum basally simple, not swollen. Female mesotibia in subapical 1/3 simple, apically without premucro. Female metatibia without premucro.

Material examined. Holotype (MZB): ARC570 (EMBL#FN429273), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.0', E140°30.4', 700–900m, 02.XII.2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 9 exx, ARC0464 (EMBL # FN429174), ARC0496 (EMBL # FN429203), ARC0498 (EMBL # FN429205), S02°31.8', E140°30.5', 600–900 m, 28.XI.2007; 12 exx, S02°31.6', E140°30.4', 900–1100 m, 28-XI-2007, beaten; 2 exx, S02°31.6', E140°30.4', 1000–1200 m, 30-XI-2007, beaten; 1 ex, S02°31.7' E140°30.3', 860–1150 m, 21-XI-2007, beaten; 2 exx, S02°32.0', E140°30.4', 700–900 m, 02-XII-2007, beaten; 4 exx, 950–1450 m, 03-X-1992; 1 ex, S02°31.794', E140°30.190', 800–860 m, 21-XI-2007, "Mim2", beaten; 7 exx, 1100–1600 m, 05-X-1991; 1 ex, 1200–1400 m, 09-VIII-1992; 3 exx, 300–1400 m, 10-VIII-1991; 5 exx, 800–1000 m, 07-VIII-1992; 4 exx, 950–1450 m, 03-X-1992.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 860–1200 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin participle *armatus* (armed) and refers to the teeth of the male meso- and metatibia.

Notes. *Trigonopterus armatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 7" by Riedel et al. (2010), respectively "*Trigonopterus* spg" in the EMBL/GenBank/DDBJ databases.

11. *Trigonopterus ascendens* Riedel, sp. n.

urn:lsid:zoobank.org:act:9362791A-D087-4D72-80AE-2D076BAFEF02
http://species-id.net/wiki/Trigonopterus_ascendens

Diagnostic description. Holotype, male (Fig. 11a). Length 2.55 mm. Color ferruginous; dorsal surface of head and pronotum black. Body subovate; in dorsal aspect with distinct constriction between pronotum and elytron; in profile with weak constriction. Rostrum densely punctate-reticulate, without longitudinal furrows or ridges. Eyes large, approximate. Pronotum coarsely punctate-reticulate. Elytra densely striate-punctate; striae deeply impressed; intervals each with dense row of deeply impressed punctures, similar to striae; interspaces costate, subglabrous. Femora edentate. Metafemur subapically with stridulatory patch. Aedeagus (Fig. 11b) apically subangulate, subglabrous; transfer apparatus spiniform, long, subequal to body; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.52–2.64 mm. Female rostrum dorsally in apical half with punctures usually isolated.

Material examined. Holotype (MZB): ARC1767 (EMBL # HE616044), WEST NEW GUINEA, Jayawijaya Reg., Poga, S03°47.575', E138°33.155' to S03°47.473', E138°33.163', 2620–2715 m, 15-VII-2010. Paratypes (SMNK, ZSM): 21 exx, ARC1768 (EMBL # HE616045), ARC1769 (EMBL # HE616046), same data as holotype.

Distribution. Jayawijaya Reg. (Poga). Elevation: ca. 2620–2715 m.

Biology. Beaten from foliage of upper montane forests.

Etymology. This epithet is based on the Latin participle *ascendens* (climbing up) and refers to its occurrence on higher elevations.

Notes. *Trigonopterus ascendens* Riedel, sp. n. was coded as "*Trigonopterus* sp. 169" by Tänzler et al. (2012).

12. *Trigonopterus augur* Riedel, sp. n.

urn:lsid:zoobank.org:act:215ECCF4-792A-4809-BC55-2E702B970739
http://species-id.net/wiki/Trigonopterus_augur

Diagnostic description. Holotype, male (Fig. 12a). Length 4.24 mm. Color black; antenna partly ferruginous. Body ovate; in dorsal aspect and in profile with constriction between pronotum and elytron. Rostrum slender, dorsally with distinct median carina and sublateral ridges; furrows bordering ridges containing each one row of mesad directed white narrow scales; subapically shining, punctate, setose. Eyes large.

Pronotum large, subglabrous, with minute punctures, in basal half sides separated by densely punctate edge. Elytra punctate with minute punctures; striae impressed as fine lines; basal margin bisinuate, bordered by row of large punctures continued behind humeri. Profemur large, anteriorly at middle with large tooth. Mesofemur and metafemur dorsally densely squamose with white scales; with anteroventral ridge at middle with inconspicuous tooth. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Aedeagus (Fig. 12b) apically weakly pointed; ductus ejaculatorius near insertion to transfer apparatus swollen, subapically with weak bulbus. **Intraspecific variation**. Length 3.28–4.16 mm. Female rostrum dorsally largely subglabrous, with submedian rows of minute punctures; in basal 1/5 punctate-rugose, with white recumbent scales.

Material examined. Holotype (MZB): ARC0444 (EMBL # FN429155), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.685', E140°30.430', 1010m, 28-XI-2007, beaten. Paratypes (ARC, NHMB, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 1 ex, ARC0445 (EMBL # FN429156), same data as holotype; 1 ex, ARC0658 (EMBL # FN429305), S02°31.794', E140°30.190', 800–860 m, 21-XI-2007, “Mim2”, beaten; 16 exx, ARC0666 (EMBL # FN429313), ARC0667 (EMBL # FN429314), S02°31.6', E140°30.4', 900–1100 m, 28-XI-2007, beaten; 3 exx, 1100–1600 m, 05-X-1991; 1 ex, 300–1400 m, 10-VIII-1991; 1 ex, 800–1000 m, 07-VIII-1992; 6 exx (1 marked as “ARC0130”), 950–1450 m, 03-X-1992; 2 exx, Lake Sentani, III-1992, 300 m.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 300–1200 m.

Biology. Collected by beating foliage in montane forest.

Etymology. This epithet is based on the Latin noun *augur* in apposition and refers to the large eyes that help the species to see birds, presumably important predators.

Notes. *Trigonopterus augur* Riedel, sp. n. was coded as “*Trigonopterus* sp. 21” by Riedel et al. (2010) and Tänzler et al. (2012), respectively “*Trigonopterus* spu” in the EMBL/GenBank/DDBJ databases.

13. *Trigonopterus balimensis* Riedel, sp. n.

urn:lsid:zoobank.org:act:3700C962-57D1-4014-87E8-3C0F2FCD6E7D
http://species-id.net/wiki/Trigonopterus_balimensis

Diagnostic description. Holotype, male (Fig. 13a). Length 2.58 mm. Color orange-ferruginous; pronotum and parts of head black. Body fusiform, almost without constriction between pronotum and elytron; in profile dorsally flat, towards apex convex. Rostrum with median costa flat, pair of submedian furrows containing sparse rows of mesad-directed setae. Pronotum subglabrous, punctate with small to minute punctures. Elytra subglabrous, punctation confused with small to minute punctures. Femora with anteroventral ridge terminating with tooth in apical third. Anteroventral ridge of mesofemur high, at middle with subangulate incision. Metafemur with crenulate dorsoposterior edge; subapically with stridulatory patch; posteroventral ridge at middle with knob. Mesotibia with dorsal edge pushed forward, apex slightly curved ventrad. Abdominal ventrite 1 besides metacoxa with brush of erect scales. Aedeagus (Fig. 13b) with body subrectangular; apex with pair of long pointed brushes; transfer-apparatus complex, symmetrical; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.11–2.96 mm. Female mesofemur with evenly denticulate anteroventral ridge, without incision at middle. Posteroventral ridge of female metafemur simple. Female mesotibia straight. Abdominal ventrite 1 besides metacoxa simple.

Material examined. Holotype (MZB): ARC0752 (EMBL # HE615435), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°57.043', E138°57.410', 1920–1950 m, “Mim 3”, 26-XI-2007. Paratypes (ARC, SMNK, NHMB, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 45 exx, ARC0753 (EMBL # HE615436), ARC0754 (EMBL # HE615437), same data as holotype; 34 exx, Jiwika, Kurulu, S03°56.146', E138°57.710', 2245–2290 m, “Mim 4”, 26-XI-2007; 35 exx, Jiwika, Kurulu, S03°56.5', E138°57.1', 1900–2245 m, 26-XI-2007; 45 exx, Jiwika, Kurulu, S03°57.161', E138°57.357', 1875 m, 11-VII-2010, sifted; 135 exx, Jiwika, Kurulu, S03°57.161', E138°57.357' to S03°56.977', E138°57.441', 1875–1990 m, 12-VII-2010; 2 exx, ARC1711 (EMBL # HE615991), ARC1712 (EMBL # HE615992), Jiwika, Kurulu, S03°57.161', E138°57.357' to S03°56.977', E138°57.441', 1875–1990 m, 12-VII-2010; 73 exx (1 marked ARC0034), Jiwika, Kurulu, 1800–2300 m, 31-V-1998; 20 exx, Jiwika, Kurulu, 1700–2300 m, 02-IX-1991; 9 exx, Jiwika, Kurulu, 1700–2300 m, 06-IX-1991; 15 exx, Jiwika, 1750–2100 m, 05-VII-1994; 18 exx, Jiwika, Kurulu, trail to Wandanku, 2240–2420 m, 28-IX-1996; 17 exx, Jiwika, Kurulu, trail to Wandanku, 1900–2150 m, 28-29-IX-1996; 19 exx, Jiwika, Kurulu, 1900–2300 m, 29-IX-1992; 6 exx, Jiwika, 1700–2100 m, 05-XII-1995; 14 exx, Jiwika, 1700–2000 m, 11-IX-1991; 4 exx, Jiwika, trail to Wandanku, 2240–2420 m, 28-IX-1996; 1 ex, Jiwika, 2300 m, 1992; 69 exx, Baliem-vall., ca. 1700 m, III-1992.

Distribution. Jayawijaya Reg. (Jiwika). Elevation: 1875–2240 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on the name of the Balim-river area which is close to the type locality.

Notes. *Trigonopterus balimensis* Riedel, sp. n. was coded as “*Trigonopterus* sp. 172” by Tänzler et al. (2012). At the time, it was lumped with a closely related but distinct species from Poga and Lake Habbema.

14. *Trigonopterus basalis* Riedel, sp. n.

urn:lsid:zoobank.org:act:72AD61FF-7493-4F5F-953F-A5A5F47C4A50
http://species-id.net/wiki/Trigonopterus_basalis

Diagnostic description. Holotype, male (Fig. 14a). Length 2.42 mm. Color black; base of elytra and legs ferruginous; antenna light ferruginous. Body subovate; in dorsal aspect with marked constriction between pronotum and elytron; in profile almost evenly convex. Rostrum dorsally scabrous, basally with indistinct median ridge;

epistome forming angulate ridge. Pronotum moderately densely punctate. Elytra with striae marked by small punctures; interval 4 basally with cluster of few subovate, cream-colored, recumbent scales; interval 7 subapically forming indistinct ridge. Meso- and metafemur with anteroventral ridge weakly dentate. Meso- and metatibia in basal half widened, subapically narrowed; dorsal edge basally granulate; uncus large, peg-shaped. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 14b) with sides of body in apical third converging, apex rounded; orifice retracted; endophallus denticulate; transfer apparatus symmetrical; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.98–2.48 mm. Female rostrum dorsally subglabrous in apical half, with small punctures, epistome simple.

Material examined. Holotype (MZB): ARC0523 (EMBL # FN429229), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts: 4 exx, ARC0524 (EMBL # FN429230), same data as holotype; 16 exx, ARC0532 (EMBL # FN429238), Doyo, S02°32.478', E140°28.835', 365 m, 27-XI-2007, sifted; 2 exx, Sentani, S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted; 5 exx (1 marked "ARC0105"), Sentani, 600 m, 22-XII-2004, sifted; 1 ex, Sentani, 700 m, 22-XII-2004, sifted; 17 exx, Sentani, S02°32.221', E140°30.526', 575 m, 19-XI-2007, sifted; 1 ex, Sentani, S02°32.166' E140°30.512', 620 m, 19-XI-2007, sifted; 3 exx, Sentani, S02°32.291', E140°30.505', 515 m, 19-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 365–785 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin adjective *basalis* (characterized by the base) and refers to the elytral base differing in color and vestiture from the remainder.

Notes. *Trigonopterus basalis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 42" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spap" in the EMBL/GenBank/DDBJ databases.

15. *Trigonopterus conformis* Riedel, sp. n.

urn:lsid:zoobank.org:act:D8E785F7-96B2-4427-A91B-DF21B3743994
http://species-id.net/wiki/Trigonopterus_conformis

Diagnostic description. Holotype, male (Fig. 15a). Length 3.34 mm. Color black, legs deep ferruginous, antenna lighter ferruginous. Body ovate; almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally tricarinate, with distinct median and pair of lateral carinae. Pronotum densely punctate. Elytra densely punctate; strial punctures slightly larger than minute punctures on intervals; striae impressed as fine lines; lateral stria behind humeri simple, not deepened. Femora edentate. Metafemur with denticulate dorsoposterior edge; subapically with stridulatory patch. Mesotibia simple, in basal half dorsal contour denticulate, but without distinct angulation. Metatibia with minute premucro; without suprauncal projection. Aedeagus (Fig. 15b) apically subangulate; dorsum sublaterally sparsely setose; transfer apparatus dentiform, short; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 3.31–3.34 mm. No female specimen available.

Material examined. Holotype (MZB): ARC1794 (EMBL # HE616071), WEST NEW GUINEA, Jayawijaya Reg., Bokondini, S03°41.787', E138°40.229' to S03°41.778', E138°40.129', 1705–1710 m, 17-VII-2010. Paratype (SMNK): 3 exx, ARC1795 (EMBL # HE616072), ARC2347 (EMBL # HF548203), ARC2348 (EMBL # HF548204) same data as holotype.

Distribution. Jayawijaya Reg. (Bokondini). Elevation: ca. 1705–1710 m.

Biology. Beaten from foliage of montane forest.

Etymology. This epithet is based on the Latin adjective *conformis* (like, similar) and refers to the similarity of this species, both to some closely related sibling species, and to others of only superficial resemblance.

Notes. *Trigonopterus conformis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 86" by Tänzler et al. (2012).

16. *Trigonopterus constrictus* Riedel, sp. n.

urn:lsid:zoobank.org:act:DB8A37EA-E484-49ED-9D6A-4EE6AF3473C5
http://species-id.net/wiki/Trigonopterus_constrictus

Diagnostic description. Holotype, male (Fig. 16a). Length 2.55 mm. Color dark brown; antenna, tarsi, and elytra ferruginous. Body dull, microreticulate; subovate; in dorsal aspect with marked constriction between pronotum and elytron; in profile with shallow constriction. Rostrum sparsely punctate, with sublateral pair of furrows; epistome simple. Eyes large, divided into dorsal and ventral portions by marked incision of posterior margin. Pronotum with distinct subapical constriction; densely punctate with deep punctures; each puncture with one elongate-ovate, ochre scale. Elytra with striae deeply incised; intervals costate, each with one row of narrow scales. Metafemur subapically without stridulatory patch. Tibial apex with stout uncus and minute premucro. Onychium ca. 2.3 × longer than tarsomere 3. Aedeagus (Fig. 16b) with sides of apical half converging to apex, in profile markedly curved; transfer apparatus tubuliform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.55–2.63 mm. Color with ferruginous elytra or entirely brown.

Material examined. Holotype (MZB): ARC1731 (EMBL # HE616008), WEST NEW GUINEA, Jayawijaya Reg., Poga, S03°47.406', E138°35.507', 2410 m, 14-VII-2010, sifted. Paratypes (SMNK): WEST NEW GUINEA, Jayawijaya Reg., Poga: 1 ex, ARC1724 (EMBL # HE616004), S03°48.382', E138°34.780'; 2330 m, 13-VII-2010, sifted.

Distribution. Jayawijaya Reg. (Poga). Elevation: 2330–2410 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Latin participle *constrictus* (constricted) and refers both to the constriction of the eye and the body between pronotum and elytron.

Notes. *Trigonopterus constrictus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 54" by Tänzler et al. (2012).

17. *Trigonopterus costatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:8640F855-706A-4462-9BB0-F50993518DCD
http://species-id.net/wiki/Trigonopterus_costatus

Diagnostic description. Holotype, male (Fig. 17a). Length 2.12 mm. Color black; antenna light ferruginous; legs deep ferruginous. Body subovate, with shallow constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half medially carinate, with pair of sublateral furrows posteriorly converging on forehead; weakly punctate, sparsely setose; epistome with transverse, angulate ridge. Pronotum with subapical constriction dorsally distinct, laterally indistinct; disk with longitudinal impressions, sparsely punctate, sparsely setose. Elytra with striae deeply incised, towards sides with deep interspersed punctures; intervals costate-carinate, subglabrous, with sparsely setose with minute recumbent setae; apex rounded. Femora edentate. Metafemur with simple dorsoposterior edge, in apical third with transverse row of small suberect setae, subapically with stridulatory patch. Abdominal ventrite 5 basally with pair of teeth. Aedeagus (Fig. 17b) apically subangulate, glabrous; with complex, symmetrical transfer apparatus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.06–2.12 mm. Female rostrum in basal half with median carina less distinct.

Material examined. Holotype (MZB): ARC0767 (EMBL # HE615450), WEST NEW GUINEA, Manokwari, Mt. Meja, S00°51.497', E134°04.949', 220 m, 05-XII-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Manokwari, Mt. Meja: 2 exx, ARC766 (EMBL # HE615449), ARC0768 (EMBL # HE615451), same data as holotype; 6 exx, S00°51.400', E134°04.918', 225 m, 06-XII-2007, sifted; 1 Ex, 200 m, 30-XII-2004.

Distribution. Manokwari Reg. (Mt. Meja). Elevation: 220–225 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is based on the Latin adjective *costatus* (ribbed) and refers to the elytral sculpture.

Notes. *Trigonopterus costatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 202" by Tänzler et al. (2012).

18. *Trigonopterus costicollis* Riedel, sp. n.

urn:lsid:zoobank.org:act:68D95F06-54A5-4B9E-90FD-9D0F12AE70D0
http://species-id.net/wiki/Trigonopterus_costicollis

Diagnostic description. Holotype, male (Fig. 18a). Length 2.80 mm. Color black; tarsi and antenna ferruginous. Body elongate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum with median costa and pair of submedian costae, furrows between with sparse rows of suberect scales; epistome flat. Pronotum with marked subapical constriction, anteriorly densely punctate; disk sparsely punctate, deeply sculptured, with median ridge and pair of broad submedian ridges; behind constriction anteriorly with pair of lateral angular protrusions. Elytra subglabrous except basally striae 1–3 with each one fovea; remaining striae indistinct, marked by minute punctures; apex rounded. Femora edentate. Metafemur subapically with stridulatory patch. Tarsomere 3 small, hardly larger than preceding, onychium ca. 2.1 × longer than tarsomere 3. Aedeagus (Fig. 18b) apically angulate, sparsely setose; transfer-apparatus flagelliform; ductus ejaculatorius with indistinct bulbus.

Material examined. Holotype (SMNK): ARC1094 (EMBL # HE615723), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, S06°43.948', E144°59.856', 915 m, 26-IX-2009, sifted.

Distribution. Simbu Prov. (Haia). Elevation: 915 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is a combination of the Latin nouns *costa* (rib, ridge) and *collum* (neck; pronotum) refers to the sculpture of its pronotum.

Notes. *Trigonopterus costicollis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 166" by Tänzler et al. (2012).

19. *Trigonopterus crassicornis* Riedel, sp. n.

urn:lsid:zoobank.org:act:C9B21DA1-F32C-4E44-8F9A-4632D30DEE1B
http://species-id.net/wiki/Trigonopterus_crassicornis

Diagnostic description. Holotype, male (Fig. 19a). Length 2.39 mm. Color orange-ferruginous; pronotum and parts of head black. Body subrhomboid, almost without constriction between pronotum and elytron; in profile dorsally flat, towards apex convex. Rostrum without median ridge, basally swollen and densely punctate, sparsely setose. Antenna with funicle swollen, continuous with club. Pronotum subglabrous, sparsely punctate with small to minute punctures. Elytra subglabrous, punctation confused with small to minute punctures. Profemur with anteroventral ridge terminating with tooth in apical third. Mesofemur with anteroventral ridge irregularly serrate; posteroventral ridge in apical half, terminating with rectangular protrusion. Metafemur laterally flattened; dorsally sparsely squamose with silvery scales; anteroventral ridge distinct; dorsoposterior edge simple; subapically with stridulatory patch. Uncus of metatibia small. Aedeagus (Fig. 19b). Body with sides converging; apex medially weakly extended, sublaterally with pair of sparse setose brushes; transfer-apparatus complex, symmetrical; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.22–2.85 mm. Female rostrum dorsally subglabrous with pair of submedian row of small punctures. Female antennal funicle less swollen. Female mesofemur along posteroventral edge simple, without rectangular protrusion.

Material examined. Holotype (MZB): ARC0756 (EMBL # HE615439), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°56.146', E138°57.710', 2245–2290 m, "Mim 4", 26-XI-2007. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 3 exx, ARC0757 (EMBL # HE615440), ARC0758 (EMBL # HE615441), same data as holotype; 72 exx, ARC1785 (EMBL # HE616062), ARC1786 (EMBL # HE616063), Bokondini, S03°40.345', E138°42.386' to S03°40.255', E138°42.189', 1655–1700 m, 18-VII-2010; 22 exx, ARC1788

(EMBL # HE616065), ARC1789 (EMBL # HE616066), Bokondini, S03°41.787', E138°40.229' to S03°41.778', E138°40.129', 1705–1710 m, 17-VII-2010; 2 exx (1 marked ARC00611), Ilugwa, Melanggama, 1900–2200 m, 09-12-IX-1990; 2 exx, Ilugwa, Melanggama, trail to Pass Valley, 2100–2300 m, 09-10-IX-1990; 3 exx, Jiwika, Kurulu, ca. 1700–2300 m, 06-IX-1991; 1 ex, Jiwika, 1800–2300 m, 31-V-1998.

Distribution. Jayawijaya Reg. (Jiwika, Ilugwa, Bokondini). Elevation: 1700–2245 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on a combination of the Latin adjective *crassus* (thick) and *cornu* (horn, antenna) and refers to the thickened antennal funicle.

Notes. *Trigonopterus crassicornis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 171" by Tänzler et al. (2012).

20. *Trigonopterus cuneipennis* Riedel, sp. n.

urn:lsid:zoobank.org:act:422E2A48-0075-4C84-AC2B-080BD7EF0185
http://species-id.net/wiki/Trigonopterus_cuneipennis

Diagnostic description. Holotype, male (Fig. 20a). Length 3.00 mm. Color black. Body slender, subrhomboid; without constriction between pronotum and elytron; in profile evenly convex. Rostrum in apical third smooth; in basal 2/3 with broad median costa and pair of sublateral ridges; furrows containing sparse row of setae. Eyes with dorsal margin carinate. Head bordering eye with elongate impression. Pronotum subglabrous, sparsely punctate with minute punctures. Elytra subglabrous, punctation confused with minute punctures; striae hardly visible, impressed as very fine lines; lateral stria behind humeri with row of ca. 5 deep punctures. Femora subglabrous, including dorsum of metafemur without scales. Mesofemur on posterior surface with longitudinal ridge. Metafemur on posterior surface with two longitudinal furrows; dorsally with smooth ridge; subapically without stridulatory patch. Meso- and metatibia subapically simple, with uncus, without premucro. Aedeagus (Fig. 20b). Apex symmetrical, with median acute extension; body dorsally with two rows of sparse short setae; transfer apparatus small, dentiform; endophallus without distinct sclerites; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.95–3.00 mm.

Material examined. Holotype (SMNK): ARC1839 (EMBL # HE616116), PAPUA NEW GUINEA, Eastern Highlands Prov., Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010. Paratypes (NAIC): PAPUA NEW GUINEA, Eastern Highlands Prov.: 1 ex, ARC1849 (EMBL # HE616126), Okapa, Kimiagomo village, Hamegoya, S06°25.727', E145°35.455', S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010.

Distribution. Eastern Highlands Prov. (Aiyura, Okapa). Elevation: 2131–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on a combination of the Latin nouns *cuneus* (wedge) and *penna* (wing, elytron) and refers to the shape of elytra.

Notes. *Trigonopterus cuneipennis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 96" by Tänzler et al. (2012).

21. *Trigonopterus cyclopensis* Riedel, sp. n.

urn:lsid:zoobank.org:act:2801D93B-6053-415C-B6FB-726952E07B33
http://species-id.net/wiki/Trigonopterus_cyclopensis

Diagnostic description. Holotype, male (Fig. 21a). Length 3.27 mm. Color black; legs deep ferruginous, antenna light ferruginous. Body ovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally densely rugose-punctate, in basal half with brown erect scales, in apical half sparsely setose. Eyes large. Pronotum densely punctate with subtriangular, setiferous punctures. Elytral striae distinct, marked by regular rows of small punctures; intervals with row of minute punctures; laterally behind humeri with ridge bordered by row of deep punctures of stria 8. Legs squamose with inconspicuous brownish scales. Femora with anteroventral ridge terminating in apical third. Metafemur with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Abdominal ventrite 5 at middle with shallow, subquadrate impression. Aedeagus (Fig. 21b) with apex subangulate; transfer-apparatus flagelliform, longer than body of aedeagus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.67–3.27 mm. Female rostrum in apical half with relatively small, sparse punctures. Abdominal ventrite 5 simple.

Material examined. Holotype (MZB): ARC478 (EMBL # FN429185), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.2', E140°30.5', 1420–1520 m, 30.XI.2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 5 exx, same data as holotype; 4 exx, ARC0423 (EMBL # FN429134), ARC0483 (EMBL # FN429190), ARC0674 (EMBL # FN429319), ARC0675 (EMBL # FN429320), S02°31.3', E140°30.5', 1200–1420 m, 30.XI.2007, beaten; 2 exx (1 marked as “ARC0409”), 1100–1600 m, 05-X-1991.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: ca. 1420 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the type locality, the Cyclops Mountains.

Notes. *Trigonopterus cyclopensis* Riedel, sp. n. was coded as “*Trigonopterus* sp. 5” by Riedel et al. (2010) and Tänzler et al. (2012), respectively “*Trigonopterus* spe” in the EMBL/GenBank/DDBJ databases.

22. *Trigonopterus dentirostris* Riedel, sp. n.

urn:lsid:zoobank.org:act:0026240A-0B72-4B1C-8DB9-7757D2C10530
http://species-id.net/wiki/Trigonopterus_dentirostris

Diagnostic description. Holotype, male (Fig. 22a). Length 1.65 mm. Color black; antenna and tarsi ferruginous. Body subovate; in dorsal aspect without constriction between pronotum and elytron; in profile with distinct constriction. Rostrum at base with median ridge and pair of submedian ridges; at middle with anteriorly hollowed protuberance dorsally bearing pair of denticles; between protuberance and epistome relatively flat, with sparse erect scales; epistome at middle with dorsoposteriad directed horn. Pronotum punctate-rugose, each puncture containing one narrow transparent scale; medially with indistinct ridge. Elytra with striae deeply impressed; punctures large, each containing one downcurved seta; intervals weakly costate, subglabrous. Metafemur dorsoposteriorly simple, subapically without stridulatory patch. Aedeagus (Fig. 22b). Body widening to shortly before apex; medially weakly extended; endophallus denticulate; transfer apparatus spiniform, curved; ductus ejaculatorius with weak bulbus. **Intraspecific variation**. Length 1.65–1.92 mm. Female rostrum dorsally even, without teeth or cavities, medially subglabrous, sublaterally punctate.

Material examined. Holotype (MZB): ARC0538 (EMBL # FN429244), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 2 exx, ARC0544 (EMBL # FN429250), S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted; 6 exx, ARC0545 (EMBL # FN429251), Sentani, S02°31.776', E140°30.215', 945 m, 21-XI-2007, sifted; 1 ex, Sentani, S02°31.603', E140°30.434', 1095 m, 28-XI-2007, sifted; 2 exx, Sentani, 950–1450 m, 03-X-1992; 6 exx (1 marked ARC0026), Sentani, 1000 m, 23-XII-2004, sifted; 1 ex, Sentani, 1100 m, 23-XII-2004, sifted; 3 exx, ARC1690 (EMBL # HE615977), ARC1691 (EMBL # HE615978), Angkasa indah, S02°30.346', E140°42.087', 490 m, 28-VI-2010, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 490–1095 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on a combination of the Latin nouns *dens* (tooth) and *rostrum* (snout) and refers to the dorsal protrusions of the rostrum.

Notes. *Trigonopterus dentirostris* Riedel, sp. n. was coded as "*Trigonopterus* sp. 49" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spaw" in the EMBL/GenBank/DDBJ databases.

23. *Trigonopterus discoidalis* Riedel, sp. n.

urn:lsid:zoobank.org:act:17DF68F9-C2DC-43E8-A0EC-03FB104DFD37
http://species-id.net/wiki/Trigonopterus_discoidalis

Diagnostic description. Holotype, male (Fig. 23a). Length 2.20 mm. Color black; legs ferruginous, antenna light ferruginous. Body subglobose; in dorsal aspect with weak constriction between pronotum and elytron; in profile almost evenly convex. Rostrum with pair of sublateral furrows and pair of submedian row of punctures, each containing row of mesally directed setae; epistome simple. Pronotum with large disk and distinct lateral edges; moderately densely punctate with small setiferous punctures. Elytra converging to subangulate apex; striae distinct, marked by small punctures; intervals subglabrous, with row of minute punctures; some punctures with one minute recumbent seta. Metafemur with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Abdominal ventrites 1–2 deeply excavated. Aedeagus (Fig.

23b) with body flattened, sides subparallel, apex subangulate; apodemes ca. 3 X as long as body; transfer-apparatus spiniform; ductus ejaculatorius, without bulbus. **Intraspecific variation**. Length 1.68–2.43 mm. Female rostrum more slender than in males, dorsally punctures smaller.

Material examined. Holotype (SMNK): ARC1175 (EMBL # HE615803), PAPUA NEW GUINEA, Morobe Prov., Huon peninsula, Mindik, S06°27.311', E147°24.073', 1570 m, 10-X-2009. Paratypes (ARC, NAIC, SMNK, ZSM): Morobe Prov., Huon peninsula, Mindik: 5 exx, same data as holotype; 12 exx, ARC1179 (EMBL # HE615807), ARC1180 (EMBL # HE615808), S06°27.221', E147°24.185', 1670 m, 10-X-2009; 5 exx, 1450 m, 26-IV-1998; 1 ex, 1400–1550 m, 27-IV-1998.

Distribution. Morobe Prov. (Mindik). Elevation: 1450–1670 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Latin adjective *discoidalis* (shaped like a disk) and refers to the species´ outline when viewed from above.

Notes. *Trigonopterus discoidalis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 88" by Tänzler et al. (2012).

24. *Trigonopterus dromedarius* Riedel, sp. n.

urn:lsid:zoobank.org:act:1B816F75-55CA-4F53-87F4-DA832747626D
http://species-id.net/wiki/Trigonopterus_dromedarius

Diagnostic description. Holotype, male (Fig. 24a). Length 3.31 mm. Color black; tarsi and tibiae dark ferruginous; antenna light ferruginous. Body subrhomboid; in dorsal aspect with marked constriction between pronotum and elytron; in profile with moderate constriction. Rostrum medially punctate, with pair of sublateral furrows converging posteriorly on forehead; epistome forming indistinct, angulate ridge. Pronotum with marked subapical constriction, sides subparallel, behind subapical constriction projecting with marked angular protrusions; center of disk densely punctate, laterally with sparse punctures. Elytra of subtriangular shape; median suture carinate; striae moderately impressed; intervals weakly punctate; surface weakly microreticulate, with sparse clusters of white recumbent scales; interval 7 subapically forming indistinct ridge. Femora edentate. Meso- and metatibia in basal half markedly widened, dorsal edge curved, denticulate. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Metathoracic and abdominal venter forming common concavity, subglabrous. Aedeagus (Fig. 24b) with body parallel-sided, markedly curved ventrad; apex medially extended; transfer apparatus spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 3.22–3.69 mm. Integument relatively smooth and with scattered white scales in specimens from Sentani, dull-coriaceous and almost nude in specimens from Angkasa indah. Aedeagus with median tip acute in specimens from Sentani, median tip more rounded in specimens from Angkasa indah.

Material examined. Holotype (MZB): ARC0512 (EMBL # FN429218), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts: 1 ex, ARC0534 (EMBL # FN429240), Sentani, S02°31.516', E140°30.436', 1150 m, 21-XI-2007, sifted; 2 exx, ARC0549 (EMBL # FN429255), Sentani, S02°31.776', E140°30.215', 945 m, 21-XI-2007, sifted; 2 exx, Sentani, S02°31.603', E140°30.434', 1095 m, 28-XI-07, sifted; 1 ex, Sentani, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted; 1 ex, ARC0092, Sentani,1000 m, 23-XII-2004, sifted; 1 ex, S02°31.425', E140°30.474', 1265 m, 30-XI-2007, sifted; 2 exx, ARC1684 (EMBL # HE615971), ARC1685 (EMBL # HE615972), Angkasa indah, S02°30.346', E140°42.087', 490 m, 28-VI-2010, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 490–1265 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the name of the dromedary camel (*Camelus dromedaries* L.) and refers to the body shape.

Notes. *Trigonopterus dromedarius* Riedel, sp. n. was coded as "*Trigonopterus* sp. 41" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spao" in the EMBL/GenBank/DDBJ databases. Specimens from Angkasa indah and Sentani exhibit minor morphological differences (e.g. tip of aedeagus; surface of integument) and a high *cox1* p-distance of 7.79%. These allopatric populations may be regarded "subspecies".

25. *Trigonopterus durus* Riedel, sp. n.

urn:lsid:zoobank.org:act:4D45A783-70C2-4DE5-B061-6B227AF90B5C
http://species-id.net/wiki/Trigonopterus_durus

Diagnostic description. Holotype, male (Fig. 25a). Length 3.69 mm. Color black; base of antennal scape ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum punctate-rugose, with pair of sublateral furrows. Eyes dorsally bordered by furrow. Pronotum subglabrous, densely punctate with minute punctures; disk subquadrate, rounded towards sides. Elytra tapering apicad; striae indistinct, marked by rows of small punctures; intervals flat, with confused minute punctures; elytral base with row of foveae continued laterally behind humeri bordering ridge. Femora subglabrous, edentate. Metafemur dorsally partly covered with silvery scales; with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Mesotibia and metatibia with inconspicuous straight premucro below tarsal insertion. Aedeagus (Fig. 25b) with sides of body basally converging, in apical 1/3 with weak constriction; apex with median, broad angular extension, sparsely setose; transfer apparatus spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 3.38–4.64 mm. Female rostrum slender, dorsally subglabrous, sparsely punctate with small punctures. Pronotum of males anteriorly subangulate, in females sides curving more evenly towards apex. Elytra of females shorter and dorsally rather convex; elytra of males apically slightly extended and dorsally slightly flattened.

Material examined. Holotype (MZB): ARC1790 (EMBL # HE616067), WEST NEW GUINEA, Jayawijaya Reg., Bokondini, S03°41.787', E138°40.229' to

S03°41.778', E138°40.129', 1705–1710 m, 17-VII-2010. Paratypes (ARC, SMNK, ZSM): 91 exx, ARC1791 (EMBL # HE616068), ARC1792 (EMBL # HE616069), same data as holotype; 6 exx, ARC1793 (EMBL # HE616070), Bokondini, S03°40.345', E138°42.386' to S03°40.255', E138°42.189', 1655–1700 m, 18-VII-2010; 85 exx, Angguruk, 1600–1700 m, 21-IX-1991; 1 ex, Angguruk, 1200–1500 m, 23-IX-1992; 2 exx, Angguruk – Tanggeam, 1500–1800 m, 28-29-IX-1991.

Distribution. Jayawijaya Reg. (Bokondini, Angguruk). Elevation: 1700–1710 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on the Latin adjective *durus* (hard, tough) and refers to the physical properties of the species. The name would be equally fitting many other species of this genus and should not be seen as diagnostic.

Notes. *Trigonopterus durus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 102" by Tänzler et al. (2012).

26. *Trigonopterus echinus* Riedel, sp. n.

urn:lsid:zoobank.org:act:A54F0EBB-1A80-4AFC-9550-3844181CD2F7
http://species-id.net/wiki/Trigonopterus_echinus

Diagnostic description. Holotype, male (Fig. 26a). Length 1.41 mm. Color black; antenna light ferruginous, club dark; legs and head dark ferruginous. Body subglobose; with distinct constriction between pronotum and elytron; in profile almost evenly rounded, with weak constriction between pronotum and elytron. Rostrum basally with indistinct, median ridge and pair of submedian ridges, sparsely setose; apical 1/3 subglabrous; epistome simple. Eyes small. Pronotum with weak subapical constriction; disk densely, coarsely punctate; each puncture with short, yellowish scale. Elytra with striae deeply incised; with suberect, yellowish scales; intervals subglabrous, markedly costate. Femora subapically ventrally constricted. Metafemur subapically with stridulatory patch. Protibia with long, hook-shaped uncus. Aedeagus (Fig. 26b) with apex rounded; transfer apparatus symmetrical, spiniform; ductus ejaculatorius with indistinct bulbus. **Intraspecific variation**. Length 1.28–1.54 mm. Female rostrum basally without ridges; apical half subglabrous. Suberect scales may be partly abraded.

Material examined. Holotype (MZB): ARC0781 (EMBL # HE615464), WEST NEW GUINEA, Manokwari, Arfak Mts, S01°04.087', E133°54.268', 1520 m, 08-XII-2007, sifted. Paratypes (SMNK, ZSM): 21 exx, ARC0782 (EMBL # HE615465), ARC0783 (EMBL # HE615466), same data as holotype; Mokwam, Siyoubrig, S01°06.107', E133°54.888', 1530 m, 10–XII-2007.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1520 m.

Biology. Sifted from leaf litter in montane forest dominated by *Nothofagus*.

Etymology. This epithet is based on the Latin noun *echinus* (hedgehog) in apposition and refers to the species´ general habitus and its suberect scales resembling spines.

Notes. *Trigonopterus echinus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 230" by Tänzler et al. (2012).

27. *Trigonopterus edaphus* Riedel, sp. n.

urn:lsid:zoobank.org:act:ACC1DBCF-2E5E-486D-A61F-0F6F6A6301FE
http://species-id.net/wiki/Trigonopterus_edaphus

Diagnostic description. Holotype, male (Fig. 27a). Length 1.48 mm. Color black; antenna light ferruginous; legs deep ferruginous. Body subglobose, in dorsal aspect with marked constriction between pronotum and elytron; dorsally flattened; anteriorly profile almost straight, convex at apex. Rostrum coarsely rugose-punctate; epistome forming distinct, transverse ridge. Pronotum coarsely punctate-reticulate. Elytra with striae deeply incised, with sparse rows of setae; intervals costate, subglabrous, with few minute punctures; interval 7 subapically forming ridge, projecting dentiform; apex subangulate. Legs. Anteroventral ridge of meso- and metafemur ending in apical third, forming indistinct tooth. Metafemur dorsoposteriorly simple, subapically with stridulatory patch. Aedeagus (Fig. 27b) with apex subtruncate, slightly angulate; transfer apparatus spiniform, shorter than body of aedeagus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.32–2.02 mm. Body of females subovate. Female rostrum dorsally subglabrous, coarsely punctate; epistome simple. Female elytral apex laterally not dentiform.

Material examined. Holotype (MZB): ARC0737 (EMBL # HE615420), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°57.161', E138°57.357', 1875 m, 24-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu: 27 exx, ARC0738 (EMBL # HE615421), ARC0739 (EMBL # HE615422), ARC0740 (EMBL # HE615423), ARC0741 (EMBL # HE615424), ARC0742 (EMBL # HE615425), same data as holotype; 64 exx, S03°57.161', E138°57.357', 1875 m, 11-VII-2010, sifted; 8 exx (1 marked ARC0074), 1900–2050 m, 24-X.1993, sifted;12 exx, 1900–2000 m, 23-IX-1992, sifted; 3 exx, 1900–2050 m, 24-IX-1992, sifted; 2 exx, ca. 1700–2300 m, 02-IX-1991, sifted; 7 exx, 1700–2000 m, 11-IX-1991, sifted.

Distribution. Jayawijaya Reg. (Jiwika). Elevation: 1875–1900 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is the latinized form of the Greek word *edaphos* (soil, ground) and treated as an adjective. It refers to the habit of this litter-dwelling species.

Notes. *Trigonopterus edaphus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 224" by Tänzler et al. (2012).

28. *Trigonopterus eremitus* Riedel, sp. n.

urn:lsid:zoobank.org:act:A26056D8-6DDE-462D-973C-CB428A9B389F
http://species-id.net/wiki/Trigonopterus_eremitus

Diagnostic description. Holotype, male (Fig. 28a). Length 3.66 mm. Color black; tarsi and antenna ferruginous. Body ovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally with distinct median carina and sparse rows of upcurved scales; submedian ridges indistinct, irregular. Pronotum densely punctate except along impunctate midline. Elytra punctate with minute punctures, especially on intervals; strial punctures slightly larger; striae impressed as fine lines; lateral stria behind humeri simple, not deepened. Femora edentate. Metafemur with denticulate dorsoposterior edge; subapically with fine stridulatory patch. Metatibia apically with uncus, without premucro. Abdominal ventrite 5 flat, densely setose with suberect setae. Aedeagus (Fig. 28b) slightly asymmetrical; with distinct, asymmetrical transfer-apparatus; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 3.38–3.72 mm. Female rostrum dorsally in basal half with median and pair of submedian ridges, apical half punctate. Female abdominal ventrite 5 flat, sparsely setose with recumbent setae.

Material examined. Holotype (MZB): ARC426 (EMBL # FN429137), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.2', E140°30.5', 1420–1520 m, 30-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 9 exx, ARC0425 (EMBL # FN429136), ARC0427 (EMBL # FN429138), same data as holotype; 1 ex (marked as "ARC0411"), 1200–1400 m, 9-VIII-1992; 1 ex, 1100–1600 m, 5.X.1991.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1400–1420 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is the latinized form of the Greek noun *eremites* (hermit) and refers to the species´ restricted occurrence in the montane forests of the Cyclops Mountains.

Notes. *Trigonopterus eremitus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 6" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spf" in the EMBL/GenBank/DDBJ databases.

29. *Trigonopterus euops* Riedel, sp. n.

urn:lsid:zoobank.org:act:1F045C52-B021-418F-9CB5-6C2EBA36352F
http://species-id.net/wiki/Trigonopterus_euops

Diagnostic description. Holotype, male (Fig. 29a). Length 1.70 mm. Color of antenna, tarsi, tibiae, and rostrum ferruginous; head and pronotum black; elytra black, with ferruginous patches near base of intervals 2–4, continued to apex with irregular patches on intervals 1–4 to apex. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Eyes large. Rostrum punctate, without distinct longitudinal ridges; laterally with rows of cream-colored scales. Pronotum densely punctate-reticulate; with few scattered cream-colored scales; each puncture containing one brownish seta. Elytra with striae deeply impressed, intervals costate, with scattered white scales. Femora ventrally edentate, subapically constricted. Tibial uncus simple, curved. Metafemur subapically with stridulatory patch. Aedeagus (Fig. 29b) with sides of body sinuate, converging; apex extended, pointed, curved ventrad; transfer apparatus compact, symmetrical; ductus ejaculatorius basally swollen, without bulbus. **Intraspecific variation**. Length 1.63–1.86 mm. Ferruginous color of elytra more or less extensive. Female rostrum dorsally subglabrous, laterally punctate. Body of males rather slender, females slightly stouter.

Material examined. Holotype (MZB): ARC0784 (EMBL # HE615467), WEST NEW GUINEA, Manokwari Reg., Manokwari, Arfak Mts, S01°04.087', E133°54.268', 1520 m, 08-XII-2007. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Manokwari Reg., Manokwari, Arfak Mts: 6 exx, same data as holotype; 4 exx, ARC0775 (EMBL # HE615458), ARC0776 (EMBL # HE615459), S01°03.723', E133°54.145', 1385 m, 08-XII-2007; 2 exx, Mokwam, Siyoubrig, S01°06.107', E133°54.888', 1530 m, 10-XII-2007.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1385–1530 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Greek *euops* (well-sighted) and refers to the species´ relatively large eyes, at least by comparison with other edaphic species.

Notes. *Trigonopterus euops* Riedel, sp. n. was coded as "*Trigonopterus* sp. 53" by Tänzler et al. (2012).

30. *Trigonopterus ferrugineus* Riedel, sp. n.

urn:lsid:zoobank.org:act:64E0AF8A-8988-484C-AA0D-1B66A9C0CD10
http://species-id.net/wiki/Trigonopterus_ferrugineus

Diagnostic description. Holotype, male (Fig. 30a). Length 2.73 mm. Color black; elytra orange-red, apically changing to black. Body with distinct constriction between pronotum and elytron; in profile almost evenly convex. Rostrum dorsally relatively flat, sparsely punctate, dorsolaterally with pair of furrows continuing along eye, furrows containing row of mesad directed setae. Pronotum densely punctate with punctures of subtriangular shape, interspaces larger than puncture´s width. Elytra with striae distinct, dorsally punctures small, along base and laterally punctures large; interspaces subglabrous. Femora edentate. Metafemur with indistinct, simple dorsoposterior edge; subapically with stridulatory patch. Thoracic and abdominal venter partly with dense erect setae. Aedeagus (Fig. 30b) apically subangulate, with pair of sublateral setose brushes; transfer apparatus flagelliform, longer than body; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.73–2.85 mm. Female venter subglabrous, sparsely setose with short recumbent setae.

Material examined. Holotype (MZB): ARC0477 (EMBL # FN429184), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.2', E140°30.5', 1420–1520 m, 30-XI-2007, beaten. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 9 exx, ARC0475 (EMBL # FN429182), ARC0476 (EMBL # FN429183), same data as holotype; 1 ex, S02°31.3', E140°30.5', 1200–1420 m, 30-XI-2007; 1 ex, S02°31.182', E140°30.542', 1510 m, 30-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1420–1510 m.

Biology. Collected by beating foliage in montane crippled forests.

Etymology. This epithet is based on the Latin adjective *ferrugineus* (rusty, red-brown) and refers to the species´ elytra.

Notes. *Trigonopterus ferrugineus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 29" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spac" in the EMBL/GenBank/DDBJ databases.

31. *Trigonopterus fusiformis* Riedel, sp. n.

urn:lsid:zoobank.org:act:863A0812-1FB3-4C7D-906B-B701FEB19B4A
http://species-id.net/wiki/Trigonopterus_fusiformis

Diagnostic description. Holotype, male (Fig. 31a). Length 2.63 mm. Color black, legs and antenna ferruginous. Body subrhomboid; almost without constriction between pronotum and elytron; in profile dorsally flat, towards apex convex. Rostrum in apical half dorsally flattened, slightly widened, rugose-punctate; basal half markedly swollen in profile, narrow in dorsal aspect; with indistinct median ridge, densely punctate; dorsolaterally with pair of wide furrows containing erect narrow scales. Pronotum subglabrous, punctate, punctures becoming larger and denser towards apex. Elytra densely punctate; strial punctures slightly larger than minute punctures on intervals; striae impressed as fine lines. Anteroventral ridge of femora terminating with tooth in apical third; tooth largest in metafemur. Metafemur laterally markedly flattened; dorsally with row of silvery scales; posteroventral ridge indistinct, at middle with denticle; dorsoposterior edge weakly denticulate; subapically with stridulatory patch. Aedeagus (Fig. 31b). Body with sides subparallel, extended dorsad; profile of body subtriangular; apex subtruncate, subglabrous; transfer-apparatus complex, symmetrical; ductus ejaculatorius with bulbus. **Intraspecific variation**. No female specimen available.

Material examined. Holotype (MZB): ARC1807 (EMBL # HE616084), WEST NEW GUINEA, Jayawijaya Reg., Bokondini, S03°41.787', E138°40.229' to S03°41.778', E138°40.129', 1705–1710 m, 17-VII-2010. Paratype (SMNK): WEST NEW GUINEA, Jayawijaya Reg.: 1 ex, ARC1805 (EMBL # HE616082), Bokondini, S03°40.345', E138°42.386' to S03°40.255', E138°42.189′, 1655–1700 m, 18-VII-2010.

Distribution. Jayawijaya Reg. (Bokondini). Elevation: 1700–1705 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is a combination of the Latin noun *fusus* (spindle) and the suffix *-formis* (-shaped) and refers to the habitus of this species.

Notes. *Trigonopterus fusiformis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 107" by Tänzler et al. (2012).

32. *Trigonopterus glaber* Riedel, sp. n.

urn:lsid:zoobank.org:act:7FBAF1AD-D9B6-447F-B0D7-F4A2F83F8A43
http://species-id.net/wiki/Trigonopterus_glaber

Diagnostic description. Holotype, male (Fig. 32a). Length 1.98 mm. Color black, antenna and tarsi ferruginous. Body laterally somewhat compressed; ovate; without constriction between pronotum and elytron; in profile almost evenly convex. Rostrum dorsally in basal half with pair of sublateral furrows; medially even, sparsely punctate. Eyes large. Pronotum subglabrous. Elytra subglabrous, laterally sparsely punctate with small punctures, striae indistinct. Femora with anteroventral ridge. Profemur subparallel. Meso- and metafemur with dorsoposterior edge subapically worn; metafemur subapically without stridulatory patch. Tibiae simple, without rows or brushes of long setae. Metaventrite laterally forming acute process over metacoxa, reaching tibial insertion. Metaventrite and abdominal ventrite 1 subglabrous, with sparse recumbent setae. Abdominal ventrite 2 fused to and forming common cavity with ventrite 1. Abdominal ventrite 5 anteriorly with pair of distinct longitudinal protrusions, indistinct median cavity posteriorly open. Aedeagus (Fig. 32b) apically with median extension and with pair of submedian teeth; body with two conspicuous pairs of endophallic sclerites; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.98–2.18 mm. Female rostrum subglabrous except in basal ¼ with ridges. Female abdominal ventrite 5 flat.

Material examined. Holotype (SMNK): ARC0960 (EMBL # HE615593), PAPUA NEW GUINEA, Central Prov., Moroka area, Kailaki, Mt. Berogoro, S09°24.213', E147°33.870' to S09°23.647', E147°34.244', 500–600 m, 20-IX-2009. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Central Prov.: 1 ex, ARC0961 (EMBL # HE615594), same data as holotype; 8 exx, Moroka area, Kailaki, Mt. Berogoro, S09°24.213', E147°33.870' to S09°23.647', E147°34.244', 500–565 m, 26-X-2009; 4 exx, ARC0942 (EMBL # HE615575), ARC0943 (EMBL # HE615576), Varirata N.P., S09°26.150', E147°21.520' to S09°26.148', E147°21.361', 700–800 m, 19-IX-2009; 16 Ex, ARC0991 (EMBL # HE615624), Moroka area, Kailaki, Wariaga, S09°25.350', E147°31.047' to S09°25.403', E147°31.315', 650–820 m, 27-X-2009; 9 exx, Moroka area, Kailaki, Wariaga, S09°25.350', E147°31.047' to S09°25.683', E147°31.707', 650–920 m, 27-X-2009; 18 exx, Moroka area, Kailaki, Wariaga, S09°25.403', E147°31.315' to S09°25.683', E147°31.707', 820–920 m, 27-X-2009; 5 exx, Moroka area, Kailaki, Beremutana ridge, S09°25.515', E147°33.136' to S09°25.754', E147°33.485', 535–700 m, 28-X-2009, beaten; 5 exx, Moroka area, Kailaki, Beremutana ridge, S09°25.754', E147°33.485' to S09°25.940', E147°33.703', 700–845 m, 28-X-2009, beaten; 2 exx, Moroka area, Kailaki, Beremutana ridge, S09°25.515', E147°33.136' to S09°25.754', E147°33.485', 535–650 m, 28-X-2009, beaten.

Distribution. Central Prov. (Varirata, Moroka). Elevation: 565–820 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Latin adjective *glaber* (hairless, bald) and refers to its smooth body.

Notes. *Trigonopterus glaber* Riedel, sp. n. was coded as "*Trigonopterus* sp. 164" by Tänzler et al. (2012).

33. *Trigonopterus gonatoceros* Riedel, sp. n.

urn:lsid:zoobank.org:act:6B7F6087-236C-4763-9BEF-032FCB98C073
http://species-id.net/wiki/Trigonopterus_gonatoceros

Diagnostic description. Holotype, male (Fig. 33a). Length 2.90 mm. Color black. Body subovate; almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally relatively flat, with two indistinct submedian rows of punctures, dorsolaterally with pair of furrows continuing along eye; surface weakly microreticulate. Pronotum sparsely punctate with double-punctures each consisting of two minute approximate punctures. Elytra with striae distinct, dorsally punctures small, laterally large; intervals flat, with row of minute punctures, subglabrous. Femora edentate. Metafemur with simple dorsoposterior edge; subapically with stridulatory patch. Tibial base dentiform, when leg extended tibial tooth overlapping femoral apex dorsally. Thoracic and abdominal venter with dense erect setae. Aedeagus (Fig. 33b) apically subangulate, subglabrous; transfer apparatus flagelliform, 1.5 X longer than body; endophallus with two pairs of sclerites; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.75–2.88 mm. Female venter subglabrous.

Material examined. Holotype (MZB): ARC1776 (EMBL # HE616053), WEST NEW GUINEA, Jayawijaya Reg., Bokondini, S03°40.345', E138°42.386' to S03°40.255', E138°42.189', 1655–1700 m, 18-VII-2010. Paratypes (SMNK, ZSM): 81 exx, ARC1777 (EMBL # HE616054), ARC1778 (EMBL # HE616055), same data as holotype.

Distribution. Jayawijaya Reg. (Bokondini). Elevation: ca. 1655–1700 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on a combination of the Greek nouns *gonatos* (knee) and *ceros* (horn) in apposition and refers to the peculiar extensions of the tibial base.

Notes. *Trigonopterus gonatoceros* Riedel, sp. n. was coded as "*Trigonopterus* sp. 121" by Tänzler et al. (2012).

34. *Trigonopterus granum* Riedel, sp. n.

urn:lsid:zoobank.org:act:08FF1F00-3CCB-4E95-997B-4B170BFF6069
http://species-id.net/wiki/Trigonopterus_granum

Diagnostic description. Holotype, male (Fig. 34a). Length 2.15 mm. Color black; legs and rostrum deep ferruginous; antenna light ferruginous. Body laterally somewhat compressed, ovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally in basal third with low median ridge and pair of submedian ridges; apically subglabrous. Eyes large. Pronotum densely punctate; dorsally punctures small, laterally larger, each with one minute seta; without scales. Elytra dorsally subglabrous, stria 1–2 hardly visible; laterally strial punctures large, relatively shallow. Femora with anteroventral ridge. Profemur converging from base to apex. Meso- and metafemur with dorsoposterior edge in apical third shortened; metafemur subapically without stridulatory patch. Tibiae simple, without rows or brushes of long setae; metatibia subapically with small suprauncal projection. Metaventrite laterally forming acute process over metacoxa, reaching tibial insertion. Metaventrite and abdominal ventrite 1 subglabrous, with sparse recumbent setae. Abdominal ventrite 2 similar to ventrites 3–4. Abdominal ventrite 5 with transverse depression, without distinct cavity; subapically with median denticle. Aedeagus (Fig. 34b) apically sinuate, with deep median incision; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.98–2.48 mm. Female abdominal ventrite 5 almost flat, densely punctate.

Material examined. Holotype (MZB): ARC0441 (EMBL # FN429152), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.2', E140°30.4', 545–700 m, 02-XII-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 38 exx, ARC0442 (EMBL # FN429153), ARC0443 (EMBL # FN429154), same data as holotype; 1 ex, ARC0653, S02°32.3', E140°30.4', 350–620 m, 19-XI-2007, beaten; 2 exx, S02°31.8', E140°30.5', 600–900 m, 28-XI-2007; 2 exx, S02°32.0', E140°30.4', 700–900 m, 02-XII-2007; 4 exx, S02°31.6', E140°30.4', 900–1100 m, 28-XI-2007, beaten; 11 exx, 950–1450 m, 03-X-1992; 21 exx, 600–1000 m, 05-X-1991; 2 exx, 800–1000 m, 07-VIII-1992; 6 exx, 300–1400 m, 10-VIII-1991; 5 exx, 400–800 m, 07-VIII-1992; 4 exx, 350–850 m, 16-X-1996; 1 ex, 300–550 m, 02-X-1992.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 620–950 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Latin noun *granum* (small kernel, seed) in apposition and refers to the general habitus.

Notes. *Trigonopterus granum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 15" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spo" in the EMBL/GenBank/DDBJ databases. It is closely related to *T. pseudogranum* sp. n., *T. velaris* sp. n., and *T. imitatus* sp. n.; from the latter two it can be distinguished by its sparsely punctate body and the structure of its male abdominal ventrite 5. The externally very similar *T. pseudogranum* sp. n. is best separated by the *cox1*-sequence which diverges 12.1 %.

35. *Trigonopterus helios* Riedel, sp. n.

urn:lsid:zoobank.org:act:A600DE45-0F31-4B37-BDD5-8ADBC6859E05
http://species-id.net/wiki/Trigonopterus_helios

Diagnostic description. Holotype, male (Fig. 35a). Length 3.14 mm. Color black; basal half of elytra with large orange spot. Body elongate-subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum slender; dorsally with distinct median costa and pair of narrow submedian ridges; at base with erect white clavate scales, apically replaced by bristles. Eyes large, medially approximate. Pronotum densely punctate-reticulate; sides anteriorly with punctures containing small white scales. Elytra subglabrous, irregularly punctate with minute punctures; striae obsolete; basal margin with ridge extending behind humeri, bordered by row of small indistinct punctures. Femora with tooth in apical half. Mesofemur and metafemur dorsally sparsely squamose with white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Abdominal ventrites 1–2 laterally swollen, medially concave; ventrite 2 posteriorly truncate, posterior face markedly projecting over ventrite 3. Aedeagus (Fig. 35b) subapically slightly widened; apex subangulate, asymmetrical, shifted to left; transfer apparatus dentiform, basally supported by crescent-shaped sclerite; ductus ejaculatorius subapically without bulbus.

Intraspecific variation. Length 3.27–3.53 mm. Female rostrum dorsally subglabrous, with submedian rows of minute punctures, with lateral furrow containing row of sparse setae. Female abdominal ventrites 1–2 convex.

Material examined. Holotype (SMNK): ARC1831 (EMBL # HE616108), PAPUA NEW GUINEA, Eastern Highlands Prov., Okapa, Kimiagomo village, Afiyaleto, S06°25.593', E145°34.862', S06°25.212', E145°35.498', 1911 m, 18-III-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 4 exx, ARC1830 (EMBL # HE616107), ARC1832 (EMBL # HE616109), same data as holotype; 1 ex, Okapa, Afiyaleto village, S06°25.593', E145°34.862', 1940 m, 18-III-2010, beaten.

Distribution. Eastern Highlands Prov. (Okapa). Elevation: 1911–1940 m.

Biology. Beaten from foliage of montane forest.

Etymology. This epithet is based on the Greek noun *helios* (sun) in apposition and refers to the bright orange spot on the elytra.

Notes. *Trigonopterus helios* Riedel, sp. n. was coded as "*Trigonopterus* sp. 136" by Tänzler et al. (2012).

36. *Trigonopterus hitoloorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:23025BDD-B5CD-4FF7-A6B3-04B8233ADA4A
http://species-id.net/wiki/Trigonopterus_hitoloorum

Diagnostic description. Holotype, male (Fig. 36a). Length 2.64 mm. Color black; tarsi and antenna ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum sparsely squamose with suberect scales; in basal half with median carina; in front of eyes with flat lateral extensions; subapically weakly scabrous; epistome smooth, posteriorly forming transverse, angulate ridge, with weak median denticle. Pronotum without subapical constriction, densely coarsely punctate; laterally above procoxa with fovea. Elytra with striae moderately incised on disk; intervals flat, with rows of small punctures; laterally subglabrous; apex subangulate, with pair of sublateral knobs; extended ventrad, slightly beak-shaped. Femora edentate. Metafemur dorsally sparsely squamose, with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Abdominal ventrite 2 projecting dentiform over elytral edge in profile. Aedeagus (Fig. 36b) apically rounded, sparsely setose; with complex, symmetrical transfer apparatus; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.28–2.64 mm. Female rostrum with median carina and transverse ridge of epistome less distinct.

Material examined. Holotype (SMNK): ARC1172 (EMBL # HE615800), PAPUA NEW GUINEA, Morobe Prov., Huon peninsula, Mindik, S06°27.311', E147°24.073', 1570 m, 10-X-2009. Paratypes (NAIC): Morobe Prov., Huon peninsula, Mindik: 1 ex, ARC1176 (EMBL # HE615804), S06°27.221', E147°24.185', 1670 m, 10-X-2009.

Distribution. Morobe Prov. (Mindik). Elevation: 1570–1670 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Hitolo, found on page 221 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus hitoloorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 195" by Tänzler et al. (2012).

37. *Trigonopterus imitatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:F0B9CC05-E2E0-4B7F-8A82-8246B16F69FE
http://species-id.net/wiki/Trigonopterus_imitatus

Diagnostic description. Holotype, male (Fig. 37a). Length 2.58 mm. Color black; legs and rostrum deep ferruginous; antenna light ferruginous. Body laterally somewhat compressed, ovate, without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally in basal third punctate-rugose; apically subglabrous. Eyes large. Pronotum densely punctate, punctures dorsally small, laterally becoming larger, bearing each one minute seta; without scales. Elytra dorsally subglabrous, stria 1–2 hardly visible; laterally strial punctures large, relatively shallow. Profemur converging from base to apex. Meso- and metafemur with in apical 1/3 with anteroventral ridge terminating as tooth. Metafemur subapically without stridulatory patch. Tibiae simple, without rows or brushes of long setae. Metaventrite laterally forming acute process over metacoxa, reaching tibial insertion. Metaventrite and abdominal ventrite 1 with long erect setae, especially near mesocoxa. Abdominal ventrite 2 similar to ventrites 3–4. Abdominal ventrite 5 with deep, transversely ovate cavity; basal third simple, swollen; laterally setose. Aedeagus (Fig. 37b) apically sinuate, with deep narrow median incision; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.98–2.58 mm. Female rostrum subglabrous except in basal ¼ with ridges. Female venter sparsely setose, abdominal ventrite 5 flat.

Material examined. Holotype (MZB): ARC1697 (EMBL # HE615984), WEST NEW GUINEA, Biak Reg., Supiori Isl., Korido, S00°49.715', E135°35.055', 50–100 m, 9-VII-2010, beaten. Paratypes (SMNK, ZSM): 4 exx, ARC1698 (EMBL # HE615985), ARC1699 (EMBL # HE615986), same data as holotype.

Distribution. Biak Reg. (Supiori Isl.). Elevation: ca. 50–100 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Latin participle *imitatus* (imitated) and refers to its morphological similarity with sibling species.

Notes. *Trigonopterus imitatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 273" by Tänzler et al. (2012). It is closely related to *T. granum* sp. n., *T. pseudogranum* sp. n., and *T. velaris* sp. n. from which it can be distinguished by the male venter with long setae. Despite its close morphological similarity its *cox1*-sequence diverges 9.9–12.3 % from the other species.

38. *Trigonopterus inflatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:8AE401E3-76B5-4768-8267-377F1BFA5695
http://species-id.net/wiki/Trigonopterus_inflatus

Diagnostic description. Holotype, male (Fig. 38a). Length 2.90 mm. Color black, elytra with greenish-bronze lustre; antenna light ferruginous, legs dark ferruginous. Body subovate; in dorsal aspect and in profile almost without constriction between pronotum and elytron. Rostrum with distinct median and pair of submedian carinae, in apical third scabrous; epistome simple. Pronotum relatively small, with weak subapical constriction; disk densely punctate, longitudinally rugose; each puncture with seta, a few with scale. Elytra with striae deeply impressed; with sparse, yellowish scales; intervals subglabrous. Meso- and metafemur edentate. Metafemur with dorsoposterior edge serrate, subapically without stridulatory patch. Metatibia apically with blunt premucro. Onychium ca. 1.1× longer than tarsomere 3. Aedeagus (Fig. 38b) with apex asymmetrical, right side forming biramose extension; basal orifice ventrally with rim; transfer apparatus spiniform, curved, directed basad; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.45–2.90 mm. Female rostrum dorsally subglabrous, with dense small punctures, in basal third with longitudinal ridges. Female metatibia apically without premucro.

Material examined. Holotype (MZB): ARC0858 (EMBL # HE615540), WEST NEW GUINEA, Biak Isl., Korim, Nernu, S00°55.784', E136°01.530', 165 m, 15-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Biak Isl.: 28 exx, ARC0859 (EMBL # HE615541), same data as holotype; 1 ex, ARC0883 (EMBL # HE615565), Korim, Nernu, S00°55.888', E136°01.671', 180 m, 15-XII-2007, sifted; 3 exx (1 marked ARC0093), Korim, Nernu, 150 m, 20-I-2005, sifted.

Distribution. Biak Isl.. Elevation: 150–180 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is based on the Latin participle *inflatus* (swollen) and refers to the shape of the elytra that appear somewhat disproportionate in relation to the pronotum.

Notes. *Trigonopterus inflatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 63" by Tänzler et al. (2012).

39. *Trigonopterus insularis* Riedel, sp. n.

urn:lsid:zoobank.org:act:493867A3-E874-4AC7-9BFD-CB42BB34EFC2
http://species-id.net/wiki/Trigonopterus_insularis

Diagnostic description. Holotype, male (Fig. 39a). Length 3.41 mm. Color black; antenna and tarsi ferruginous. Body subovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median carina and pair of indistinct sublateral ridges; with sparse rows of white scales; subapical third subglabrous, weakly punctate; in front of antennal insertion with weak constriction.

Eyes large, medially approximate. Pronotum densely punctate with small punctures; sides separated by indistinct edge bearing dense row of punctures; laterally above coxa sparsely squamose with white scales. Elytral striae distinct with small punctures; intervals flat, subglabrous, sparsely punctate with minute punctures; basal margin straight, simple. Femora with anteroventral ridge distinct, at base abruptly ending and forming markedly projecting blunt angle; edentate. Mesofemur and metafemur dorsally densely squamose with white scales but partly abraded. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Aedeagus (Fig. 39b) with apodemes ca. 3× as long as body; sides of body in basal half subparallel, markedly sclerotized, mid-portion of body weakly sclerotized; apex subangulate; transfer apparatus flagelliform, longer than body; ductus ejaculatorius subapically with bulbus. **Intraspecific variation**. Length 3.38–3.41 mm. No female specimen available.

Material examined. Holotype (MZB): ARC1694 (EMBL # HE615981), WEST NEW GUINEA, Biak Reg., Supiori Isl., Korido, S00°49.715´, E135°35.055´, 50–100 m, 09-VII-2010. Paratype (SMNK): 1 ex, ARC1695 (EMBL # HE615982), same data as holotype.

Distribution. Biak Reg. (Supiori Isl.). Elevation: ca. 50–100 m.

Biology. Beaten from foliage of lowland forest.

Etymology. This epithet is based on the Latin adjective *insularis* (of an island) and refers to the type locality, Supiori Island.

Notes. *Trigonopterus insularis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 57" by Tänzler et al. (2012).

40. *Trigonopterus irregularis* Riedel, sp. n.

urn:lsid:zoobank.org:act:475C5E3F-9BD7-4BAA-A617-C25E7A754C92
http://species-id.net/wiki/Trigonopterus_irregularis

Diagnostic description. Holotype, male (Fig. 40a). Length 2.36 mm. Legs ferruginous, antenna light ferruginous, remainder black except elytral apex deep ferruginous, especially along sides. Body elongate; with distinct constriction between pronotum and elytron; in profile dorsally flat. Rostrum with distinct median and pair of submedian carinae, in apical ¼ relatively smooth. Pronotum densely punctate-reticulate, interspaces smaller than puncture´s diameter. Elytra dorsally with dense punctation confused, partly reticulate; striae laterally impressed as fine lines; basal margin medially bordered by narrow glabrous band. Femora edentate. Profemur in basal third posteriorly with callus. Meso- and metafemur on dorsal edge densely squamose with cream-colored scales. Metafemur subapically with indistinct stridulatory patch. Aedeagus (Fig. 40b) with sides curved, apex rounded; body flattened, transfer apparatus spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.34–2.59 mm. Female rostrum dorsally subglabrous, with pair of submedian rows of large punctures.

Material examined. Holotype (MZB): ARC0780 (EMBL # HE615463), WEST NEW GUINEA, Manokwari, Arfak Mts, S01°03.723', E133°54.145', 1385 m, 08-XII-2007. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Manokwari, Mokwam, Siyoubrig: 1 ex, ARC0804 (EMBL # HE615487), S01°06.107', E133°54.888', 1530 m, 10-XII-2007, beaten; 1 ex, ARC0851 (EMBL # HE615533), S01°06.7', E133°54.6', 1580–1750 m, 11-XII-2007; 1 ex, Minyambou – Mokwam, 1300–1900 m, 16-IV-1993; 2 exx, Mokwam, Kwau, 1300–1650 m, 17-IV-1993.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1385–1580 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin adjective *irregularis* (irregular) and refers to the elytral punctation.

Notes. *Trigonopterus irregularis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 247" by Tänzler et al. (2012).

41. *Trigonopterus ixodiformis* Riedel, sp. n.

urn:lsid:zoobank.org:act:53B538F7-D7F3-47C9-9A95-5BC50A01AC31
http://species-id.net/wiki/Trigonopterus_ixodiformis

Diagnostic description. Holotype, male (Fig. 41a). Length 2.39 mm. Color black; elytral base and legs dark ferruginous, antenna light ferruginous. Body subovate, with shallow constriction between pronotum and elytron; in profile almost evenly convex. Rostrum scabrous, basally with indistinct median ridge; epistome forming angulate ridge. Pronotum moderately densely punctate. Elytra with striae marked by small punctures; interval 4 basally with cluster of few narrow, cream-colored, recumbent scales; interval 7 subapically forming indistinct ridge. Meso- and metafemur with anteroventral ridge distinctly dentate. Meso- and metatibia in basal half widened; dorsal edge basally denticulate; subapically narrowed; uncus large, peg-shaped. Metafemur with serrate dorsoposterior edge, subapically without stridulatory patch. Venter subglabrous, concave. Aedeagus (Fig. 41b) with sides of body in apical third converging, apex rounded; orifice retracted; endophallus weakly granulate; transfer apparatus symmetrical, heart-shaped frame relatively thin; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.75–2.39 mm. Female rostrum dorsally subglabrous, sparsely punctate; epistome simple.

Material examined. Holotype (MZB): ARC0762 (EMBL # HE615445), WEST NEW GUINEA, Manokwari, Mt. Meja, S00°51.497', E134°04.949', 220 m, 05-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Manokwari: 23 exx, ARC0763 (EMBL # HE615446), ARC0764 (EMBL # HE615447), same data as holotype; 4 exx, Mt. Meja, S00°51.400', E134°04.918', 225 m, 06-XII-2007, sifted; 16 exx, Mt. Meja, 200 m, 30-XII-2004, sifted; 6 exx, Mt. Meja, 200 m, 30-XII-2000, sifted; 9 exx, Mt. Meja, 22-23-IX-1990, sifted; 6 exx, Mt. Meja, 200 m, 19-IV-1993; 1 ex, ARC0772 (EMBL # HE615455), Arfak Mts, S01°01.465', E133°54.243', 685 m, 08-XII-2007, sifted.

Distribution. Manokwari Reg. (Mt. Meja, Arfak Mts). Elevation: 200–685 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is a combination of the name Ixodidae and the Latin suffix *-formis* (having the form of) and refers to the species´ superficial resemblance with ticks.

Notes. *Trigonopterus ixodiformis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 222" by Tänzler et al. (2012).

42. ***Trigonopterus kanawiorum*** Riedel, sp. n.

urn:lsid:zoobank.org:act:AF3FBA36-231F-4BF0-AE98-F2D28A70D967
http://species-id.net/wiki/Trigonopterus_kanawiorum

Diagnostic description. Holotype, male (Fig. 42a). Length 2.68 mm. Color black; antenna and tarsi ferruginous. Body ovate; in dorsal aspect with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally with median ridge and pair of submedian ridges, furrows with sparse rows of yellowish scales; in apical 1/3 weakly punctate-rugose. Pronotum densely punctate. Elytra densely punctate with minute punctures, especially on intervals; strial punctures slightly larger; striae impressed as fine lines; lateral stria behind humeri simple, not deepened. Femora edentate. Mesofemur and metafemur dorsally densely squamose with silvery scales. Metafemur with denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus, without premucro. Abdominal ventrite 5 tomentose. Aedeagus (Fig. 42b) symmetrical; apex subangulate, sparsely setose; body at middle slightly constricted; transfer-apparatus asymmetrical, spiniform; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.45–2.76 mm. Female rostrum dorsally in apical half flattened, subglabrous, with submedian rows of small punctures. Female abdominal ventrite 5 with sparse recumbent scales.

Material examined. Holotype (SMNK): ARC1133 (EMBL # HE615762), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Simbu Prov.: 8 exx, ARC1134 (EMBL # HE615763), same data as holotype; 2 exx, ARC1149 (EMBL # HE615777), ARC1150 (EMBL # HE615778), Haia, Supa, S06°40.047', E145°03.464' to S06°40.078', E145°03.207', 1075–1220 m, 02-X-2009; 7 exx, Haia, Supa station, S06°39.905', E145°03.880' to S06°39.796', E145°03.873', 1220–1320 m, 01-X-2009, beaten; 1 ex, ARC1142 (EMBL # HE615770), Haia, Supa, S06°40.047', E145°03.464' to S06°39.815', E145°03.169', 1075–1240 m, 30-IX-2009; 24 exx, ARC1168 (EMBL # HE615796), Haia, S06°41.216', E145°00.945' to S06°40.976', E145°00.979', 970–1135 m, 04-X-2009; 1 ex, ARC1083 (EMBL # HE615714), Haia, S06°41.553', E145°00.355' to S06°41.624', E145°00.728', 800–960 m, 25-IX-2009; 9 exx, Haia, S06°41.259', E145°00.822' to S06°41.102', E145°00.979', 900–1005 m, 27-IX-2009; 4 exx, Haia, S06°41.102', E145°00.979', 1005–1020 m, 27-IX-2009, beaten, "Mimikry-sample"; 10 exx, Haia, S06°41.102', E145°00.979' to S06°40.976', E145°00.979', 1020–1135m, 27-IX-2009, beaten.

Distribution. Simbu Prov. (Haia). Elevation: 960–1220 m.

Biology. Collected by beating foliage in primary forest.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Kanawi, found on page 236 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus kanawiorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 209" by Tänzler et al. (2012).

43. *Trigonopterus katayoi* Riedel, sp. n.

urn:lsid:zoobank.org:act:3C9EA32F-2234-49F8-8D1A-F3CA5336C632
http://species-id.net/wiki/Trigonopterus_katayoi

Diagnostic description. Holotype, male (Fig. 43a). Length 2.68 mm. Color black, elytra in basal third orange. Body slender, ovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum in apical third smooth; in basal 2/3 with median ridge and pair of sublateral ridges; furrows containing sparse row of setae. Eyes with dorsal margin carinate. Head bordering eye with bean-shaped impression. Pronotum subglabrous, sparsely punctate with minute punctures. Elytra subglabrous, punctation confused with minute punctures; striae hardly visible, impressed as very fine lines; lateral stria behind humeri with row of ca. 5 deep punctures. Femora subglabrous, including dorsum of metafemur without scales. Mesofemur on posterior surface with longitudinal ridge. Metafemur on posterior surface with indistinct longitudinal impression; dorsoposteriorly simple, subapically without stridulatory patch. Meso- and metatibia subapically simple, with uncus, without premucro. Aedeagus (Fig. 43b). Apex symmetrical, with median acute extension; transfer apparatus small, dentiform; endophallus without distinct sclerites; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.50–2.93 mm. Color of elytral base orange in specimens from Goroka, dark ferruginous in specimens from Okapa.

Material examined. Holotype (SMNK): ARC1052 (EMBL # HE615683), PAPUA NEW GUINEA, Eastern Highlands Prov., Goroka, Mt. Gahavisuka, S06°00.864', E145°24.779', 2150–2250 m, 22-IX-2009. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 2 exx, ARC1051 (EMBL # HE615682), ARC1053 (EMBL # HE615684), same data as holotype; 3 exx, Goroka, Mt. Gahavisuka, S06°00.864', E145°24.779', 2150–2280 m, 24-X-2009; 2 exx, ARC1836 (EMBL # HE616113), ARC1837 (EMBL # HE616114), Okapa, Konafi to Isimomo, S06°25.593', E145°34.862', 1911–2131 m, 18-III-2010; 2 exx, ARC1838 (EMBL # HE616115), Okapa, Kimiagomo village, Afiyaleto, S06°25.593', E145°34.862' to S06°25.212', E145°35.498', 1911 m, 18-III-2010.

Distribution. Eastern Highlands Prov. (Goroka, Okapa). Elevation: 1911–2150 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is named in honour of our colleague Katayo Sagata (Goroka) who greatly supported our field-work in PNG and who collected some of the specimens.

Notes. *Trigonopterus katayoi* Riedel, sp. n. was coded as "*Trigonopterus* sp. 97" by Tänzler et al. (2012).

44. *Trigonopterus koveorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:0C660759-395A-4536-92ED-7BBD31110121
http://species-id.net/wiki/Trigonopterus_koveorum

Diagnostic description. Holotype, male (Fig. 44a). Length 3.13 mm. Color black; antennal scape and funicle ferruginous. Body ovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally densely punctate, without ridges or furrows, towards apex punctures becoming minute; laterally and at base with white scales. Pronotum densely punctate; dorsally punctures minute, laterally larger, anterolaterally with scattered white scales. Elytra dorsally with minute, confused punctures, subglabrous; laterally strial punctures sparse but deeply impressed. Femora edentate. Mesofemur and metafemur dorsally densely squamose with white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Metatibia apically with uncus, without premucro. Abdominal ventrites 1–2 weakly concave. Aedeagus (Fig. 44b) symmetrical; apex subangulate, subglabrous; transfer-apparatus simple, dentiform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.95–3.41 mm. Female rostrum in apical 2/3 dorsally subglabrous. Female abdominal ventrites 1–2 flat.

Material examined. Holotype (SMNK): ARC1846 (EMBL # HE616123), PAPUA NEW GUINEA, Eastern Highlands Prov., Okapa, Kimiagomo village, Hamegoya, S06°25.727', E145°35.455', S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010. Paratypes (NAIC, SMNK, ZSM): 4 exx, ARC1847 (EMBL # HE616124), ARC1848 (EMBL # HE616125), same data as holotype.

Distribution. Eastern Highlands Prov. (Okapa). Elevation: ca. 1891–2131 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Kove, found on page 248 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus koveorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 149" by Tänzler et al. (2012).

45. *Trigonopterus kurulu* Riedel, sp. n.

urn:lsid:zoobank.org:act:E6CF5ADF-BFC3-4B89-8AFF-16FF8DC9153A
http://species-id.net/wiki/Trigonopterus_kurulu

Diagnostic description. Holotype, male (Fig. 45a). Length 2.43 mm. Color black; antenna and tarsi light ferruginous; tibiae and femora deep ferruginous. Body subrhomboid; in dorsal aspect with marked constriction between pronotum and elytron; in profile almost evenly convex, with shallow constriction. Rostrum rugose-punctate; epistome forming indistinct, angulate ridge. Pronotum basally angulate, densely punctate with deep punctures; each with one small, upcurved seta. Elytra with striae deeply incised; intervals costate, each with one row of small punctures. Metafemur with simple dorsoposterior edge, subapically with stridulatory patch. Aedeagus (Fig. 45b) with apex subtruncate, setose; subapically sides with pair of membranous protrusions; transfer apparatus minute; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.26–2.73 mm. Female rostrum with epistome simple.

Material examined. Holotype (MZB): ARC0733 (EMBL # HE615416), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°57.161', E138°57.357', 1875 m, 24-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 11 exx, ARC0734 (EMBL # HE615417), ARC0735 (EMBL # HE615418), same data as holotype; 6 exx, Jiwika, Kurulu, S03°56.481', E138°57.073', 2070 m, 26-XI-2007, sifted; 2 exx, Jiwika, Kurulu, S03°56.289', E138°57.622', 2200 m, 26-XI-2007, sifted; 25 exx, S03°57.161', E138°57.357', 1875 m, 11-VII-2010, sifted; 4 exx, ca. 1700–2300 m, 02-IX-1991, sifted; 3 exx (1 marked ARC0002), ca. 1700–2300 m, 06-IX-1991, sifted; 2 exx, 2300 m, 06-IX-1991, sifted; 1 ex, 2300 m, 1992, sifted; 6 exx, 1900–2000 m, 23-IX-1992, sifted; 7 exx, 1900–2050 m, 24-X.1993; 2 exx, ARC1716 (EMBL # HE615996), ARC1717 (EMBL # HE615997), Poga, S03°48.382', E138°34.780', 2330 m, 13-VII-2010.

Distribution. Jayawijaya Reg. (Jiwika, Poga). Elevation: 1875–2330 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is a noun in apposition. Kurulu, who lived near Jiwika, was a famous Dani leader in the 1960´s. The district around Jiwika bears his name today. The species´ name refers both to the type locality and is a reference to the disappearing culture of the indigenous people of this area.

Notes. *Trigonopterus kurulu* Riedel, sp. n. was coded as "*Trigonopterus* sp. 226" by Tänzler et al. (2012).

46. *Trigonopterus lekiorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:461E47B8-1A15-4A4E-BDF8-AD6461576CC6
http://species-id.net/wiki/Trigonopterus_lekiorum

Diagnostic description. Holotype, male (Fig. 46a). Length 2.19 mm. Color black; antenna and tarsi ferruginous. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Eyes large. Rostrum basally with median and pair of submedian ridges; median and lateral pairs of longitudinal furrows each with row of overlapping almond-shaped white scales. Pronotum densely punctate; anterolaterally with scattered white scales. Elytra with striae distinct; intervals flat, subglabrous. Profemur edentate, mesofemur with small blunt tooth, metafemur with small acute tooth. Mesofemur and metafemur dorsally sparsely squamose with white scales. Metafemur subapically with stridulatory patch. Metatibia subapically ventrally concave, without brush of long setae; uncus hook-like extended, curved ventrobasad. Aedeagus (Fig. 46b) with apodemes 2.0 X as long as body; sides of body in basal half subparallel; apex extended, pointed, markedly curved ventrad; transfer apparatus flagelliform, longer than body of aedeagus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.18–2.30 mm. Female rostrum dorsally in apical half subglabrous, sparsely punctate, basally with pair of lateral furrows containing row of scales. Female metatibia apically simple, with simple uncus and minute premucro.

Material examined. Holotype (SMNK): ARC1116 (EMBL # HE615745), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Simbu Prov.: 3 exx, ARC1117 (EMBL # HE615746), same data as holotype; 1 ex, Haia, Supa station, S06°39.815', E145°03.169' to S06°39.609', E145°03.012', 1240–1450m, 30-IX-2009, beaten; 1 ex, ARC1108 (EMBL # HE615737), Haia, S06°43.515', E145°00.128' to S06°43.948', E144°59.856', 750–915 m, 26-IX-2009; 1 ex, Haia, Supa station, S06°40.047', E145°03.464' to S06°39.905', E145°03.880', 1075–1220 m, 01-X-2009, beaten; 1 ex, Haia, Supa station, S06°39.905', E145°03.880' to S06°39.796', E145°03.873', 1220–1320 m, 01-X-2009, beaten.

Distribution. Simbu Prov. (Haia). Elevation: 915–1240 m.

Biology. Collected by beating foliage in primary forest.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Leki, found on page 256 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus lekiorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 79" by Tänzler et al. (2012).

47. *Trigonopterus lineatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:5247DE6B-FC3D-4DD9-80AC-BB9628E3406B
http://species-id.net/wiki/Trigonopterus_lineatus

Diagnostic description. Holotype, male (Fig. 47a). Length 3.00 mm. Color black; tarsi and antenna ferruginous. Body subrhomboid; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum in basal half with median costa bordered by furrows; in front of eyes with flat lateral extensions; subapically scabrous, with suberect scales; epistome smooth, posteriorly forming transverse, angulate ridge. Pronotum with subapical constriction, anteriorly densely coarsely punctate, with sparse lanceolate scales; disk subglabrous, with sparse punctures. Elytra with striae 1–6 deeply incised; intervals flat, with rows of small punctures and minute recumbent setae; laterally subglabrous; apex subangulate, with pair of sublateral knobs; apex extended ventrad, slightly beak-shaped. Femora edentate. Metafemur with weakly denticulate dorsoposterior edge, subapically with stridulatory patch. Aedeagus (Fig. 47b) apically simple, weakly rounded, without setae; with complex, symmetrical transfer apparatus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.78–3.13 mm. Female rostrum only basally with median ridge; in apical third punctate, epistome without distinct transverse ridge.

Material examined. Holotype (MZB): ARC0520 (EMBL # FN429226), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 1 ex, ARC0519 (EMBL # FN429225), same data as holotype; 1 ex, ARC0510 (EMBL # FN429216), S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted; 1 ex, ARC0656 (EMBL # FN429303), S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 710–960 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin participle *lineatus* (marked with parallel lines) and refers to the elytral sculpture.

Notes. *Trigonopterus lineatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 35" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spai" in the EMBL/GenBank/DDBJ databases.

48. *Trigonopterus lineellus* Riedel, sp. n.

urn:lsid:zoobank.org:act:91B66959-0B3C-473D-9640-DAF4EB7A71F7
http://species-id.net/wiki/Trigonopterus_lineellus

Diagnostic description. Holotype, male (Fig. 48a). Length 3.23 mm. Color black; tibiae and antenna ferruginous. Body elongate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum basally with distinct median and pair of submedian carinae, in apical ¼ relatively smooth; in front of eye sparsely squamose. Pronotum densely punctate with large punctures, interspaces smaller than puncture´s diameter. Elytra dorsally with striae deeply incised, intervals with 1–2 rows of punctures; laterally striae impressed as fine lines, strial punctures deep. Femora edentate. Profemur in basal third posteriorly with callus. Metafemur subapically without stridulatory patch. Abdominal ventrites 1–2 concave. Aedeagus (Fig. 48b) apically bluntly angulate, with pair of stout setae; body flattened, sides diverging to shortly before apex; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.83–3.63 mm. Body of females more slender. Female rostrum dorsally subglabrous, punctate, in front of eye sparsely squamose. Female abdominal ventrites 1–2 flat.

Material examined. Holotype (MZB): ARC0625 (EMBL # FN429282), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.6', E140°30.4', 1000–1200 m, 30-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 1 ex, ARC0422 (EMBL # FN429133), S02°31.3', E140°30.5', 1200–1420 m, 30.XI.2007; 4 exx, ARC0465 (EMBL # FN429175), ARC0466 (EMBL # FN429176), ARC0621 (EMBL # FN429278), ARC0622 (EMBL # FN429279), S02°31.8', E140°30.5', 600–900 m, 28.XI.2007; 1 ex, ARC0623 (EMBL # FN429280), S02°31.6', E140°30.4', 900–1100 m, 28.XI.2007; 1 ex, ARC0624 (EMBL # FN429281), S02°31.6', E140°30.4', 1000–1200 m, 30.XI.2007; 1 ex (marked as ARC0043"), 950–1450 m, 03-X-1992; 2 exx, 800–1000 m, 07-VIII-1992; 3 exx, 300–1400 m, 10-VIII-1991; 1 ex, 400–800 m, 07-VIII-1992; 1 ex, 1200–1400 m, 09-VIII-1992; 1 ex, 600–1100 m, 05-X-1991; 1 ex, 850–950 m, 16-X-1996.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 800–1200 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin participle *lineellus* (marked with weak parallel lines) and refers to the elytral sculpture.

Notes. *Trigonopterus lineellus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 11" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spk" in the EMBL/GenBank/DDBJ databases.

49. *Trigonopterus maculatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:28208496-2A6D-4941-9D7A-F7EA09FF0105
http://species-id.net/wiki/Trigonopterus_maculatus

Diagnostic description. Holotype, male (Fig. 49a). Length 3.92 mm. Color black; basal half of elytra with large orange spot. Body elongate-subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum slender; dorsally punctate-rugose, with indistinct median ridge and pair of submedian ridges; apical 1/3 sparsely punctate; at base with erect white elongate scales, apically replaced by bristles. Eyes large, medially approximate. Pronotum densely punctate-reticulate; disk basally at middle with punctures containing each one long erect seta; basal contours of disk subparallel, slightly converging in straight line; laterally in front of procoxa with acute process, squamose with white scales. Elytra subglabrous; striae distinct, marked by small to minute punctures; intervals with row of minute punctures; basal margin with ridge extending behind humeri, medially somewhat swollen, bordered by indistinct row of small punctures. Femora with acute tooth at middle. Mesofemur and metafemur dorsally sparsely squamose with narrow silvery scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Thoracic and abdominal venter concave, medially densely setose. Abdominal ventrite 5 sublaterally with pair of knobs, medially densely punctate and setose. Aedeagus (Fig. 49b) with apex subangulate; ventral surface of body subapically with pair of denticles; transfer apparatus dentiform, basally supported by Y-shaped sclerite; ductus ejaculatorius subapically without bulbus. **Intraspecific variation**. Length 3.74–3.92 mm. Female rostrum dorsally subglabrous, sparsely punctate, at base with erect white scales. Female venter subglabrous, abdominal ventrites 1–2 weakly convex.

Material examined. Holotype (SMNK): ARC1840 (EMBL # HE616117), PAPUA NEW GUINEA, Eastern Highlands Prov., Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 3 exx, ARC1841 (EMBL # HE616118), same data as holotype; 2 exx, ARC1842 (EMBL # HE616119), Okapa, Kimiagomo village, Hamegoya, S06°25.727', E145°35.455', S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010.

Distribution. Eastern Highlands Prov. (Aiyura, Okapa). Elevation: 2131–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on a combination of the Latin noun *macula* (mark, spot) and refers to the conspicuous orange spot on the elytra.

Notes. *Trigonopterus maculatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 132" by Tänzler et al. (2012).

50. *Trigonopterus mimicus* Riedel, sp. n.

urn:lsid:zoobank.org:act:89EC9D74-0A8A-4E90-87F2-FBB8F47DA265
http://species-id.net/wiki/Trigonopterus_mimicus

Diagnostic description. Holotype, male (Fig. 50a). Length 2.73 mm. Color orange-ferruginous; head and pronotum black; elytra orange-ferruginous, much darker along suture and apex. Body subrhomboid; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum with distinct median and pair of submedian costae, furrows with rows of coarse punctures; in apical 1/3 weakly rugose-punctate. Pronotum moderately densely punctate with small punctures. Elytra with striae indistinct, marked by small to minute punctures, intervals with row of minute punctures. Femora edentate, with distinct anteroventral ridge. Metafemur dorsally with 1–2 rows of silvery scales; subapically with stridulatory patch. Abdominal ventrite 5 densely coarsely punctate, densely setose. Aedeagus (Fig. 50b) with apex subangulate; ostium with rectangular sclerite extending far basad; ventral surface of body in basal 1/3 with constriction and pair of angulate carinae in front of insertion of apodemes; endophallus with asymmetrical sclerites; transfer-apparatus spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.65–3.06 mm. Elytral color usually as in holotype, in some specimens from Tiom and Yohosim – Kiroma dark brownish. Female rostrum dorsally in apical half subglabrous, punctate. Female abdominal ventrite 5 subglabrous, sparsely punctate.

Material examined. Holotype (MZB): ARC1743 (EMBL # HE616020), WEST NEW GUINEA, Jayawijaya Reg., Poga, S03°47.575', E138°33.155' to S03°47.473', E138°33.163', 2620–2715 m, 15-VII-2010. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 1 ex, ARC0755 (EMBL # HE615438), Jiwika, Kurulu, S03°56.146', E138°57.710', 2245–2290 m, 26-XI-2007; 1 ex, Jiwika, trail to Wandanku, 2240–2420 m, 28-IX-1996; 2 exx (1 marked as "ARC0032"), Jiwika, 1800–2300 m, 31-V-1998; 1 ex, Jiwika, 2300 m, 1992, sifted; 2 exx, Ilugwa, Melanggama, trail to Pass-valley, 2100–2300 m, 9–10-IX-1990; 69 exx, ARC1744 (EMBL # HE616021), same data as holotype; 32 exx, ARC1808 (EMBL # HE616085), ARC1809 (EMBL # HE616086), W Wamena, road to Lake Habbema, S04°07.625', E138°49.992', 2520 m, 20-VII-2010; 2 exx, ARC1810 (EMBL # HE616087), ARC1811 (EMBL # HE616088), W Wamena, road to Lake Habbema, S04°08.256', E138°49.049', 2770 m, 20-VII-2010; 2 exx, Moss forest between Theila and L. Habbema, 2800–2950 m, 22-X-1993, beaten at night; 19 exx, Moss forest between Theila and L. Habbema, 2800–2950 m, 22-X-1993; 18 exx, Tiom, Wanuga, 2750–2900 m, 08-XII-1995; 1 ex, Poga, 2100–2500 m, 06-07-IV-1999; 7 exx, Kwiyawagi, 2750 m, 09-10-XII-1995; 3 exx, Yohosim – Kiroma, 2500–2700 m, 13-IX-1991.

Distribution. Jayawijaya Reg. (Jiwika, Ilugwa, Poga, L. Habbema, Tiom). Elevation: 2290–2800 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on the Latin adjective *mimicus* (acting, imitating) and refers to the resemblance to other species with ferruginous elytra.

Notes. *Trigonopterus mimicus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 213" by Tänzler et al. (2012).

51. *Trigonopterus monticola* Riedel, sp. n.

urn:lsid:zoobank.org:act:322A13D0-EEC1-43A9-A205-2414585A0D53
http://species-id.net/wiki/Trigonopterus_monticola

Diagnostic description. Holotype, male (Fig. 51a). Length 3.50 mm. Color black, legs and antenna deep ferruginous. Body ovate; with weak constriction between pronotum and elytron; in profile almost evenly convex, elytral base medially weakly swollen and slightly projecting. Rostrum dorsally rugose-punctate in basal half, punctate in apical half. Pronotum densely punctate except along impunctate midline. Elytra densely punctate; strial punctures slightly larger than minute punctures on intervals; striae impressed as fine lines; lateral stria behind humeri with dense row of deep punctures. Profemur and metafemur in basal half with anteroventral ridge terminating as tooth; tooth of profemur small. Metafemur with denticulate dorsoposterior edge; with crenulate anteroventral ridge, terminating in apical 1/3 as acute tooth; subapically with stridulatory patch. Abdominal ventrite 5 with shallow impression, densely punctate, sublaterally setose. Aedeagus (Fig. 51b) with ostium somewhat retracted; with distinct, symmetrical transfer-apparatus; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.63–3.53 mm. Female rostrum basally punctate, towards apex dorsally subglabrous, with rows of small punctures. Female abdominal ventrite 5 flat, sparsely punctate.

Material examined. Holotype (MZB): ARC0420 (EMBL # FN429131), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.7', E140°30.3', 900–1150 m, 21.XI.2007, beaten, marked "stridul. 3". Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 23 exx, ARC0431 (EMBL # FN429142), S02°31.2', E140°30.5', 1420–1520 m, 30-XI-2007; 2 exx, ARC0450 (EMBL # FN429161), ARC0454 (EMBL # FN429165), S02°31.7', E140°30.3', 850–1000 m, 30.XI.2007; 8 exx, S02°31.6', E140°30.4', 1000–1200 m, 30-XI-2007, beaten; 38 exx, ARC0484 (EMBL # FN429191), ARC0487 (EMBL # FN429194), S02°31.3', E140°30.5', 1200–1420 m, 30-XI-2007; 1 ex, S02°31.425', E140°30.474', 1265 m, 30-XI-2007, sifted; 1 ex, ARC0686 (EMBL # FN429331), S02°31.182', E140°30.542', 1510 m, 30-XI-2007; 17 exx [1 marked "ARC 042"], 950–1450 m, 03-X-1992; 4 exx, 1100–1600 m, 05-X-1991; 17 exx, 1200–1400 m, 09-VIII-1992; 17 exx, 1100–1600 m, 05-X-1991; 13 exx, 1400 m, 10-VIII-1991; 4 exx, 950–1450 m, 03-X-1992.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1000–1510 m.

Biology. Collected by beating foliage in lowland forests.

Etymology. This epithet is based on the Latin noun *monticola* (mountain dweller) and refers to the species´ restriction to the upper elevations of the Cyclops Mountains.

Notes. *Trigonopterus monticola* Riedel, sp. n. was coded as "*Trigonopterus* sp. 3" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spc" in the EMBL/GenBank/DDBJ databases.

52. *Trigonopterus montivagus* Riedel, sp. n.

urn:lsid:zoobank.org:act:1A9FE62A-E6EF-43B3-8F2C-43A56E5F7771
http://species-id.net/wiki/Trigonopterus_montivagus

Diagnostic description. Holotype, male (Fig. 52a). Length 2.94 mm. Color black; antennae light ferruginous, legs deep ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges, furrows with sparse rows of yellowish scales; apically weakly punctate, sparsely setose. Pronotum coarsely punctate-reticulate. Elytra with dense, somewhat confused punctation; striae distinct, impressed as very fine lines, strial punctures small; intervals with slightly smaller punctures; laterally behind humeri simple. Femora edentate. Metafemur with denticulate dorsoposterior edge, with sparse row of suberect silvery scales; subapically with stridulatory patch. Metatibia apically with uncus and minute premucro. Abdominal ventrite 5 with shallow impression, densely punctate, with dense suberect scales. Aedeagus (Fig. 52b) with sides in apical 1/3 converging, weakly rounded, sparsely setose; transfer-apparatus spiniform; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.53–3.20 mm. Female rostrum dorsally subglabrous, sparsely punctate, in basal ¼ with longitudinal ridges and furrows. Elytral sculpture differing markedly among populations: striae weakly or hardly impressed in specimens from Eastern Highlands; distinctly impressed in specimens from Pindiu; deeply incised forming well-defined furrows in specimens from Mindik.

Material examined. Holotype (SMNK): ARC1873 (EMBL # HE616150), PAPUA NEW GUINEA, Eastern Highlands Prov., Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA: 2 exx, ARC1874 (EMBL # HE616151), ARC1875 (EMBL # HE616152), same data as holotype; 4 exx, Okapa, Afiyaleto village, S06°25.593', E145°34.862' to S06°25.212', E145°35.498', 1911 m, 18-III-2010, beaten; 1 ex, Okapa, Isimomo, S06°25.003', E145°34.527', 2131 m, 22-XII-2010; 2 exx, Okapa, Konafi to Isimomo, S06°25.593', E145°34.862', S06°25.003', E145°34.527', 1911–2131 m, 18-III-2010, 3 exx, Okapa, Kimiagomo village, Hamegoya, S06°25.727', E145°35.455', S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010; 3 exx, ARC1054 (EMBL

HE615685), ARC1055 (EMBL # HE615686), ARC1056 (EMBL # HE615687), Eastern Highlands Prov., Goroka, Mt. Gahavisuka, S06°00.864', E145°24.779', 2150–2250 m, 24-X-2009; 6 exx, ARC1191 (EMBL # HE615819), ARC1192 (EMBL # HE615820), ARC1193 (EMBL # HE615821), Morobe Prov., Huon peninsula, Mindik, S06°27.380', E147°25.099' to S06°27.267', E147°25.049', 1500–1650 m, 09-X-2009; 2 exx, Mindik, 1200–1500 m, 26-IV-1994; 11 exx, Mindik, 1670–1710 m, S06°27.221', E147°24.185' to S06°27.196', E147°24.276', 10-X-2009, beaten; 22 exx, ARC1243 (EMBL # HE615871), ARC1244 (EMBL # HE615872), ARC1245 (EMBL # HE615873), Morobe Prov., Huon peninsula, mountain SW Pindiu, S06°27.437', E147°30.512' to S06°27.435', E147°30.310', 1170–1225 m, 14-X-2009; 1 ex, mountain SW Pindiu, 1225–1340 m, S06°27.435', E147°30.310' to S06°27.307', E147°30.168', 14-X-2009, beaten; 8 exx, Boana, Saruwaged-Mts, 1000–1500 m, 21–22-X-1992; 4 exx, E Pindiu, Kobau, 1250–1400 m, 24-IV-1998; 1 ex, W Pindiu, 1000–1400 m, 1200–1500 m, 26-IV-1998.

Distribution. Eastern Highlands Prov. (Aiyura, Goroka, Okapa); Morobe Prov. (Mindik, Pindiu). Elevation: 1340–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on a combination of the Latin noun *mons* (mountain) and the participle *vagus* (wandering) and refers to the relatively wide distribution in the highlands of Papua New Guinea.

Notes. *Trigonopterus montivagus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 205" by Tänzler et al. (2012).

53. *Trigonopterus moreaorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:B28315B8-C173-4FEC-8BDE-5AB9733790D7
http://species-id.net/wiki/Trigonopterus_moreaorum

Diagnostic description. Holotype, male (Fig. 53a). Length 3.76 mm. Color black. Body elongate-subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum slender; dorsally punctate-rugose, with distinct median ridge and pair of submedian ridges; apical 1/3 sparsely punctate; at base with erect white elongate scales, apically replaced by bristles. Eyes large, medially approximate. Pronotum densely punctate, each puncture containing one short seta; basally with indistinct lateral edge, in basal half contours of disk subparallel; sides anteriorly with few scattered white scales. Elytra subglabrous; irregularly punctate with minute punctures; basal margin with distinct ridge extending behind humeri, bordered by row of coarse punctures. Femora with acute tooth at middle. Mesofemur and metafemur dorsally densely squamose with narrow white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Meso- and metatibia with rows of long erect setae. Venter with sparse pubescence of long suberect setae. Metaventrite and abdominal ventrites 1–2 medially forming common concavity. Aedeagus (Fig. 53b) with apex subangulate, with long setae; body containing somewhat

X-shaped sclerite subequal to length of body; transfer apparatus dentiform, ductus ejaculatorius subapically without bulbus. **Intraspecific variation**. Length 3.31–3.76 mm. Female rostrum in apical 2/3 dorsally flattened, subglabrous, sparsely punctate; at base with erect, white, elongate scales. Female venter subglabrous, with scattered long suberect scales; female abdominal ventrites 1–2 flat.

Material examined. Holotype (SMNK): ARC1862 (EMBL # HE616139), PAPUA NEW GUINEA, Eastern Highlands Prov., Okapa, Kimiagomo village, Verefare, S06°24.760', E145°35.575', 1940 m, 18-III-2010. Paratypes (NAIC, SMNK): PAPUA NEW GUINEA, Eastern Highlands Prov.: 2 exx, ARC1863 (EMBL # HE616140), ARC1864 (EMBL # HE616141), same data as holotype.

Distribution. Eastern Highlands Prov. (Okapa). Elevation: 1940 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Morea, found on page 275 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus moreaorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 145" by Tänzler et al. (2012).

54. *Trigonopterus myops* Riedel, sp. n.

urn:lsid:zoobank.org:act:B3936427-7F5C-4541-844E-E3DECD929C3D
http://species-id.net/wiki/Trigonopterus_myops

Diagnostic description. Holotype, male (Fig. 54a). Length 1.66 mm. Color dark ferruginous, elytra almost black; antenna light ferruginous. Body subovate, in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum with indistinct, median ridge, bordered by row of coarse punctures, sparsely setose; epistome simple. Eyes small, anteriorly angularly projecting. Pronotum with weak subapical constriction; disk densely, coarsely punctate; each puncture with short, yellowish scale. Elytra with striae deeply impressed; each puncture with suberect, yellowish scale; intervals subglabrous, uneven, intervals 3, 5 and 7 distinctly costate; apex extended ventrad, slightly beak-shaped. Meso- and metafemur ventrally dentate. Metafemur subapically without stridulatory patch. Aedeagus (Fig. 54b) with apex asymmetrical, right side forming long curved extension; basal orifice ventrally with rim; transfer apparatus spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.35–1.76 mm. Female rostrum dorsally subglabrous, sparsely punctate, in basal third coarsely punctate. Abdominal ventrite 3 of females with flattened subtriangular process projecting over ventrite 4 with pair of submedian spines. Female abdominal ventrites 4–5 weakly sclerotized.

Material examined. Holotype (MZB): ARC0777 (EMBL # HE615460), WEST NEW GUINEA, Manokwari Reg., Manokwari, Arfak Mts, S01°03.723', E133°54.145', 1385 m, 08-XII-2007. Paratypes (SMNK, ZSM): WEST NEW

GUINEA, Manokwari Reg., Manokwari, Arfak Mts: 14 exx, ARC0778 (EMBL # HE615461), same data as holotype; 14 exx, Arfak Mts, S01°04.087', E133°54.268', 1520 m, 08-XII-2007; 51 exx, ARC0799 (EMBL # HE615482), Mokwam, Siyoubrig, S01°06.668', E133°54.594', 1535 m, 08-XII-2007; 5 exx, Mokwam, Siyoubrig, S01°06.107', E133°54.888', 1530 m, 10-XII-2007; 21 exx, Mokwam, Siyoubrig, S01°06.086', E133°55.027', 1500 m, 10-XII-2007, sifted.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1385–1535 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Greek *myops* (short-sighted) and refers to its peculiar eyes of a few ommatidia.

Notes. *Trigonopterus myops* Riedel, sp. n. was coded as "*Trigonopterus* sp. 232" by Tänzler et al. (2012).

55. *Trigonopterus nangiorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:E10159AB-092C-4CDF-A3F8-D5FC52AB99D7
http://species-id.net/wiki/Trigonopterus_nangiorum

Diagnostic description. Holotype, male (Fig. 55a). Length 3.17 mm. Color black; antenna and tarsi ferruginous. Body subovate; with distinct constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally with median and pair of submedian ridges, furrows with sparse rows of setae; subapically sparsely punctate. Pronotum densely punctate; interspaces dull, micrograngulate; with indistinct lateral edges converging in straight line to shortly before apex. Elytra densely punctate; striae distinct, marked by fine lines and rows of small punctures; intervals with row of minute punctures; laterally behind humeri with dense row of deep punctures of stria 9. Femora edentate. Mesofemur and metafemur dorsally with sparse yellowish lanceolate scales. Metafemur with denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus and distinct premucro. Procoxa ventrally with dense patch of long erect setae. Posteroventral rim of mesoventral receptacle densely setose with long erect setae. Abdominal ventrite 5 with distinct impression, densely punctate. Aedeagus (Fig. 55b) with sides subparallel, apically rounded with median nipple-shaped extension, sparsely setose; body dorsally with patches of long setae; transfer-apparatus flagelliform; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.69–3.17 mm. Female rostrum in apical half dorsally with sculpture shallower than in males. Male pronotum anteriorly subangularly projecting, in females rather rounded. Female mesoventral receptacle with posteroventral rim subglabrous. Female abdominal ventrite 5 flat, subglabrous, sparsely punctate.

Material examined. Holotype (SMNK): ARC1865 (EMBL # HE616142), PAPUA NEW GUINEA, Eastern Highlands Prov., Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA

NEW GUINEA, Eastern Highlands Prov.: 10 exx, ARC1866 (EMBL # HE616143), ARC1867 (EMBL # HE616144), same data as holotype; 2 exx, ARC0351 (EMBL # HE615164), ARC0352 (EMBL # HE615165), Aiyura, S06°21.131', E145°54.398', 1670 m, 05-IV-2006.

Distribution. Eastern Highlands Prov. (Aiyura). Elevation: 1670–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Nagi, found on page 280 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus nangiorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 175" by Tänzler et al. (2012).

56. *Trigonopterus nothofagorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:19817145-716A-41D7-A77E-296475D433A6
http://species-id.net/wiki/Trigonopterus_nothofagorum

Diagnostic description. Holotype, male (Fig. 56a). Length 2.10 mm. Color ferruginous, center of pronotum black. Body subrhomboid; in dorsal aspect with marked constriction between pronotum and elytron; in profile with shallow constriction. Rostrum with indistinct median wrinkle and pair of submedian wrinkles, coarsely punctate; epistome forming angulate ridge, medially with weak denticle. Pronotum with subapical constriction; with indistinct lateral flanges; coarsely punctate-reticulate; punctures each with one ochre scale. Elytra heart-shaped, humeri prominent; striae deeply incised; intervals costate; sparsely squamose with ochre scales. Femora ventrally markedly dentate. Metafemur subapically with stridulatory patch. Onychium subequal to tarsomere 3, fusiform. Aedeagus (Fig. 56b) with apex rounded; transfer apparatus flagelliform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.78–2.17 mm. Color ranging from ferruginous with black spots to largely black with few ferruginous spots. Body of females subovate. Female rostrum with rows of coarse punctures; epistome simple. Female elytra with humeri simple, not prominent as in males. Femoral tooth smaller or larger.

Material examined. Holotype (MZB): ARC0786 (EMBL # HE615469), WEST NEW GUINEA, Manokwari, Arfak Mts, S01°04.087', E133°54.268', 1520 m, 08-XII-2007, sifted. Paratypes (SMNK, ZSM): 25 exx, ARC0787 (EMBL # HE615470), ARC0788 (EMBL # HE615471), ARC0789 (EMBL # HE615472), same data as holotype; 10 exx, Mokwam, Siyoubrig, S01°06.107', E133°54.888', 1530 m, 10-XII-2007, sifted.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1520–1530 m.

Biology. Sifted from leaf litter in montane forest dominated by *Nothofagus*.

Etymology. This epithet is based on the plant genus *Nothofagus*.

Notes. *Trigonopterus nothofagorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 235" by Tänzler et al. (2012).

57. *Trigonopterus ovatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:AF215921-4907-479E-BA54-D519D9124B48
http://species-id.net/wiki/Trigonopterus_ovatus

Diagnostic description. Holotype, male (Fig. 57a). Length 3.56 mm. Color black; antennal scape and funicle ferruginous. Body ovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally densely punctate, without ridges or furrows. Pronotum densely punctate; dorsally punctures minute, laterally larger, anterolaterally with scattered white scales. Elytra punctate with minute punctures, especially on intervals; strial punctures slightly larger; striae impressed as fine lines; lateral stria behind humeri simple, not deepened. Femora edentate. Mesofemur and metafemur dorsally densely squamose with white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Metatibia apically with uncus, without premucro. Aedeagus (Fig. 57b) symmetrical; apex subangulate, subglabrous; transfer-apparatus simple; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.97–3.94 mm. Female rostrum in apical half slightly narrower than in male, dorsally with punctures slightly sparser and smaller.

Material examined. Holotype (SMNK): ARC1127 (EMBL # HE615756), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009. Paratypes (NAIC, SMNK, ZSM): Simbu Prov., Karimui Dist., Haia: 143 exx, ARC1154 (EMBL # HE615782), ARC1155 (EMBL # HE615783), ARC1156 (EMBL # HE615784), S06°41.216', E145°00.945' to S06°40.976', E145°00.979', 970–1135 m, 04-X-2009; 2 exx, S06°43.515', E145°00.128' to S06°43.948', E144°59.856', 750–915 m, 26-IX-2009; 15 exx, Haia, S06°41.259', E145°00.822' to S06°41.102', E145°00.979', 900–1005 m, 27-IX-2009; 27 exx, Simbu Prov., Karimui Dist., Haia, S06°41.102', E145°00.979', 1005–1020 m, 27-IX-2009, beaten, "Mimikry-sample"; 52 exx, Haia, S06°41.102', E145°00.979' to S06°40.976', E145°00.979', 1020–1135 m, 27-IX-2009, beaten; 1 ex, S06°41.553', E145°00.355' to S06°41.624', E145°00.728', 800–960 m, 25-IX-2009; 7 exx, ARC1128 (EMBL # HE615757), same data as holotype; 3 exx, Haia, Supa station, S06°39.815', E145°03.169' to S06°39.609', E145°03.012', 1240–1450 m, 30-IX-2009, beaten; 12 exx, Haia, Supa station, S06°40.047', E145°03.464' to S06°39.905', E145°03.880', 1075–1220 m, 01-X-2009, beaten; 17 exx, Haia, Supa station, S06°39.905', E145°03.880' to S06°39.796', E145°03.873', 1220–1320 m, 01-X-2009, beaten.

Distribution. Simbu Prov. (Haia). Elevation: 915–1240 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Latin adjective *ovatus* (egg-shaped) and refers to the species´ body form.

Notes. *Trigonopterus ovatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 147" by Tänzler et al. (2012).

58. *Trigonopterus oviformis* Riedel, sp. n.

urn:lsid:zoobank.org:act:E10C6E76-3AAE-40A5-9B83-322703ED5182
http://species-id.net/wiki/Trigonopterus_oviformis

Diagnostic description. Holotype, male (Fig. 58a). Length 2.45 mm. Color black with bronze lustre, antenna and tarsi ferruginous. Body subovate; in dorsal aspect and in profile with weak constriction between pronotum and elytron. Rostrum dorsally with median and pair of submedian ridges; sparsely squamose with slender subrecumbent scales. Pronotum relatively small; disk sparsely punctate; laterally with sparse, almond-shaped, cream-colored scales. Elytra with striae distinct; intervals flat, subglabrous; interval 2 basally with patch of almond-shaped, cream-colored scales. Femora ventrally with minute denticle. Meso- and metafemur especially dorsally squamose with cream-colored scales; metafemur subapically with stridulatory patch. Meso- and metatibia in apical half with regular row of setae, near uncus with small brush of long setae. Aedeagus (Fig. 58b) apically subtruncate, with dense fringe of setae; subapically sides with pair of membranous protrusions; orifice and body with complex sclerites; transfer apparatus symmetrical; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.16–2.45 mm. Female rostrum dorsally punctate and sparsely setose, in basal 1/3 coarsely punctate-rugose.

Material examined. Holotype (SMNK): ARC1086 (EMBL # HE615716), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, S06°41.624', E145°00.728', 960 m, 25-IX-2009. Paratypes (NAIC): 1 ex, ARC1092 (EMBL # HE615722), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia S06°43.948', E144°59.856', 915 m, 26-IX-2009.

Distribution. Simbu Prov. (Haia). Elevation: 915–960 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on a combination of the Latin noun *ovum* (egg) and the suffix *-formis* (-shaped) and refers to the habitus of this species.

Notes. *Trigonopterus oviformis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 254" by Tänzler et al. (2012).

59. *Trigonopterus parumsquamosus* Riedel, sp. n.

urn:lsid:zoobank.org:act:78AA5E83-38E8-4898-94A2-4C938342C306
http://species-id.net/wiki/Trigonopterus_parumsquamosus

Diagnostic description. Holotype, male (Fig. 59a). Length 2.03 mm. Color black; legs ferruginous; antenna light ferruginous. Body subovate, in dorsal aspect with marked constriction between pronotum and elytron; in profile almost evenly convex. Rostrum dorsally scabrous, basally with indistinct median ridge and pair of sublateral ridges; epistome forming angulate ridge and small median denticle. Pronotum densely punctate with ovate punctures, medially subglabrous; at middle with pair of transverse squamose patches; scales cream-colored, subtriangular. Elytra with striae marked by small punctures; interval 4 at middle with cluster of few cream-colored recumbent scales. Meso- and metafemur with anteroventral ridge simple. Meso- and metatibia in basal half widened, subapically narrowed. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 59b) with sides of body subparallel, apex rounded; transfer apparatus flagelliform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.60–2.03 mm. Female rostrum in apical half medially subglabrous, sublaterally punctate, without ridges; epistome simple. Cream-colored scales of pronotum and elytron in some specimens largely abraded.

Material examined. Holotype (MZB): ARC0527 (EMBL # FN429233), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 6 exx, ARC0528 (EMBL # FN429234), ARC0529 (EMBL # FN429235), same data as holotype; 2 exx, ARC0654 (EMBL # FN FN429301), ARC0655 (EMBL # FN429302), S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted; 1 ex, ARC0657 (EMBL # FN429304), S02°31.776', E140°30.215', 945 m, 21-XI-2007, sifted; 2 exx, S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted; 3 exx (1 marked ARC0412), 700 m, 22-XII-2004, sifted; 3 exx, 1000 m, 23-XII-2004, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 700–1065 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on a combination of the Latin words *parum* (sparse) and *squamosus* (scaled) and refers to the few scattered scales.

Notes. *Trigonopterus parumsquamosus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 43" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spaq" in the EMBL/GenBank/DDBJ databases.

60. *Trigonopterus parvulus* Riedel, sp. n.

urn:lsid:zoobank.org:act:1F696E2A-E177-460B-B948-9CB293658E17
http://species-id.net/wiki/Trigonopterus_parvulus

Diagnostic description. Holotype, male (Fig. 60a). Length 1.54 mm. Antenna, legs, and head ferruginous; pronotum, elytra, and tarsi black. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum punctate; epistome simple. Eyes small, anterior margin angularly projecting. Pronotum with weak subapical constriction; disk densely, coarsely punctate; each puncture with short, yellowish scale. Elytra with striae deeply impressed; each puncture with suberect, yellowish scale; intervals subglabrous, costate, partly transversely confluent. Meso- and metafemur ventrally dentate. Metafemur subapically without stridulatory patch. Onychium ca. 1.6× longer than tarsomere 3. Aedeagus (Fig. 60b) with apex asymmetrical, right side forming long curved extension; basal orifice ventrally with rim; transfer apparatus dentiform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.46–1.54 mm. Female rostrum slightly longer, dorsally subglabrous, sparsely punctate, in basal third coarsely punctate. Female elytral apex markedly extended ventrad, beak-shaped. Abdominal ventrite 3 of females with flattened process projecting over ventrite 4, medially with bifid extension reaching base of ventrite 5, sublaterally with pair of shorter spines. Female abdominal ventrites 4–5 weakly sclerotized.

Material examined. Holotype (MZB): ARC0832 (EMBL # HE983631), WEST NEW GUINEA, Manokwari, Arfak Mts, Mokwam, Siyoubrig, S01°07.066', E133°54.710', 1870 m, 11-XII-2007, sifted. Paratypes (SMNK, ZSM): 23 exx, ARC0833 (EMBL # HE615515), ARC0834 (EMBL # HE615516), same data as holotype.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1870 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Latin adjective *parvulus* (little) and refers to the species´ small body size.

Notes. *Trigonopterus parvulus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 233" by Tänzler et al. (2012).

61. *Trigonopterus phoenix* Riedel, sp. n.

urn:lsid:zoobank.org:act:76A1163B-D718-47F4-9466-2773F1EEDFB9
http://species-id.net/wiki/Trigonopterus_phoenix

Diagnostic description. Holotype, male (Fig. 61a). Length 2.63 mm. Color black; antennae, tarsi and elytra ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges, furrows with sparse rows of yellowish scales; apically weakly punctate, sparsely setose. Pronotum coarsely punctate-reticulate. Elytra with distinct striae of small punctures; intervals with row of minute punctures; laterally behind humeri with ridge bordered by 4 deep punctures of stria 9. Femora edentate. Mesofemur and metafemur dorsally squamose with silvery scales. Metafemur with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus and minute premucro. Abdominal ventrite 5 coarsely punctate, in apical half with round depression fringed with dense erect scales. Aedeagus (Fig. 61b) apically weakly pointed, sparsely setose; transfer-apparatus spiniform; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.53–2.63 mm. Female rostrum in apical half slender, dorsally subglabrous, with sublateral furrows. Female abdominal ventrite 5 densely punctate, with suberect scales, with median ridge.

Material examined. Holotype (SMNK): ARC1153 (EMBL # HE615781), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°39.815', E145°03.169' to S06°39.609', E145°03.012', 1240–1450 m, 30-IX-2009. Paratypes (NAIC): PAPUA NEW GUINEA, Simbu Prov.: 1 ex, ARC1132 (EMBL # HE615761), S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009.

Distribution. Simbu Prov. (Haia). Elevation: ca. 1240–1450 m.

Biology. Collected by beating foliage in primary forest.

Notes. *Trigonopterus phoenix* Riedel was coded as "*Trigonopterus* sp. 207" by Tänzler et al. (2012).

62. *Trigonopterus plicicollis* Riedel, sp. n.

urn:lsid:zoobank.org:act:C92E1947-7151-4164-A216-68C190AD848E
http://species-id.net/wiki/Trigonopterus_plicicollis

Diagnostic description. Holotype, male (Fig. 62a). Length 2.75 mm. Color black; legs deep ferruginous, antenna light ferruginous. Body in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum in basal half with 3 ridges posteriorly continued to forehead; furrows each with 1 row of mesad directed setae; epistome weakly swollen, with transverse ridge. Pronotum deeply sculptured; with marked subapical constriction, apical collar with coarse punctures; disk with glabrous median ridge, on each side with additional three highly elevated coarsely punctate ridges; sides with oblique wrinkles and deep punctures. Elytra with striae deeply incised, towards sides with interspersed punctures; intervals costate, subglabrous, with sparse small punctures and wrinkles; apex extended ventrad, slightly beak-shaped. Femora edentate. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 62b) apically with submedian tooth shifted to the left; body at middle with broad depression visible in lateral aspect; transfer apparatus flagelliform, shorter than body, pointing basad; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.10–2.75 mm. Female rostrum in apical half dorsally flattened, subglabrous, with sparse punctures and lateral furrows; epistome simple.

Material examined. Holotype (MZB): ARC0543 (EMBL # FN429249), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 6 exx, same data as holotype; 2 exx, ARC0539 (EMBL # FN429245), ARC0540 (EMBL # FN429246), S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted; 1 ex, 700 m, 22-XII-2004; 3 exx, 1000 m, 23-XII-2004, sifted; 1 ex, 1320 m, 23-XII-2004, sifted; 4 exx, 1100 m, 23-XII-2004, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 960–1320 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on a combination of the Latin nouns *plica* (fold) and *collum* (neck, pronotum) and refers to the surface of the pronotum.

Notes. *Trigonopterus plicicollis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 32" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spaf" in the EMBL/GenBank/DDBJ databases.

63. *Trigonopterus politoides* Riedel, sp. n.

urn:lsid:zoobank.org:act:336C5055-B4B6-4CAA-A6FE-332300F35FD0
http://species-id.net/wiki/Trigonopterus_politoides

Diagnostic description. Holotype, male (Fig. 63a). Length 2.18 mm. Color black; antenna ferruginous. Body slender, ovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum in apical half smooth; in basal half with two pairs of longitudinal furrows containing sparse scales; above eye simple. Eyes with dorsal margin continuous with head, not carinate. Pronotum subglabrous, sparsely punctate with minute punctures. Elytra subglabrous, striae hardly visible but each with a deep pit along basal margin. Femora subglabrous; metafemur dorsally with silvery scales (partly abraded). Metafemur on posterior surface with longitudinal impression and row of scales; with smooth dorsoposterior edge; subapically without stridulatory patch. Mesotibia basally with external angulation, subapically simple, with uncus. Metatibia subapically simple, with uncus and few recumbent setae. Abdominal ventrite 5 with median impression. Aedeagus (Fig. 63b). Apex asymmetrical, with angular extension shifted to the right; laterally with dense brushes of weakly curved setae; proximal part of ductus ejaculatorius parallel to axis of aedeagus, enclosed by sclerites of transfer apparatus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.18–2.51 mm. Female abdominal ventrite 5 flat.

Material examined. Holotype (MZB): ARC0500 (EMBL # FN429207), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.2', E140°30.4', 545–700 m, 02-XII-2007, beaten. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 1 ex, ARC0501 (EMBL # FN429208), same data as holotype; 1 ex, ARC0503 (EMBL # FN429210), S02°32.0', E140°30.4', 700–900 m, 02-XII-2007, beaten.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 700 m.

Biology. Collected by beating foliage.

Etymology. This epithet is based on a combination of the name of *Trigonopterus politus* (Faust) and the Greek suffix *eides* (similar) and refers to their superficial similarity.

Notes. *Trigonopterus politoides* Riedel, sp. n. was coded as "*Trigonopterus* sp. 25" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spy" in the EMBL/GenBank/DDBJ databases.

64. *Trigonopterus pseudogranum* Riedel, sp. n.

urn:lsid:zoobank.org:act:ECC19B3C-AC8F-4B57-A3EC-C29C95118BC6
http://species-id.net/wiki/Trigonopterus_pseudogranum

Diagnostic description. Holotype, male (Fig. 64a). Length 2.26 mm. Color black; legs and rostrum dark ferruginous; antenna light ferruginous. Body laterally somewhat compressed, elongate-ovate, without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally in basal third with low median ridge and pair of submedian ridges; apically subglabrous. Eyes large. Pronotum densely punctate, punctures dorsally small, laterally becoming larger, bearing each one minute seta; without scales. Elytra with striae distinct, punctures of stria 1–2 small, laterad strial punctures becoming larger, relatively shallow. Femora with anteroventral ridge. Profemur converging from base to apex. Meso- and metafemur with dorsoposterior edge subapically worn; metafemur subapically without stridulatory patch. Tibiae simple, without rows or brushes of long setae. Metatibia subapically with small suprauncal projection.

Metaventrite laterally forming acute process over metacoxa, reaching tibial insertion. Metaventrite and abdominal ventrite 1 subglabrous, with sparse recumbent setae. Abdominal ventrite 2 similar to ventrites 3-4. Abdominal ventrite 5 with deep, subrotund cavity almost filling complete ventrite. Aedeagus (Fig. 64b) apically sinuate, with deep median incision; ductus ejaculatorius without bulbus. **Intraspecific variation**. Female rostrum subglabrous except in basal ¼ with ridges. Female abdominal ventrite 5 flat.

Material examined. Holotype (MZB): ARC0774 (EMBL # HE615457), WEST NEW GUINEA, Manokwari, Arfak Mts, S01°01.465', E133°54.243', 685 m, 08-XII-2007, beaten. Paratype (ARC): 1 ex, WEST NEW GUINEA, Manokwari, Mt. Meja, 200 m, 18-III-1993, beaten.

Distribution. Manokwari Reg. (Arfak Mts, Mt. Meja). Elevation: 200–685 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Greek prefix *pseudo* (false) and the name of the sibling species *Trigonopterus granum*.

Notes. *Trigonopterus pseudogranum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 271" by Tänzler et al. (2012). It is closely related to *T. granum* sp. n., *T. pseudogranum* sp. n., and *T. imitatus* sp. n. from which it can be distinguished by the denser punctation of the pronotum and the structure of the male abdominal ventrite 5. Despite its close morphological similarity its *cox1*-sequence diverges 10.4–13.1 % from the other species.

65. *Trigonopterus pseudonasutus* Riedel, sp. n.

urn:lsid:zoobank.org:act:67C45350-3ABD-4AB6-AAD7-245B6C202360
http://species-id.net/wiki/Trigonopterus_pseudonasutus

Diagnostic description. Holotype, male (Fig. 65a). Length 2.48 mm. Color black; legs deep ferruginous to black; antenna lighter ferruginous. Body subovate; in dorsal aspect and in profile with constriction between pronotum and elytron. Rostrum dorsally swollen, with distinct median carina, remainder coarsely punctate with erect white scales, subapical third subglabrous, weakly punctate. Eyes medially approximate. Pronotum subglabrous, with minute punctures, in front of elytral humeri with row of deep punctures, evenly rounded towards sides. Elytra subglabrous with minute punctures; striae obsolete; basal margin straight, simple. Femora with anteroventral ridge distinct, at base abruptly ending and forming markedly projecting blunt angle; at middle with inconspicuous tooth. Mesofemur and metafemur dorsally densely squamose with white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Aedeagus (Fig. 65b) apically subangulate; ductus ejaculatorius subapically with weak bulbus. **Intraspecific variation**. Length 2.30–2.88 mm. Female rostrum in apical 2/3 dorsally flattened, subglabrous, sparsely punctate; basally swollen, with erect white scales.

Material examined. Holotype (MZB): ARC0700 (EMBL # FN429344), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Doyo, S02°32.5', E140°28.8', 300–400 m, 27-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts: 1 ex, ARC0701 (EMBL # FN429345), same data as holotype; 9 exx, ARC0457 (EMBL # FN429168), Sentani, S02°32.2', E140°30.4', 545–700 m, 02-XII-2007; 1 ex, ARC0492 (EMBL # FN429199), Sentani, S02°31.7', E140°30.3', 850–1000 m, 30-XI-2007; 3 exx, ARC0495 (EMBL # FN429202), Sentani, S02°31.8', E140°30.5', 600–900 m, 28-XI-2007; 3 exx, S02°31.6', E140°30.4', 900–1100 m, 28-XI-2007, beaten; 2 exx, ARC0690 (EMBL # FN429334), ARC0691 (EMBL # FN429335), Sentani, S02°32.2', E140°30.4', 545–700 m, 02-XII-2007; 2 exx, S02°32.0', E140°30.4', 700–900 m, 02-XII-2007; 3 exx, Sentani, S02°32.2', E140°30.5', 500–600 m, 28-XI-07; 3 exx, Sentani, "Mim 1", S02°32.166', E140°30.512', 600–620 m, 19-XI-07; 2 exx, Sentani, S02°31.794', E140°30.190', 800–860 m, 21-XI-07; 8 exx, Sentani, S02°32.3', E140°30.4', 350–620 m, 19-XI-07; 1 ex, Sentani, S02°31.8', E140°30.2', 630–800 m, 21-XI-2007; 1 ex, Sentani, 300–1400 m, 10-VIII-1991; 5 exx, Sentani, 600–1100 m, 05-X-1991; 3 exx, Sentani, 400–500 m, 10-VIII-1992; 4 exx, Sentani, 300–450 m, 07-10-VIII-1992; 4 exx, Sentani, 300–550 m, 02-X-1992; 1 ex ("marked as ARC0415"), 950–1450 m, 03-X-1992; 5 exx, Sentani, 300–500 m, 31-X-1992; 12 exx, Sentani, III-1992; 1 ex, Sentani, 350–850 m, 16-X-1996; 9 exx, Sentani, S02°32.535', E140°30.728', 250–385 m, 30-VI-2010.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 385–950 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Greek prefix *pseudo* (false) and the name of *Trigonopterus nasutus* (Pascoe) which is superficially very similar and occurs sympatrically.

Notes. *Trigonopterus pseudonasutus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 22" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spv" in the EMBL/GenBank/DDBJ databases.

66. *Trigonopterus ptolycoides* Riedel, sp. n.

urn:lsid:zoobank.org:act:37E45438-EBB4-4FD0-BC0E-B72E4D9979F8
http://species-id.net/wiki/Trigonopterus_ptolycoides

Diagnostic description. Holotype, male (Fig. 66a). Length 4.28 mm. Color ferruginous, elytral disk with some irregular darker spots; integument partly covered with yellowish-brownish tomentum. Body dorsally flattened, with irregular lateral ridge; with constrictions at middle of pronotum, between pronotum and elytron, and in basal third of elytron. Rostrum in basal half with distinct median ridge and pair of submedian ridges; basally above eyes with pair of protrusions; apical ¼ subglabrous, punctulate. Pronotum with subapical constriction; with marked lateral flanges; coarsely rugose-punctate; punctures containing each one upcurved scale and much finer tomentum. Elytra with distinct striae; intervals with irregular tomentose tubercles; with marked lateral flanges; base bisinuate; apex extended ventrad, slightly beak-shaped. Femora narrow, parallel-sided, edentate. Meso- and metafemur dorsally with fringe of erect scales; metafemur subapically with stridulatory patch. Meso- and metatibia tapering from base to apex. Tarsi asymmetrical; tarsomere 3 with anterior lobe much larger than posterior lobe. Abdominal ventrite 5 apically deeply emarginate. Aedeagus (Fig. 66b) with body flattened, sides subparallel, apex pointed; transfer-apparatus short, spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 3.92–4.28 mm. Female abdominal ventrite 5 apically rounded.

Material examined. Holotype (SMNK): ARC1415 (EMBL # HE615964), PAPUA NEW GUINEA, Eastern Highlands Prov., 37 km S Goroka, Hogave vill., Mt. Michael, S06°22.798', E145°15.427' to S06°22.925', E145°16.645', 2179–2800 m, 09-15-VII-2009, sifted. Paratypes (NAIC, SMNK, ZSM): 6 exx, ARC1416 (EMBL # HE615965), ARC1417 (EMBL # HE615966), same data as holotype.

Distribution. Eastern Highlands Prov. (Mt. Michael). Elevation: ca. 2179–2800 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is a combination of the genus name *Ptolycus* and the Latin suffix *-oides* (having the form of) and refers to the species´ resemblance in habitus.

Notes. *Trigonopterus ptolycoides* Riedel, sp. n. was coded as "*Trigonopterus* sp. 68" by Tänzler et al. (2012).

67. *Trigonopterus punctulatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:76389482-C7E2-49BA-9A72-900EAE695906
http://species-id.net/wiki/Trigonopterus_punctulatus

Diagnostic description. Holotype, male (Fig. 67a). Length 3.72 mm. Color black, legs and antenna deep ferruginous. Body ovate; almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally tricarinate, with distinct median and pair of lateral carinae to shortly before apex. Pronotum densely punctate. Elytra densely punctate; strial punctures slightly larger than minute punctures on intervals; striae impressed as fine lines; lateral stria behind humeri simple, not deepened. Femora edentate. Metafemur with denticulate dorsoposterior edge; subapically with stridulatory patch. Mesotibia subapically narrow, subbasally widened, dorsal contour with angulation. Metatibia without premucro; with small suprauncal projection. Aedeagus (Fig. 67b) apically subangulate; dorsum sublaterally sparsely setose; transfer apparatus spiniform, curved; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.92–3.92 mm. Female rostrum basally punctate, towards apex rugose-punctate.

Material examined. Holotype (MZB): ARC419 (EMBL # FN429130), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.7', E140°30.3', 900–1150 m, 21-XI-2007, beaten, marked "stridul. 2". Paratypes (ARC, NHMB, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 10 exx, ARC0424 (EMBL # FN429135), ARC0482 (EMBL # FN429189), S02°31.3', E140°30.5', 1200–1420 m, 30.XI.2007; 1 ex, ARC0664 (EMBL # FN429311), S02°31.8', E140°30.2', 630–800 m, 21-XI-2007; 8 exx, S02°31.794', E140°30.190', 800–860 m, 21-XI-2007, "Mim2", beaten; 8 exx, S02°31.7', E140°30.3', 860–1150 m, 21-XI-2007, beaten; 7 exx, S02°31.6', E140°30.4', 900–1100 m, 28-XI-2007, beaten;

3 exx, ARC0680 (EMBL # FN429325), ARC0681 (EMBL # FN429326), S02°31.2', E140°30.5', 1420–1520 m, 30-XI-2007; 1 ex, ARC0696 (EMBL # FN429340), S02°32.2', E140°30.4', 545–700 m, 02-XII-2007; 5 exx, S02°31.7', E140°30.3', 850–1000 m, 30-XI-2007, beaten; 5 exx, S02°31.6', E140°30.4', 1000–1200 m, 30-XI-2007, beaten; 1 ex, S02°31.603', E140°30.434', 1095 m, 28-XI-2007, sifted; 14 exx [1 marked "ARC 041"], 950–1450 m, 03-X-1992; 4 exx, 1100–1600 m, 05-X1991; 7 exx, 1200–1400 m, 09-VIII-1992; 10 exx, 1100–1600 m, 05-X-1991; 5 exx, 1400 m, 10-VIII-1991; 5 exx, 950–1450 m, 03-X-1992; 5 exx, Lake Sentani, 300 m, III-1992.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 300–1420 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Latin participle *punctulatus* (provided with little punctures) and refers to the species´ surface scattered with small punctures.

Notes. *Trigonopterus punctulatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 2" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spb" in the EMBL/GenBank/DDBJ databases.

68. *Trigonopterus ragaorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:FE9AA1AF-43EF-4A40-9EB5-54D2AF0702CF
http://species-id.net/wiki/Trigonopterus_ragaorum

Diagnostic description. Holotype, male (Fig. 68a). Length 2.57 mm. Color black; antennae and tarsi ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges, furrows with sparse rows scales and setae; apically weakly punctate, sparsely setose. Pronotum punctate-reticulate. Elytra with striae impressed as very fine lines; strial punctures very small; intervals flat, subglabrous; basal margin bordered by row of small punctures; laterally behind humeri with ridge bordered by 4 deep punctures of stria 9. Femora edentate. Mesofemur and metafemur dorsally squamose with silvery scales. Metafemur with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus and minute premucro. Abdominal ventrite 5 densely setose with erect setae. Aedeagus (Fig. 68b) apically weakly pointed, sparsely setose; body dorsally with 2 rows of sparse setae; in profile apical 2/3 of body markedly curved ventrad; transfer-apparatus spiniform; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.30–2.65 mm. Female rostrum in apical half dorsally subglabrous, sparsely punctate, with shallow furrows. Female abdominal ventrite 5 with subrecumbent setae.

Material examined. Holotype (SMNK): ARC1876 (EMBL # HE616153), PAPUA NEW GUINEA, Eastern Highlands Prov., Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA: 29 exx, ARC1877 (EMBL # HE616154), ARC1878 (EMBL # HE616155), ARC1879 (EMBL # HE616156), ARC1880 (EMBL # HE616157), ARC1881 (EMBL # HE616158), same data as holotype; 1 ex, ARC0354 (EMBL # HE615167), Aiyura, S06°21.131', E145°54.398', 1670 m, 05-IV-2006.

Distribution. Eastern Highlands Prov. (Aiyura). Elevation: 1670–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Raga, found on page 315 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus ragaorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 208" by Tänzler et al. (2012).

69. *Trigonopterus rhinoceros* Riedel, sp. n.

urn:lsid:zoobank.org:act:E52A2105-B7CB-4350-A8F3-9E8B78A8C25E
http://species-id.net/wiki/Trigonopterus_rhinoceros

Diagnostic description. Holotype, male (Fig. 69a). Length 2.14 mm. Color black; tarsi ferruginous; antenna light ferruginous. Body subglobose; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with median ridge and pair of submedian ridges, at middle with tubercle; apical half laterally bordered by ridges; epistome at middle with dorsoposteriad directed horn. Pronotum basally angulate; apex, base, and sides densely punctate, disk medially and sublaterally subglabrous. Elytra with suture and striae 1–3 incised; all striae marked by small punctures; intervals subglabrous, with row of minute punctures; base with yellowish, posteriad directed scales; interval 7 subapically swollen. Meso- and metafemur with anteroventral ridge weakly dentate. Metatibia ventrally in apical half with row of long setae. Metafemur with stridulatory patch. Aedeagus (Fig. 69b) with apex rounded; endophallus distally with brace-shaped sclerite; ductus ejaculatorius, without bulbus. **Intraspecific variation**. Length 1.76–2.26 mm. Female rostrum dorsally flattened, medially subglabrous, with rows of punctures and lateral furrows; epistome simple. Female metatibia subapically simple, without long setae.

Material examined. Holotype (MZB): ARC0554 (EMBL # FN429260), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.182', E140°30.542', 1510 m, 30-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Senani: 7 exx, ARC0555 (EMBL # FN429261), ARC0562 (EMBL # FN429268), same data as holotype; 1 ex, S02°31.383', E140°30.490', 1275 m, 30-XI-2007, sifted; 1 ex, S02°31.281', E140°30.535', 1420 m, 30-XI-2007, sifted; 4 exx (1 marked ARC0095), 1320 m, 23-XII-2004, sifted; 2 exx, 300–1400 m, 10-VIII-1991; 1 ex, 1200–1400 m, 09-VIII-1992, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1275–1510 m.

Biology. Sifted from leaf litter in montane crippled forest.

Etymology. This epithet is a noun in apposition and refers to the horn on the rostral apex, resembling the one of a mammal rhinoceros.

Notes. *Trigonopterus rhinoceros* Riedel, sp. n. was coded as "*Trigonopterus* sp. 44" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spar" in the EMBL/GenBank/DDBJ databases.

70. *Trigonopterus rhomboidalis* Riedel, sp. n.

urn:lsid:zoobank.org:act:E072A3FE-B753-4634-ACAC-4548BD13EDB8
http://species-id.net/wiki/Trigonopterus_rhomboidalis

Diagnostic description. Holotype, male (Fig. 70a). Length 2.98 mm. Color orange-ferruginous, head and pronotum black. Body subrhomboid; almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum with weak median and pair of submedian costae, basally with few distinct punctures; in apical 1/3 weakly rugose-punctate; sparsely setose. Pronotum punctate with small punctures becoming larger from base to apex; sides anteriorly with large punctures, posteriorly subglabrous. Elytra with striae indistinct, marked by small to minute punctures, intervals with row of minute punctures. Femora edentate, with distinct anteroventral ridge. Metafemur posteriorly subglabrous except subapically with stridulatory patch. Aedeagus (Fig. 70b) with sides of body subparallel, apex subtruncate, with small median tip; endophallus with two pairs of narrow sclerites; complex transfer-apparatus symmetrical; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.43–3.03 mm. Punctures of pronotum relatively small in specimens from Poga, especially basally; in specimens from Bokondini and Lake Habbema pronotum evenly coarsely punctate except along subglabrous midline.

Material examined. Holotype (MZB): ARC1753 (EMBL # HE616030), WEST NEW GUINEA, Jayawijaya Reg., Poga, S03°47.631', E138°35.459' to S03°47.406', E138°35.507', 2260–2410 m, 14-VII-2010. Paratypes (ARC, NHMB, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 3 exx, ARC1755 (EMBL # HE616032), same data as holotype; 1 ex, ARC1752 (EMBL # HE616029), Poga, S03°47.575', E138°33.155' to S03°47.473', E138°33.163', 2620–2715 m, 15-VII-2010; 1 ex, ARC1714 (EMBL # HE615994), Jiwika, Kurulu, S03°57.161', E138°57.357' to S03°56.977', E138°57.441', 1875–1990 m, 12-VII-2010; 2 exx, Jiwika, 1800–2300 m, 31-V-1998; 2 exx, Ilugwa, trail to Pass valley, 1900–2500 m, 14-IX-1990; 1 ex, ARC1806 (EMBL # HE616083), Bokondini, S03°40.345', E138°42.386' to S03°40.255', E138°42.189', 1655–1700 m, 18-VII-2010; 8 exx, ARC1815 (EMBL # HE616092), ARC1816 (EMBL # HE616093), W Wamena, road to Lake Habbema, S04°07.625', E138°49.992', 2520 m, 20-VII-2010; 62 exx, W Wamena, road to Lake Habbema, S04°08.256', E138°49.049', 2770 m, 20-VII-2010; 21 exx, Baliem-vall., ca. 1700 m, III-1992.

Distribution. Jayawijaya Reg. (Bokondini, Poga, Ilugwa, Jiwika, L. Habbema). Elevation: 1700–2770 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on the Latin adjective *rhomboidalis* (shaped like a rhomboid) and refers to the body-shape.

Notes. *Trigonopterus rhomboidalis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 81" by Tänzler et al. (2012).

71. ***Trigonopterus rubiginosus*** Riedel, sp. n.

urn:lsid:zoobank.org:act:B5E826C2-162D-4CF8-B781-6DCFFC180673
http://species-id.net/wiki/Trigonopterus_rubiginosus

Diagnostic description. Holotype, male (Fig. 71a). Length 2.93 mm. Color orange-ferruginous; pronotum, tarsi and antennal club black. Body elongate; with distinct constriction between pronotum and elytron; in profile dorsally flat. Rostrum with distinct median and pair of submedian costae, in apical 1/3 scabrous. Pronotum densely punctate; interspaces subequal to puncture´s diameter. Elytra with striae marked by small punctures and hardly visible fine lines, intervals with smaller punctures interspersed; intervals 1–3 near base with larger and denser punctures. Mesocoxa with densely setose patch. Femora edentate. Profemur in basal third posteriorly with callus. Metafemur dorsally with row of white scales; subapically with indistinct stridulatory patch interspersed with coarse punctures. Metatibia ventrally with sparse row of long setae. Aedeagus (Fig. 71b) apically subangulate, with brushes of stout, apically hooked setae; body flattened, sides subparallel; transfer apparatus simple, spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.81–3.09 mm. No female specimen available.

Material examined. Holotype (MZB): ARC1756 (EMBL # HE616033), WEST NEW GUINEA, Jayawijaya Reg., Poga, S03°47.631', E138°35.459' to S03°47.406', E138°35.507', 2260–2410 m, 14-VII-2010. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 13 exx, ARC1736 (EMBL # HE616013), ARC1737 (EMBL # HE616014), ARC1738 (EMBL # HE616015), Poga, S03°48.382', E138°34.780', 2285–2345 m, 13-VII-2010; 1 ex (marked as "ARC0033"), Jiwika, 1800–2300 m, 31-V-1998; 1 ex, Ilugwa, Melanggama, 1900–2200 m, 09-12-IX-1990.

Distribution. Jayawijaya Reg. (Jiwika, Ilugwa, Poga). Elevation: 2200–2285 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on the Latin adjective *rubiginosus* (rusty-red)

Notes. *Trigonopterus rubiginosus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 248" by Tänzler et al. (2012).

72. ***Trigonopterus rubripennis*** Riedel, sp. n.

urn:lsid:zoobank.org:act:EB5923DD-599C-4CEA-9EA2-EA61BA28D9F1
http://species-id.net/wiki/Trigonopterus_rubripennis

Diagnostic description. Holotype, male (Fig. 72a). Length 2.43 mm. Color black; antennae, legs and elytra ferruginous. Body subrhomboid; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges; with lateral constriction; sparsely setose. Pronotum densely punctate-reticulate. Elytra with striae distinct; strial punctures small; intervals with row of minute punctures; laterally behind humeri with ridge bordered by 4 deeper punctures of stria 9. Femora edentate. Anteroventral ridge of profemur in apical 1/3 shortened, forming weak angulation. Mesofemur and metafemur dorsally sparsely squamose. Metafemur subapically with stridulatory patch. Metatibia apically with uncus and minute premucro. Abdominal ventrite 5 with shallow depression and patch of dense erect setae. Aedeagus (Fig. 72b) apically weakly pointed, sparsely setose; body dorsally with two combs of setae; transfer-apparatus spiniform, curved; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.14–2.43 mm. Female rostrum in apical half subglabrous, sparsely punctate. Female abdominal ventrite 5 flat, with subrecumbent setae.

Material examined. Holotype (SMNK): ARC1834 (EMBL # HE616111), PAPUA NEW GUINEA, Eastern Highlands Prov., Okapa, Konafi to Isimomo, S06°25.593', E145°34.862', S06°25.003', E145°34.527', 1911–2131 m, 18-III-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 4 exx, ARC1835 (EMBL # HE616112), same data as holotype; 1 ex, Okapa, Isimomo, S06°25.003', E145°34.527', 2131 m, 22-XII-2010; 7 exx, ARC1833 (EMBL # HE616110), Okapa, Kimiagomo village, Hamegoya, S06°25.727', E145°35.455', S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010; 1 ex, Okapa, Afiyaleto village, S06°25.593', E145°34.862' to S06°25.212', E145°35.498', 1911 m, 18-III-2010, beaten.

Distribution. Eastern Highlands Prov. (Okapa). Elevation: ca. 1911–2131 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on a combination of the Latin adjective *ruber* (red) and the noun *penna* (wing, elytron).

Notes. *Trigonopterus rubripennis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 206" by Tänzler et al. (2012).

73. *Trigonopterus rufibasis* Riedel, sp. n.

urn:lsid:zoobank.org:act:A01D3C2B-6BB0-451E-B8CB-077A16A49BD3
http://species-id.net/wiki/Trigonopterus_rufibasis

Diagnostic description. Holotype, male (Fig. 73a). Length 2.38 mm. Color black; basal 1/3 of elytra ferruginous; legs dark ferruginous except tarsi, knees and base of femora black. Body subovate; with weak constriction between pronotum and elytron; in profile almost evenly convex. Rostrum dorsally relatively flat, with two submedian rows of punctures, dorsolaterally with pair of furrows continuing along eye. Pronotum sparsely punctate with minute punctures, subapically punctures larger and denser. Elytra with striae distinct, dorsally punctures small, along base and laterally behind humeri punctures large; intervals subglabrous. Femora edentate. Metafemur with simple dorsoposterior edge; subapically with stridulatory patch. Aedeagus (Fig. 73b) apically rounded, sparsely setose; transfer apparatus spiniform, curved, much shorter than body; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.91–2.55 mm. Color of legs ferruginous or black. Female rostrum dorsally with punctures smaller and sparser than in male.

Material examined. Holotype (MZB): ARC1764 (EMBL # HE616041), WEST NEW GUINEA, Jayawijaya Reg., Poga, S03°47.575', E138°33.155' to S03°47.473', E138°33.163', 2620–2715 m, 15-VII-2010. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg., Poga: 12 exx, ARC1765 (EMBL # HE616042), ARC1766 (EMBL # HE616043), same data as holotype.

Distribution. Jayawijaya Reg. (Poga). Elevation: ca. 2620–2715 m.

Biology. Beaten from foliage of upper montane forests.

Etymology. This epithet is based on the combination of the Latin adjective *rufus* (reddish) and the noun *basis* (base) and refers to the elytral coloration.

Notes. *Trigonopterus rufibasis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 124" by Tänzler et al. (2012).

74. *Trigonopterus scabrosus* Riedel, sp. n.

urn:lsid:zoobank.org:act:41D1ED4D-256D-40EA-959C-7E2978F22AF5
http://species-id.net/wiki/Trigonopterus_scabrosus

Diagnostic description. Holotype, male (Fig. 74a). Length 2.08 mm. Color of legs and elytral base dark ferruginous; antenna light ferruginous; remainder black. Body subovate, in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum with median carina bordered by pair of sublateral furrows, posteriorly continued to hind-level of eyes; at level of antennal insertion median carina high, denticulate; with sparse, erect scales; epistome with transverse, angulate ridge provided with three teeth, medially with horn and laterally with pair of teeth. Pronotum with subapical constriction; disk coarsely punctate, areolate. Elytra with striae deeply incised, intervals costate, sparsely setose with minute recumbent setae; interval 7 subapically forming ridge; apex subangulate. Femora edentate. Metafemur with weakly denticulate dorsoposterior edge, in apical third with transverse row of small suberect setae, subapically with stridulatory patch. Abdominal ventrites 1–2 cavernous. Abdominal ventrite 2 projecting dentiform over elytral edge in profile. Aedeagus (Fig. 74b) apically subtruncate; transfer apparatus small, tridentate; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.90–2.45 mm. Color of elytra ranging from almost black (except base of intervals 4–5 ferruginous) to ferruginous in basal half. Female rostrum dorsally with low median costa bearing two rows of punctures, bordered by pair of lateral furrows, without protrusions; epistome simple.

Material examined. Holotype (MZB): ARC0759 (EMBL # HE615442), WEST NEW GUINEA, Manokwari, Mt. Meja, S00°51.497', E134°04.949', 220 m, 05-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Manokwari, Mt. Meja: 3 exx, ARC0760 (EMBL # HE615443), ARC0761 (EMBL # HE615444), same data as holotype; 1 ex, 22-23-IX-1990, sifted; 4 exx, 200 m, 30-XII-2004, sifted.

Distribution. Manokwari Reg. (Mt. Meja). Elevation: 200–220 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is based on the Latin adjective *scabrosus* (rough) and refers to sculpture, especially the one of the pronotum.

Notes. *Trigonopterus scabrosus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 204" by Tänzler et al. (2012).

75. *Trigonopterus scissops* Riedel, sp. n.

urn:lsid:zoobank.org:act:5E783DAA-30CE-41D6-A8DE-0FEE8E94B143
http://species-id.net/wiki/Trigonopterus_scissops

Diagnostic description. Holotype, male (Fig. 75a). Length 1.78 mm. Color black; antenna and tarsi ferruginous; tibiae and femora dark ferruginous. Body subovate; in dorsal aspect and in profile with marked constriction between pronotum and elytron. Rostrum with submedian and sublateral pair of furrows; epistome simple. Eyes large, divided into dorsal and ventral portions by marked incision of posterior margin. Pronotum with marked subapical constriction; densely punctate with deep punctures; each puncture with one narrow, elongate, ochre scale. Elytra with striae deeply incised; intervals costate, each with one row of narrow scales. Metafemur subapically without stridulatory patch. Tibia apically confluent with stout uncus. Onychium ca. 1.9× longer than tarsomere 3. Aedeagus (Fig. 75b) dorsoventrally flattened, widened to subangulate apex; transfer apparatus short, tubuliform. **Intraspecific variation**. Length 1.78–2.10 mm.

Material examined. Holotype (MZB): ARC0836 (EMBL # HE615518), WEST NEW GUINEA, Manokwari Reg., Arfak Mts, Mokwam, Siyoubrig, S01°07.066', E133°54.710', 1870 m, 11-XII-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Manokwari Reg., Arfak Mts: 7 exx, ARC0835 (EMBL # HE615517), ARC0837 (EMBL # HE615519), same data as holotype.

Distribution. Manokwari Reg. (Arfak Mts). Elevation: 1870 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is composed of the Latin participle *scissus* (split) and the Greek noun *ops* (eye) and refers to the remarkable morphology of the eye of this species.

Notes. *Trigonopterus scissops* Riedel, sp. n. was coded as "*Trigonopterus* sp. 55" by Tänzler et al. (2012).

76. *Trigonopterus scharfi* Riedel, sp. n.

urn:lsid:zoobank.org:act:8D7C7A25-B2D6-416F-813B-2F9186048CB2
http://species-id.net/wiki/Trigonopterus_scharfi

Diagnostic description. Holotype, male (Fig. 76a). Length 1.40 mm. Color black; head, antenna, tarsi and tibiae ferruginous. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum with indistinct, median ridge, sparsely setose. Eyes in subdorsal position, approximate. Pronotum with weak subapical constriction; disk with median ridge; densely punctate with large punctures; each puncture with curved, suberect, yellowish scale. Elytra with striae deeply impressed; each puncture with curved, suberect, yellowish scale; intervals weakly costate, subglabrous. Meso- and metafemur ventrally dentate. Metafemur subapically with stridulatory patch. Aedeagus (Fig. 76b) with apex extended, pointed, curved ventrad; transfer apparatus spiniform; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 1.40–1.60 mm. Female rostrum dorsally slightly flattened, in apical half subglabrous, weakly punctate.

Material examined. Holotype (MZB): ARC0536 (EMBL # FN429242), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 2 exx, ARC0535 (EMBL # FN429241), ARC0537 (EMBL # FN429243), same data as holotype; 17 exx, S02°31.383', E140°30.490', 1275 m, 30-XI-2007, sifted; 20 exx, ARC0678 (EMBL # FN429323), ARC0679 (EMBL # FN429324), S02°31.281', E140°30.535', 1420 m, 30-XI-2007, sifted; 67 exx, ARC0684 (EMBL # FN429329), ARC0685 (EMBL # FN429330), S02°31.182', E140°30.542', 1510 m, 30-XI-2007, sifted; 6 exx, S02°31.425', E140°30.474', 1265 m, 30-XI-2007, sifted; 1 ex, S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted; 14 exx, 1000 m, 23-XII-2004, sifted; 5 exx, S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted; 2 exx, Sentani, S02°31.603', E140°30.434', 1095 m, 28-XI-07, sifted; 5 exx, 1100 m, 23-XII-2004, sifted; 6 exx, 1200–1400 m, 09-VIII-1991, sifted; 44 exx, 300–1400 m, 10-VIII-1991, sifted; 2 exx, S02°31.516', E140°30.436', 1150 m, 21-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 960–1510 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This species is named in honor of Stefan Scharf (Karlsruhe), who has spent months creating a 3D computer model of one of the paratypes.

Notes. *Trigonopterus scharfi* Riedel, sp. n. was coded as "*Trigonopterus* sp. 51" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spay" in the EMBL/GenBank/DDBJ databases.

77. *Trigonopterus signicollis* Riedel, sp. n.

urn:lsid:zoobank.org:act:1F97F68E-A68D-40AB-832E-AFB33A98CAE3
http://species-id.net/wiki/Trigonopterus_signicollis

Diagnostic description. Holotype, male (Fig. 77a). Length 1.79 mm. Color black; legs and apex of pronotum deep ferruginous; antenna and tarsi light ferruginous. Body subglobose; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum in basal half with 3 ridges posteriorly continued to and uniting on forehead; subapically scabrous; epistome forming curved, transverse ridge. Pronotum deeply sculptured; with marked subapical constriction, apical collar and lateral costate flanges punctate, sparsely setose; transversely ovate disk swollen, glabrous except medially with few punctures. Elytra subglabrous, on disk striae deeply incised, intervals costate, towards sides and near apex with deep punctures; intervals 3, 5, and 6 more prominent; apex extended ventrad, beak-shaped; lateral interval subapically with row of setae. Meso- and metafemur weakly dentate. Metafemur with weakly denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 77b) with apex medially pointed; body in apical half with broad depression visible in lateral aspect; transfer apparatus markedly asymmetrical, flagelliform, curled, pointing laterad; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 1.71–2.03 mm. Female rostrum in apical half dorsally flattened, subglabrous, with sparse punctures; epistome simple.

Material examined. Holotype (MZB): ARC0553 (EMBL # FN429259), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.383', E140°30.490', 1275 m, 30-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 2 exx, same data as holotype; 2 exx, ARC0560 (EMBL # FN429266), ARC0561 (EMBL # FN429267), S02°31.425', E140°30.474', 1265 m, 30-XI-2007, sifted; 2 exx, S02°31.281', E140°30.535', 1420 m, 30-XI-2007, sifted; 3 exx, ARC0682 (EMBL # FN429327), ARC0683 (EMBL # FN429328), S02°31.182', E140°30.542', 1510 m, 30-XI-2007, sifted; 1 ex, 1320 m, 23-XII-2004.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1265–1510 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on a combination of the Latin nouns *signum* (mark, seal) and *collum* (neck, pronotum) and refers to the distinct, central portion of the pronotal disk.

Notes. *Trigonopterus signicollis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 38" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spal" in the EMBL/GenBank/DDBJ databases.

78. *Trigonopterus simulans* Riedel, sp. n.

urn:lsid:zoobank.org:act:7F9C0CC2-B228-4134-8548-19243C03D182
http://species-id.net/wiki/Trigonopterus_simulans

Diagnostic description. Holotype, male (Fig. 78a). Length 2.15 mm. Color black, with bronze lustre; legs and antenna ferruginous. Body subovate; in dorsal aspect without constriction between pronotum and elytron; in profile with distinct constriction. Rostrum with weak median ridge and pair of submedian furrows. Pronotum anteriorly densely punctate, with yellowish elongate apicad directed scales; disk subglabrous, with sparse minute punctures. Elytra near base and before apex with sparse, yellowish, elongate scales; remainder subglabrous, with sparse minute punctures; striae obsolete. Anteroventral ridges of femora simple. Metafemur with weakly denticulate dorsoposterior edge, subapically without stridulatory patch. Abdominal ventrite 5 swollen, at middle with depression. Aedeagus (Fig. 78b) with apex rounded; behind orifice containing X-shaped pair of sclerites; in profile dorsal contour convex; transfer apparatus spiniform, 0.3× as long as body of aedeagus. **Intraspecific variation**. Length 2.15–2.30 mm. Female rostrum slender, dorsally subglabrous, sparsely punctate.

Material examined. Holotype (MZB): ARC0518 (EMBL # FN429224), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 2 exx, ARC0511 (EMBL # HE615270), ARC0513 (EMBL # FN429219), S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted; 1 ex, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted; 2 exx, ARC0542 (EMBL # FN HE615301), S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 710–960 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin adjective *simulans* (imitating). It refers to the close resemblance of this species with other closely related ones.

Notes. *Trigonopterus simulans* Riedel, sp. n. was coded as "*Trigonopterus* sp. 45" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spas" in the EMBL/GenBank/DDBJ databases.

79. *Trigonopterus soiorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:74800A1A-4341-4D75-9D36-3700E71A7DE3
http://species-id.net/wiki/Trigonopterus_soiorum

Diagnostic description. Holotype, male (Fig. 79a). Length 3.06 mm. Color black; base of antennal scape ferruginous. Body elongate; in dorsal aspect with distinct constriction between pronotum and elytron; in profile with weak constriction. Rostrum slender; dorsally with carina and pair of short submedian ridges; at base with erect white elongate scales, apically replaced by bristles. Eyes large, medially approximate. Pronotum with disk subglabrous, with minute punctures; with distinct edge lateral edge except in apical 1/4 evenly rounded; posterior angles with coarse punctures and sparse white scales; sides along anterior margin with few white scales; above procoxa coarsely punctate. Elytra subglabrous, irregularly punctate with minute punctures; striae obsolete; basal margin straight; laterally behind humeri with ridge bordered by row of shallow punctures. Femora with anteroventral ridge distinct, terminating at base; profemur at middle with tooth. Mesofemur and metafemur dorsally densely squamose with white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Metaventrite and abdominal ventrites 1–2 forming common, subglabrous concavity. Abdominal ventrite 5 with subrotund densely setose impression, laterally bordered by distinct ridges. Aedeagus (Fig. 79b) with body markedly curved in profile; apex subangulate, subglabrous; transfer apparatus short, spiniform; ductus ejaculatorius subapically without bulbus. **Intraspecific variation**. Length 3.06–3.38 mm. Female rostrum in apical 2/3 dorsally subglabrous, sparsely punctate, sublaterally with furrow containing row of setae; at base bordering eyes with white elongate scales. Female abdominal ventrite 5 flat, subglabrous.

Material examined. Holotype (SMNK): ARC1858 (EMBL # HE616135), PAPUA NEW GUINEA, Eastern Highlands Prov., Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 1 ex, ARC1857 (EMBL # HE616134), same data as holotype; 5 exx, ARC1859 (EMBL # HE616136), ARC1860 (EMBL # HE616137), Okapa, Kimiagomo village, Verefare, S06°24.760', E145°35.575', 1940 m, 18-III-2010; 2 exx, Okapa, Kofare village, S06°25.212', E145°35.498', 2140 m, 18-III-2010, beaten; 2 exx, Okapa, Anurite village, S06°24.760', E145°35.575', 1940 m, 18-III-2010, beaten; 3 exx, Okapa, Nakaloyate village, S06°24.760', E145°35.575', 1940 m, 18-III-2010.

Distribution. Eastern Highlands Prov. (Aiyura, Okapa). Elevation: 1940–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Soi, found on page 330 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus soiorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 58" by Tänzler et al. (2012).

80. *Trigonopterus sordidus* Riedel, sp. n.

urn:lsid:zoobank.org:act:4FC14699-33FD-4559-A77E-4838ED9272D5
http://species-id.net/wiki/Trigonopterus_sordidus

Diagnostic description. Holotype, male (Fig. 80a). Length 1.98 mm. Color black; antenna and tarsi light ferruginous; tibiae, femora, and head deep ferruginous. Body subovate; in dorsal aspect with distinct constriction between pronotum and elytron; in profile evenly convex. Rostrum rugose-punctate; epistome weakly, transversely swollen. Pronotum deeply rugose-punctate, each puncture containing one scale; majority of scales narrow, ochre; few scales almond-shaped, white. Elytra with striae deeply impressed; strial punctures with same set of scales as pronotum; intervals costate, largely subglabrous, but with scattered scales. Femora dentate. Metafemur with simple dorsoposterior edge, subapically with stridulatory patch. Aedeagus (Fig. 80b) complex, laterally incised, with dorsolateral well-sclerotized flanges; apex subtruncate, sparsely setose. Endophallus with various sclerites. transfer apparatus drop-shaped, apically pointed; ductus ejaculatorius with weak bulbus. **Intraspecific variation**. Length 1.86–2.28 mm. Color ferruginous in some possibly teneral specimens. Scattered scales on elytra more or less numerous.

Material examined. Holotype (MZB): ARC0736 (EMBL # HE615419), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°57.161', E138°57.357', 1875 m, 24-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu: 1 ex, ARC1715 (EMBL # HE615995), S03°57.161', E138°57.357', 1875 m, 12-VII-2010, sifted; 2 exx (1 marked ARC0080), ca. 1700–2300 m, 02-IX-1991, sifted; 9 exx, 1900–2000 m, 23-IX-1992, sifted; 2 exx, 1900–2050 m, 24-X.1993.

Distribution. Jayawijaya Reg. (Jiwika). Elevation: 1875–1900 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Latin adjective *sordidus* (dirty) and refers both to the occurrence of incrustations and the species´ general appearance making it hard to distinguish from a grain of dirt.

Notes. *Trigonopterus sordidus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 176" by Tänzler et al. (2012).

81. *Trigonopterus squamirostris* Riedel, sp. n.

urn:lsid:zoobank.org:act:909E35FA-AA5F-479E-AF66-B5A9E59317E6
http://species-id.net/wiki/Trigonopterus_squamirostris

Diagnostic description. Holotype, male (Fig. 81a). Length 1.70 mm. Color black; tarsi and elytra dark ferruginous, antenna light ferruginous. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Eyes large. Rostrum punctate, surface microreticulate, densely squamose with cream-colored almond-shaped scales, without distinct furrows or ridges. Pronotum densely punctate; anterolaterally with scattered cream-colored scales. Elytra with striae distinct; intervals flat, subglabrous; stria 3 near base and apex with few scales. Femora edentate, dorsally with few scattered scales. Metafemur subapically with stridulatory patch. Metatibia simple; uncus hook-like extended, curved ventroposteriad. Aedeagus (Fig. 81b) with apodemes 2.0 X as long as body; sides of body weakly bisinuate; apex extended, pointed, markedly curved ventrad; transfer apparatus small, symmetrical; ductus ejaculatorius basally swollen, without bulbus. **Intraspecific variation**. Length 1.38–1.88 mm. Color of elytra ferruginous or black. Female rostrum dorsally subglabrous, submedially with row of punctures, sublateral furrow containing sparse row of setae. Female metatibia with uncus simple, not hook-like.

Material examined. Holotype (SMNK): ARC1119 (EMBL # HE615748), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009. Paratypes (NAIC, SMNK, ZSM): Simbu Prov., Karimui Dist., Haia: 1 ex, ARC1104 (EMBL # HE615733), S06°41.018', E145°00.995',1090 m, 04-X-2009, sifted; 28 exx, ARC1113 (EMBL # HE615742), ARC1114 (EMBL # HE615743), ARC1118 (EMBL # HE615747), ARC1120 (EMBL # HE615749), ARC1121 (EMBL # HE615750), same data as holotype; 1 ex, Haia, S06°41.259', E145°00.822' to S06°41.102', E145°00.979', 900–1005 m, 27-IX-2009; 3 exx, Haia, S06°41.216', E145°00.945' to S06°40.976', E145°00.979', 970–1135 m, 04-X-2009, beaten; 3 exx, Haia, Supa station, S06°40.047', E145°03.464' to S06°39.815', E145°03.169', 1075–1240m, 30-IX-2009, beaten; 1 ex, Haia, Supa station, S06°40.047', E145°03.464' to S06°39.905', E145°03.880', 1075–1220 m, 01-X-2009, beaten; 1 ex, Haia, Supa station, S06°39.905', E145°03.880' to S06°39.796', E145°03.873', 1220–1320 m, 01-X-2009, beaten; 3 exx, Haia, Supa station, S06°40.047', E145°03.464' to S06°40.078', E145°03.207', 1075–1220 m, 02-X-2009, beaten.

Distribution. Simbu Prov. (Haia). Elevation: 1005–1220 m.

Biology. Mostly collected by beating foliage in montane forest.

Etymology. This epithet is based on a combination of the Latin nouns *squama* (scale) and rostrum (snout) and refers to the clothed rostrum of the males.

Notes. *Trigonopterus squamirostris* Riedel, sp. n. was coded as "*Trigonopterus* sp. 225" by Tänzler et al. (2012).

82. *Trigonopterus striatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:BF617D19-62C4-4847-9CFD-99F747C7564D
http://species-id.net/wiki/Trigonopterus_striatus

Diagnostic description. Holotype, male (Fig. 82a). Length 1.92 mm. Color of antenna and tarsi light ferruginous; tibiae, head, and anterior part of pronotum deep ferruginous; remainder black. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum rugose-punctate, sparsely setose with recumbent mesad directed setae. Pronotum with distinct subapical constriction; disk longitudinally rugose-punctate; sparsely setose. Elytra with striae deeply impressed; each puncture with inconspicuous seta; intervals weakly costate, subglabrous; sutural interval more distinctly raised; apex extended ventrad, slightly beak-shaped. Meso- and metafemur ventrally weakly dentate. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Abdominal venter excavated. Abdominal ventrites 4 simple; ventrite 5 flat, ferruginous. Aedeagus (Fig. 82b) with apex extended, bent to the left; transfer apparatus short, spiniform; basal orifice ventrally with rim; apodemes short; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.43–1.96 mm. Female rostrum dorsally subglabrous, sparsely punctate. Abdominal ventrite 3 of females with flattened process projecting over retracted, subglabrous ventrites 4–5; process of ventrite 3 shaped like a flattened thistle-leaf with one long median spine and two shorter spines on each side.

Material examined. Holotype (MZB): ARC0603 (EMBL # HE615329), WEST NEW GUINEA, Manokwari, Mt. Meja, S00°51.497', E134°04.949', 220 m, 05-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Manokwari, Mt. Meja: 2 exx, ARC0604 (EMBL # HE615330), ARC0605 (EMBL # HE615331), same data as holotype; 6 exx, S00°51.400', E134°04.918', 225 m, 06-XII-2007, sifted; 13 exx (1 marked as "ARC00141"), 200 m, 30-XII-2004, sifted; 3 exx, 22-23-IX-1990, sifted; 5 exx, 200 m, 19-IV-1993, sifted; 19 exx, 200 m, 30-XII-2000, sifted.

Distribution. Manokwari Reg. (Mt. Meja). Elevation: 200–225 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is based on the Latin participle *striatus* (provided with furrows) and refers to the species´ body-sculpture.

Notes. *Trigonopterus striatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 256" by Tänzler et al. (2012).

83. *Trigonopterus strigatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:AA765190-0387-4301-A5EA-4806700C0D1F
http://species-id.net/wiki/Trigonopterus_strigatus

Diagnostic description. Holotype, male (Fig. 83a). Length 2.95 mm. Color black; antenna and tarsi ferruginous. Body ovate; in dorsal aspect almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges, furrows with sparse rows of yellowish scales; apically weakly punctate, sparsely setose. Pronotum densely punctate-reticulate. Elytra dorsally with striae deeply incised forming well-defined furrows; intervals each with one secondary furrow of fused elongate punctures; laterally subglabrous, sparsely punctate. Femora somewhat widened, with distinct anteroventral ridge, edentate. Metafemur dorsally sparsely squamose with silvery scales; with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus, without premucro. Abdominal ventrite 5 with shallow depression, densely punctate, with dense suberect setae. Aedeagus (Fig. 83b) apically angulate, subglabrous; complex transfer-apparatus symmetrical; ductus ejaculatorius basally swollen, with indistinct bulbus. **Intraspecific variation**. Length 2.94–3.06 mm. Female rostrum in apical half slender, dorsally subglabrous, punctate, posteriorly with furrows. Female abdominal ventrite 5 densely punctate, with sparse recumbent scales, medially with weak swelling.

Material examined. Holotype (SMNK): ARC1188 (EMBL # HE615816), PAPUA NEW GUINEA, Morobe Prov., Huon peninsula, Mindik, S06°27.380', E147°25.099' to S06°27.267', E147°25.049', 1500–1650 m, 09-X-2009. Paratypes (ARC, NAIC, SMNK, ZSM): Morobe Prov., Huon peninsula, Mindik: 7 exx, ARC1189 (EMBL # HE615817), ARC1190 (EMBL # HE615818), same data as holotype; 4 exx, 1500–1670 m, S06°27.311', E147°24.073' to S06°27.221', E147°24.185', beaten, 10-X-2009; 1 ex (marked as ARC0060), 1200–1500 m, 26-IV-1998; 1 ex, 1400–1550 m, 27-IV-1998.

Distribution. Morobe Prov. (Mindik). Elevation: 1500 m.

Biology. Beaten from foliage of montane forests.

Etymology. This epithet is based on the Latin participle *strigatus* (striated) and refers to the species´ elytral sculpture.

Notes. *Trigonopterus strigatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 216" by Tänzler et al. (2012).

84. *Trigonopterus strombosceroides* Riedel, sp. n.

urn:lsid:zoobank.org:act:482BE1A0-47AB-4F78-83B8-ACCFB436F5EA
http://species-id.net/wiki/Trigonopterus_strombosceroides

Diagnostic description. Holotype, male (Fig. 84a). Length 2.75 mm. Color black; tarsi and antenna ferruginous. Body elongate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum with longitudinal ridges and rows of coarse punctures, with sparse suberect scales; epistome flat, with small punctures. Pronotum with marked subapical constriction, anteriorly densely punctate; disk deeply sculptured, with median ridge and pair of broad submedian ridges; ridges densely punctate; behind constriction anteriorly with pair of lateral angular protrusions. Elytra with striae deeply incised; with sparse narrow cream-colored scales; intervals irregularly costate, with rows of small punctures, along two transverse bands depressed; apex rounded. Femora edentate. Metafemur with weakly denticulate dorsoposterior edge, subapically with stridulatory patch. Tarsomere 3 small, hardly larger than preceding, onychium ca. 1.5 X longer than tarsomere 3. Abdominal ventrites 1–2 with common impression; abdominal ventrite 5 concave, tomentose. Aedeagus (Fig. 84b) apically subtruncate, without setae; with asymmetrical transfer apparatus; ductus ejaculatorius without bulbus. Intraspecific variation. Length 2.75–2.93 mm. **Material examined.** Holotype (MZB): ARC0546 (EMBL # FN429252), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.776', E140°30.215', 945 m, 21-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 4 exx, ARC0547 (EMBL # FN429253), ARC0548 (EMBL # FN429254), same data as holotype; 1 ex (marked as ARC0090), 1100 m, 23-XII-2004, sifted; 2 exx, S02°31.425', E140°30.474', 1265 m, 30-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 945–1265 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is a combination of the name Stromboscerinae and the Latin ending *-oides* (having the form of) and refers to the species´ resemblance in habitus with members of this subfamily of Dryophthoridae.

Notes. *Trigonopterus strombosceroides* Riedel, sp. n. was coded as "*Trigonopterus* sp. 37" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spak" in the EMBL/GenBank/DDBJ databases.

85. *Trigonopterus subglabratus* Riedel, sp. n.

urn:lsid:zoobank.org:act:44E2D57D-14C1-4E38-84E8-B8D39449ED0A
http://species-id.net/wiki/Trigonopterus_subglabratus

Diagnostic description. Holotype, male (Fig. 85a). Length 2.09 mm. Color ferruginous, pronotum and elytra black with bronze lustre. Body subovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum with weak median ridge, pair of submedian furrows, sparsely squamose. Pronotum anteriorly sparsely punctate with small punctures, with yellowish ovate to elongate scales; disk subglabrous. Elytra subglabrous, striae obsolete except stria 4 and suture weakly incised; subapically laterally sparsely squamose. Anteroventral ridges of femora simple. Metafemur with dorsoposterior edge simple, subapically without stridulatory patch. Metaventrite and abdominal ventrites 1–2 forming common concavity. Abdominal ventrite 5 markedly swollen, subapically with shallow impression. Aedeagus (Fig. 85b) with apex rounded; in profile dorsal contour forming right angle; transfer apparatus very short, spiniform. **Intraspecific variation**. Length 2.09–2.48 mm. Female rostrum in apical half sparsely punctate with minute punctures. Female metaventrite and abdominal ventrites 1–2 less markedly concave.

Material examined. Holotype (MZB): ARC0638 (EMBL # FN429291), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Doyo, S02°32.478', E140°28.835', 365 m, 27-XI-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 1 ex, ARC0514 (EMBL # FN429220), S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted; 2 exx, ARC0633 (EMBL # FN429288), ARC0634 (EMBL # FN429289), Sentani, S02°32.221', E140°30.526', 575 m, 19-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 365–710 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on a combination of the Latin prefix *sub-* (less than; almost) and the participle *glabratus* (smoothened). It refers to its smooth body surface.

Notes. *Trigonopterus subglabratus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 47" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spat" in the EMBL/GenBank/DDBJ databases.

86. *Trigonopterus sulcatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:E795D8B6-C12D-4300-A91F-1D0977604471
http://species-id.net/wiki/Trigonopterus_sulcatus

Diagnostic description. Holotype, male (Fig. 86a). Length 2.24 mm. Color black; legs and apex of pronotum deep ferruginous; antenna light ferruginous. Body subovate-globose; with distinct constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half medially weakly carinate, coarsely punctate, sparsely setose; epistome with transverse, angulate ridge. Pronotum with subapical constriction, laterally with pair of blunt denticles; disk coarsely punctate, weakly rugose. Elytra with striae deeply incised, towards sides with deep interspersed punctures; intervals costate, subglabrous, with sparse small punctures and minute recumbent setae; apex rounded. Femora edentate. Metafemur with weakly denticulate dorsoposterior edge, subapically with stridulatory patch. Abdominal ventrite 2 laterally projecting dentiform over elytral edge in profile; abdominal ventrites 1–2 with common cavity; abdominal ventrite 5 sublaterally with pair of denticles. Aedeagus (Fig. 86b) apically sparsely setose; with complex, symmetrical transfer apparatus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.23–2.64 mm.

Material examined. Holotype (MZB): ARC0632 (EMBL # FN429287), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.221', E140°30.526', 575 m, 19-XI-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 2 exx, ARC0508 (EMBL #

FN429214), ARC0509 (EMBL # FN429215), S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 575–710 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is based on the Latin participle *sulcatus* (furrowed, grooved) and refers to the elytral sculpture.

Notes. *Trigonopterus sulcatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 33" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spag" in the EMBL/GenBank/DDBJ databases.

87. *Trigonopterus taenzleri* Riedel, sp. n.

urn:lsid:zoobank.org:act:C31E3CFE-9696-480E-ABF1-6AD099FEBC87
http://species-id.net/wiki/Trigonopterus_taenzleri

Diagnostic description. Holotype, male (Fig. 87a). Length 2.16 mm. Color black; head and legs deep ferruginous; antenna light ferruginous. Body subglobose; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Rostrum in basal half with 3 ridges posteriorly continued to and uniting on forehead; subapically scabrous; epistome forming indistinct transverse ridge. Pronotum deeply punctate except medially glabrous; with distinct subapical constriction. Elytra subglabrous, striae deeply impressed, intervals with irregular knobs and costae; apex extended ventrad, beak-shaped. Femora weakly dentate. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 87b) with apex medially pointed; body in apical half with broad depression visible in lateral aspect; laterally with rows of setae; transfer apparatus markedly flagelliform, longer than body, curled, pointing apicad; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.16–2.43 mm. Female rostrum in apical half dorsally flattened, subglabrous, with sparse punctures and lateral furrows; epistome simple.

Material examined. Holotype (MZB): ARC0551 (EMBL # FN429257), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.603', E140°30.434', 1095 m, 28-XI-2007, sifted. Paratypes (SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 1 ex, S02°31.383', E140°30.490', 1275 m, 30-XI-2007, sifted; 2 exx, ARC0552 (EMBL # FN429258), same data as holotype; 1 ex, ARC0541 (EMBL # FN429247), S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted; 1 ex, 1000 m, 23-XII-2004, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1000–1275 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This species is named in honor of Rene Tänzler (Munich), who has spent years working on *Trigonopterus* weevils.

Notes. *Trigonopterus taenzleri* Riedel, sp. n. was coded as "*Trigonopterus* sp. 39" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spam" in the EMBL/GenBank/DDBJ databases.

88. *Trigonopterus talpa* Riedel, sp. n.

urn:lsid:zoobank.org:act:6CDBE834-7B01-4548-B9B9-277B74341B30
http://species-id.net/wiki/Trigonopterus_talpa

Diagnostic description. Holotype, male (Fig. 88a). Length 2.63 mm. Color black; legs dark ferruginous; antenna light ferruginous. Body subrhomboid; with marked constriction between pronotum and elytron; in profile evenly convex to subapical constriction of pronotum. Rostrum with pair of sublateral furrows converging posteriorly on forehead; pair of submedian furrows shallow; epistome forming angulate ridge and median denticle. Pronotum with marked subapical constriction, sides weakly converging, behind subapical constriction with angular protrusions; disk with pair of deep furrows curving anteriad joining subapical constriction; center of disk coriaceous, sparsely punctate; laterally rugose. Elytra subovate, apically subangulate; striae weakly impressed; surface dull, microgranulate, almost nude, with sparse minute setae; interval 7 subapically forming distinct, weakly denticulate ridge; apex extended ventrad, slightly beak-shaped in profile. Femora edentate. Meso- and metatibia in basal half widened, subapically narrowed. Metafemur with denticulate dorsoposterior edge, subapically without stridulatory patch. Aedeagus (Fig. 88b) with body parallel-sided; apex medially extended into subtruncate tip; transfer apparatus thick spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.30–2.63 mm. Female rostrum in apical half medially subglabrous, with two rows of punctures; epistome simple.

Material examined. Holotype (MZB): ARC1686 (EMBL # HE615973), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Angkasa indah, S02°30.346', E140°42.087', 490 m, 28-VI-2010, sifted. Paratype (SMNK): 1 ex, ARC1687 (EMBL # HE615974), same data as holotype.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 490 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin noun *talpa* (mole) in apposition and refers both to the species´ habitus and its edaphic habits.

Notes. *Trigonopterus talpa* Riedel, sp. n. was coded as "*Trigonopterus* sp. 77" by Tänzler et al. (2012).

89. *Trigonopterus taurekaorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:AAE8DBE8-E025-4A63-9B6A-26D78755ACEF
http://species-id.net/wiki/Trigonopterus_taurekaorum

Diagnostic description. Holotype, male (Fig. 89a). Length 3.44 mm. Color black. Body subovate; with distinct constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally rugose-punctate, basally with median ridge and indistinct pair of submedian ridges, furrows with sparse rows of setae and yellowish scales. Pronotum densely punctate. Elytra densely punctate; striae distinct, consisting of small punctures; intervals with row of minute punctures; laterally behind humeri with ridge bordered by dense row of deep punctures of stria 9. Femora edentate. Mesofemur and metafemur dorsally densely squamose with silvery scales. Metafemur with denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus and small premucro. Abdominal ventrite 5 with shallow impression, densely punctate, with sparse erect setae. Aedeagus (Fig. 89b) apically pointed, with tuft of long setae; body containing pair of elongate sclerites; transfer-apparatus symmetrical, with lyriform sclerite; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.91–3.58 mm. Body of females more slender than males. Female rostrum in apical 2/3 slender, dorsally subglabrous, with submedian rows of small punctures and lateral furrows. Pronotum of females basally at middle with punctures smaller and sparser, in males punctures evenly deep and dense. Female abdominal ventrite 5 flat, without erect setae.

Material examined. Holotype (SMNK): ARC1151 (EMBL # HE615779), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06°39.905', E145°03.880' to S06°39.796', E145°03.873', 1220–1320 m, 01-X-2009. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Simbu Prov.: 6 exx, ARC1152 (EMBL # HE615780), same data as holotype; 4 exx, Haia, Supa station, S06°40.047', E145°03.464' to S06°39.815', E145°03.169', 1075–1240 m, 30-IX-2009, beaten; 2 exx, Haia, Supa station, S06°39.815', E145°03.169' to S06°39.609', E145°03.012', 1240–1450 m, 30-IX-2009, beaten; 16 exx, ARC1129 (EMBL # HE615758), ARC1130 (EMBL # HE615759), Haia, Supa, S06°40.078', E145°03.207' to S06°39.609', E145°03.012', 1220–1450 m, 02-X-2009; 20 exx, ARC1167 (EMBL # HE615795), Haia, S06°41.216', E145°00.945' to S06°40.976', E145°00.979', 970–1135 m, 04-X-2009; 14 exx, Haia, S06°43.515', E145°00.128' to S06°43.948', E144°59.856', 750–915 m, 26-IX-2009; 7 exx, ARC1169 (EMBL # HE615797), Haia, S06°41.259', E145°00.822' to S06°41.102', E145°00.979', 900–1005 m, 27-IX-2009; 1 ex, Simbu Prov., Karimui Dist., Haia, S06°41.102', E145°00.979', 1005–1020 m, 27-IX-2009, beaten, "Mimikry-sample"; 2 exx, Haia, S06°41.216', E145°00.945', 965 m, 27-IX-2009, beaten; 3 exx, ARC1082 (EMBL # HE615713), Haia, S06°41.553', E145°00.355' to S06°41.624', E145°00.728', 800–960 m, 25-IX-2009.

Distribution. Simbu Prov. (Haia). Elevation: 915–1240 m.

Biology. Collected by beating foliage in primary forest.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Taureka, found on page 338 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus taurekaorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 76" by Tänzler et al. (2012).

90. *Trigonopterus tialeorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:C3792D70-1DA1-4462-8739-AA4888E64087
http://species-id.net/wiki/Trigonopterus_tialeorum

Diagnostic description. Holotype, male (Fig. 90a). Length 3.59 mm. Color black; base of antennal scape ferruginous. Body subovate; in dorsal aspect with weak constriction between pronotum and elytron; in profile with distinct constriction. Rostrum slender; dorsally with carina and pair of submedian ridges; at base with erect white elongate scales, apically replaced by bristles. Eyes large, medially approximate. Pronotum with disk subglabrous, with minute punctures; basal ¼ in front of elytral humeri with indistinct edge bordered by row of deep punctures; anteriorly evenly rounded towards sides; sides anteriorly with white recumbent scales. Elytra subglabrous, irregularly punctate with minute punctures; striae obsolete; basal margin straight; laterally behind humeri with ridge bordered by row of deep punctures. Femora with anteroventral ridge distinct, terminating at base; profemur at middle with tooth. Mesofemur and metafemur dorsally densely squamose with white scales. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Abdominal ventrite 5 hardly impressed at middle, sparsely setose with suberect setae, laterally sparsely squamose. Aedeagus (Fig. 90b) with sides of body dorsally carinate; apex flattened, subangulate; transfer apparatus flagelliform, subequal to body, relatively thick; ductus ejaculatorius subapically without bulbus. **Intraspecific variation**. Length 3.59–3.64 mm. Female rostrum dorsally subglabrous, sparsely punctate. Abdominal ventrite 5 flat, subglabrous, sparsely punctate.

Material examined. Holotype (SMNK): ARC1829 (EMBL # HE616106), PAPUA NEW GUINEA, Eastern Highlands Prov., Okapa, Kimiagomo village, Verefare, S06°24.760', E145°35.575', 1940 m, 18-III-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 37 exx, same data as holotype; 22 exx, ARC1824 (EMBL # HE616101), ARC1825 (EMBL # HE616102), Okapa, Kimiagomo village, Afiyaleto, S06°25.593', E145°34.862', S06°25.212', E145°35.498', 1911 m, 18-III-2010; 36 exx, Okapa, Nakaloyate village, S06°24.760', E145°35.575', 1940 m, 18-III-2010; 8 exx, Okapa, Kofare village, S06°25.212', E145°35.498', 2140 m, 18-III-2010, beaten; 7 exx, Okapa, Anurite village, S06°24.760', E145°35.575', 1940 m, 18-III-2010, beaten; 10 exx, Okapa, Verefare village, S06°24.760', E145°35.575', 1940 m, 18-III-2010, beaten; 4 exx, Okapa, Afiyaleto village, S06°25.593', E145°34.862', 1940 m, 18-III-2010, beaten; 3 exx, Okapa, Afiyaleto village, S06°25.593', E145°34.862' to S06°25.212', E145°35.498', 1911 m, 18-III-2010, beaten; 4 exx, Okapa, Mayakumate village, 2100 m, 18-III-2010, beaten; 3 exx, Okapa, Isimomo, S06°25.003', E145°34.527', 2131 m, 18-III-2010; 3 exx, Okapa, Hamegoya, S06°25.727', E145°35.455' to S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010; 7 Ex, ARC1826 (EMBL # HE616103), ARC1827 (EMBL # HE616104), ARC1828 (EMBL # HE616105), Aiyura, S06°21.033', E145°54.597', 2169 m, 06-II-2010; 1 ex, ARC1057 (EMBL # HE615688), Goroka, Mt. Gahavisuka, S06°00.864', E145°24.779', 2150–2250 m, 24-X-2009.

Distribution. Eastern Highlands Prov. (Aiyura, Okapa). Elevation: 1911–2169 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Tiale, found on page 341 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus tialeorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 59" by Tänzler et al. (2012).

91. *Trigonopterus tibialis* Riedel, sp. n.

urn:lsid:zoobank.org:act:6ABBA0D1-8197-4BFA-9C26-A4F7B3A4732C
http://species-id.net/wiki/Trigonopterus_tibialis

Diagnostic description. Holotype, male (Fig. 91a). Length 2.25 mm. Color black; legs deep ferruginous; antenna and tarsi light ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally rugose-punctate, at middle with low median ridge and pair of submedian ridges. Eyes large. Pronotum punctate; interstices usually larger than diameter of punctures. Elytra punctate with small punctures; striae weakly impressed; intervals with minute punctures; lateral stria behind humeri with dense row of deep punctures. Femora with small tooth at middle. Metafemur dorsoposteriorly punctate-denticulate; subapically with stridulatory patch. Tibiae dorsally carinate, with rows of dark scales partly projecting over dorsal edge. Abdominal ventrite 5 flat, densely punctate. Aedeagus (Fig. 91b) with sides converging in apical half; apex rounded, sparsely setose; transfer-apparatus asymmetrical, spiniform, curved somewhat S-shaped, subequal to body of aedeagus; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.86–2.58 mm. Female rostrum dorsally without distinct ridges, with rows of punctures.

Material examined. Holotype (MZB): ARC0428 (EMBL # FN429139), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.2', E140°30.5', 1420–1520 m, 30-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 15 exx, ARC0429 (EMBL # FN429140), ARC0430 (EMBL # FN429141), same data as holotype; 16 exx, S02°31.3', E140°30.5', 1200–1420 m, 30-XI-2007; 2 exx, S02°31.281', E140°30.535', 1420 m, 30-XI-2007; 1 ex, 1100–1600 m, 05-X-1991; 2 exx, 950–1450 m, 03-X-1992; 2 exx, 300–1400 m, 10-VIII-1991; 5 exx (1 marked as "ARC00410") 1100–1600 m, 05-X-1991; 1 ex, 1200–1400 m, 09-VIII-1992.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1400–1420 m.

Biology. Collected by beating foliage in montane forests.

Etymology. This epithet is based on the Latin noun *tibia* (shinbone) and refers to the species´ diagnostic tibial morphology.

Notes. *Trigonopterus tibialis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 16" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spp" in the EMBL/GenBank/DDBJ databases.

92. *Trigonopterus tridentatus* Riedel, sp. n.

urn:lsid:zoobank.org:act:CE40CDC8-9F6A-4CD5-9499-DAB3D4A4A365
http://species-id.net/wiki/Trigonopterus_tridentatus

Diagnostic description. Holotype, male (Fig. 92a). Length 2.90 mm. Color black; antenna light ferruginous, legs dark ferruginous. Body subovate, with marked constriction between pronotum and elytron; in profile almost evenly convex. Rostrum in basal half with median carina continued to forehead; with pair of shorter submedian costae; at middle with anteriorly hollowed, heart-shaped protuberance; between protuberance and epistome relatively flat, with sparse erect setae; epistome with transverse, angulate ridge provided with three teeth, median tooth shorter than lateral ones. Pronotum with subapical constriction; disk densely punctate-rugose, lower parts microreticulate, median line subglabrous; laterally above procoxa with cavity. Elytra with striae deeply incised, intervals costate, densely punctate. Femora edentate. Metafemur with denticulate dorsoposterior edge, subapically with stridulatory patch. Abdominal ventrite 2 projecting dentiform over elytral edge in profile. Aedeagus (Fig. 92b) before angulate apex widened; transfer apparatus small, spiniform; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.14–2.90 mm. Female rostrum dorsally with low median costa bearing double-row of punctures, with lateral pair of furrows; epistome simple.

Material examined. Holotype (MZB): ARC0765 (EMBL # HE615448), WEST NEW GUINEA, Manokwari, Mt. Meja, S00°51.497', E134°04.949', 220 m, 05-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Manokwari, Mt. Meja: 2 exx, ARC0606 (EMBL # HE615332), ARC0607 (EMBL # HE615333), same data as holotype; 11 exx, S00°51.400', E134°04.918', 225 m, 06-XII-2007, sifted; 1 ex, 22-23-IX-1990, sifted; 9 exx, 200 m, 19-IV-1993, sifted; 2 exx, 200 m, 30-XII-2000, sifted; 8 exx, 200 m, 30-XII-2004, sifted.

Distribution. Manokwari Reg. (Mt. Meja). Elevation: 200–225 m.

Biology. Sifted from leaf litter in lowland forest.

Etymology. This epithet is composed of the Latin prefix *tri-* (three) and the participle *dentatus* (toothed) and refers to the three apical teeth of the male rostrum.

Notes. *Trigonopterus tridentatus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 265" by Tänzler et al. (2012).

93. *Trigonopterus uniformis* Riedel, sp. n.

urn:lsid:zoobank.org:act:AD26DAEC-6157-4ECA-9B7D-2B6E4968C677
http://species-id.net/wiki/Trigonopterus_uniformis

Diagnostic description. Holotype, male (Fig. 93a). Length 2.68 mm. Color black; legs deep ferruginous, antenna light ferruginous. Body ovate, with weak constriction between pronotum and elytron; in profile almost evenly convex. Rostrum dorsally in basal half rugose-punctate, in apical half punctate. Pronotum densely punctate except along partly impunctate midline. Elytra densely punctate with small punctures; striae impressed as fine lines; intervals with confused punctures; lateral stria behind humeri with row of deep punctures. Femora in apical 1/3 with anteroventral ridge terminating as tooth. Metafemur with denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus, premucro, and supra-uncal tooth. Aedeagus (Fig. 93b) medially weakly extended; transfer-apparatus asymmetrical, spiniform, curved; endophallus basally with shell-shaped sclerite; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.50–2.78 mm. Female rostrum dorsally subglabrous, sparsely punctate, basally sparsely squamose.

Material examined. Holotype (MZB): ARC0769 (EMBL # HE615452), WEST NEW GUINEA, Manokwari, Mt. Meja, S00°51.497', E134°04.949', 220 m, 05-XII-2007. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Manokwari, Mt. Meja: 2 exx, ARC0220 (EMBL # HE615157), ARC0221 (EMBL # HE615158), 200 m, 31-I-2006; 1 exx, S00°51.400', E134°04.918', 225 m, 06-XII-2007; 2 exx, ARC0770 (EMBL # HE615453), ARC0771 (EMBL # HE615454), same data as holotype; 4 exx, 200 m, 30-XII-2000 – 01-I-2001; 3 exx, 22-23-IX-1990; 7 exx, 200 m, 24-VIII-1991; 1 ex, 200 m, 18-III-1993.

Distribution. Manokwari Reg. (Mt. Meja). Elevation: 200–225 m.

Biology. Beaten from foliage of lowland forest.

Etymology. This epithet is based on the Latin adjective *uniformis* (uniform) and refers its average habitus which is similar to hundreds of other *Trigonopterus* species.

Notes. *Trigonopterus uniformis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 118" by Tänzler et al. (2012).

94. *Trigonopterus variabilis* Riedel, sp. n.

urn:lsid:zoobank.org:act:87F7E821-34C5-44F3-B2D2-C4A7F2DDBABD
http://species-id.net/wiki/Trigonopterus_variabilis

Diagnostic description. Holotype, male (Fig. 94a). Length 1.38 mm. Color of head ferruginous; legs and pronotum largely black; elytra ferruginous, in apical half each side with one black spot. Body subovate; in dorsal aspect and in profile with distinct constriction between pronotum and elytron. Eyes large. Rostrum punctate, sparsely setose, without distinct longitudinal ridges; antennal insertion in apical 1/3, anteriorly rostrum with shallow constriction; epistome simple. Pronotum densely punctate-reticulate; each puncture containing one inconspicuous seta. Elytra with striae deeply impressed, intervals costate, subglabrous. Meso- and metafemur ventrally with acute tooth. Tibial uncus simple, curved. Metafemur subapically with indistinct stridulatory patch. Aedeagus (Fig. 94b) with body flattened, almond-shaped, its central portion rather hyaline; transfer apparatus dentiform, encased by capsule stained blue by chlorazol black; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 1.19–1.66 mm. Color ranging from ferruginous with more or less extensive black pattern to completely black. Female rostrum dorsally subglabrous, punctate, basally with lateral furrows containing sparse row of setae; antennal insertion of females near middle of rostrum.

Material examined. Holotype (SMNK): ARC1096 (EMBL # HE615725), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, S06°40.976', E145°00.979', 1135 m, 27-IX-2009, sifted. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Simbu Prov.: 6 exx, ARC1097 (EMBL # HE615726), ARC1102 (EMBL

HE615731), ARC1103 (EMBL # HE615732), same data as holotype; 13 exx, Haia, S06°40.976', E145°00.979', 1135 m, 04-X-2009, sifted; 7 exx, Haia, S06°41.018', E145°00.995', 1090 m, 04-X-2009, sifted.

Distribution. Simbu Prov. (Haia). Elevation: 1090–1135 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is based on the Latin adjective *variabilis* (variable) and refers to the coloration which differs considerably among specimens.

Notes. *Trigonopterus variabilis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 162" by Tänzler et al. (2012).

95. *Trigonopterus velaris* Riedel, sp. n.

urn:lsid:zoobank.org:act:FB3401F8-39E4-48C8-ABC0-557EDB3C373A
http://species-id.net/wiki/Trigonopterus_velaris

Diagnostic description. Holotype, male (Fig. 95a). Length 2.45 mm. Color black; legs and rostrum deep ferruginous; antenna light ferruginous. Body laterally somewhat compressed, ovate, without constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally in basal third with low median ridge and pair of submedian ridges; apically subglabrous. Eyes large. Pronotum densely punctate-rugose, punctures dorsally small, laterally becoming larger, bearing each one minute seta; without scales. Elytra with striae distinct, punctures of stria 1–2 small, laterad strial punctures becoming larger, relatively shallow. Femora with anteroventral ridge. Profemur converging from base to apex. Meso- and metafemur with dorsoposterior edge subapically worn; metafemur subapically without stridulatory patch. Tibiae simple, without rows or brushes of long setae. Metatibia subapically with small suprauncal projection. Metaventrite laterally forming acute process over metacoxa, reaching tibial insertion. Metaventrite and abdominal ventrite 1 subglabrous, with sparse recumbent setae. Abdominal ventrite 2 similar to ventrites 3-4. Abdominal ventrite 5 with deep, transversely ovate cavity almost filling complete ventrite; anterior edge of cavity distinct, swollen. Aedeagus (Fig. 95b) apically sinuate, with deep narrow median incision; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.31–2.59 mm. Female rostrum subglabrous except in basal ¼ with ridges. Female abdominal ventrite 5 flat.

Material examined. Holotype (SMNK): ARC0963 (EMBL # HE615596), PAPUA NEW GUINEA, Central Prov., Moroka area, Kailaki, Mt. Berogoro, S09°24.213', E147°33.870' to S09°23.647', E147°34.244', 500–600 m, 20-IX-2009, beaten. Paratypes (SMNK, NAIC, ZSM): PAPUA NEW GUINEA: 26 exx, ARC0962 (EMBL # HE615595), same data as holotype; 10 exx, Moroka area, Kailaki, Mt. Berogoro, S09°24.213', E147°33.870' to S09°23.647', E147°34.244', 500–565 m, 26-X-2009; 25 exx, Moroka area, Kailaki, Wariaga, S09°25.350', E147°31.047' to S09°25.683', E147°31.707', 650–920 m, 27-X-2009; 5 exx, ARC1079 (EMBL # HE615710), ARC1080 (EMBL # HE615711), Simbu Prov., Karimui Dist., Haia, S06°41.553', E145°00.355' to S06°41.624', E145°00.728', 800–960 m, 25-IX-2009; 2 exx, ARC1165 (EMBL # HE615793), Simbu Prov., Karimui Dist., Haia, S06°41.216', E145°00.945' to S06°40.976', E145°00.979', 970–1135 m, 04-X-2009; 1 ex, Haia, S06°40.976', E145°00.979', 1135 m, sifted, 04-X-2009.

Distribution. Central Prov. (Moroka), Simbu Prov. (Haia). Elevation: 600–1135 m.

Biology. Collected by beating foliage in primary forests.

Etymology. This epithet is based on the Latin adjective *velaris* (concealed) and refers to its morphological similarity with sibling species.

Notes. *Trigonopterus velaris* Riedel, sp. n. was coded as "*Trigonopterus* sp. 272" by Tänzler et al. (2012). It is closely related to *T. granum* sp. n., *T. pseudogranum* sp. n., and *T. imitatus* sp. n. from which it can be distinguished by the denser punctation of the pronotum and the structure of the male abdominal ventrite 5. Despite its close morphological similarity its cox1-sequence diverges 12.1–13.1 % from the other species.

96. *Trigonopterus verrucosus* Riedel, sp. n.

urn:lsid:zoobank.org:act:CDC03F92-0FAC-4C78-AABA-B8CBF3992E2B
http://species-id.net/wiki/Trigonopterus_verrucosus

Diagnostic description. Holotype, male (Fig. 96a). Length 2.56 mm. Color black, antenna and tarsi ferruginous. Body subovate, extremely uneven, in dorsal aspect with distinct constriction between pronotum and elytron; in profile without such constriction. Rostrum in basal half medially carinate, coarsely punctate, sparsely setose; epistome with transverse, angulate ridge. Pronotum with marked subapical constriction; laterally projecting with marked angular protrusions; disk longitudinally costate-tuberculate, in basal half medially with prominent ridge. Elytra with striae deeply incised; intervals undulating-costate, some areas markedly elevated, constricted along 2 transverse lines, subglabrous, with sparse minute punctures and setae; apex extended ventrad, slightly beak-shaped, ventrally truncate. Metafemur with dorsoposterior edge simple, in apical third with transverse row of small suberect setae, subapically with stridulatory patch. Disk of abdominal ventrites 1–2 excavated; ventrite 2 projecting dentiform over elytral edge in profile. Aedeagus (Fig. 96b) with apex medially pointed; transfer apparatus complex, symmetrical; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.09–2.56 mm. Female rostrum dorsally with median costa in basal half; epistome simple.

Material examined. Holotype (MZB): ARC0743 (EMBL # HE615426), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°57.161', E138°57.357', 1875 m, 24-XI-2007, sifted. Paratypes (ARC, SMNK): WEST NEW GUINEA, Jayawijaya Reg. Jiwika, Kurulu: 1 ex (marked as ARC0612), 1900–2000 m, 23-IX-1992, sifted; 1 ex, ca. 1700–2300 m, 02-IX-1991, sifted.

Distribution. Jayawijaya Reg. (Jiwika). Elevation: 1875–1900 m.

Biology. Sifted from leaf litter in montane forest.

Etymology. This epithet is based on the Latin adjective *verrucosus* (full of warts) and refers to the species´ remarkable body-sculpture.

Notes. *Trigonopterus verrucosus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 196" by Tänzler et al. (2012).

97. *Trigonopterus violaceus* Riedel, sp. n.

urn:lsid:zoobank.org:act:154511E2-E70E-4D78-BFBB-EA95A730ACC0
http://species-id.net/wiki/Trigonopterus_violaceus

Diagnostic description. Holotype, male (Fig. 97a). Length 2.63 mm. Color black, with violet lustre. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum dorsally relatively flat, sparsely punctate, dorsolaterally with pair of furrows continuing along eye. Pronotum sparsely punctate with minute punctures, subapically punctures larger and denser. Elytra nude, striae deeply impressed with coarse punctures; intervals costate, with sparse minute punctures; intervals 1–3 near base with few larger punctures and coriaceous. Femora edentate. Metafemur subapically with stridulatory patch. Abdominal and thoracic venter with dense erect setae. Aedeagus (Fig. 97b) apically subangulate, with two brushes of long setae; transfer apparatus complex, with flagellum ca. 1.5× as long as body; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.20–2.95 mm. Color ranging from greenish-blue to dark violet. Female rostrum dorsally subglabrous, with punctures smaller than in males. Elytral intervals more or less costate, rarely almost flat.

Material examined. Holotype (MZB): ARC1813 (EMBL # HE616090), WEST NEW GUINEA, Jayawijaya Reg., W Wamena, road to Lake Habbema, S04°07.625', E138°49.992', 2520 m, 20-VII-2010. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg.: 8 exx, ARC1812 (EMBL # HE616089), ARC1814 (EMBL # HE616091), same data as holotype; 1 ex, ARC1775 (EMBL # HE616052), Poga, S03°47.575', E138°33.155' to S03°47.473', E138°33.163', 2620–2715 m, 15-VII-2010; 4 exx, Ilugwa, Melanggama, trail to Pass valley, 2100–2300 m, 09-10-IX-1990; 2 exx, Ilugwa, trail to Pass valley, 1900–2500 m, 14-IX-1990; 4exx, Kurima, Yohosim – Kiroma, 2500–2700 m, 13-IX-1991.

Distribution. Jayawijaya Reg. (Poga, Ilugwa, L. Habbema, Kurima). Elevation: 2300–2620 m.

Biology. Beaten from foliage of upper montane forests.

Etymology. This epithet is based on the Latin adjective *violaceus* (violet-colored) and refers to the coloration of the species.

Notes. *Trigonopterus violaceus* Riedel, sp. n. was coded as "*Trigonopterus* sp. 123" by Tänzler et al. (2012).

98. ***Trigonopterus viridescens*** Riedel, sp. n.

urn:lsid:zoobank.org:act:884E60CB-8362-44DC-9FF1-FF0834E054B9
http://species-id.net/wiki/Trigonopterus_viridescens

Diagnostic description. Holotype, male (Fig. 98a). Length 2.86 mm. Color black with marked greenish lustre. Body slender, ovate; without constriction between pronotum and elytron; in profile evenly convex. Rostrum weakly sculptured, dorsally in basal half with pair of shallow sublateral furrows, with sparse rows of mesad-directed scales, sparsely punctate. Forehead laterally with pair of cavities bordering eyes. Eyes with dorsal margin carinate. Pronotum subglabrous, sparsely punctate with minute punctures. Elytra subglabrous, striae hardly visible. Femora subglabrous, sparsely punctate and squamose, without teeth. Metafemur with smooth dorsoposterior edge; subapically without stridulatory patch. Mesotibia subapically with premucro larger than uncus. Metatibia with premucro somewhat smaller than uncus. Aedeagus (Fig. 98b). Apex symmetrical, with median, pointed extension; transfer apparatus spiniform, apically bordered by pair of curved sclerites; ductus ejaculatorius without bulbus. **Intraspecific variation**. Length 2.48–3.05 mm. Female meso- and metatibia subapically with minute premucro.

Material examined. Holotype (MZB): ARC0434 (EMBL # FN429145), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°31.2', E140°30.5', 1420–1520 m, 30-XI-2007, beaten. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 2 exx, ARC0433 (EMBL # FN429144), ARC0435 (EMBL # FN429146), same data as holotype; 1 ex, 1100–1600 m, 05-X-1991; 5 exx, ARC0671 (PCR failed), ARC0672 (PCR failed), S02°31.3', E140°30.5', 1200–1420 m, 30-XI-2007.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 1420–1520 m.

Biology. Collected by beating foliage in montane crippled forests.

Etymology. This epithet is based on the Latin participle *viridescens* (greenish) and refers to the species´ coloration.

Notes. *Trigonopterus viridescens* Riedel, sp. n. was coded as "*Trigonopterus* sp. 24" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spx" in the EMBL/GenBank/DDBJ databases.

99. ***Trigonopterus wamenaensis*** Riedel, sp. n.

urn:lsid:zoobank.org:act:8ACAA7C2-667F-47CE-BC45-1002891F195B
http://species-id.net/wiki/Trigonopterus_wamenaensis

Diagnostic description. Holotype, male (Fig. 99a). Length 3.17 mm. Color orange-ferruginous; dorsal surface of head and pronotum black. Body subrhomboid, almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum with distinct median and pair of submedian carinae, furrows containing sparse rows of mesad-directed scales. Pronotum densely punctate. Elytra with striae 1–6 distinct, marked by dense rows of small punctures, intervals with minute punctures; lateral striae obsolete; sides with sparse, confused punctures. Femora edentate; anteroventral ridge terminating at middle with inconspicuous denticle. Metafemur with crenulate dorsoposterior edge; subapically with stridulatory patch. Protibia with relatively long uncus. Metatibia apically with uncus and premucro, in apical 1/3 dorsal edge with 4–5 large setiferous punctures. Ventrite 5 densely punctate, medially with broad impression. Aedeagus (Fig. 99b) with apex medially pointed; ostium with intensely-sclerotized asymmetrical sclerite and connected to it with pair of two elongate undulating sclerites reaching far into endophallus; flagelliform transfer-apparatus longer than body of aedeagus; ductus ejaculatorius with bulbus. **Intraspecific variation**. Length 2.72–3.28 mm. Female rostrum dorsally in apical half subglabrous, with submedian rows of punctures. Impression of female abdominal ventrite 5 less marked.

Material examined. Holotype (MZB): ARC0744 (EMBL # HE615427), WEST NEW GUINEA, Jayawijaya Reg., Jiwika, Kurulu, S03°57.161', E138°57.357', 1875 m, 24-XI-2007. Paratypes (ARC, NHMB, NKME, SMNK, ZSM): WEST NEW GUINEA, Jayawijaya Reg. Jiwika, Kurulu: 1 ex, ARC1713 (EMBL # HE615993), S03°57.161', E138°57.357' to S03°56.977', E138°57.441', 1875–1990 m, 12-VII-2010; 1 ex, ARC1735 (EMBL # HE616012), S03°57.161', E138°57.357', 1875 m, 11-VII-2010; 4 exx, Jiwika, ca. 1700–2300 m, 02-IX-1991; 12 exx, Jiwika, 1700–2300 m, 11-IX-1991; 1 ex (marked as ARC0035), Jiwika, 1800–2300 m, 31-V-1998; 7 exx, Wamena, 1600 m, 31-VIII-1990; 6 exx, Jiwika, 1750–2100 m, 05-VII-1994; 3 exx, Jiwika, 1700–2100 m, 05-XII-1995; 1 ex, Ibele river vall., S04°02.283', E138°50.533', 1600 m, 25-I-1999; 504 exx, Baliem-vall., ca. 1700 m, III-1992.

Distribution. Jayawijaya Reg. (Jiwika, Wamena, Ibele vall.). Elevation: 1600–1875 m.

Biology. Beaten from foliage.

Etymology. This epithet is based on the name of Wamena, the main town of the Balim-valley.

Notes. *Trigonopterus wamenaensis* Riedel, sp. n. was coded as "*Trigonopterus* sp. 179" by Tänzler et al. (2012).

100. *Trigonopterus wariorum* Riedel, sp. n.

urn:lsid:zoobank.org:act:B9671ED6-13B0-43CC-9D42-FE6CECFB07AB
http://species-id.net/wiki/Trigonopterus_wariorum

Diagnostic description. Holotype, male (Fig. 100a). Length 3.05 mm. Color black; antenna and tarsi ferruginous. Body ovate; in dorsal aspect almost without constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges, furrows with sparse rows of yellowish scales; apically weakly punctate, sparsely setose. Pronotum densely punctate-reticulate. Elytra densely punctate; striae distinct, consisting of small punctures; intervals with row of smaller punctures; near base and suture with additional, larger, interspersed punctures; surface dull, microgranulate, almost nude. Femora somewhat widened, edentate. Metafemur dorsally with sparse rows of silvery scales; with almost smooth dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus, without premucro. Abdominal ventrite 5 with dense erect setae. Aedeagus (Fig. 100b) apically rounded, subglabrous; complex transfer-apparatus containing flagellum slightly longer than body; ductus ejaculatorius basally swollen, with indistinct bulbus. **Intraspecific variation**. Length 2.45–3.05 mm. Female rostrum slender, apical 2/3 dorsally subglabrous, punctate, sublaterally with furrow containing row of setae. Female abdominal ventrite 5 with subrecumbent setae.

Material examined. Holotype (SMNK): ARC1853 (EMBL # HE616130), PAPUA NEW GUINEA, Eastern Highlands Prov., Okapa, Kimiagomo village, Hamegoya, S06°25.727', E145°35.455', S06°25.117', E145°35.225', 1891–2131 m, 18-III-2010. Paratypes (NAIC, SMNK, ZSM): PAPUA NEW GUINEA, Eastern Highlands Prov.: 1 ex, ARC1854 (EMBL # HE616131), same data as holotype; 2 exx, ARC1855 (EMBL # HE616132), ARC1856 (EMBL # HE616133), Okapa, Kimiagomo village, Afiyaleto, S06°25.593', E145°34.862', S06°25.212', E145°35.498', 1911 m, 18-III-2010; 2 exx, ARC1882 (EMBL # HE616159), ARC1883 (EMBL # HE616160), Okapa, Konafi to Isimomo, S06°25.593', E145°34.862', S06°25.003', E145°34.527', 1911–2131 m, 18-III-2010.

Distribution. Eastern Highlands Prov. (Okapa). Elevation: 1911 m.

Biology. Beaten from foliage of montane forests.

Etymology. This species is dedicated to the people of Papua New Guinea. The epithet is based on the family name Wari, found on page 356 of the Papua New Guinea Telephone Directory of 2010 and treated in genitive plural.

Notes. *Trigonopterus wariorum* Riedel, sp. n. was coded as "*Trigonopterus* sp. 217" by Tänzler et al. (2012).

101. *Trigonopterus zygops* Riedel, sp. n.

urn:lsid:zoobank.org:act:ECEFF208-6A4F-4F07-ACAD-BC5E5840C169
http://species-id.net/wiki/Trigonopterus_zygops

Diagnostic description. Holotype, male (Fig. 101a). Length 2.06 mm. Color of antenna, tarsi, tibiae, and apex of femora ferruginous; head and pronotum black; elytra black, with ferruginous patches near base of intervals 3–4, transverse irregular band near middle and indistinct patches near apex. Body subovate; with weak constriction between pronotum and elytron; in profile with distinct constriction. Eyes large. Rostrum with median ridge and pair of submedian ridges, lateral furrow with row of overlapping almond-shaped white scales. Pronotum densely punctate, subapically squamose. Elytra with striae deeply impressed, intervals costate, sparsely squamose. Femora ventrally weakly dentate. Tibial uncus simple, curved. Metafemur subapically with stridulatory patch. Aedeagus (Fig. 101b) with sides of body bisinuate, converging; apex extended, pointed, curved ventrad; orifice well-defined, ovate; transfer apparatus flagelliform, subequal to body of aedeagus; ductus ejaculatorius basally swollen, without bulbus. **Intraspecific variation**. Length 1.68–2.16 mm. Ferruginous patches on elytra more or less numerous, in some specimens absent. Female rostrum dorsally subglabrous, punctate, with longitudinal ridges, only basally with scales.

Material examined. Holotype (MZB): ARC0516 (EMBL # FN429222), WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani, S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted. Paratypes (ARC, SMNK, ZSM): WEST NEW GUINEA, Jayapura Reg., Cyclops Mts, Sentani: 3 exx, ARC0517 (EMBL # FN429223), ARC0687 (EMBL # FN429332), ARC0688 (EMBL # FN429333), same data as holotype; 4 exx, ARC0533 (EMBL # FN429239), ARC0615 (EMBL # HE615336), ARC0617 (EMBL # FN429274), Doyo, S02°32.478', E140°28.835', 365 m, 27-XI-2007, sifted; 8 exx, ARC0618 (EMBL # FN429275), ARC0619 (EMBL # FN429276), ARC0620 (EMBL # FN429277), Sentani, S02°31.594', E140°30.407', 1065 m, 21-XI-2007, sifted; 2 exx, ARC0643 (EMBL # HE615355), ARC0644 (EMBL # FN429292), Sentani, S02°32.221', E140°30.526', 575 m, 19-XI-2007, sifted; 1 ex, ARC0648 (EMBL # FN429296), Sentani, S02°32.291', E140°30.505', 515 m, 19-XI-2007, sifted; 5 exx, S02°32.031', E140°30.412', 710 m, 02-XII-2007, sifted; 3 exx, S02°31.912', E140°30.416', 785 m, 02-XII-2007, sifted; 1 ex, ARC0668 (EMBL # FN429315), Sentani, S02°31.603', E140°30.434', 1095 m, 28-XI-2007, sifted; 6 exx, S02°31.683', E140°30.281', 960 m, 21-XI-2007, sifted; 4 exx (1 marked ARC00116), Sentani, 1100 m, 23-XII-2004, sifted; 2 exx, Sentani, 1000 m, 23-XII-2004, sifted; 4 exx, Sentani, S02°32.221', E140°30.526', 575 m, 19-XI-2007, sifted; 3 exx, Sentani, S02°31.776', E140°30.215', 945 m, 21-XI-2007, sifted.

Distribution. Jayapura Reg. (Cyclops Mts). Elevation: 365–1095 m.

Biology. Sifted from leaf litter in primary forest.

Etymology. This epithet is a noun in apposition and refers to the generic name *Zygops* Schoenherr, a group with similar large eyes.

Notes. *Trigonopterus zygops* Riedel, sp. n. was coded as "*Trigonopterus* sp. 48" by Riedel et al. (2010) and Tänzler et al. (2012), respectively "*Trigonopterus* spav" in the EMBL/GenBank/DDBJ databases. The holotype and one paratype exhibit a relatively high divergence (5–13% uncorrected p-distance) from the other specimens. So far, we could not find other indications that they represent a cryptic species different from the remainder of paratypes, but the possibility cannot be ruled out.

Overview of the species-groups of *Trigonopterus* in New Guinea

The following catalogue and key to species groups is intended as a provisional aid to recognize major species groups of *Trigonopterus*. It is neither comprehensive nor will it be free of mistakes. Results of a preliminary molecular phylogenetic analysis are incorporated to ensure that mainly monophyletic groups are defined. However, additional data and further analyses are required to arrive at a stable hypothesis of the infrageneric classification of *Trigonopterus*.

Provisional key to species groups of *Trigonopterus* in New Guinea

1 Eyes divided into dorsal and ventral portions by deep incision of posterior margin. Edaphic habitat.......... ***T. scissops*-group**

– Outline of eyes without deep incision of posterior margin.......... **2**

2 (1) Metafemur subapically without stridulatory patch.......... **3**

– Metafemur subapically with stridulatory patch.......... **11**

3 (2) Aedeagus usually with asymmetrical tip; ventral rim of basal orifice with protruding rim; transfer processes in repose curved basad. Edaphic habitat.......... **subgenus *Mimidotasia* Voss**

– Aedeagus with tip usually symmetrical; transfer processes in repose directed apicad.......... **4**

4 (3) Edaphic species.......... **5**

– Species found on foliage.......... **8**

5 (4) Metafemur with denticulate dorsoposterior edge.......... ***T. basalis*-group**

– Metafemur with simple dorsoposterior edge.......... **6**

6 (5) Rostrum at middle with protuberance and at epistome with dorsoposteriad directed horn.......... ***T. dentirostris*-group**

– Rostrum dorsally simple, at most with weak median ridge.......... **7**

7 (6) Body small, 1.13–1.59 mm; densely punctate, with sparse minute setae.......... **subgenus *Microgymnapterus* Voss**

– Body polished, with or without scales; 2.09–2.48 mm.......... ***T. curtus*-group**

8 (4) Eyes in thanatosis largely covered by pronotum.......... **9**

– Eyes medially approximate, in thanatosis partly exposed.......... **10**

9 (8) Rostrum dorsally weakly sculptured; with two pairs of longitudinal furrows containing sparse mesad directed scales or setae. Disk of pronotum subglabrous. Dorsal edge of metafemur basally contiguous with elytron during thanatosis.......... ***T. politus*-group**

– Rostrum dorsally at base densely squamose. Disk of pronotum punctate. Metafemur distant from elytron during thanatosis.......... ***T. oblongus*-group**

10 (8) Pronotum and elytra evenly convex. Dorsal edge of metafemur at least basally contiguous with elytron during thanatosis.......... ***T. vanus*-group**

– With weak constriction between pronotum and elytra. Metafemur distant from elytron during thanatosis.......... ***T. nasutus*-group**

11 (2) Edaphic species.......... **12**

– Species found on foliage.......... **18**

12 (11) Rostrum basally above eyes with pair of protrusions. Tarsomere 3 asymmetrical, with anterior lobe much larger than posterior lobe.... ***T. ptolycoides*-group**

– Rostrum basally above eyes without pair of protrusions. Tarsomere 3 symmetrical.... **13**

13 (12) Body elongate, with distinct constriction between pronotum and elytron. Tarsomere 3 small, hardly larger than tarsomere 2.... ***T. strombosceroides*-group**

– Body more compact. Tarsomere 3 distinctly larger than tarsomere 2.... **14**

14 (13) Pronotum with preapical constriction (indistinct in *T. hitoloorum* Riedel, sp. n.).... **15**

– Pronotum without preapical constriction.... **16**

15 (14) Rostrum medially costate, at least basally. Femora edentate. Pronotum apically extended over head, or with distinct preapical constriction.... ***T. sulcatus*-group**

– Rostrum coarsely punctate, with median wrinkle. Femora dentate. Pronotum with preapical constriction.... ***T. nothofagorum*-group**

16 (14) Eyes large, exposed in thanatosis. Rostrum dorsally densely squamose. Sides of aedeagus converging to pointed apex.... **part of *T. zygops*-group**

– Eyes smaller. Rostrum at most sparsely squamose. Shape of aedeagus different.... **17**

17 (15) Male rostrum at epistome with horn. Body roundish. Pronotum basally angulate.... ***T. rhinoceros*-group**

– Male rostrum at epistome without horn.... **"*T. edaphus*-group"**

18 (11) Habitus elongate.... **19**

– Habitus subovate or subrhomboid.... **20**

19 (18) Femora edentate.... ***T. honestus*-group**

– Femora dentate.... ***T. dilaticollis*-group**

20 (18) Eyes large, half-exposed in thanatosis.... **21**

– Eyes smaller, largely concealed in thanatosis.... **22**

21 (20) Legs relatively long. Metatibial uncus markedly hook-shaped. Species of midmontane forests.... **part of *T. zygops*-group**

– Legs of normal length. Metatibial uncus not markedly extended. Species of upper montane forests and subalpine vegetation.... ***T. ascendens*-group**

22 (20) All femora edentate.... **23**

– At least one pair of femora dentate.... **25**

23 (22) Rostrum dorsally relatively flat, with rows of punctures or shallow furrows. Thoracic venter and abdominal ventrites 1-2 with long erect setae.... ***T. gonatocerus*-group**

– Rostrum with distinct ridges or swollen in basal half. Thoracic venter and abdominal ventrites 1-2 sparsely setose with subrecumbent setae or subglabrous.... **24**

24 (23) Rostrum dorsally swollen at base; in profile dorsal contour sinuate.... **part of *T. vandekampi*-group**

– Rostrum in basal half with distinct median ridge and pair of submedian ridges. in profile evenly convex.. ***T. montivagus*-group**

25 (22) Pronotum subglabrous, sparsely punctate. Meso- and metafemur ventrally with denticulate or serrate ridges and knobs.................***T. balimensis*-group**

– Pronotum densely punctate. Meso- and metafemur ventrally with simple tooth...**26**

26 (25) Pronotum coarsely punctate, elytron subglabrous ....***T. illex*-group**

– Difference of sculpture between pronotum and elytron less evident ....**part of *T. vandekampi*-group**

Provisional catalogue of species groups of *Trigonopterus* in New Guinea

subgenus *Microgymnapterus* Voss: *T. micros* Riedel

subgenus *Mimidotasia* Voss: *T. aeneipennis* Riedel, sp. n., *T. aeneus* Riedel, sp. n., *T. inflatus* Riedel, sp. n., *T. myops* Riedel, sp. n., *T. parvulus* Riedel, sp. n., *T. striatus* Riedel, sp. n., *T. oblitus* Riedel, *T. vossi* Riedel.

***T. ascendens*-group**: *T. ascendens* Riedel, sp. n.

***T. balimensis*-group**: *T. balimensis* Riedel, sp. n., *T. crassicornis* Riedel, sp. n.

***T. basalis*-group**: *T. agathis* Riedel, sp. n., *T. amplipennis* Riedel, sp. n., *T. basalis* Riedel, sp. n., *T. dromedarius* Riedel, sp. n., *T. ixodiformis* Riedel, sp. n., *T. parumsquamosus* Riedel, sp. n., *T. plicicollis* Riedel, sp. n., *T. signicollis* Riedel, sp. n., *T. taenzleri* Riedel, sp. n., *T. talpa* Riedel, sp. n.

***T. curtus*-group**: *T. basimaculatus* (Voss), *T. curtus* (Voss), *T. flavomaculatus* (Voss), *T. simulans* Riedel, sp. n., *T. subglabratus* Riedel, sp. n.

***T. dentirostris*-group**: *T. dentirostris* Riedel, sp. n.

***T. dilaticollis*-group**: *T. apicalis* Riedel, sp. n., *T. difficilis* (Faust), *T. dilaticollis* (Faust), *T. morokensis* (Faust)

***T.* "*edaphus*-group"**: assemblage of probably unrelated species of uncertain affinities: *T. discoidalis* Riedel, sp. n., *T. echinus* Riedel, sp. n., *T. edaphus* Riedel, sp. n., *T. kurulu* Riedel, sp. n., *T. oviformis* Riedel, sp. n., *T. sordidus* Riedel, sp. n.

***T. gonatoceros*-group**: *T. ferrugineus* Riedel, sp. n., *T. gonatoceros* Riedel, sp. n., *T. rufibasis* Riedel, sp. n., *T. violaceus* Riedel, sp. n.

***T. honestus*-group**: *T. angustus* Riedel, sp. n., *T. honestus* (Pascoe), *T. irregularis* Riedel, sp. n., *T. lineellus* Riedel, sp. n., *T. rubiginosus* Riedel, sp. n.

***T. illex*-group**: *T. densatus* (Faust), *T. illex* (Faust)

***T. montivagus*-group**: *T. ampliatus* (Pascoe), *T. kanawiorum* Riedel, sp. n., *T. mimicus* Riedel, sp. n., *T. montivagus* Riedel, sp. n., *T. phoenix* Riedel, sp. n., *T. ragaorum* Riedel, sp. n., *T. rubripennis* Riedel, sp. n., *T. strigatus* Riedel, sp. n., *T. wariorum* Riedel, sp. n.

***T. nasutus*-group**: *T. augur* Riedel, sp. n., *T. cribratus* (Faust), *T. ephippiatus* (Faust), *T. femoralis* (Faust), *T. gibbirostris* (Faust), *T. helios* Riedel, sp. n., *T. illitus* (Faust), *T. insularis* Riedel, sp. n., *T. impar* (Faust), *T. maculatus* Riedel, sp. n., *T. melas*

(Faust), *T. moreaorum* Riedel, sp. n., *T. nasutus* (Pascoe), *T. pseudonasutus* Riedel, sp. n., *T. salubris* (Faust), *T. sellatus* (Faust), *T. soiorum* Riedel, sp. n., *T. tialeorum* Riedel, sp. n.

***T. nothofagorum*-group**: *T. nothofagorum* Riedel, sp. n.

***T. oblongus*-group**: *T. cuneatus* (Faust), *T. oblongus* (Pascoe), *T. similis* (Heller)

***T. politus*-group**: *T. cuneipennis* Riedel, sp. n., *T. durus* Riedel, sp. n., *T. katayoi* Riedel, sp. n., *T. obnixus* (Faust), *T. politoides* Riedel, sp. n., *T. politus* (Faust), *T. viridescens* Riedel, sp. n.

***T. ptolycoides*-group**: *T. ptolycoides* Riedel, sp. n.

***T. rhinoceros*-group**: *T. rhinoceros* Riedel, sp. n.

***T. scissops*-group**: *T. constrictus* Riedel, sp. n., *T. scissops* Riedel, sp. n.

***T. strombosceroides*-group**: *T. costicollis* Riedel, sp. n., *T. strombosceroides* Riedel, sp. n.

***T. sulcatus*-group**: *T. angulatus* Riedel, sp. n., *T. costatus* Riedel, sp. n., *T. hitoloorum* Riedel, sp. n., *T. lineatus* Riedel, sp. n., *T. scabrosus* Riedel, sp. n., *T. sulcatus* Riedel, sp. n., *T. tridentatus* Riedel, sp. n., *T. verrucosus* Riedel, sp. n.

***T. vandekampi*-group**: *T. armatus* Riedel, sp. n., *T. monticola* Riedel, sp. n., *T. pulchellus* (Pascoe), *T. vandekampi* Riedel

***T. vanus*-group**: *T. agilis* Riedel, sp. n., *T. glaber* Riedel, sp. n., *T. granum* Riedel, sp. n., *T. imitatus* Riedel, sp. n., *T. neglectus* (Faust), *T. proximus* (Voss), *T. pseudogranum* Riedel, sp. n., *T. sejunctus* (Faust), *T. vanus* (Faust), *T. velaris* Riedel, sp. n.

***T. zygops*-group**: *T. ancoruncus* Riedel, sp. n., *T. euops* Riedel, sp. n. *T. lekiorum* Riedel, sp. n., *T. scharfi* Riedel, sp. n., *T. squamirostris* Riedel, sp. n., *T. variabilis* Riedel, sp. n., *T. zygops* Riedel, sp. n.

Discussion

For the last few decades it has been common practice for taxonomists maintaining a good reputation to revise monophyletic groups with all the known species, to prepare elaborate descriptions bearing in mind the potential value of every tiny character for a phylogenetic analysis, and to make great efforts on the preparation of elaborate identification keys based on these characters. As a consequence, hyperdiverse taxa such as the genus *Trigonopterus* are usually avoided, simply because it appears impossible to get this task completed during a lifetime. Such considerations are a lesser issue for a minority of taxonomists with a lower quality-standard, the so called “mass-describers”, usually publishing their works in journals without peer-review. Often, they do not refrain from proposing new names based on specimens without sufficient diagnostic characters, such as unique females, relying on the community to later sort out the resulting identification problems. This exacerbates the deterrence of such “difficult” taxa which are then prime examples and causes of a “taxonomic impediment”, in this case not only an impediment to the end-users of taxonomy, but also to the taxonomists themselves (Ebach et al. 2011, Godfray 2002). In fact, at this stage taxonomic information becomes rather a burden to science than a useful tool. We believe that technologies developed within the past decade enable us to stop this vicious circle. Two components are of fundamental importance, i.e. online wiki databases and molecular systematics (Riedel et al. 2013).

Online wiki databases such as the Species-Id portal (http://species-id.net/wiki/Main_Page) are not recognized as means of publication by the International Code of Zoological Nomenclature (1999), so their significance needs some explanation. Journals such as "ZooKeys" make a new name available with a traditional paper publication, simultaneously creating a wiki with the same content. This wiki can be updated later anytime with additional data, be it an elaborate 3D-model or a "quantum contribution" (Maddison et al. 2012) such as fixing a typo of the original description or adding a simple collecting record. At the time the species becomes formally named there is no urgency to provide the description with all possible data. It should contain a reasonable basis, so that its diagnosis is guaranteed. We expect that most users will later rather consult the online working description, gradually being supplemented with additional data. Thus, the formal species description is like a healthy newborn which is expected to grow into an adult with the help of its environment. In the case of *Trigonopterus*, characters such as the functional morphology of thanatosis or the morphology of the metendosternite, surely of great interest but of little diagnostic value can be added at a later stage without compromising their visibility. This approach does in fact bundle useful features of numerous other initiatives such as the Encyclopedia of Life (eol.org).

The impact of molecular systematics on species-descriptions is twofold and can be divided into reconstruction of species relationships and attempts to diagnose species. But let us start one step earlier, with the advent of phylogenetic systematics (Hennig 1966) and phenetics (Sneath and Sokal 1973). Both had a profound but little-noticed effect on the preparation of species descriptions. Since more and more taxonomic revisions incorporated phylogenetic analyses, it was attempted to maximize the number of informative characters. Thus, even characters of little value for species diagnosis were included in the descriptions. Another consequence was that species descriptions within a study were sought to be standardized, best illustrated by the program Delta (Partridge et al. 1993). Negative character states (i.e. the absence of a character) were often explicitly stated. Often enough, all this time-consuming procedure did not increase the usability of descriptions for the purpose of diagnosis, but rather inflated them. And after all, standardization among different authors was never achieved not to mention failure to introduce an urgently needed minimum standard.

Although in some taxa, phylogenies based on morphological data are still needed, in recent years the trend clearly goes towards purely molecular phylogenies. In the case of *Trigonopterus* we feel that our molecular data set is strong enough to produce a stable phylogeny without morphological characters included. So, for us it is time to ask – do we really need to describe every character with the hope that this might be a valuable addition to our character-matrix? For us, the answer is "no"! With changing needs on a species description, taxonomists should reflect if they want to carry on like during the past decades, or if it is time to adjust procedures and streamline descriptions to the purpose of diagnosis.

The potential of using a standard DNA marker for species identification, also known as "DNA barcoding", was recognized almost ten years ago (Hebert et al. 2003). Despite some initial criticism it proved to be a powerful tool. In many taxa, the *cox1* sequence will pinpoint the correct species without additional information. In others it may not delineate species unambiguously (Hendrich et al. 2010), but even then it is possible to safely pinpoint a group of e.g. 5–10 species. For many taxa, be it nematodes, moss mites or rove beetles, a non-expert would hardly achieve this within reasonable time using traditional keys. After all, in combination with a few morphological characters the species can be safely identified in most cases. One of the great advantages of sequence data is that they can be databased, searched and accessed anytime from anywhere. The situation with type specimens is quite different: often they are not accessible, or if so, it is very time-consuming both for museum curators and active researchers to send them around the globe. Often enough, they give the only clue what species an insufficient description is referring to, or if the species is placed in the correct genus at all. Such issues could be much faster solved using "DNA barcodes". We strongly believe that the ICZN should make the publication of genetic data obligatory for the description of new extant species. Until such a decision is made, the contest between descriptions containing DNA barcodes and the ones without may give an answer of what is really needed. The combination of short expert morphological descriptions provided with a few high-resolution photographs and DNA-sequences appears to us as the way to proceed. We predict that similar works are to be expected in the near future on various taxa of hyperdiverse organisms.

Plates

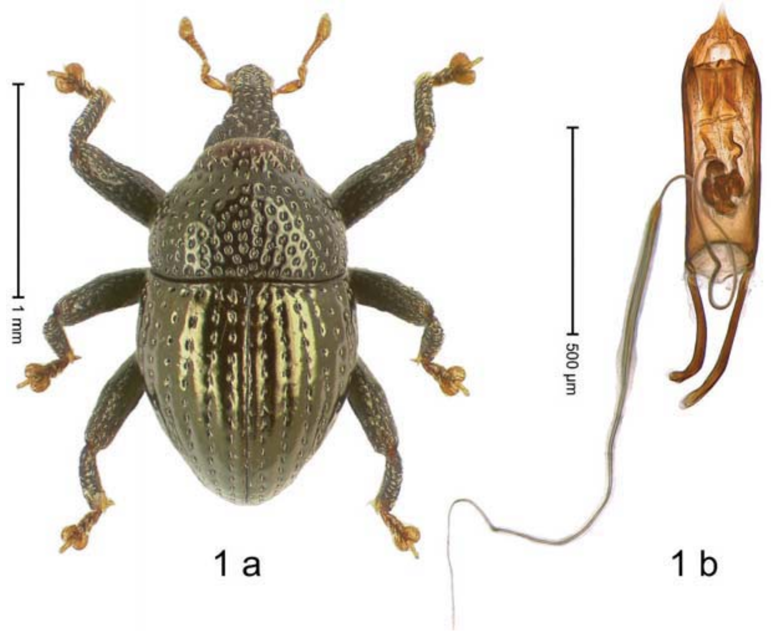


Figure 1. *Trigonopterus aeneipennis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

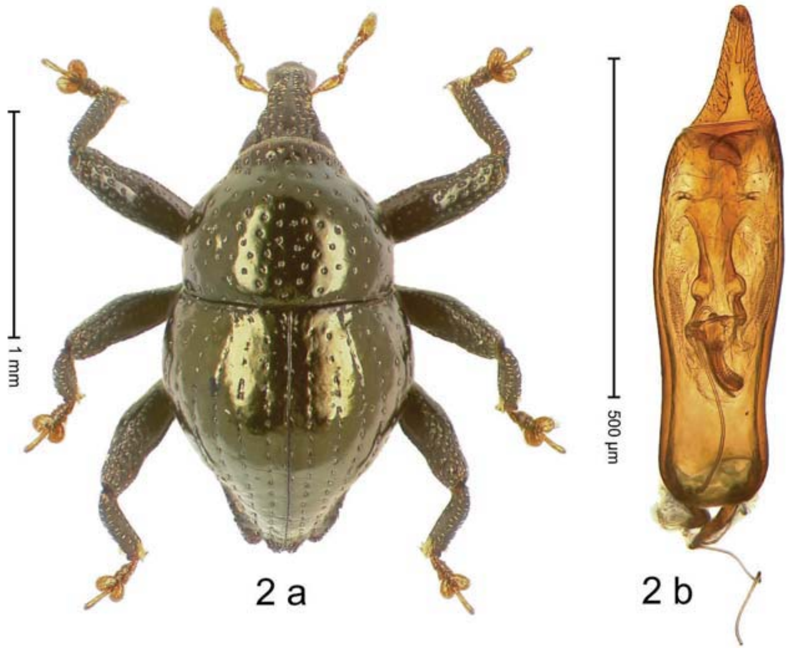


Figure 2. *Trigonopterus aeneus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

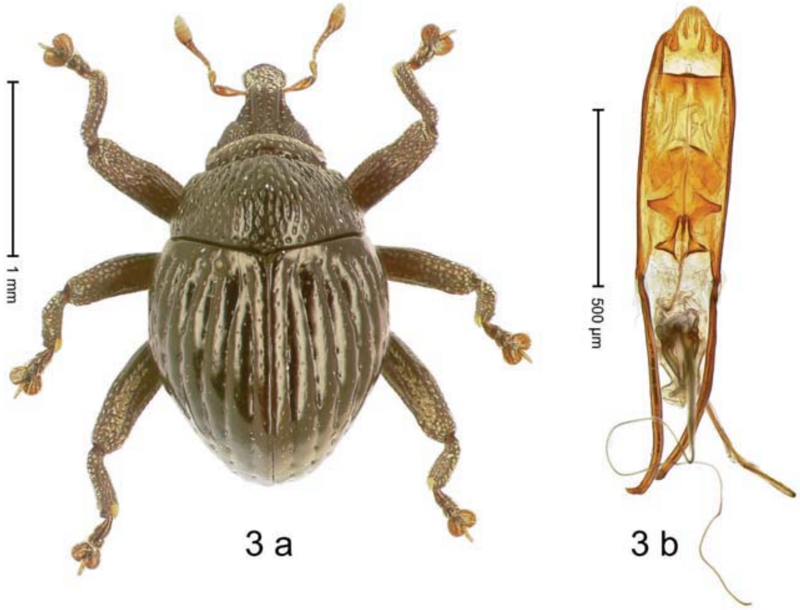


Figure 3. *Trigonopterus agathis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

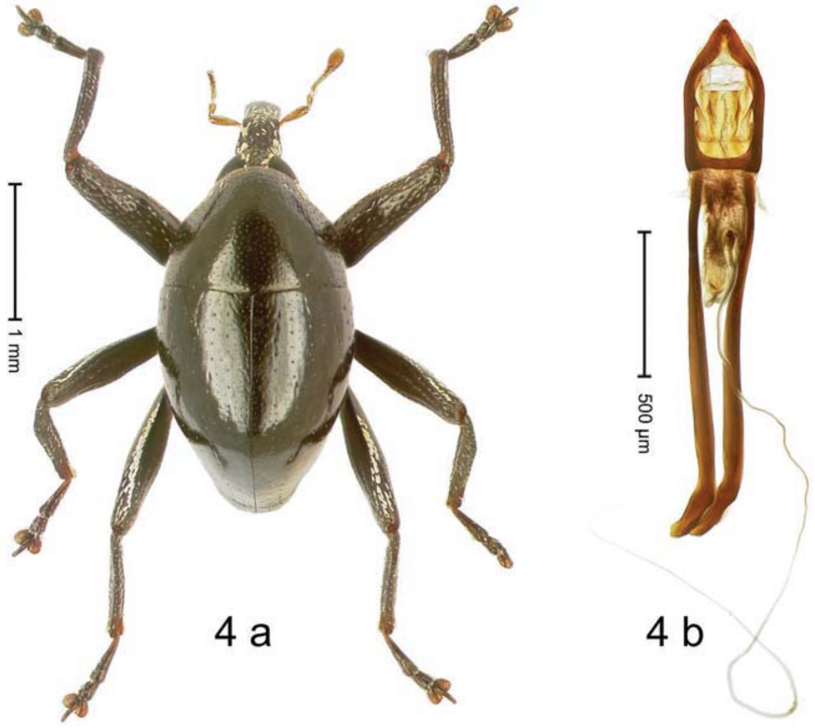


Figure 4. *Trigonopterus agilis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

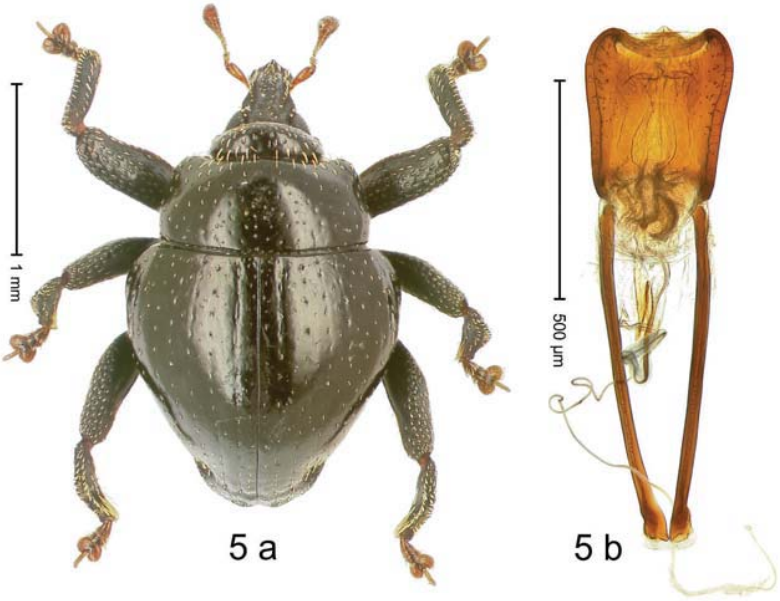


Figure 5. *Trigonopterus amplipennis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

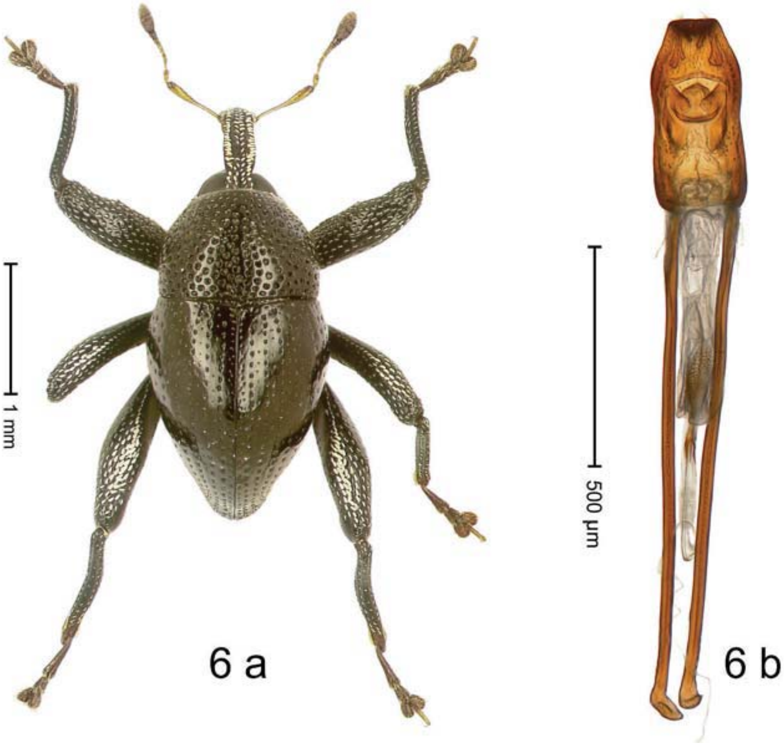


Figure 6. *Trigonopterus ancoruncus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

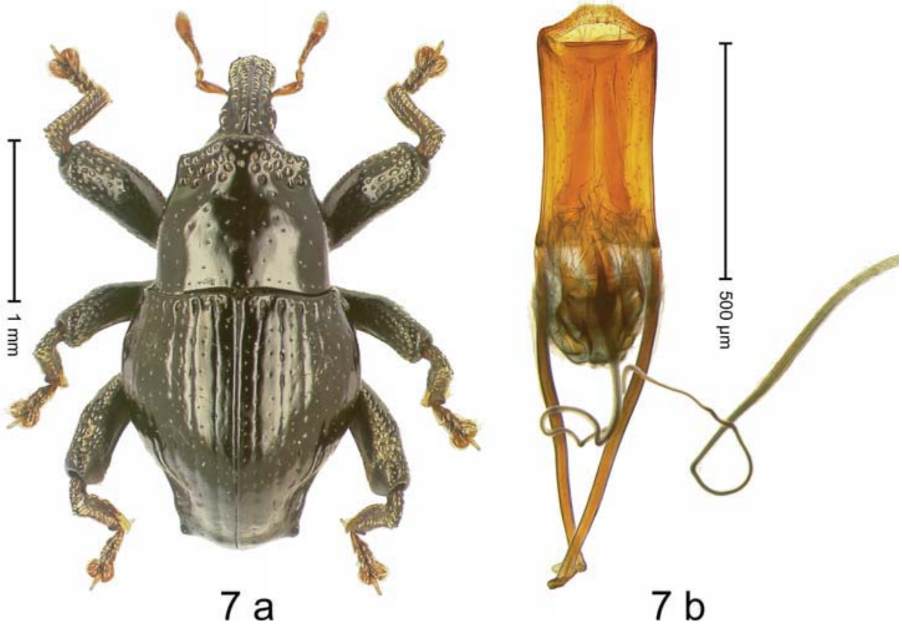


Figure 7. *Trigonopterus angulatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

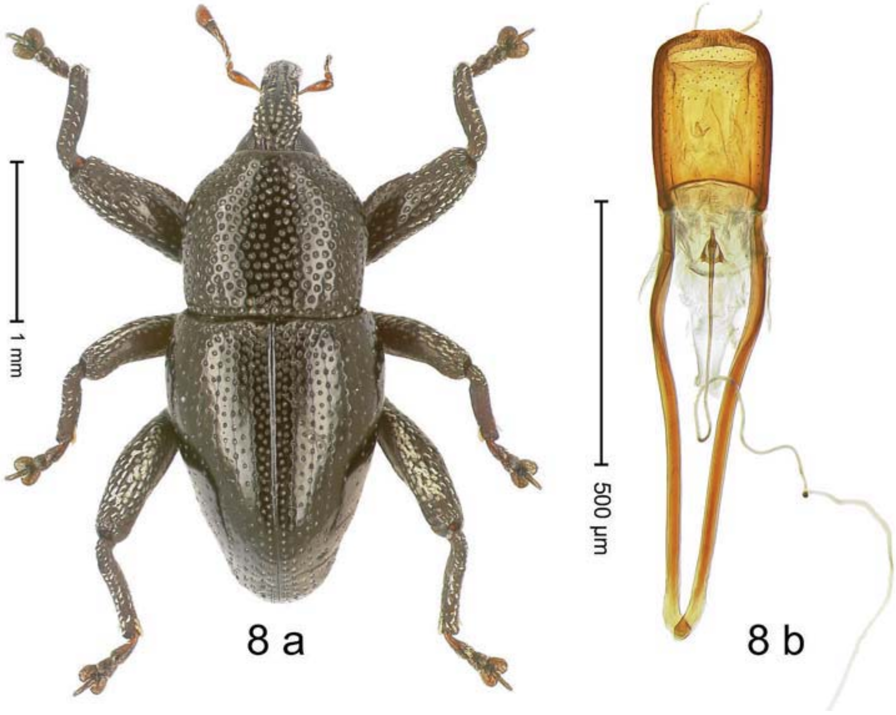


Figure 8. *Trigonopterus angustus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

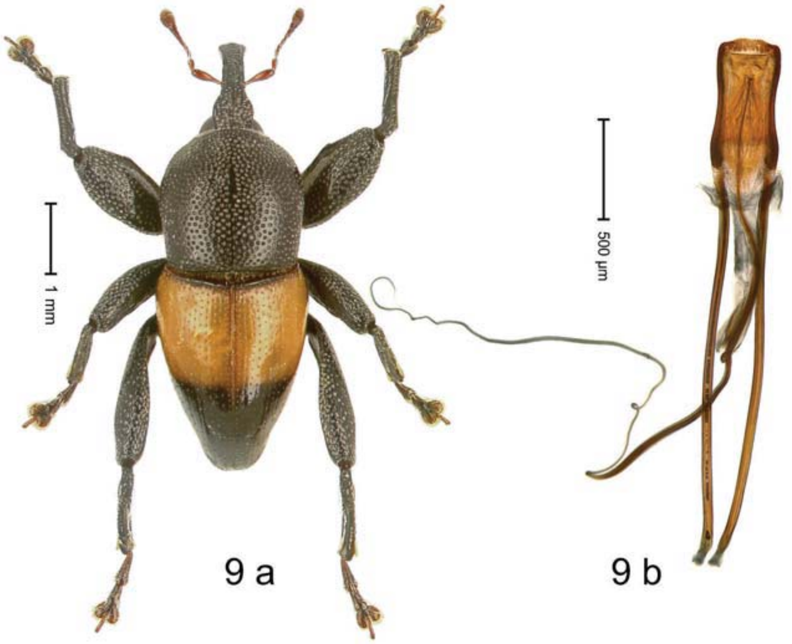


Figure 9. *Trigonopterus apicalis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

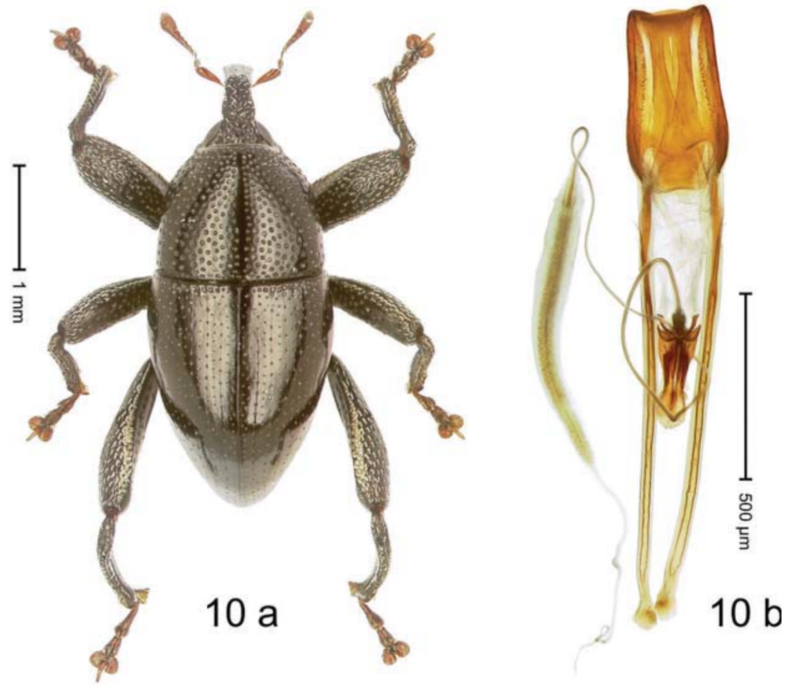


Figure 10. *Trigonopterus armatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

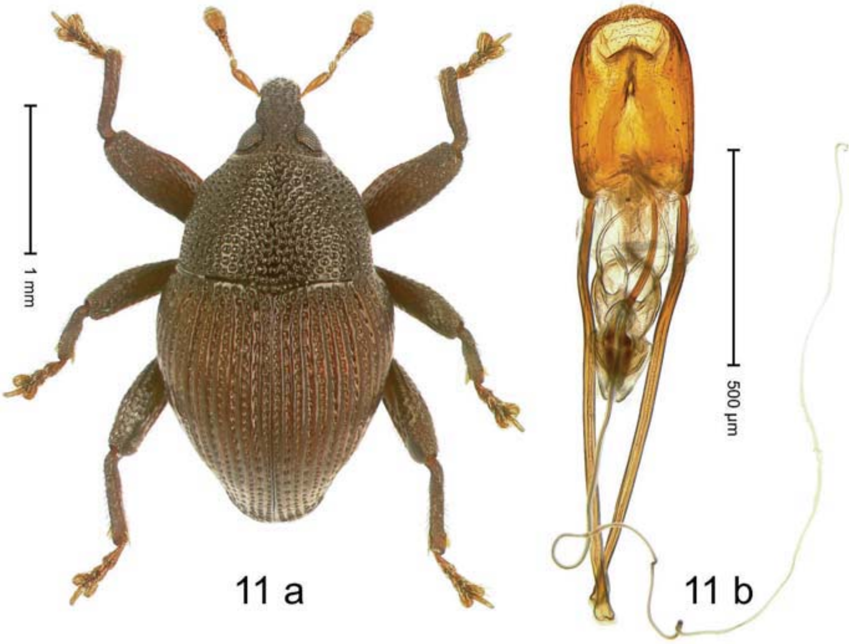


Figure 11. *Trigonopterus ascendens* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

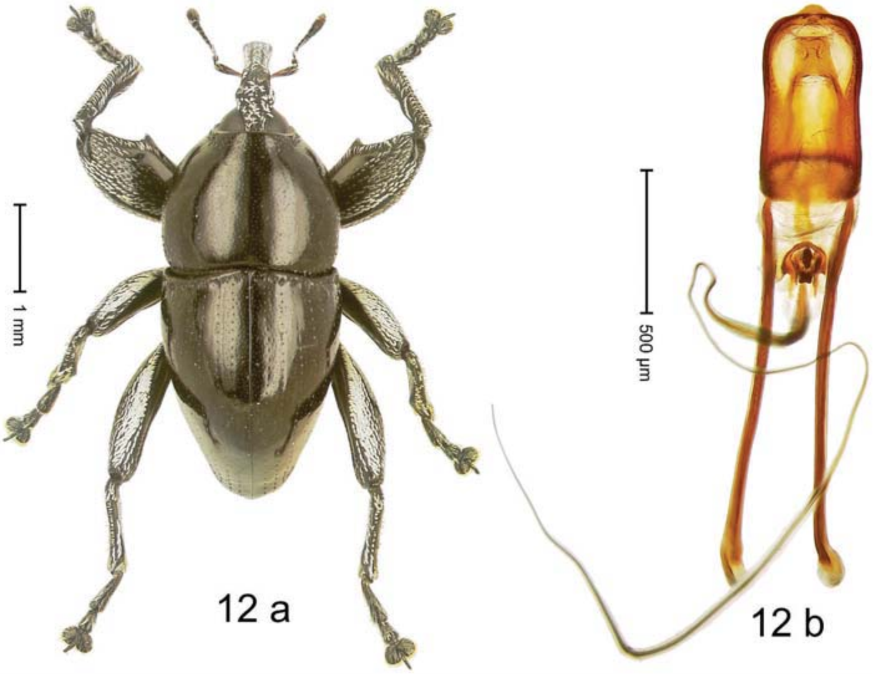


Figure 12. *Trigonopterus augur* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

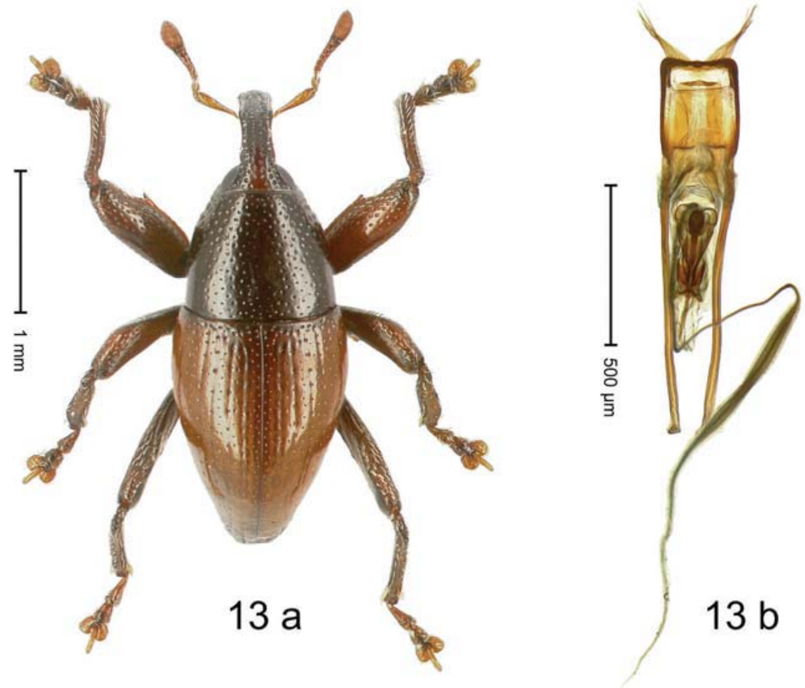


Figure 13. *Trigonopterus balimensis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

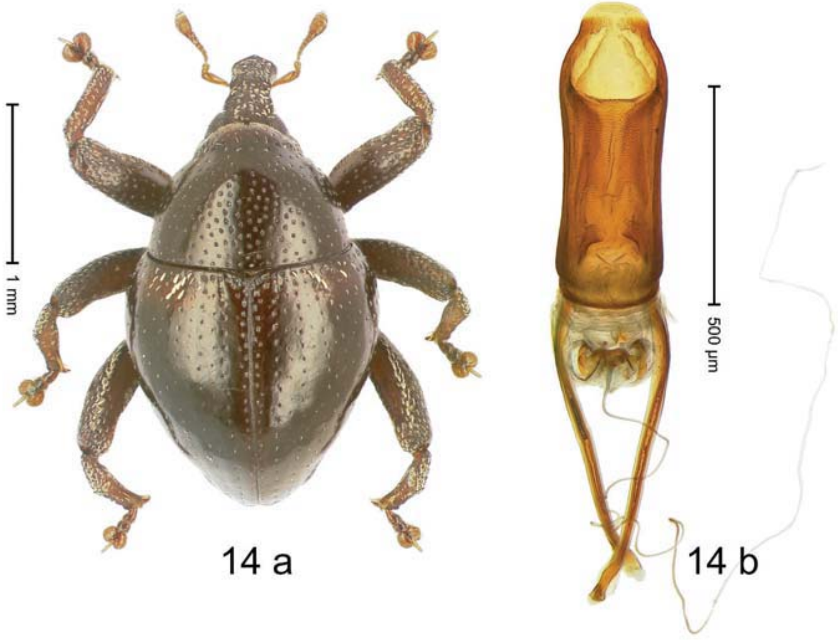


Figure 14. *Trigonopterus basalis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

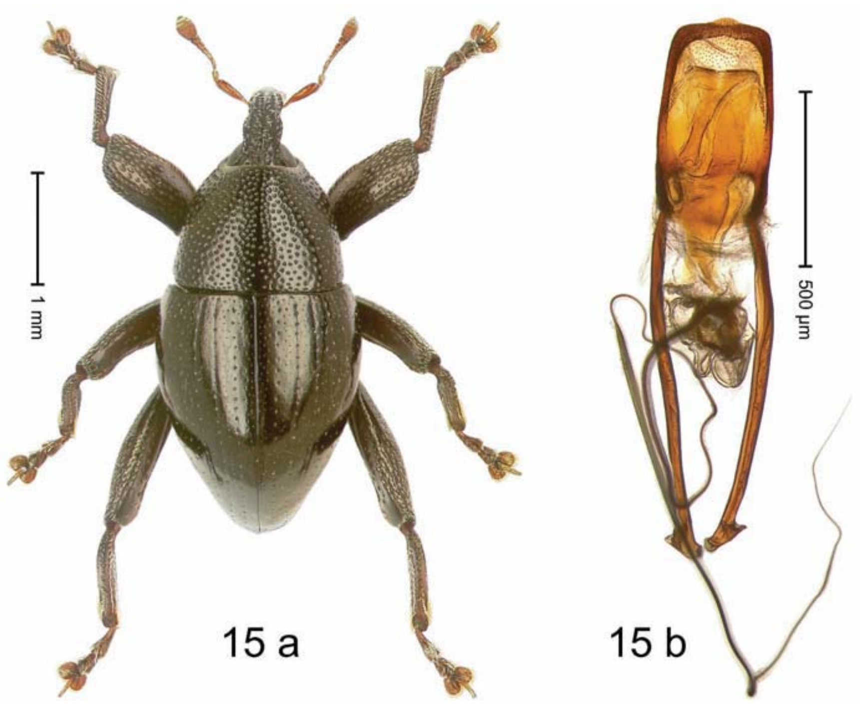


Figure 15. *Trigonopterus conformis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

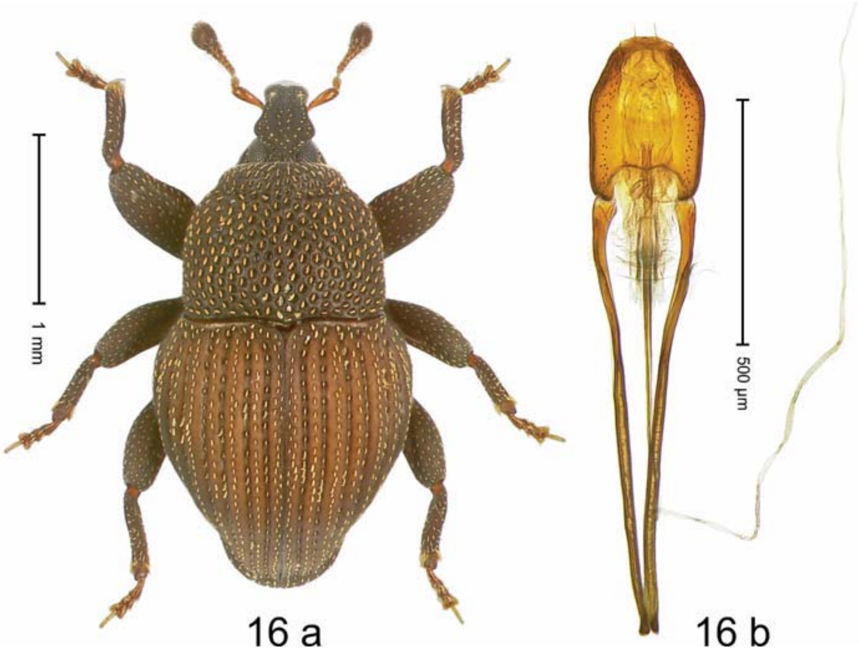


Figure 16. *Trigonopterus constrictus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

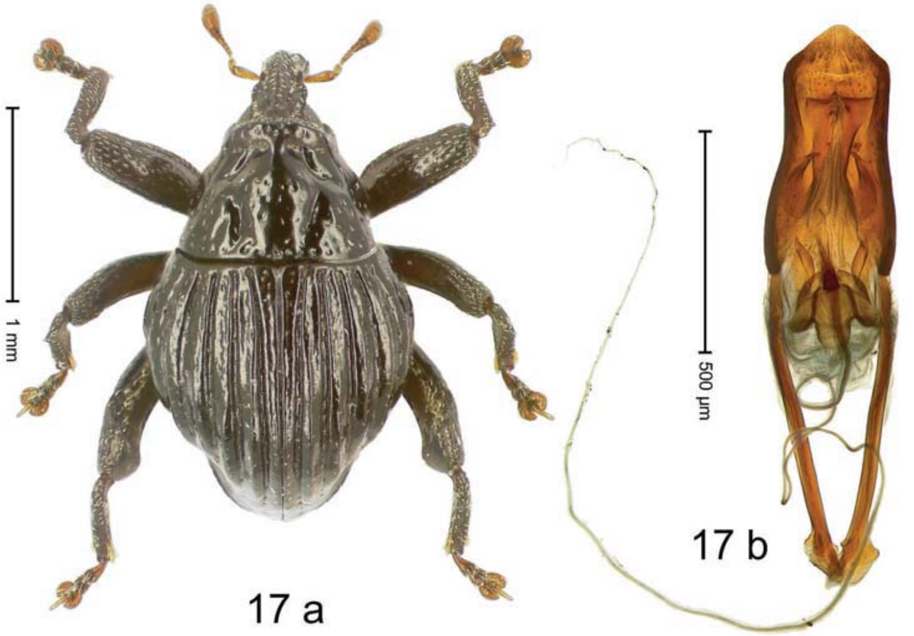


Figure 17. *Trigonopterus costatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

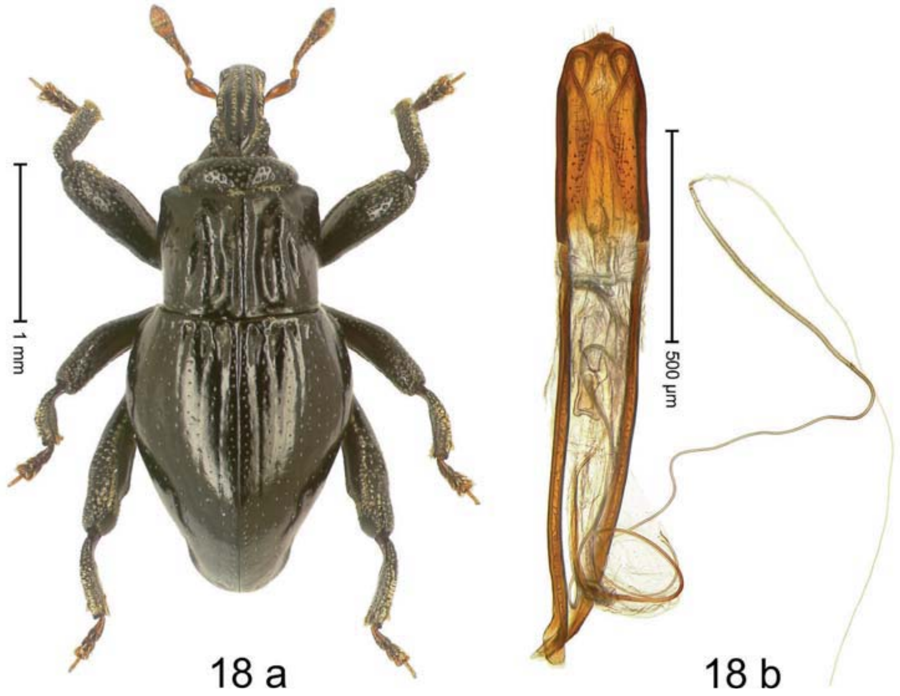


Figure 18. *Trigonopterus costicollis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

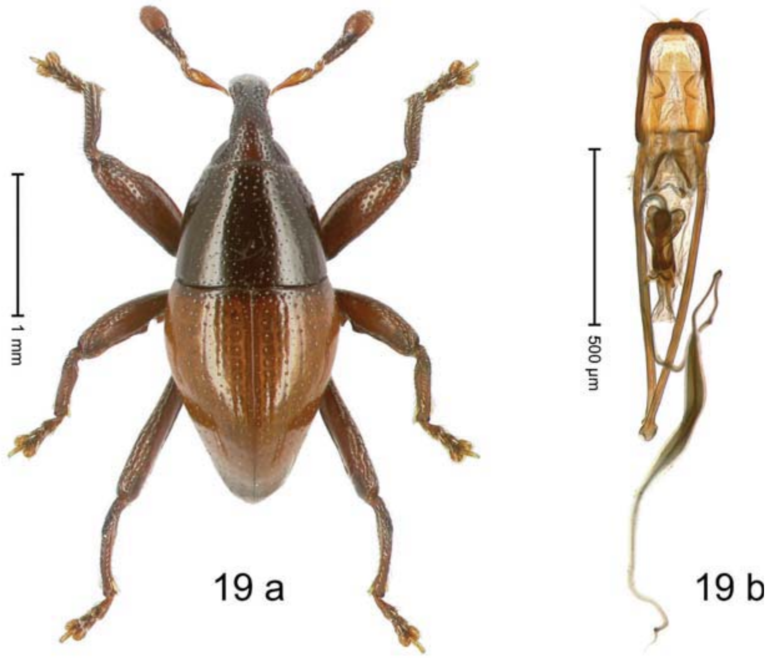


Figure 19. *Trigonopterus crassicornis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

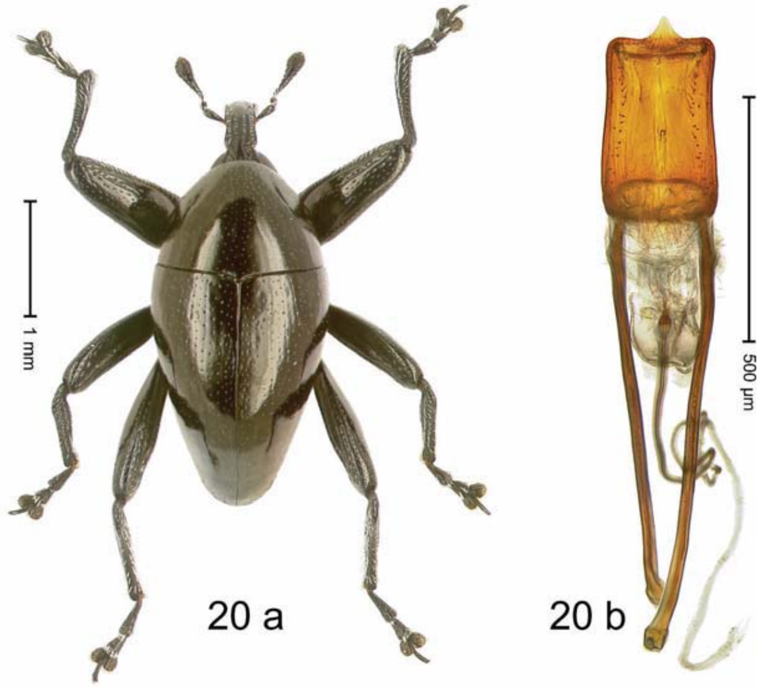


Figure 20. *Trigonopterus cuneipennis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

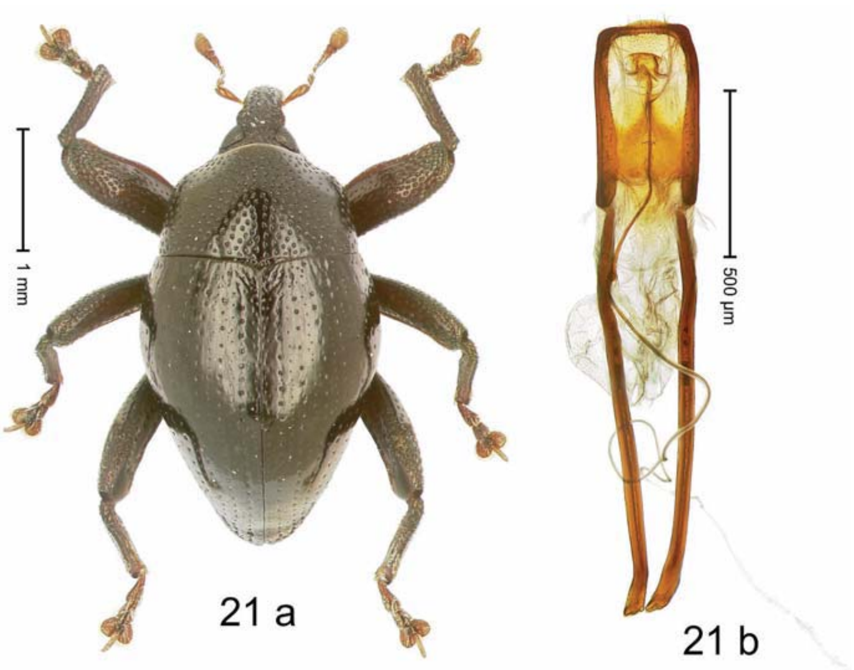


Figure 21. *Trigonopterus cyclopensis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

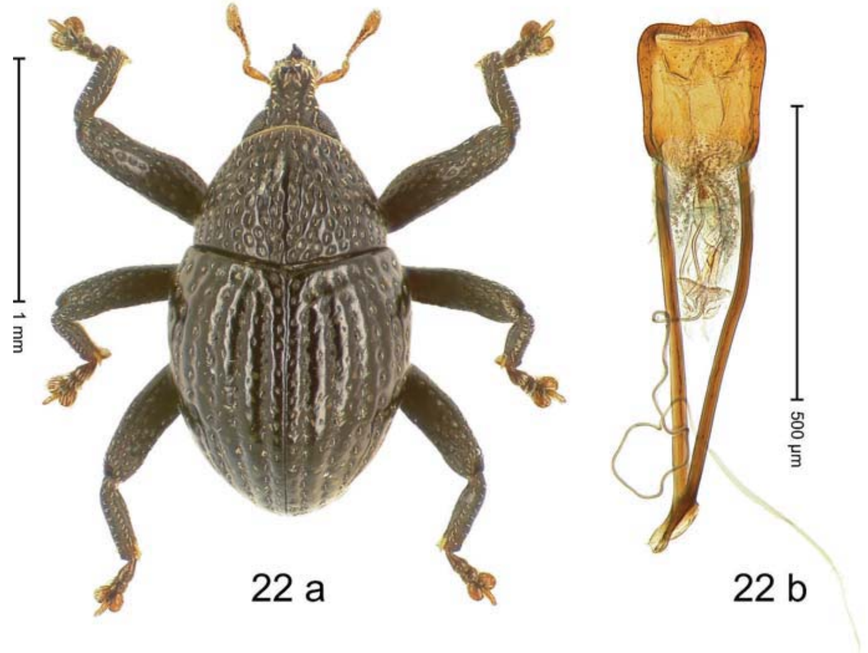


Figure 22. *Trigonopterus dentirostris* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

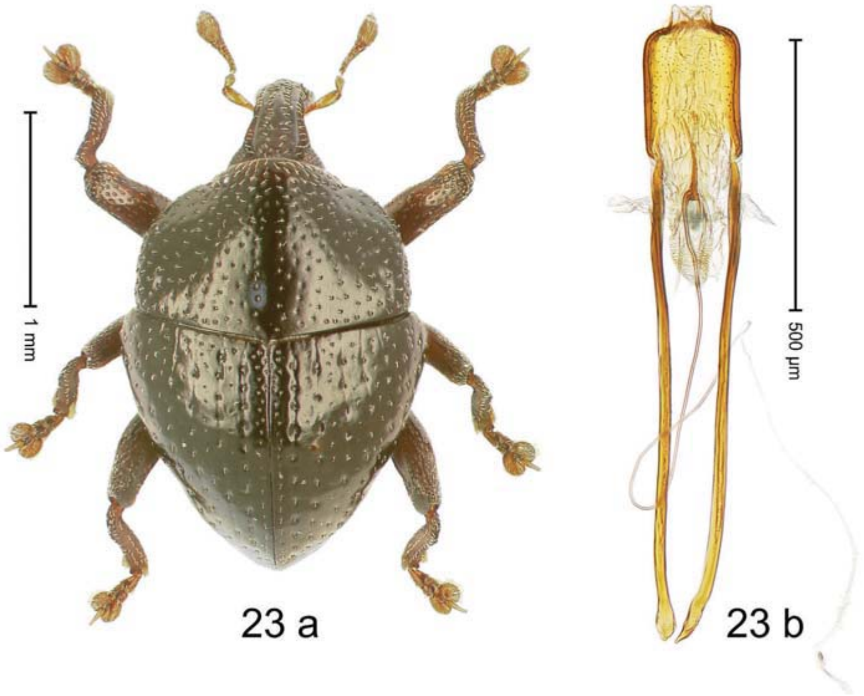


Figure 23. *Trigonopterus discoidalis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

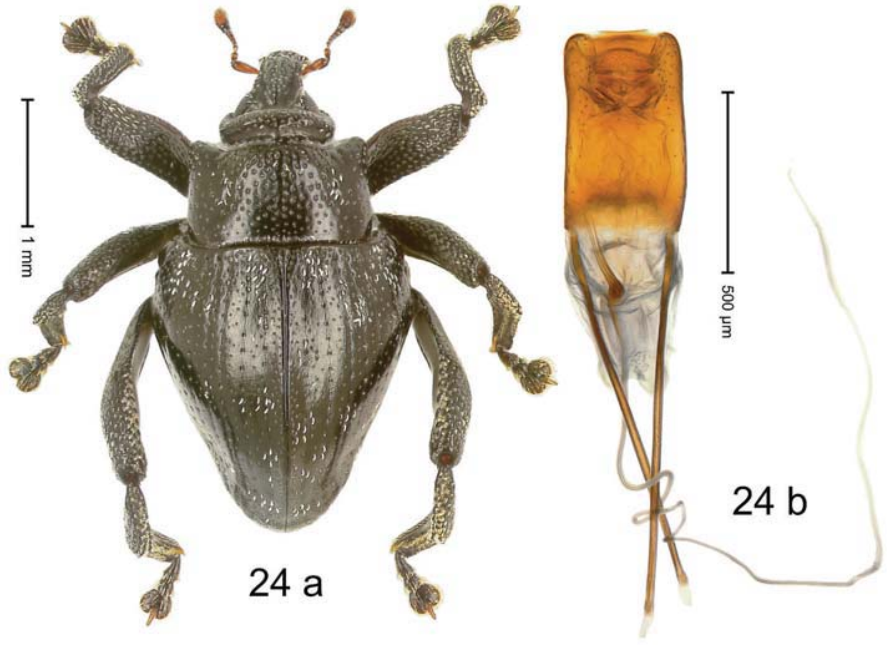


Figure 24. *Trigonopterus dromedarius* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

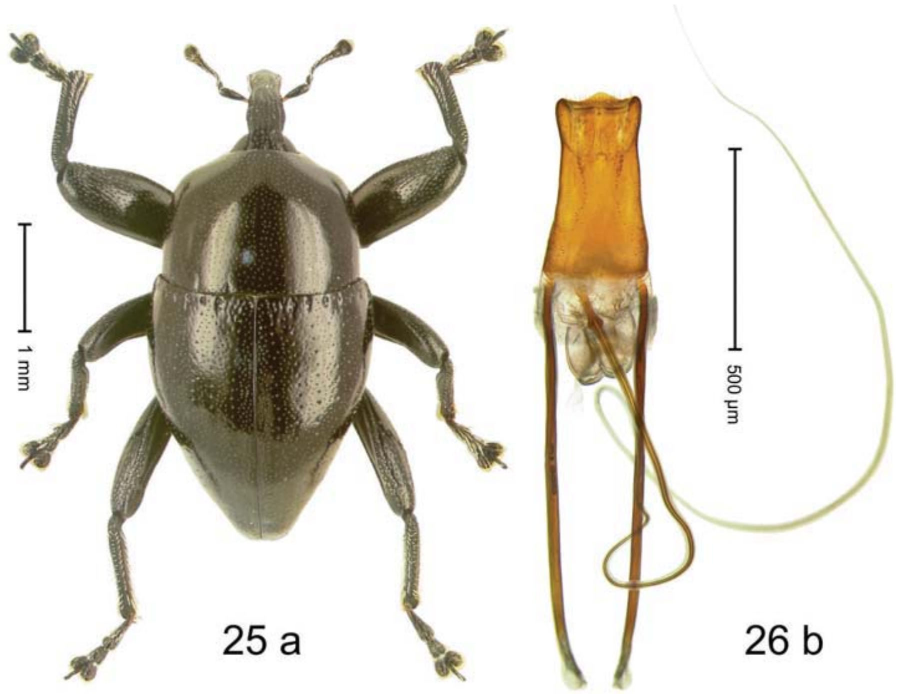


Figure 25. *Trigonopterus durus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

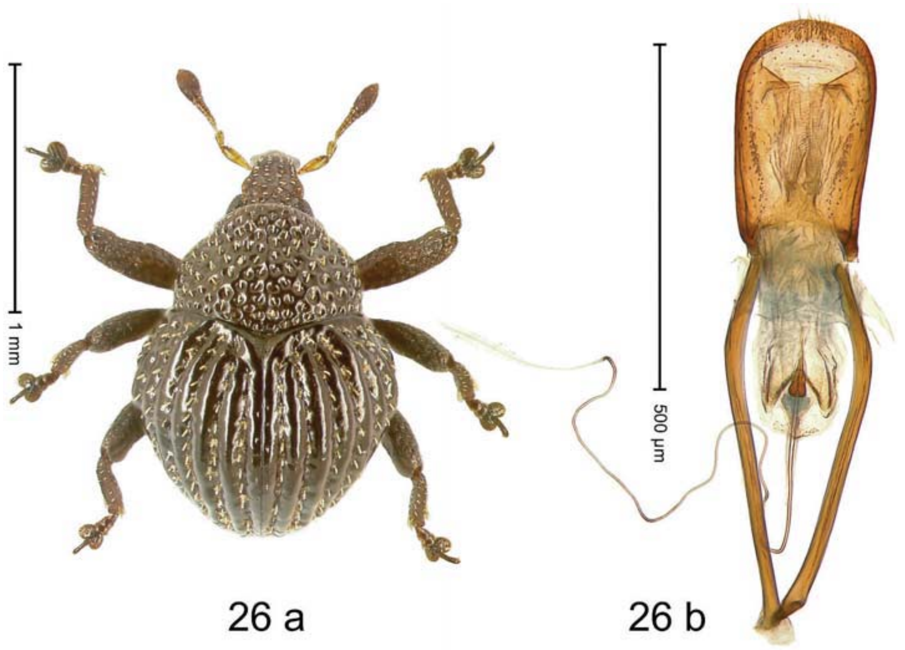


Figure 26. *Trigonopterus echinus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

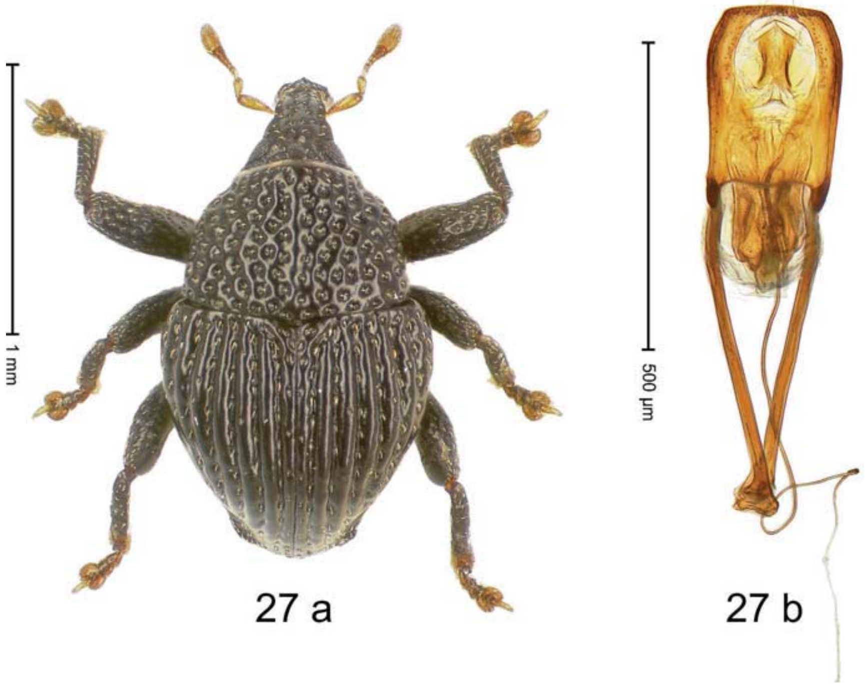


Figure 27. *Trigonopterus edaphus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

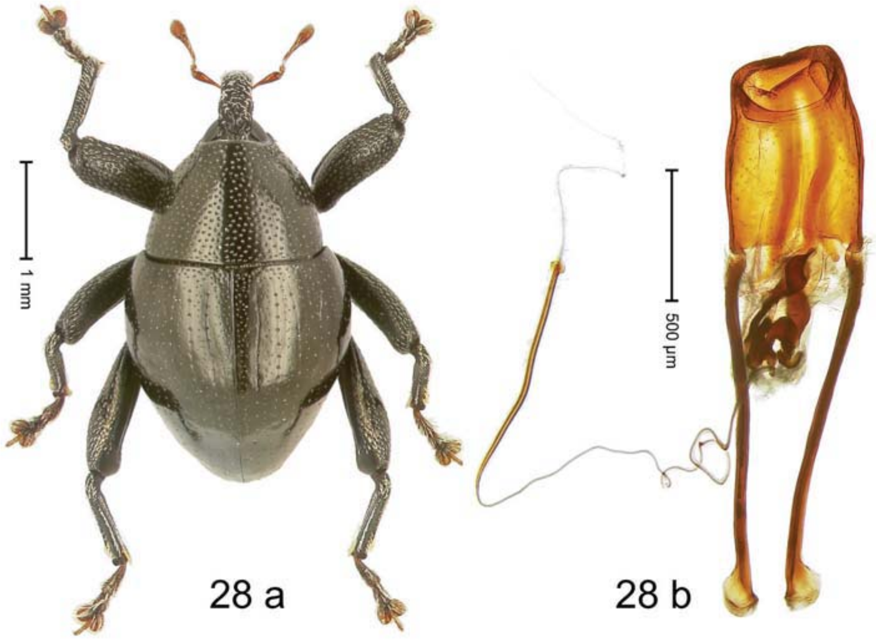


Figure 28. *Trigonopterus eremitus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

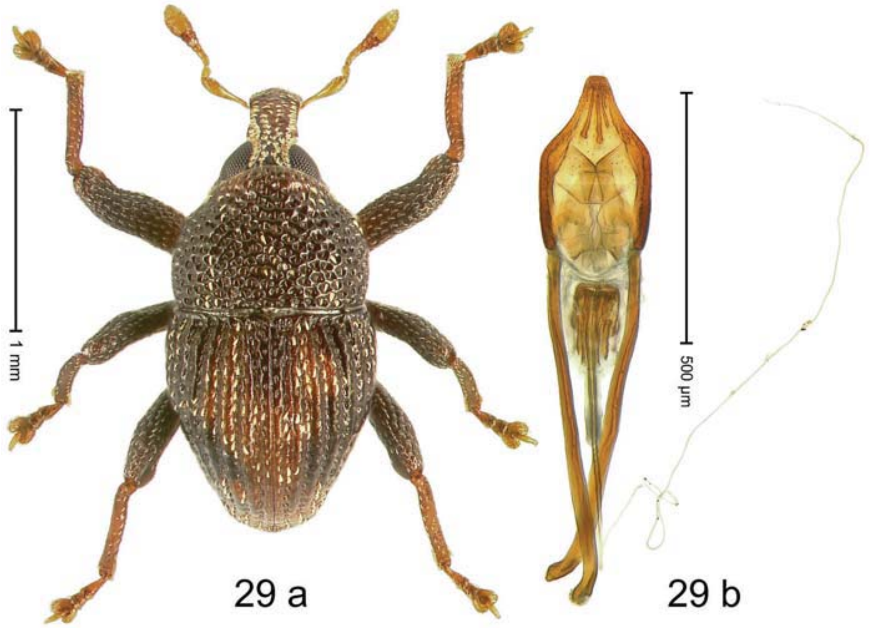


Figure 29. *Trigonopterus euops* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

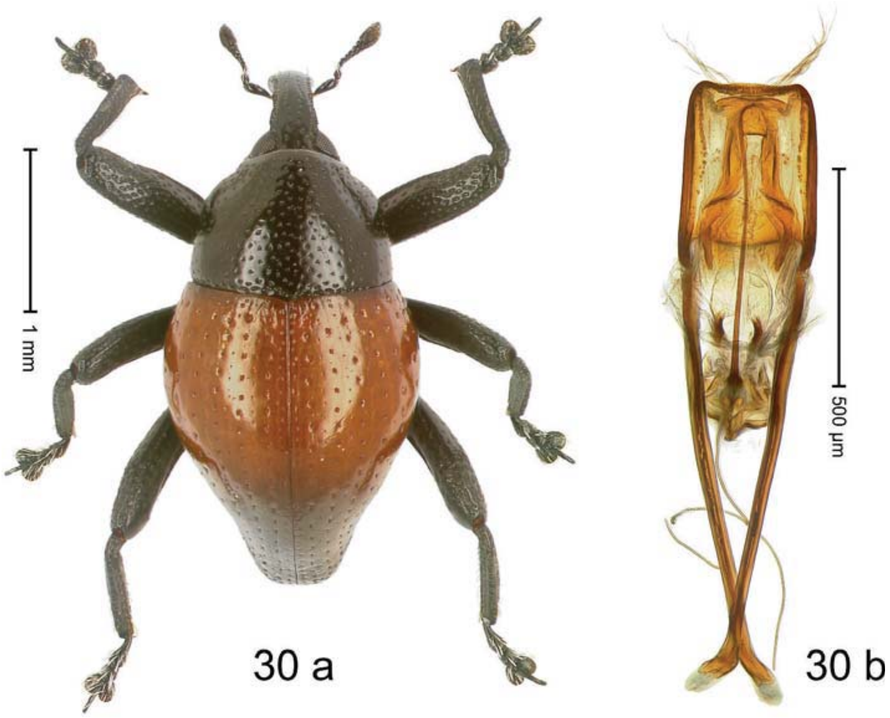


Figure 30. *Trigonopterus ferrugineus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

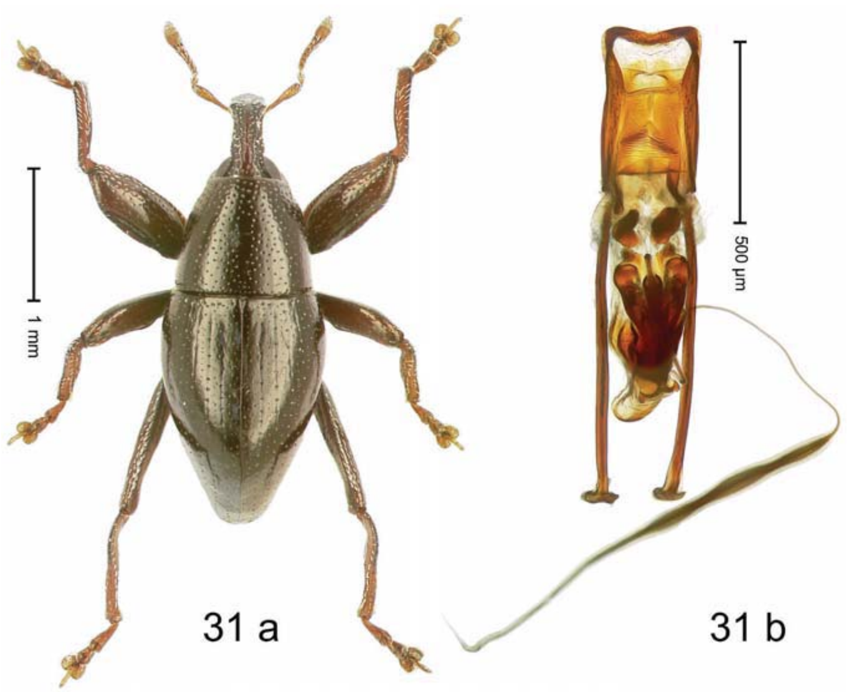


Figure 31. *Trigonopterus fusiformis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

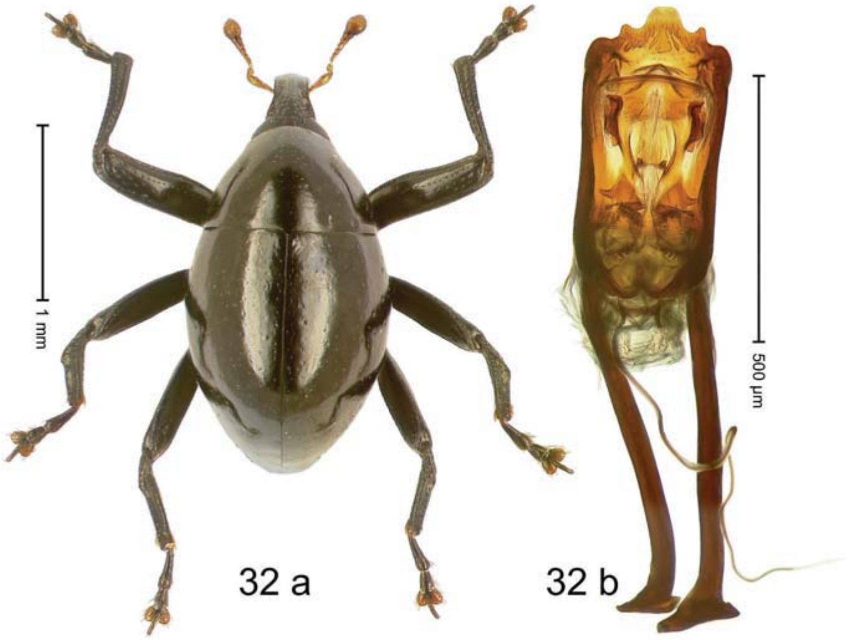


Figure 32. *Trigonopterus glaber* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

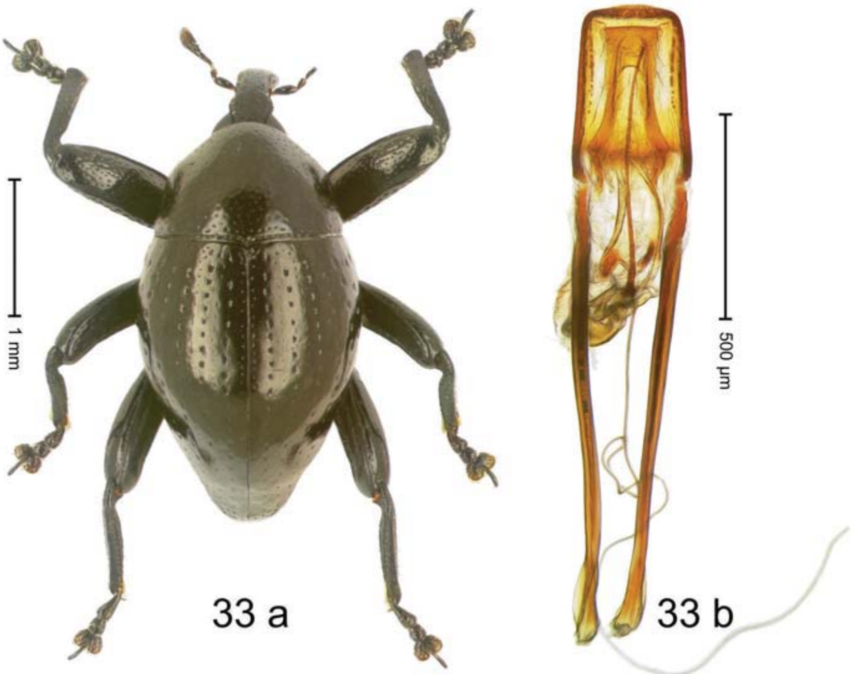


Figure 33. *Trigonopterus gonatoceros* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

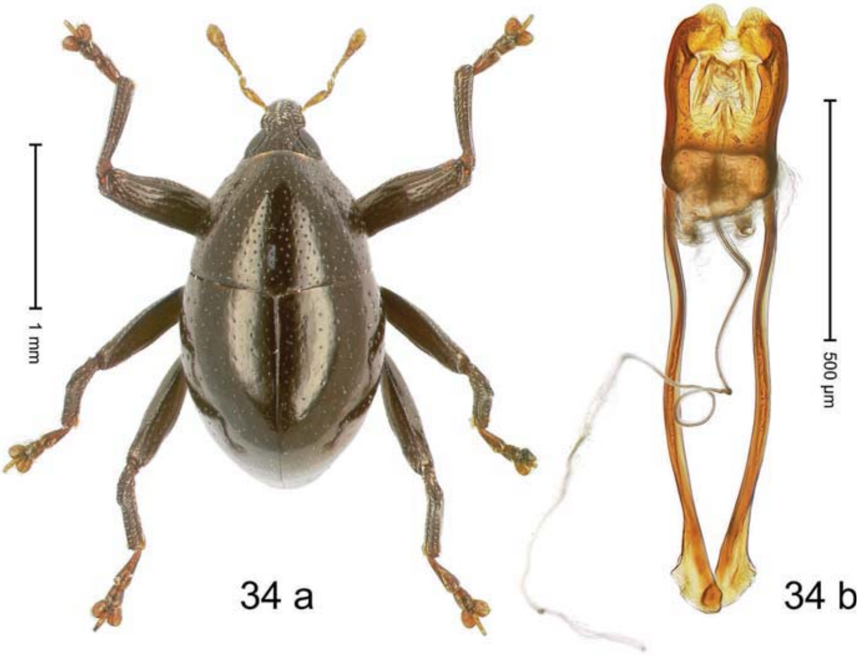


Figure 34. *Trigonopterus granum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

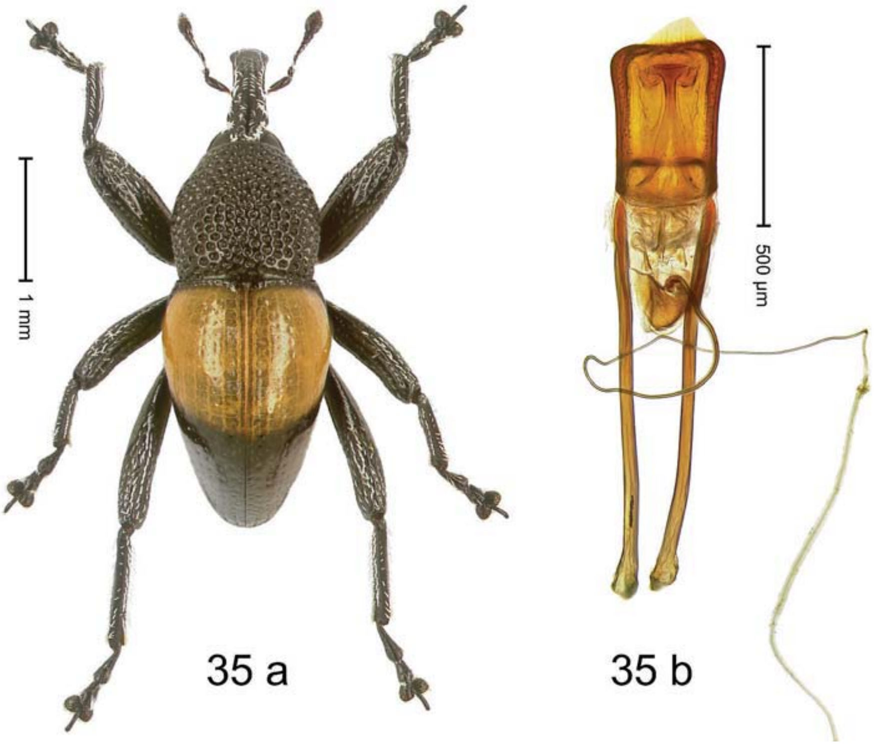


Figure 35. *Trigonopterus helios* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

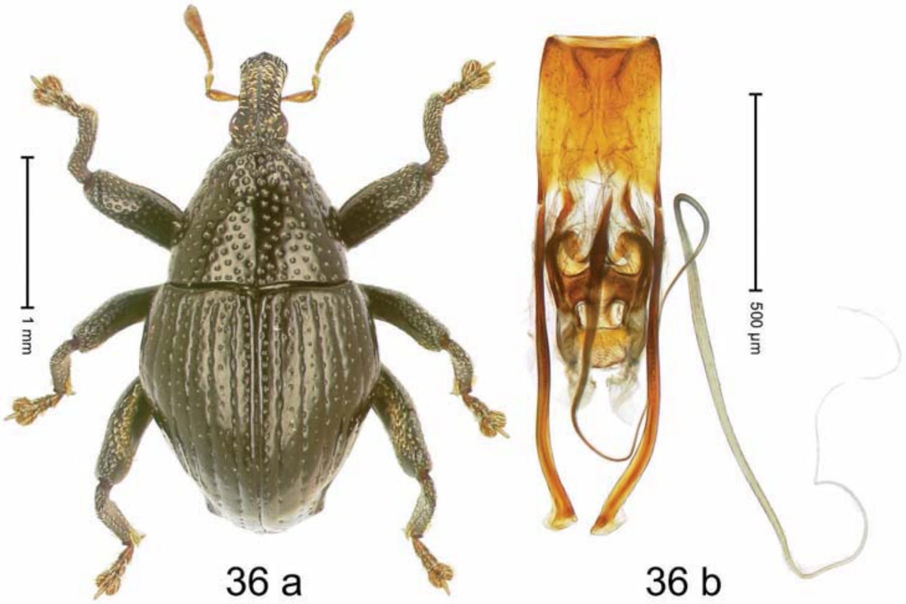


Figure 36. *Trigonopterus hitoloorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

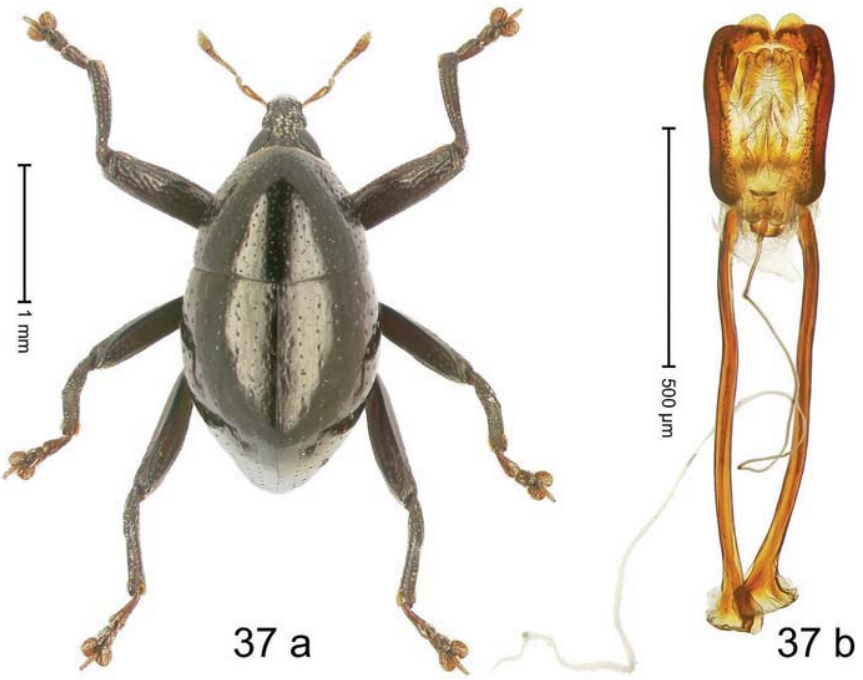


Figure 37. *Trigonopterus imitatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

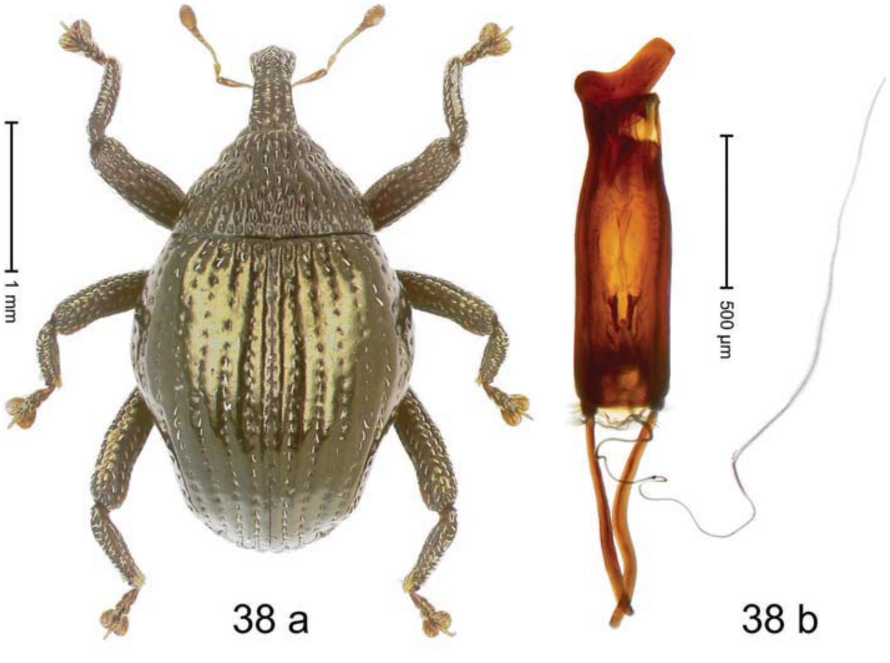


Figure 38. *Trigonopterus inflatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

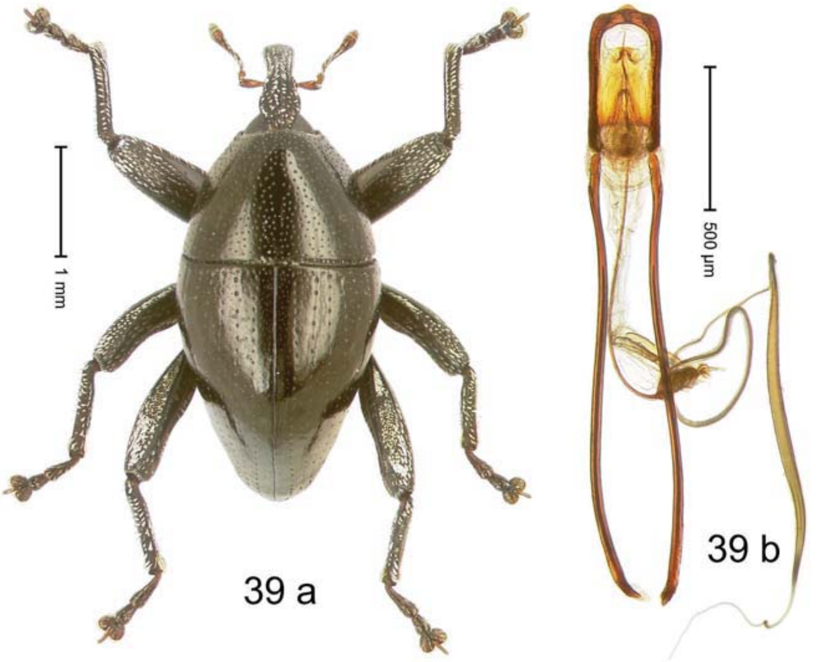


Figure 39. *Trigonopterus insularis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

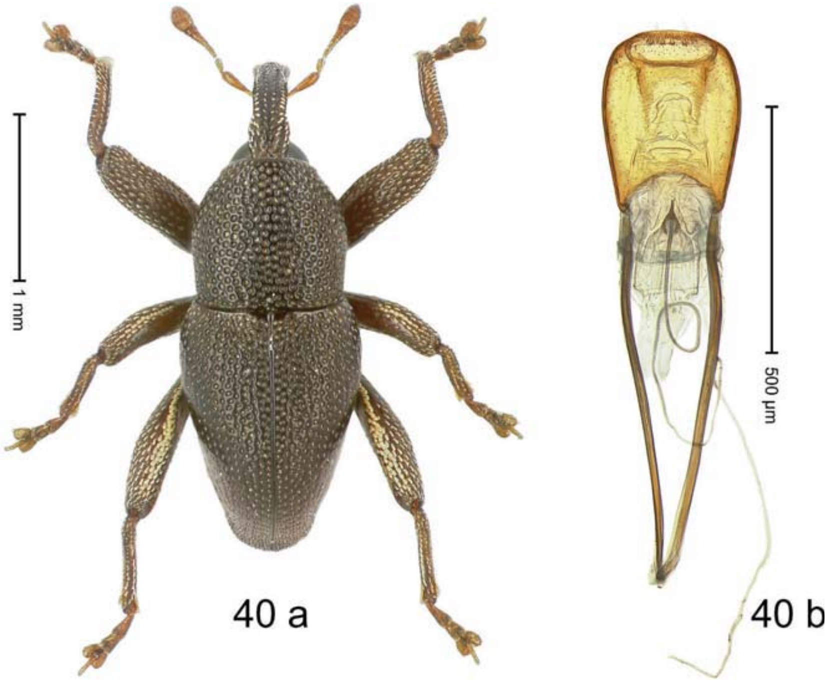


Figure 40. *Trigonopterus irregularis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

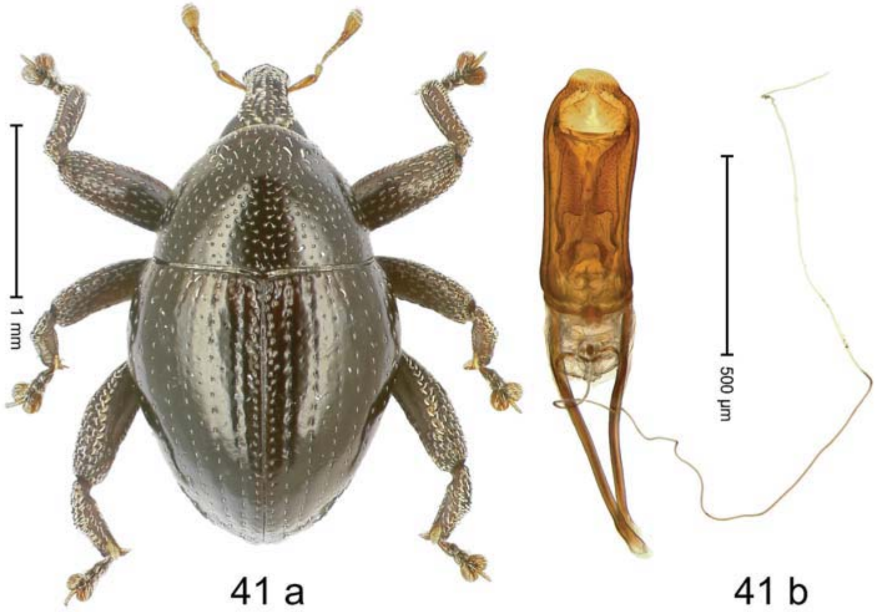


Figure 41. *Trigonopterus ixodiformis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

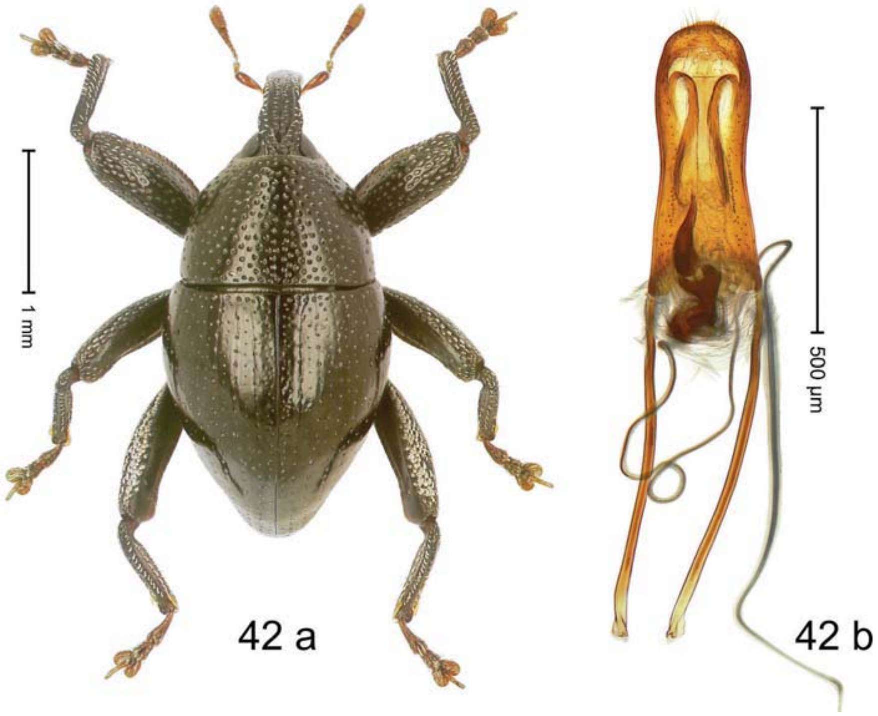


Figure 42. *Trigonopterus kanawiorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

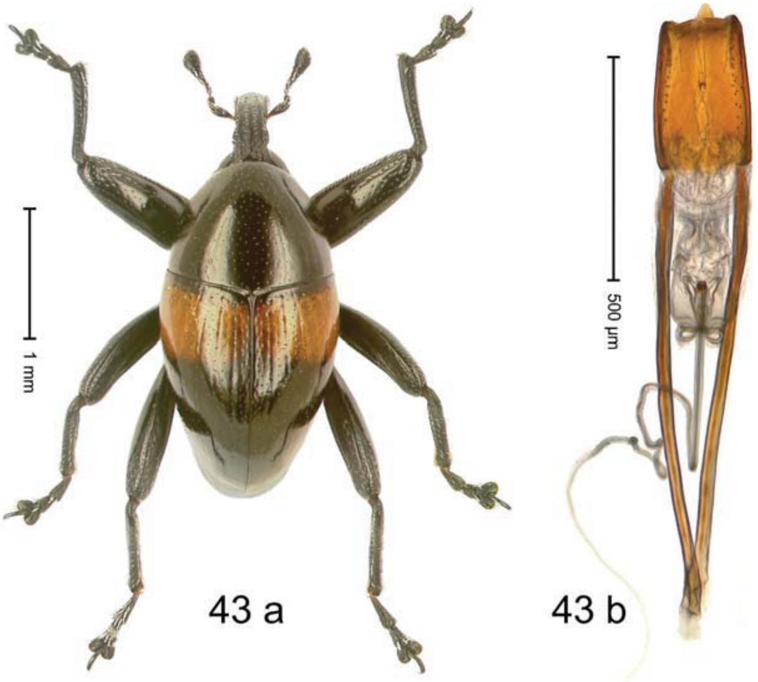


Figure 43. *Trigonopterus katayoi* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

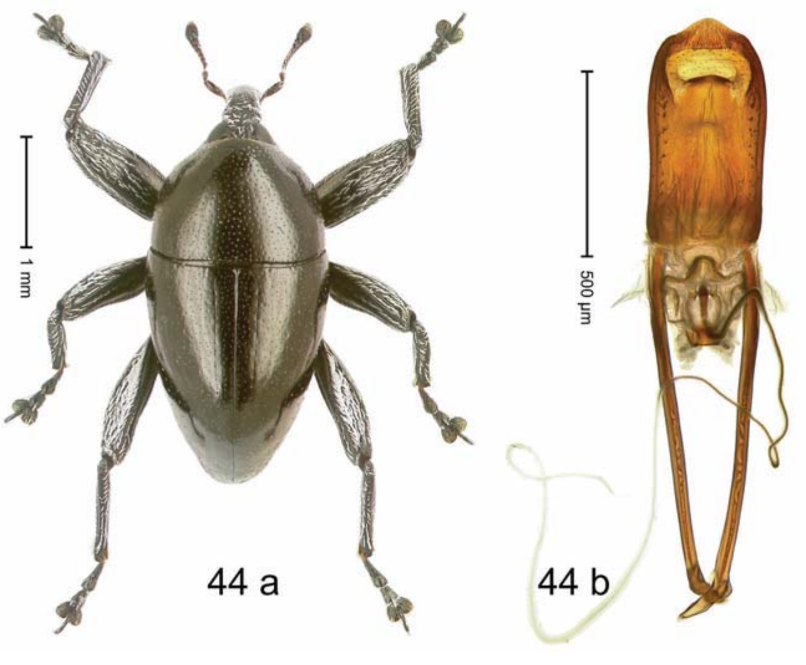


Figure 44. *Trigonopterus koveorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

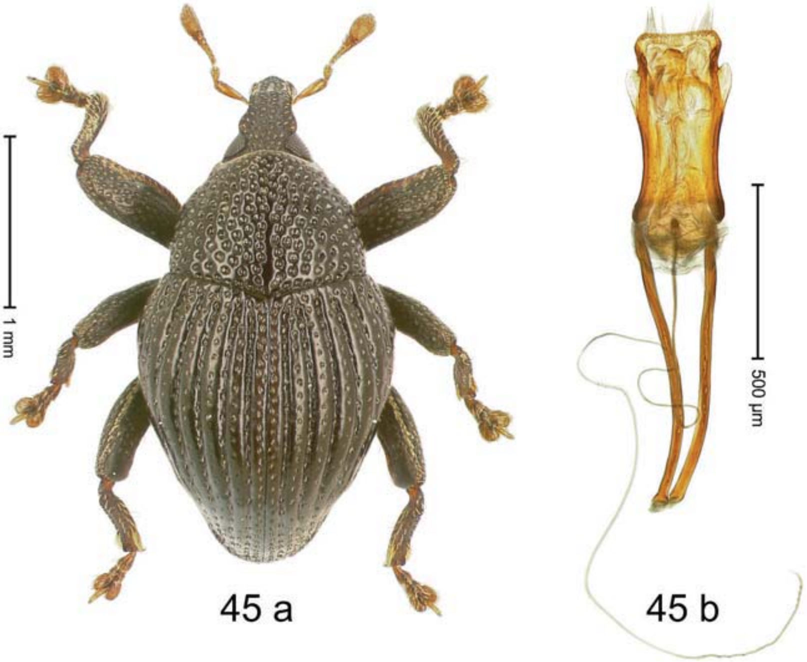


Figure 45. *Trigonopterus kurulu* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

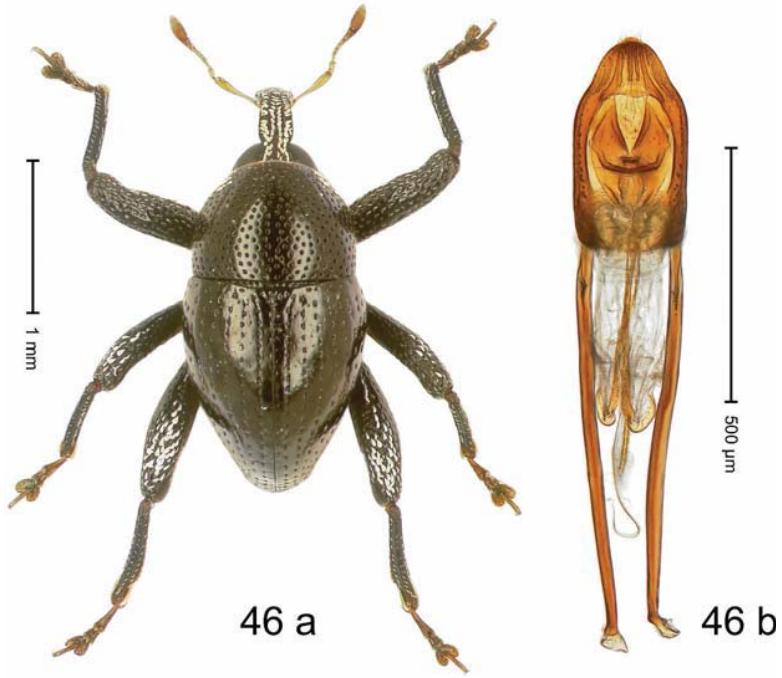


Figure 46. *Trigonopterus lekiorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

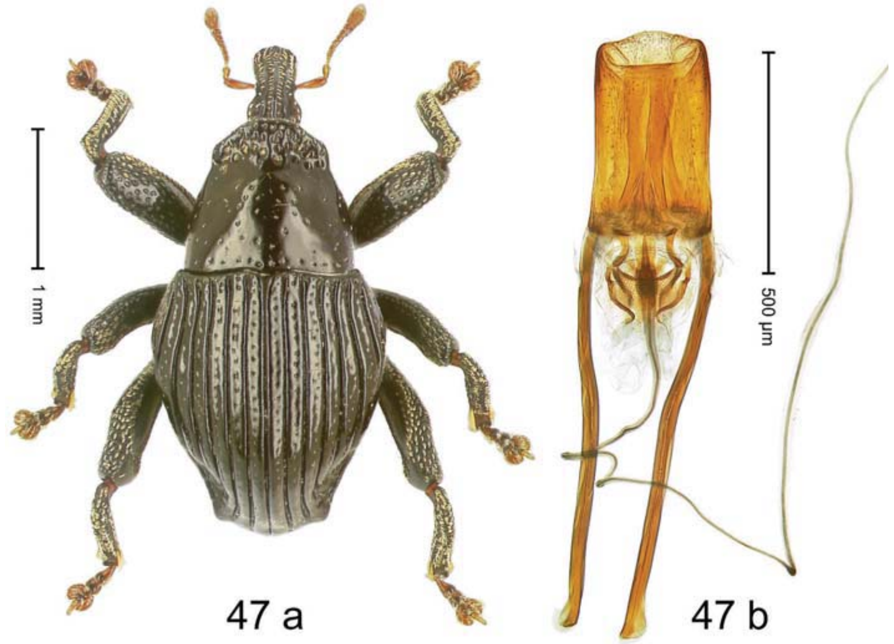


Figure 47. *Trigonopterus lineatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

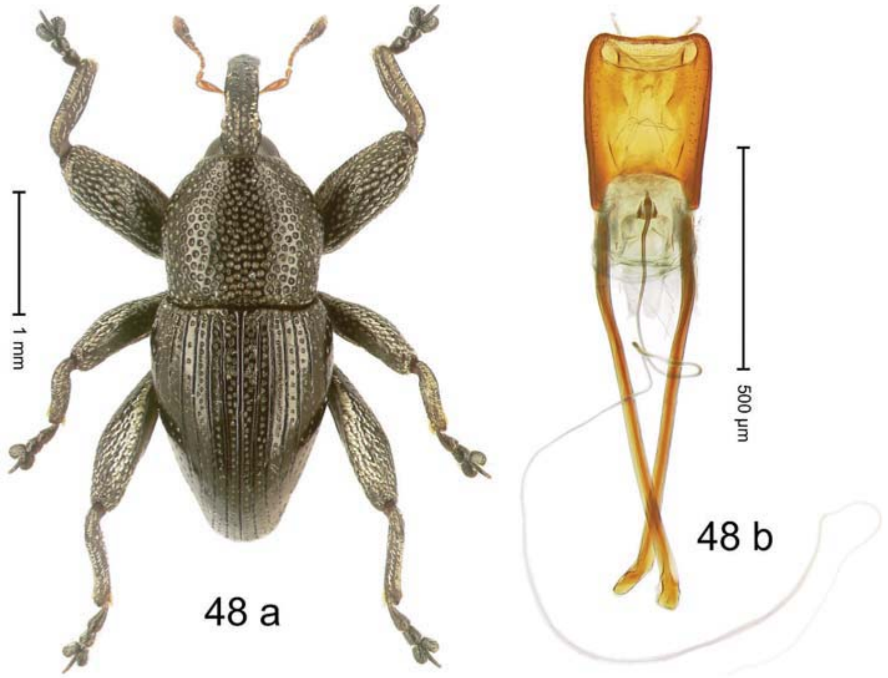


Figure 48. *Trigonopterus lineellus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

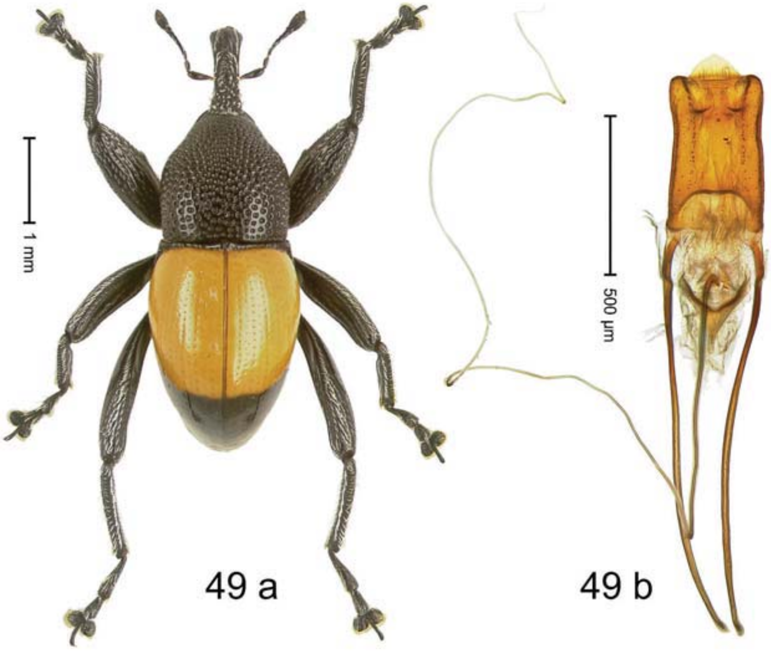


Figure 49. *Trigonopterus maculatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

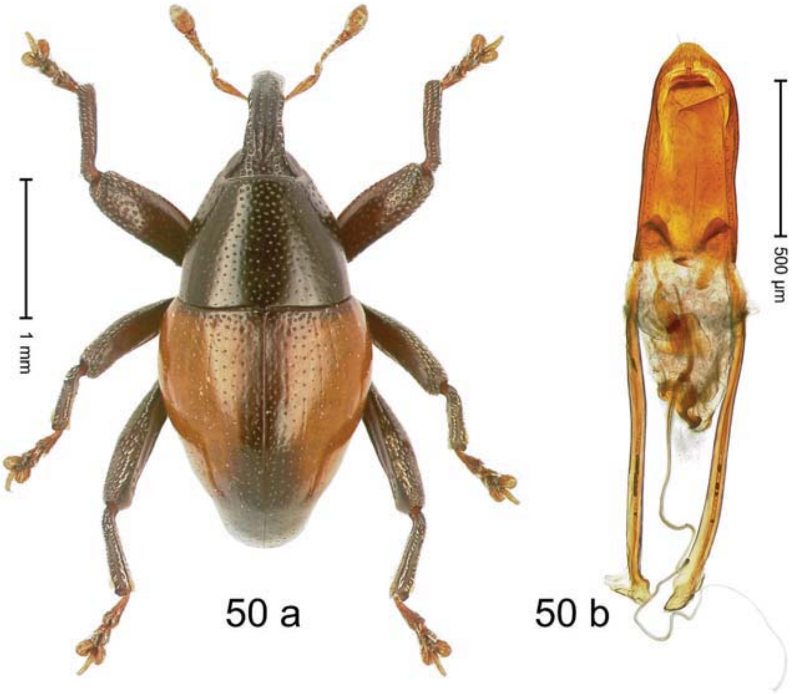


Figure 50. *Trigonopterus mimicus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

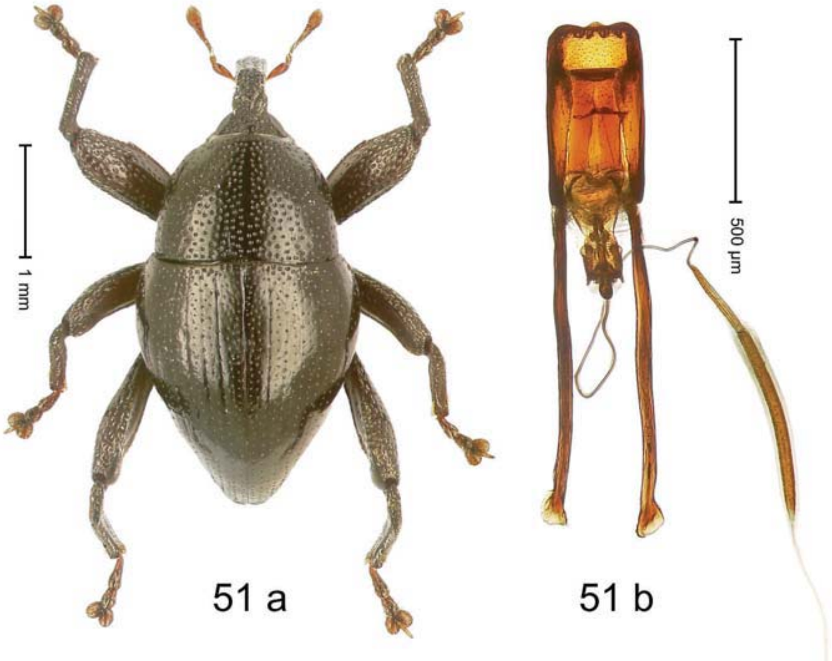


Figure 51. *Trigonopterus monticola* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

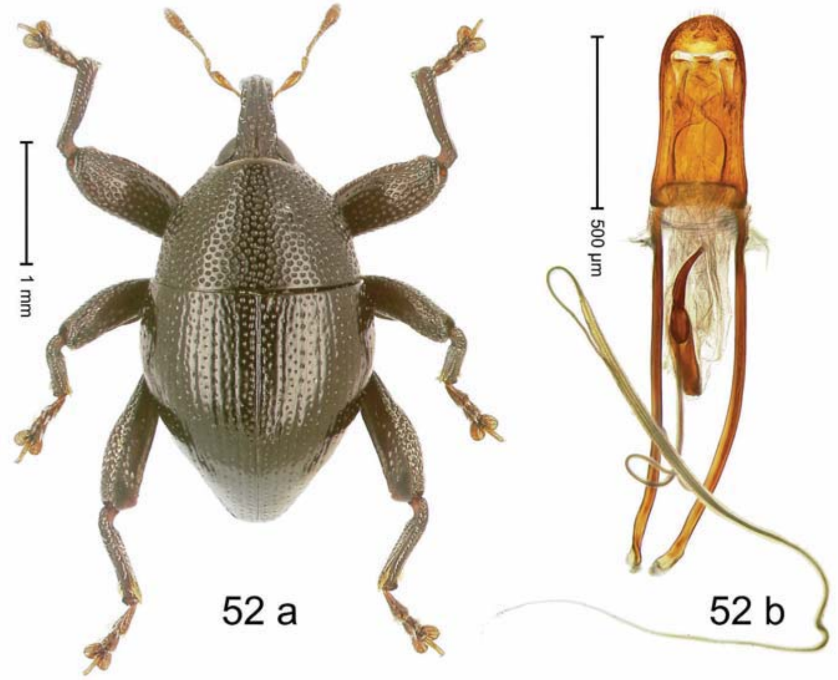


Figure 52. *Trigonopterus montivagus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

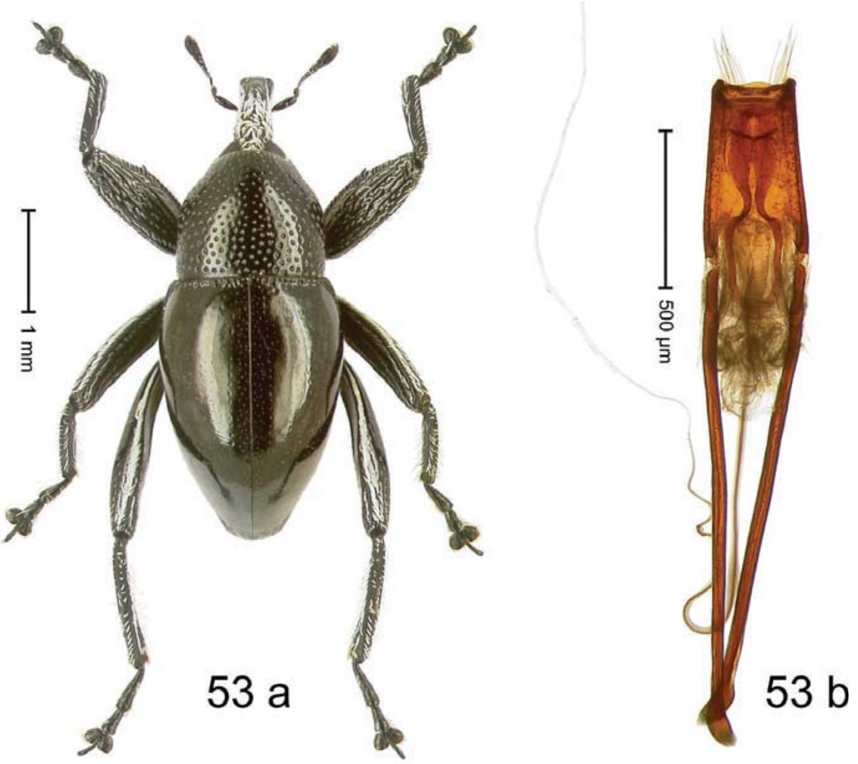


Figure 53. *Trigonopterus moreaorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

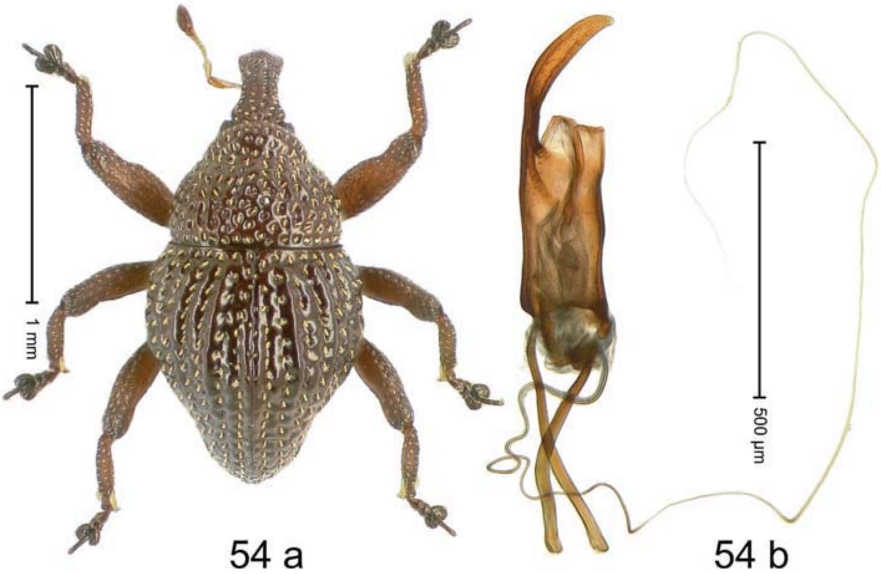
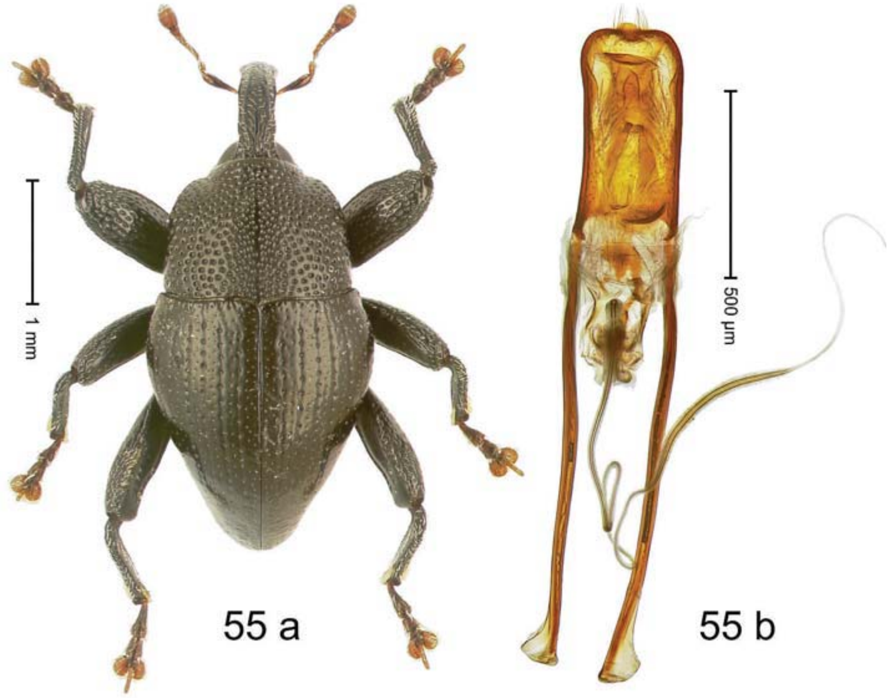


Figure 54. *Trigonopterus myops* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.



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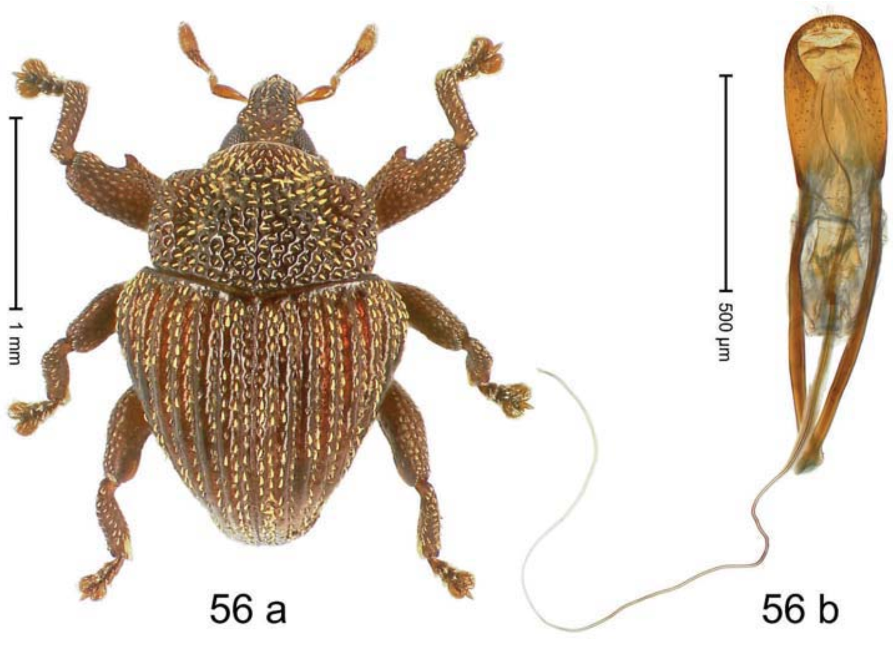


Figure 56. *Trigonopterus nothofagorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

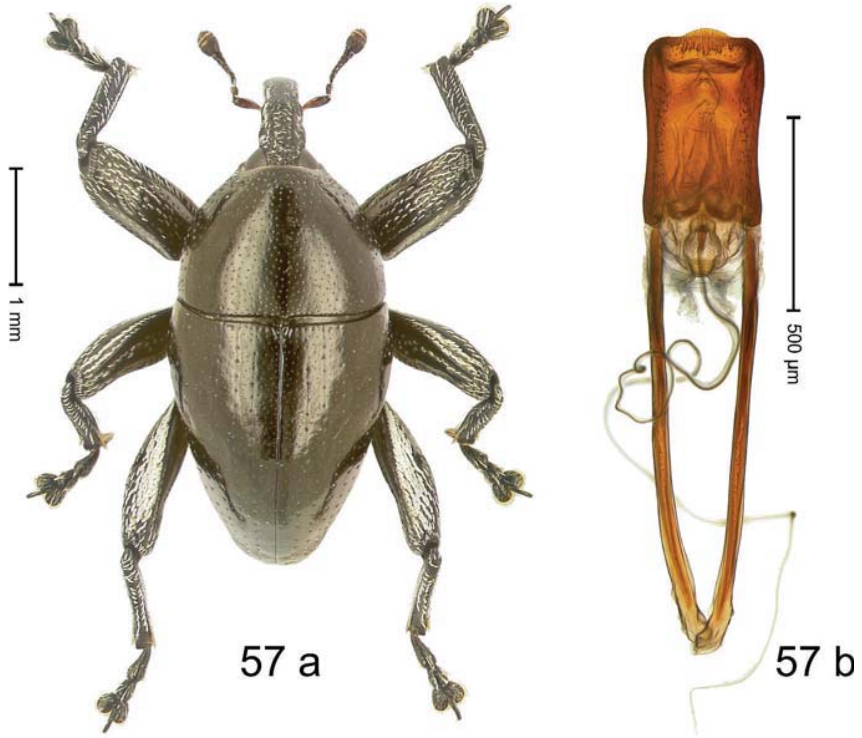


Figure 57. *Trigonopterus ovatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

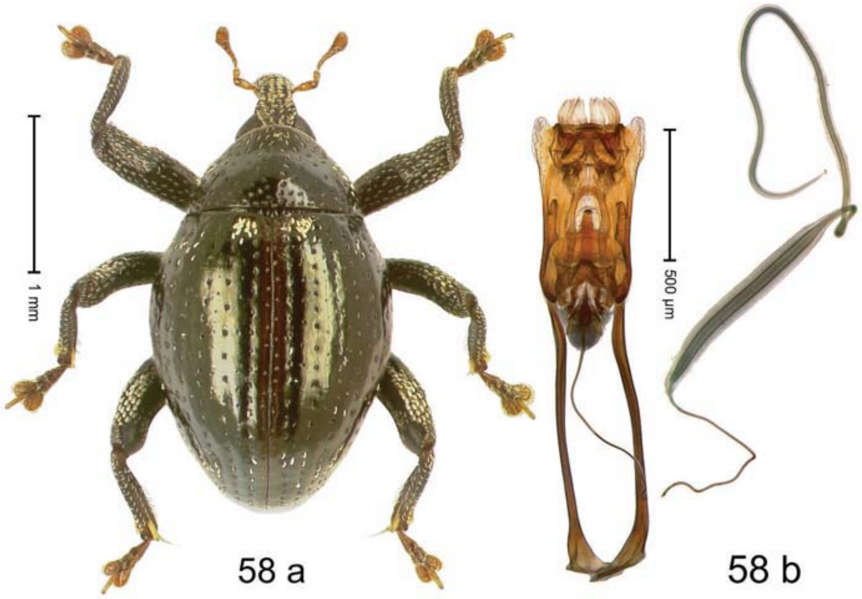


Figure 58. *Trigonopterus oviformis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

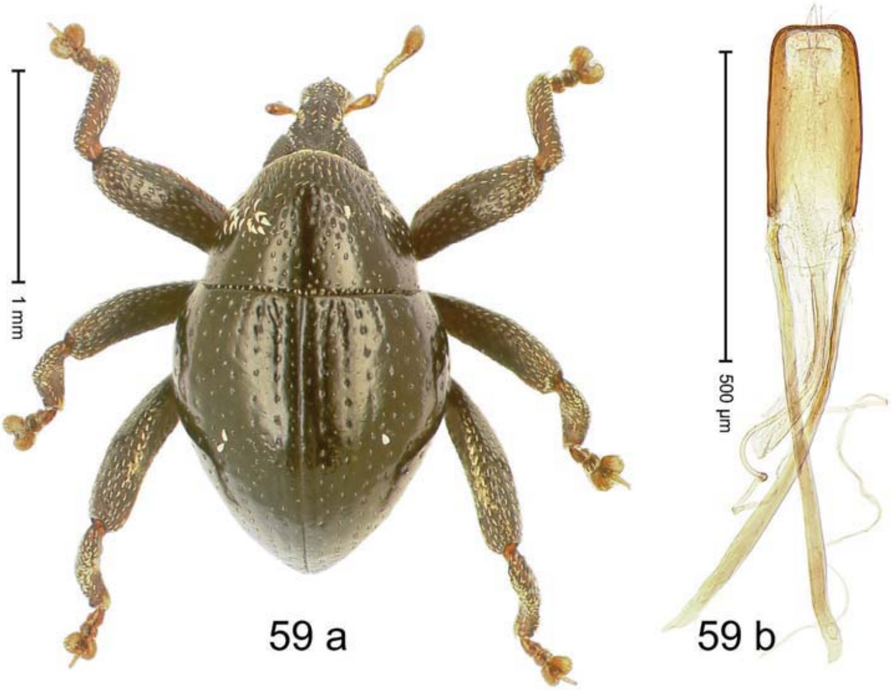


Figure 59. *Trigonopterus parumsquamosus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

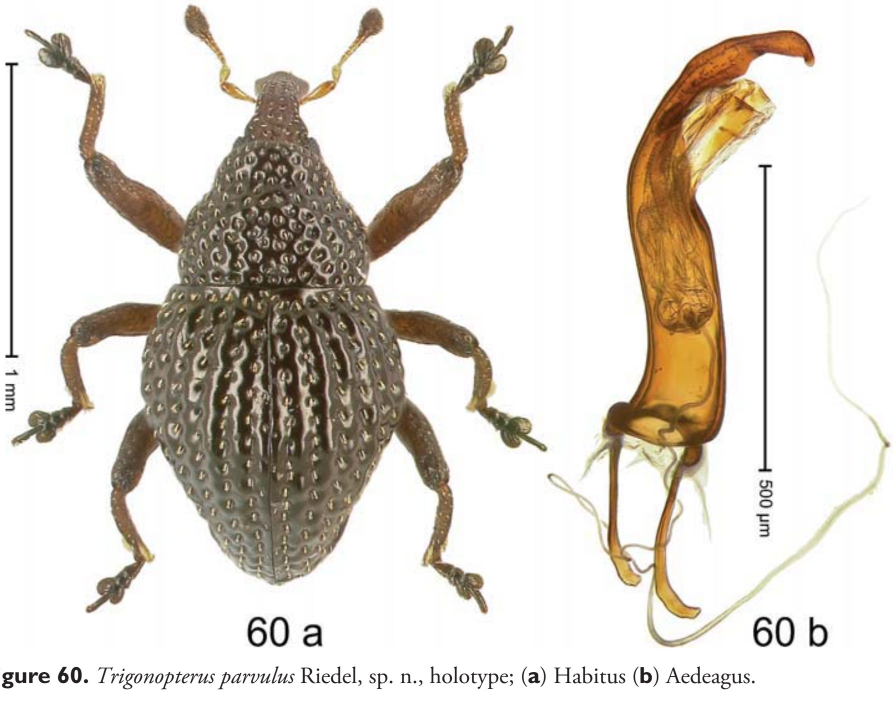


Figure 60. *Trigonopterus parvulus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

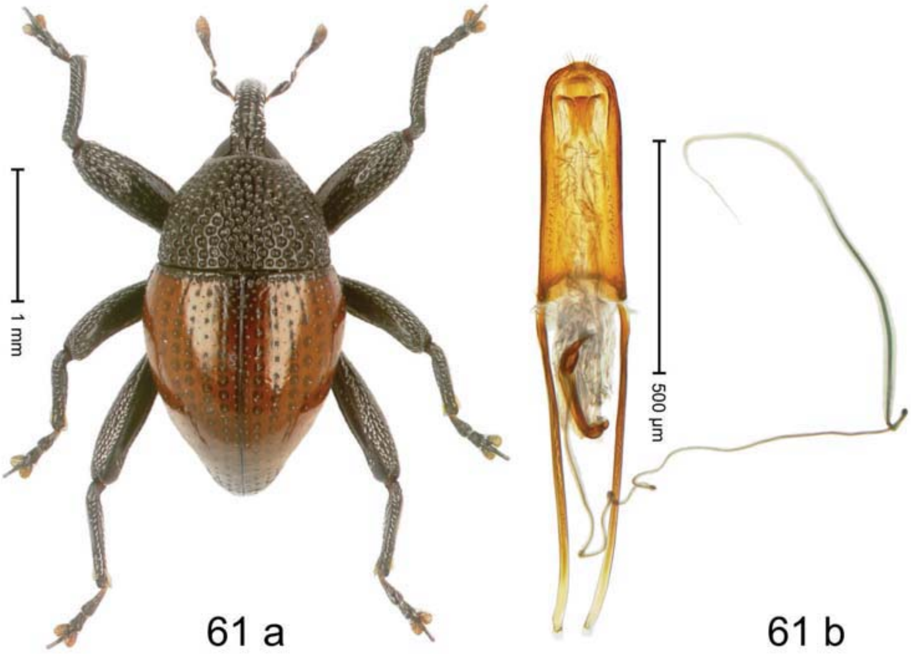


Figure 61. *Trigonopterus phoenix* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

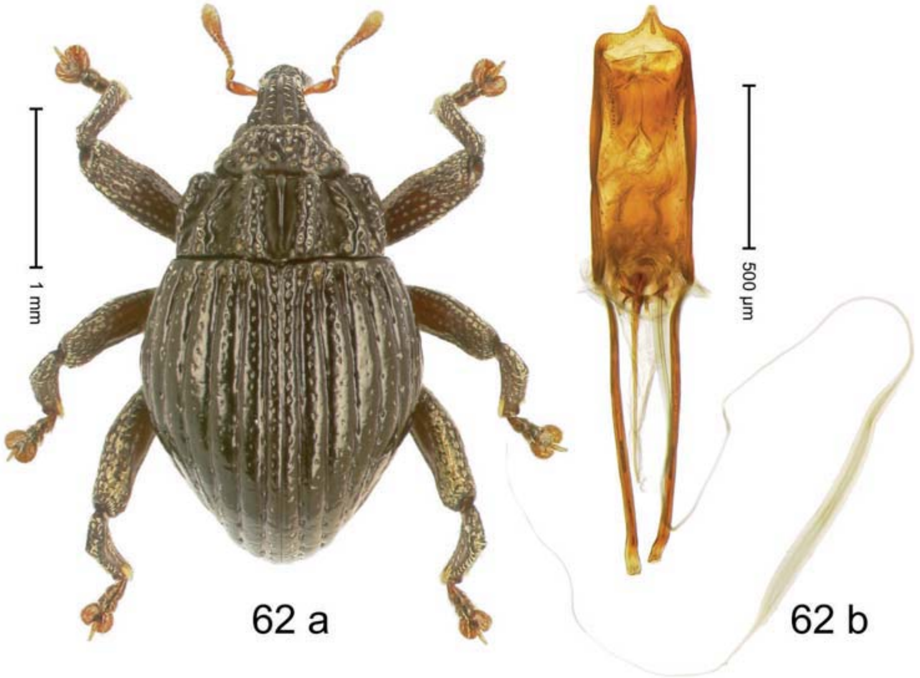


Figure 62. *Trigonopterus plicicollis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

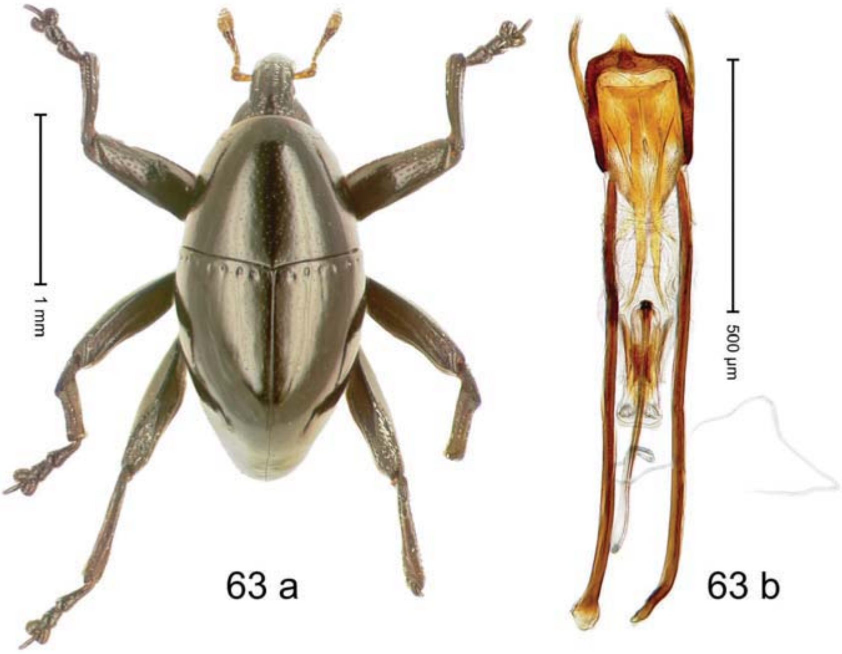


Figure 63. *Trigonopterus politoides* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

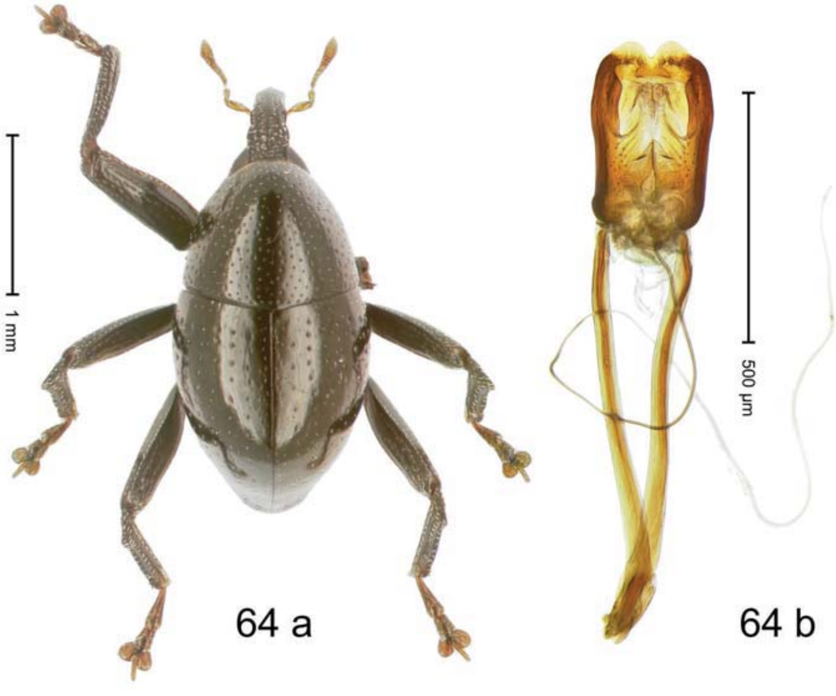


Figure 64. *Trigonopterus pseudogranum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

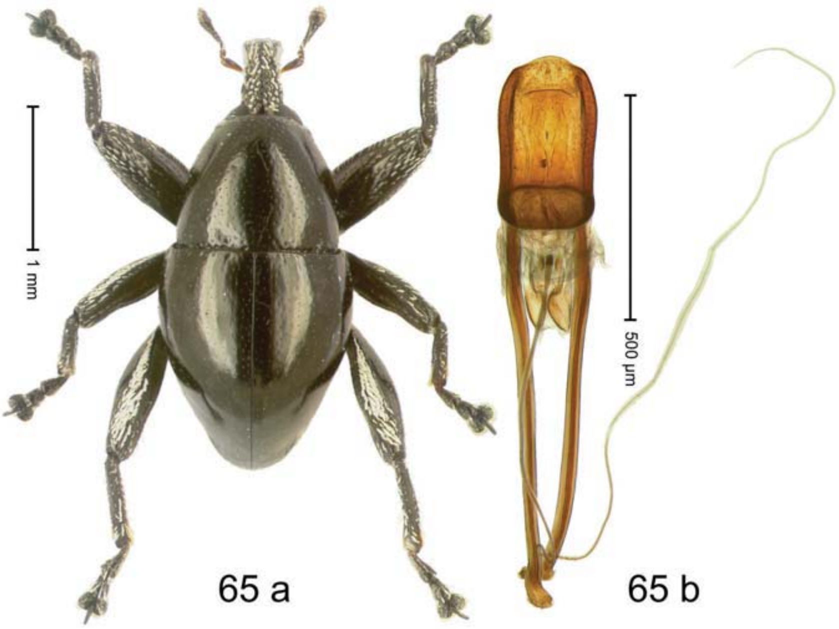


Figure 65. *Trigonopterus pseudonasutus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

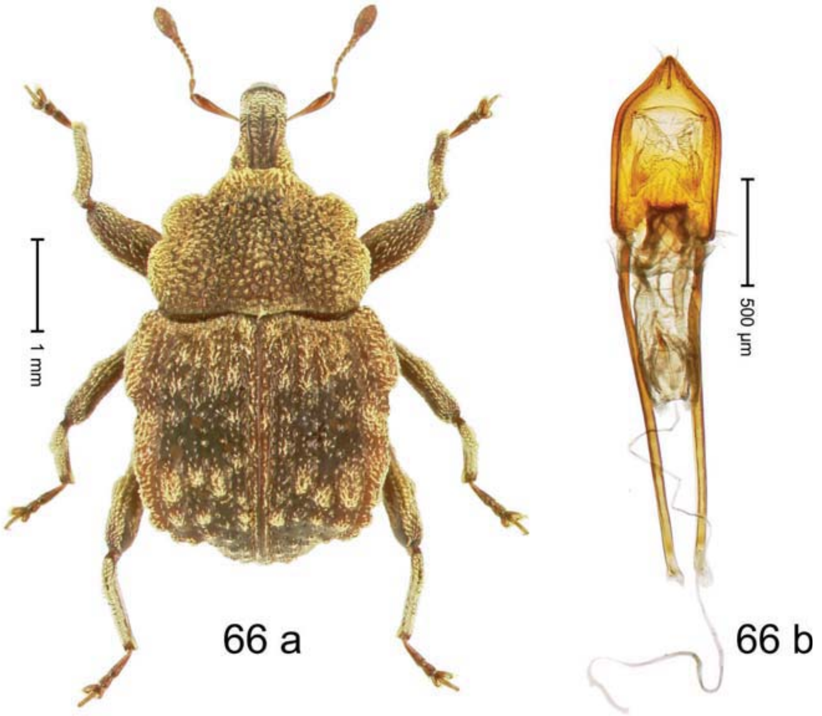


Figure 66. *Trigonopterus ptolycoides* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

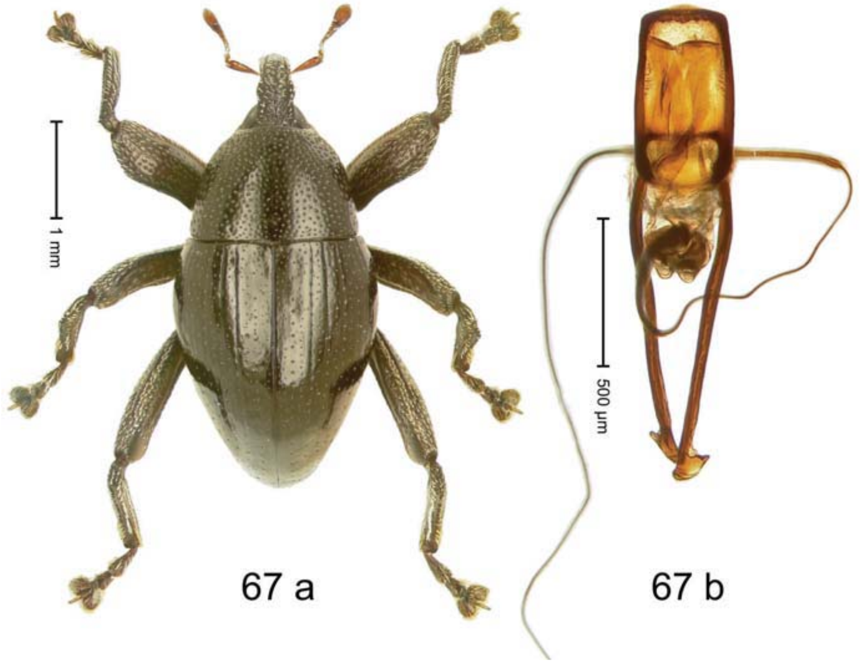


Figure 67. *Trigonopterus punctulatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

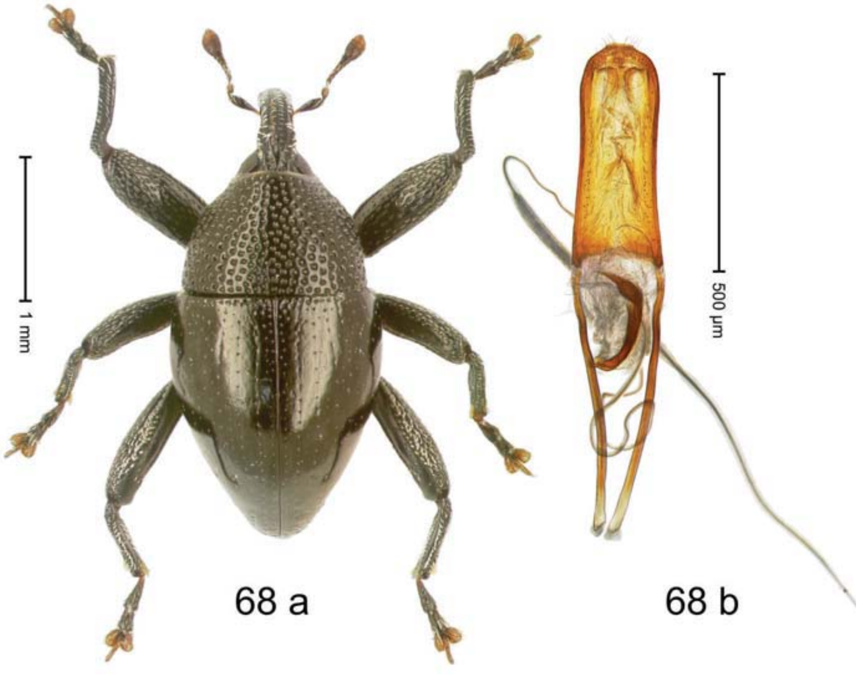


Figure 68. *Trigonopterus ragaorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

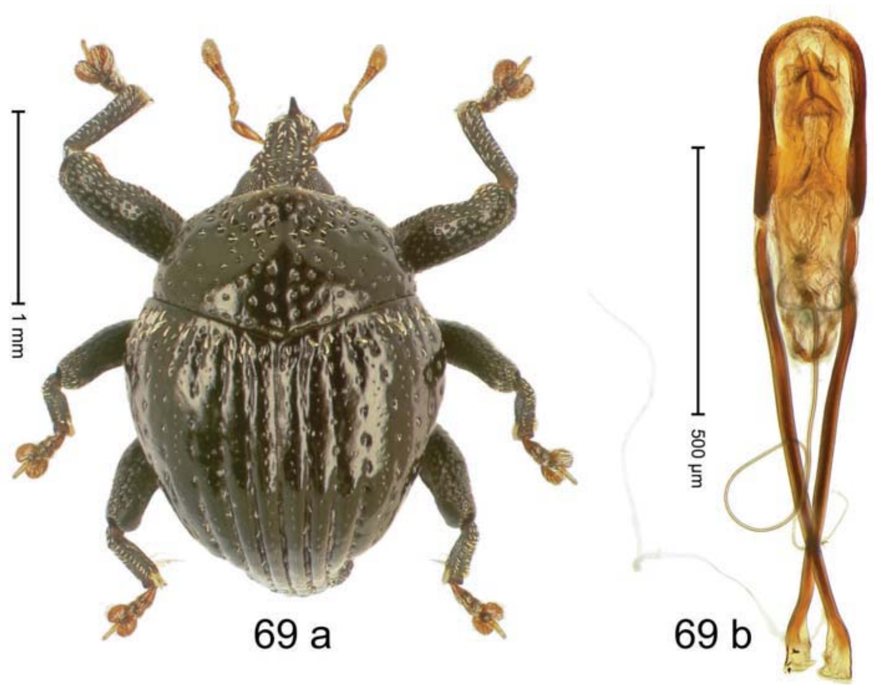


Figure 69. *Trigonopterus rhinoceros* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

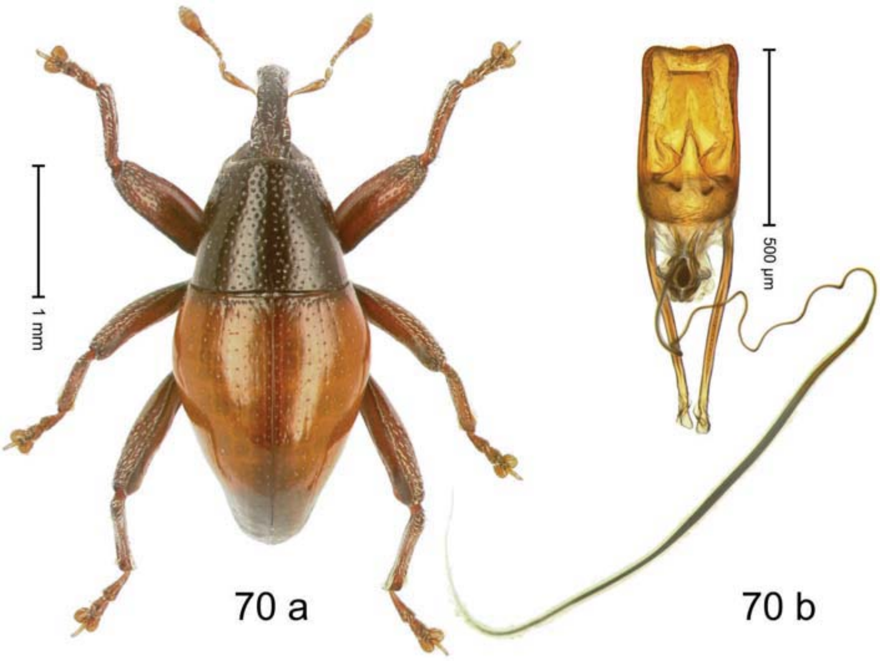


Figure 70. *Trigonopterus rhomboidalis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

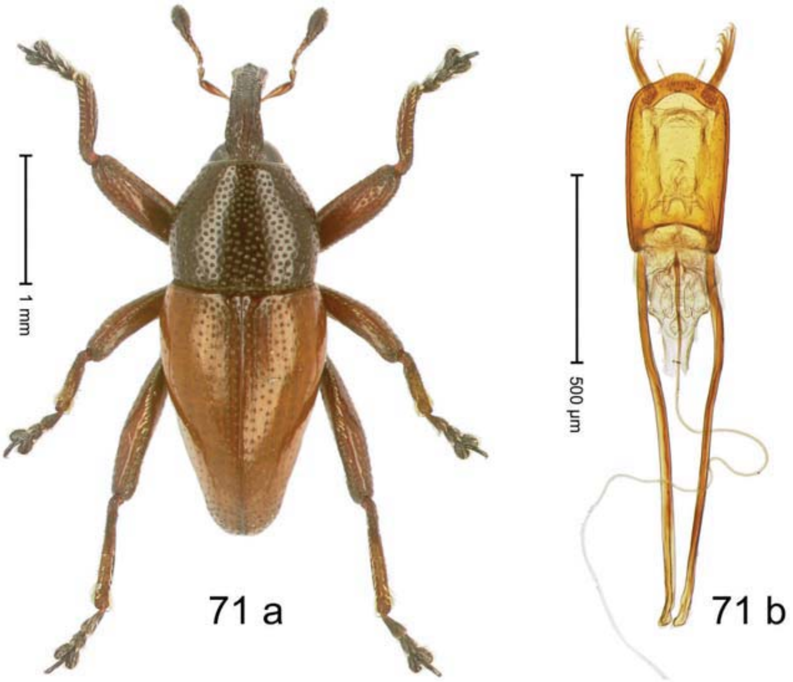


Figure 71. *Trigonopterus rubiginosus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

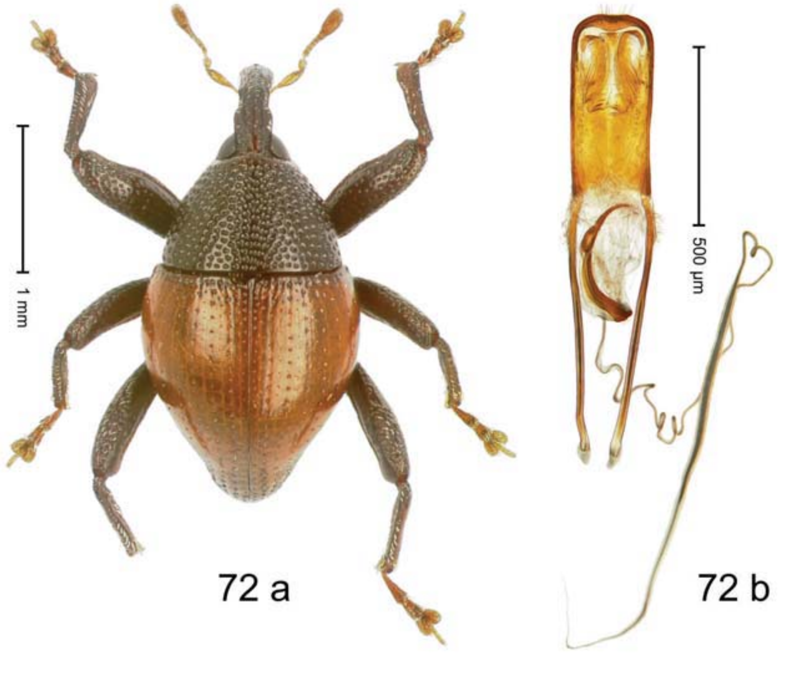


Figure 72. *Trigonopterus rubripennis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

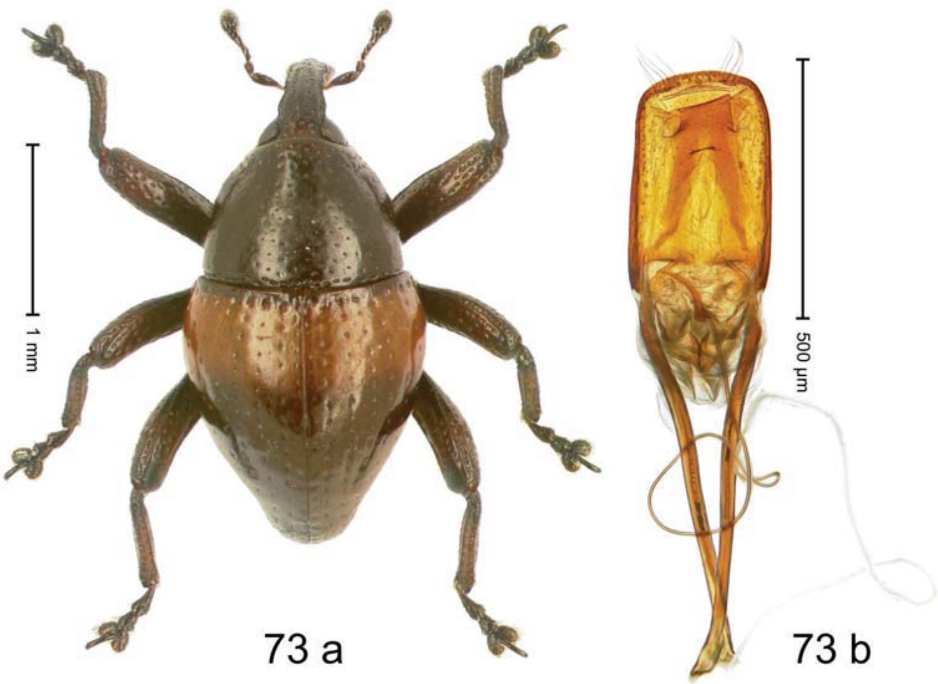


Figure 73. *Trigonopterus rufibasis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

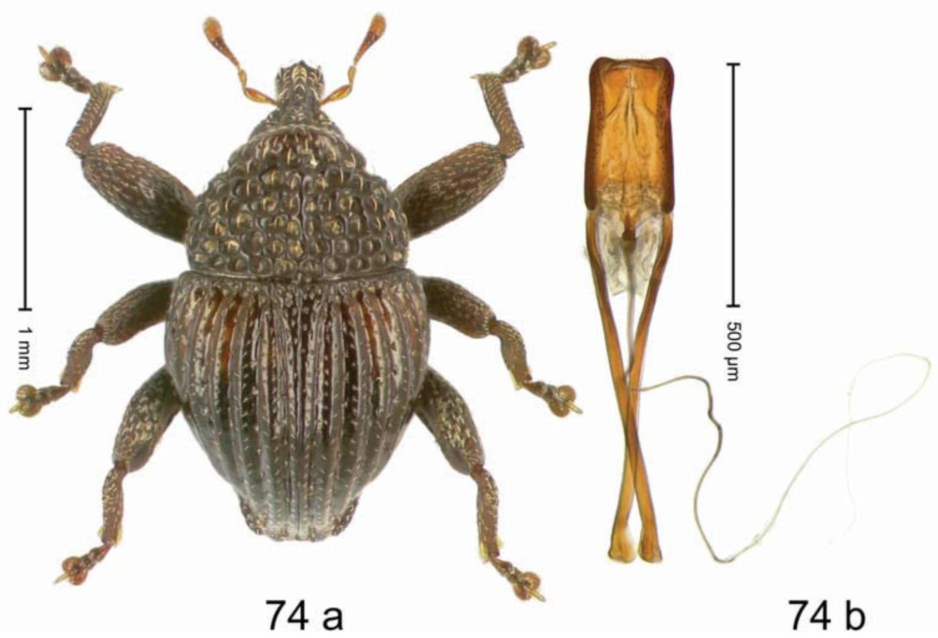


Figure 74. *Trigonopterus scabrosus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

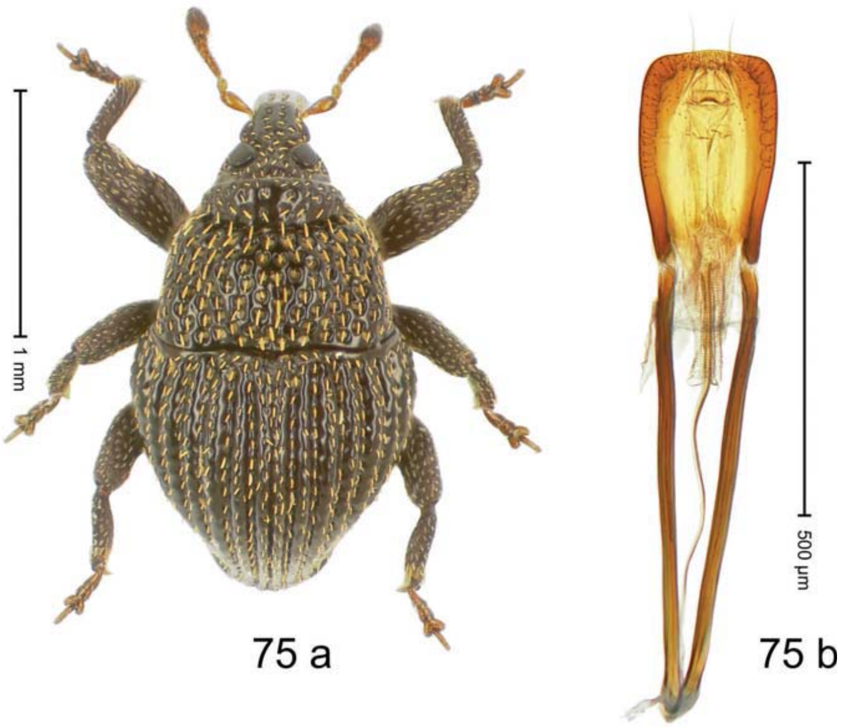


Figure 75. *Trigonopterus scissops* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

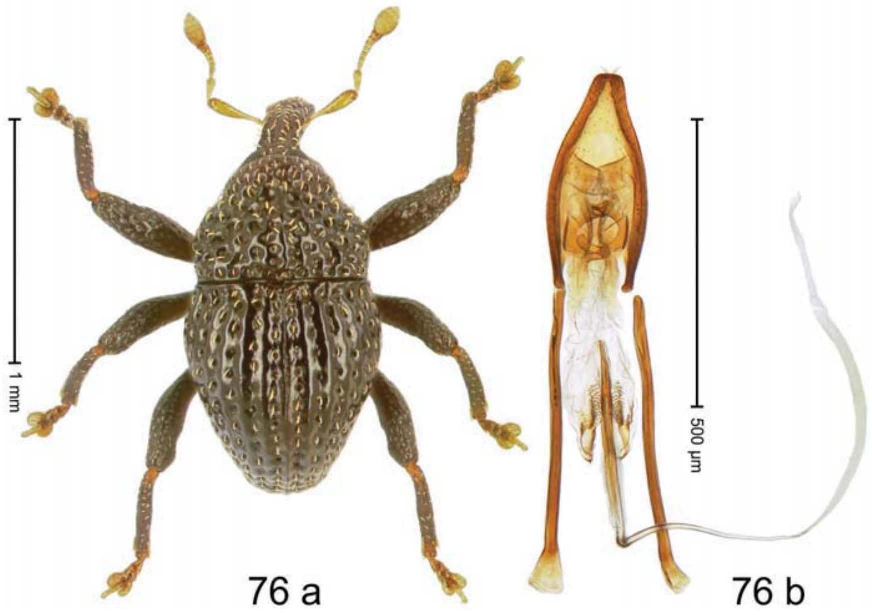


Figure 76. *Trigonopterus scharfi* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

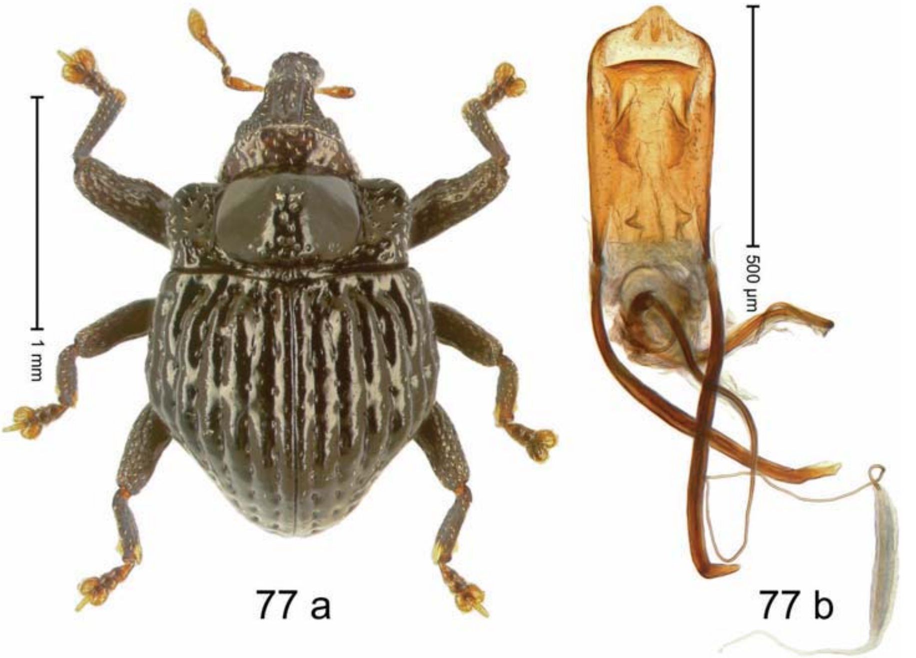


Figure 77. *Trigonopterus signicollis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

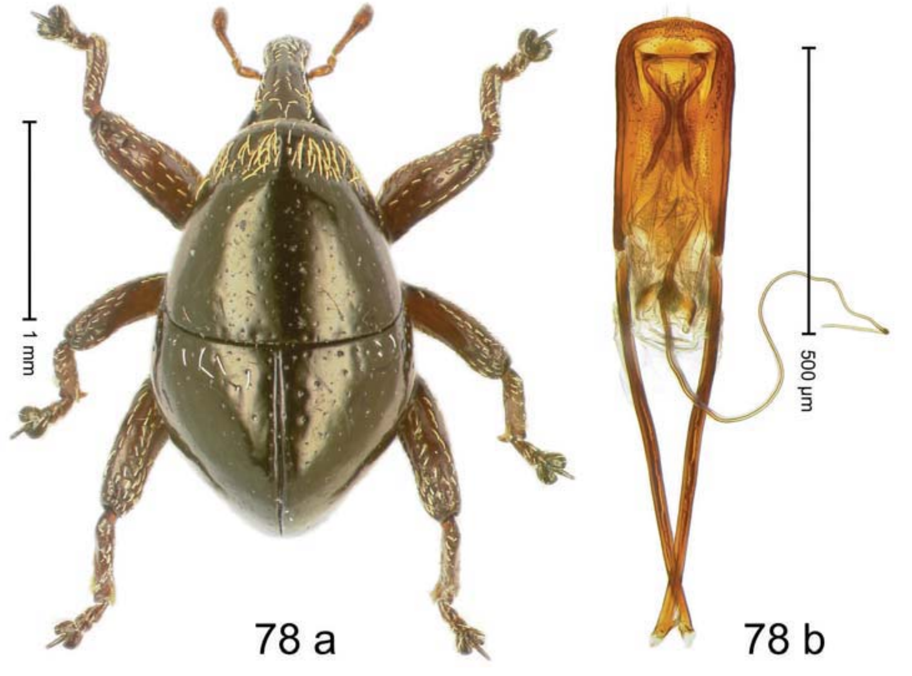


Figure 78. *Trigonopterus simulans* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

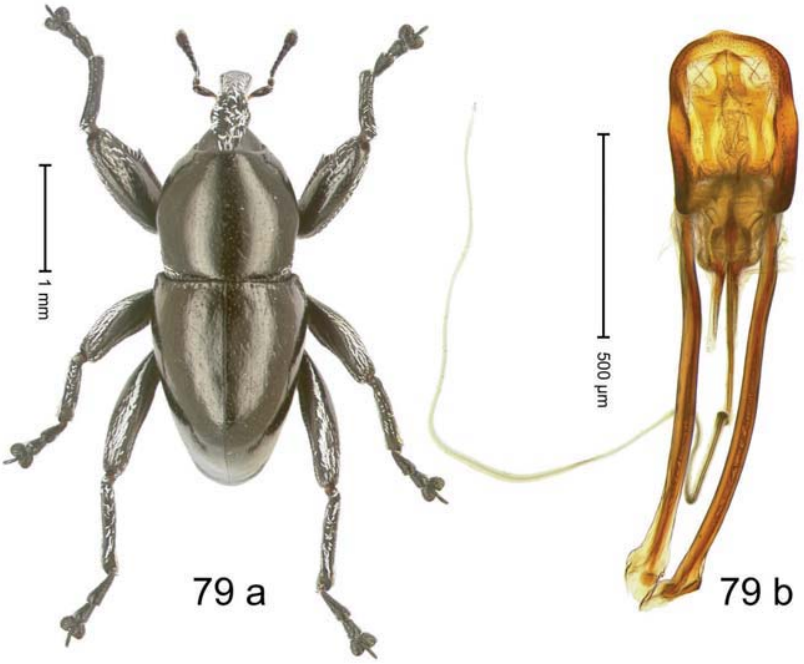


Figure 79. *Trigonopterus soiorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

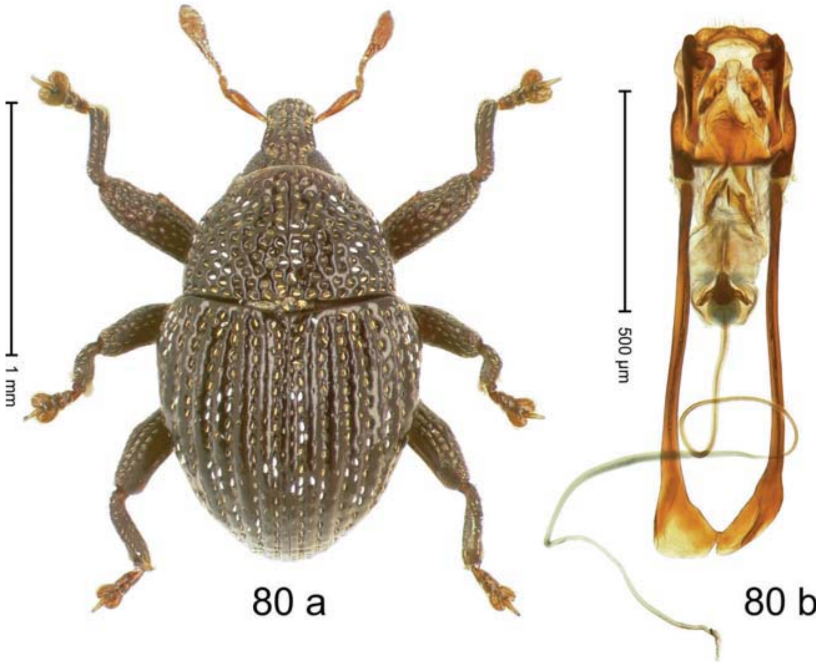


Figure 80. *Trigonopterus sordidus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

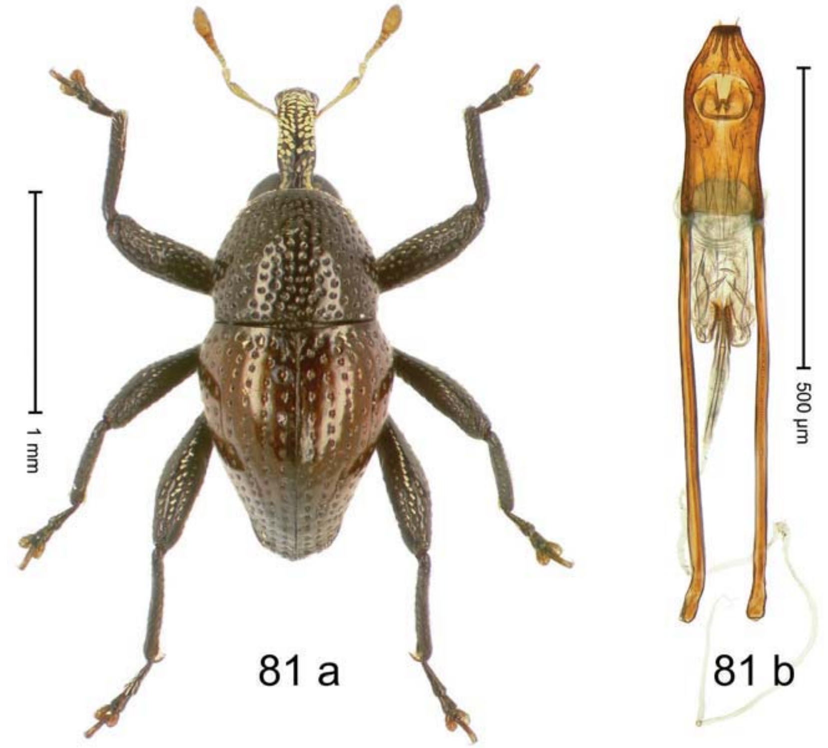


Figure 81. *Trigonopterus squamirostris* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

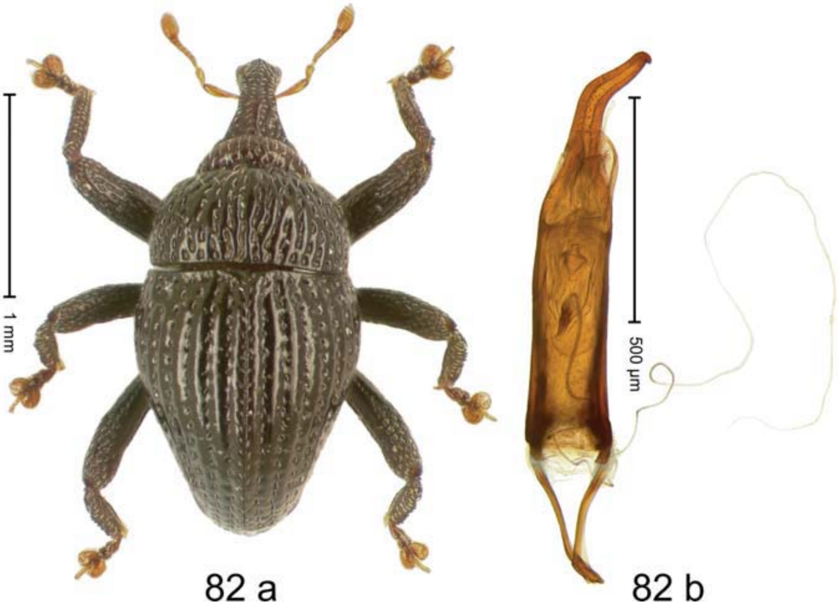


Figure 82. *Trigonopterus striatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

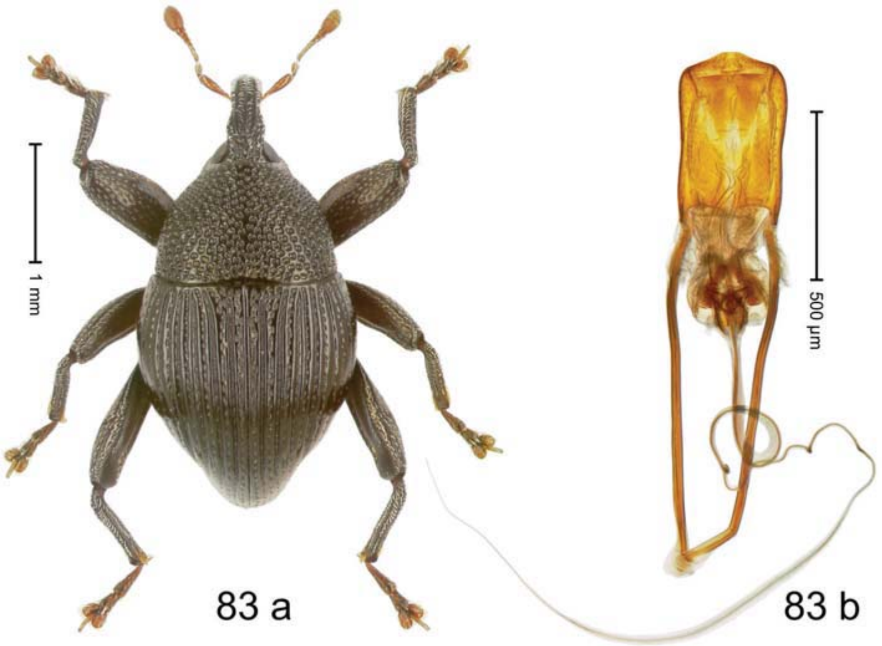


Figure 83. *Trigonopterus strigatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

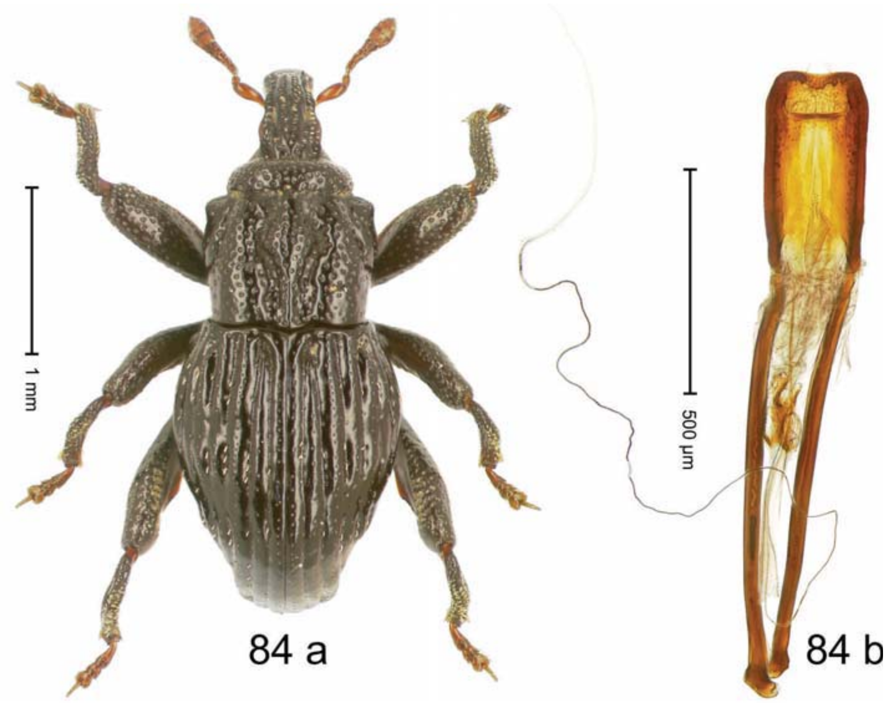
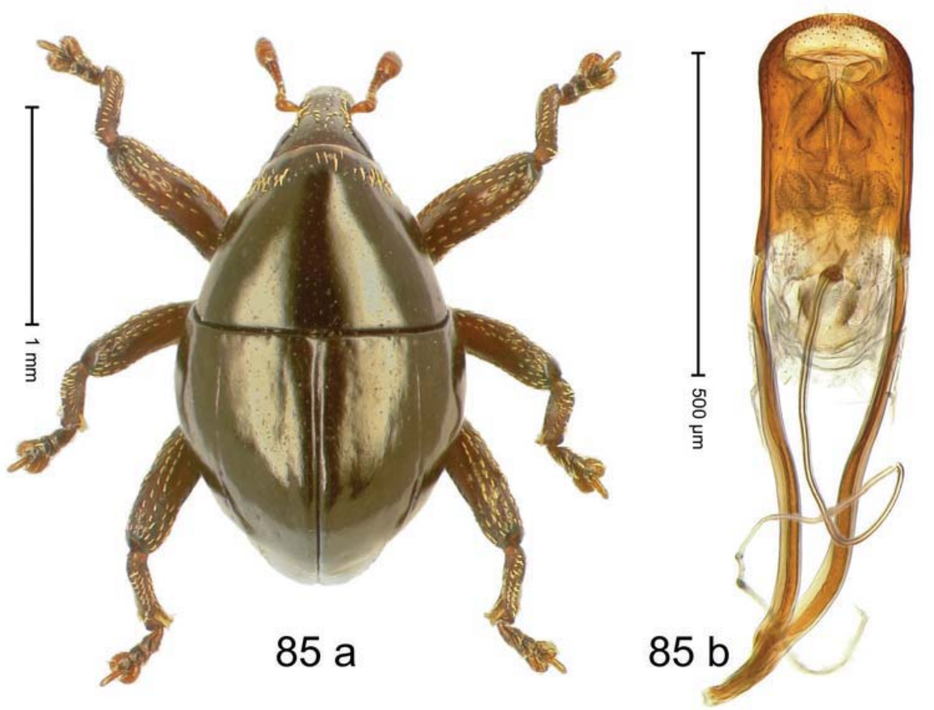


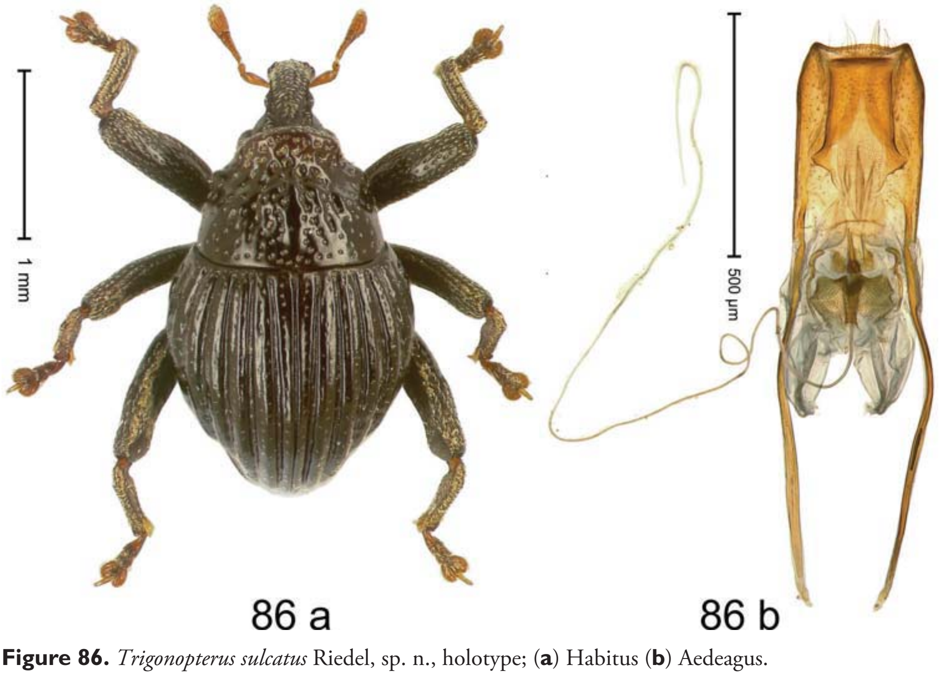
Figure 84. *Trigonopterus strombosceroides* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.



85 a

85 b

Figure 85. *Trigonopterus subglabratus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.



86 a

86 b

Figure 86. *Trigonopterus sulcatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

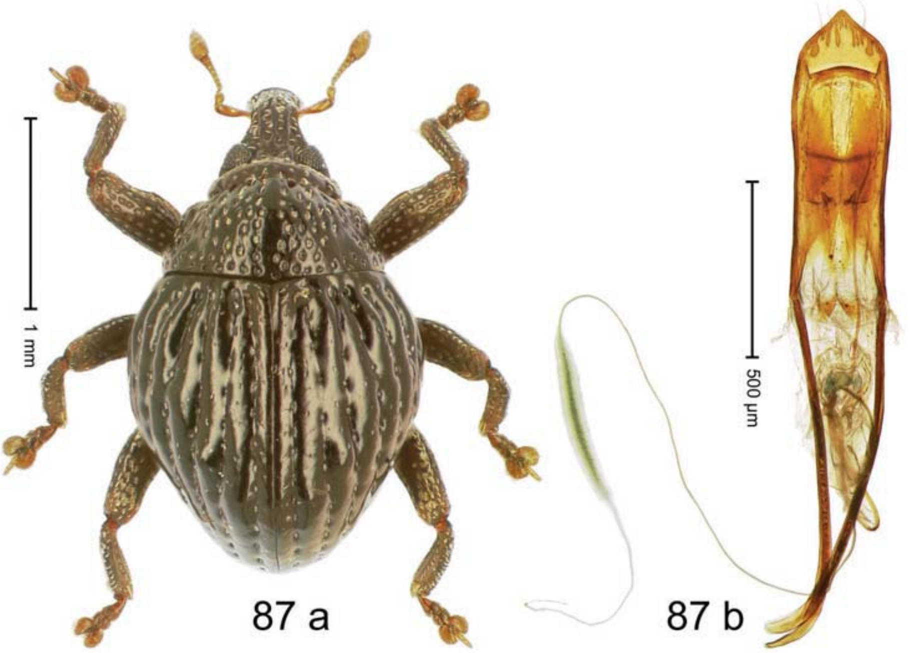


Figure 87. *Trigonopterus taenzleri* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

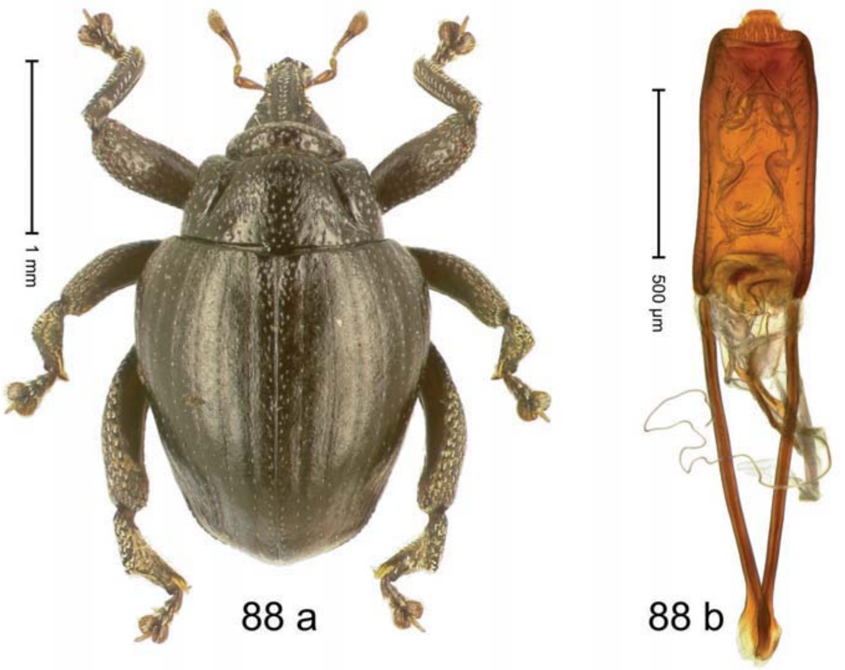


Figure 88. *Trigonopterus talpa* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

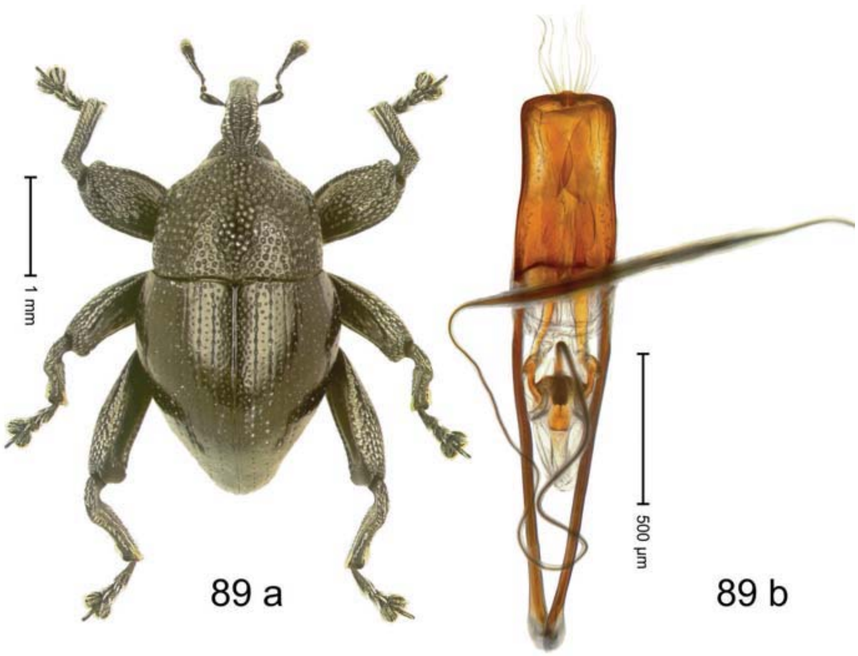


Figure 89. *Trigonopterus taurekaorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

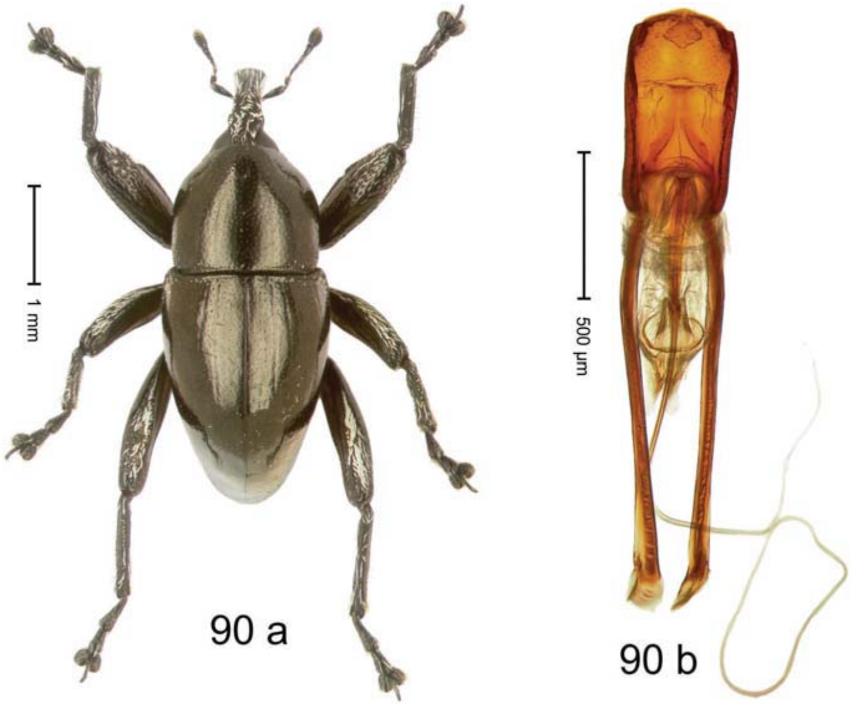


Figure 90. *Trigonopterus tialeorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

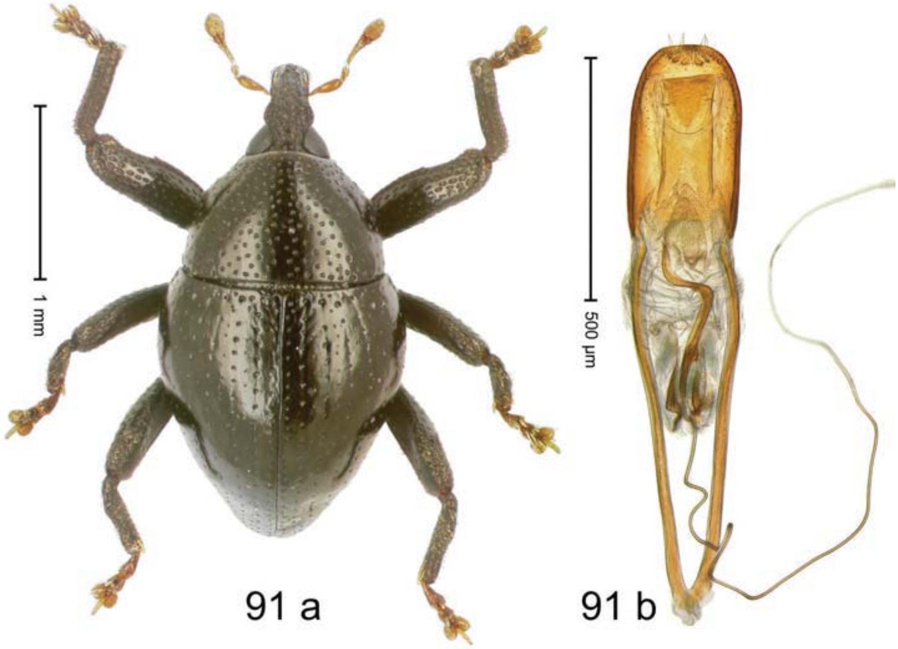


Figure 91. *Trigonopterus tibialis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

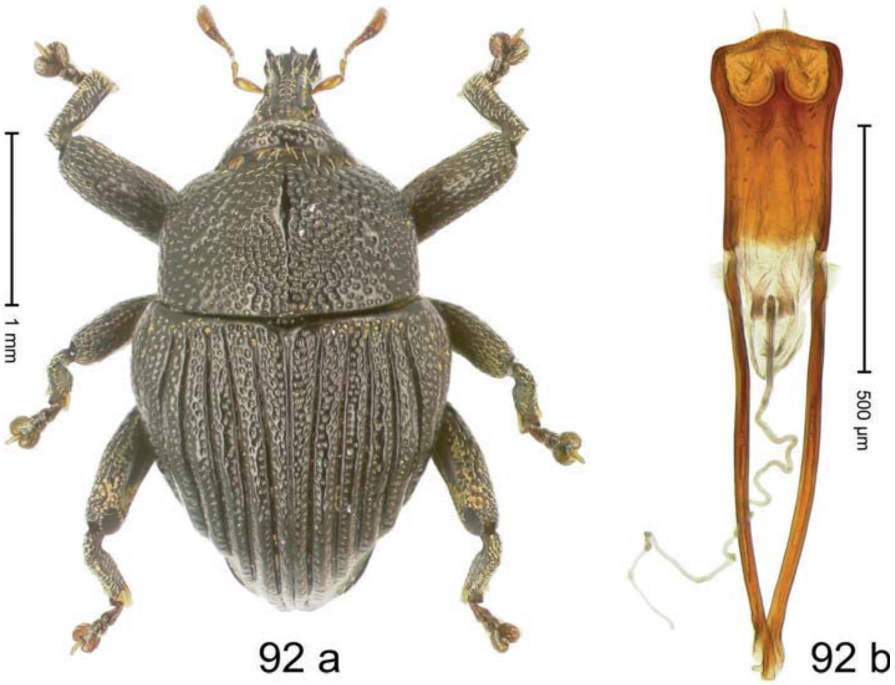


Figure 92. *Trigonopterus tridentatus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

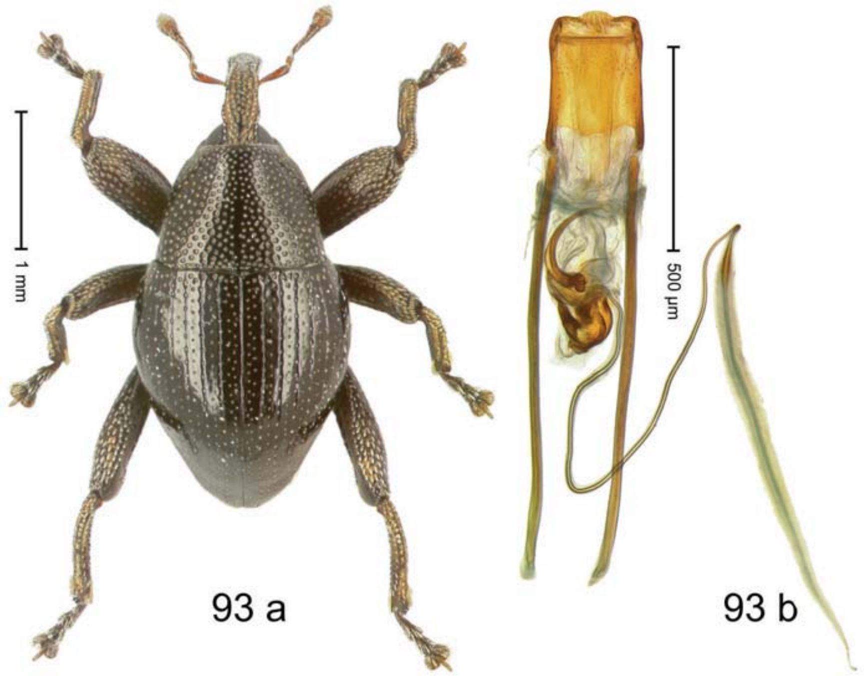


Figure 93. *Trigonopterus uniformis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

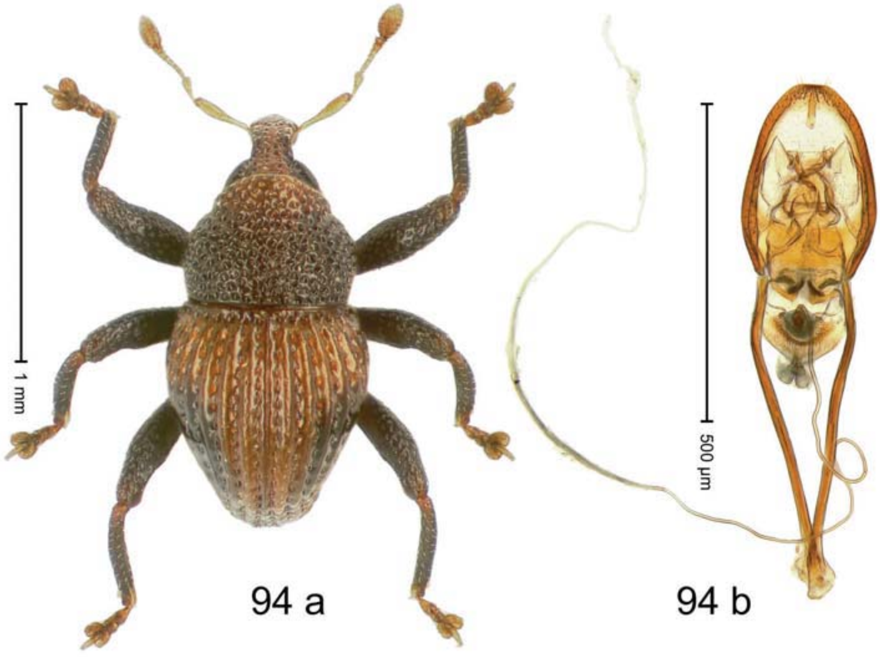


Figure 94. *Trigonopterus variabilis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

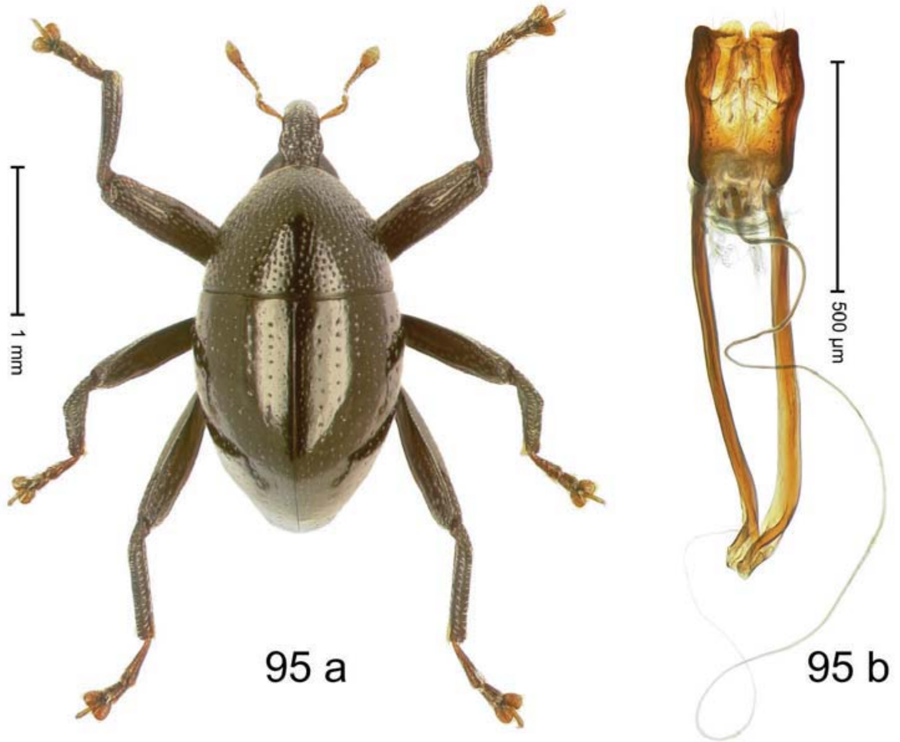


Figure 95. *Trigonopterus velaris* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

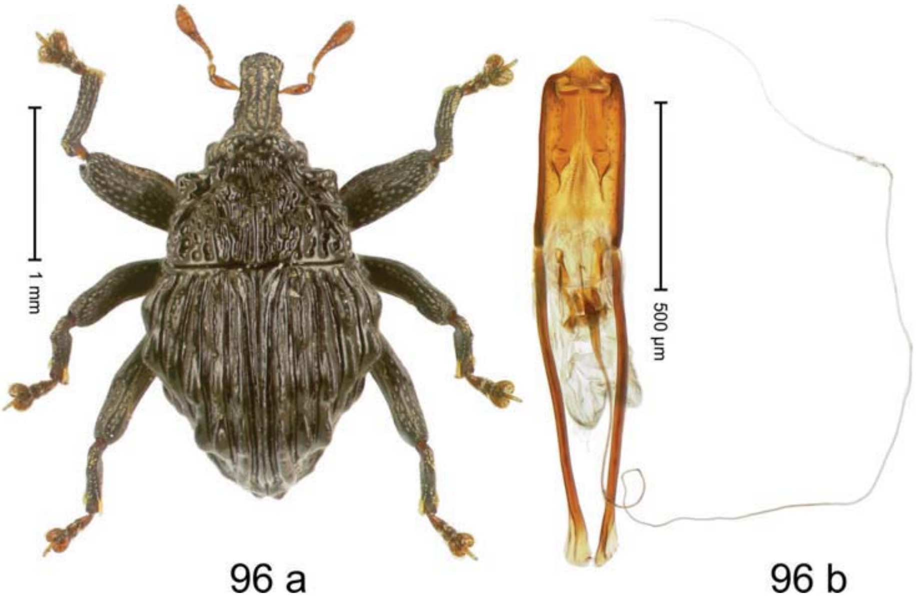


Figure 96. *Trigonopterus verrucosus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

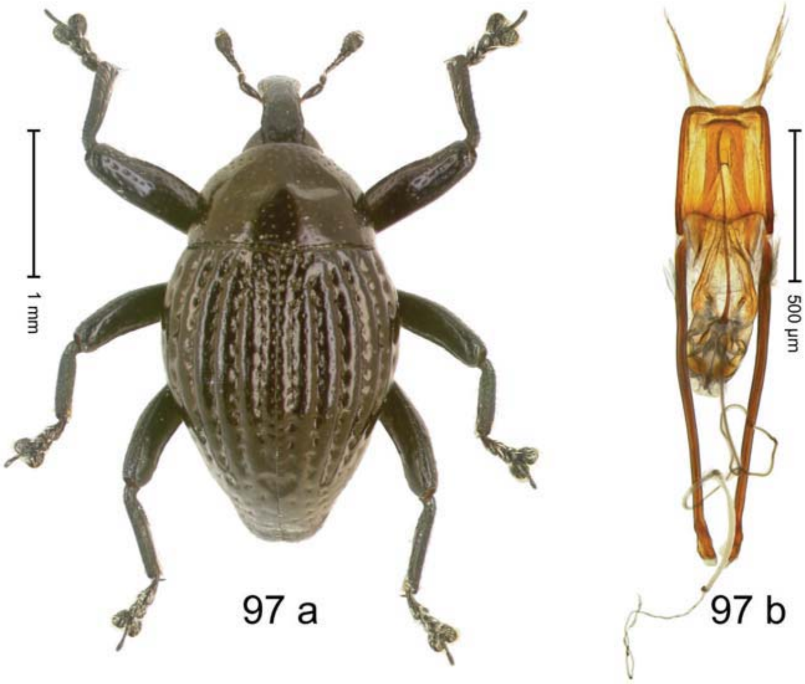


Figure 97. *Trigonopterus violaceus* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

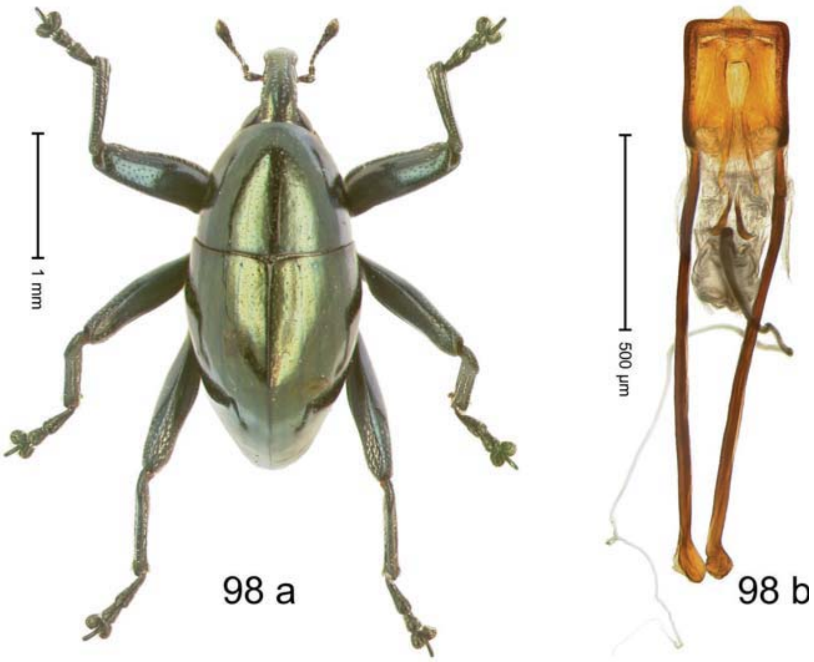


Figure 98. *Trigonopterus viridescens* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

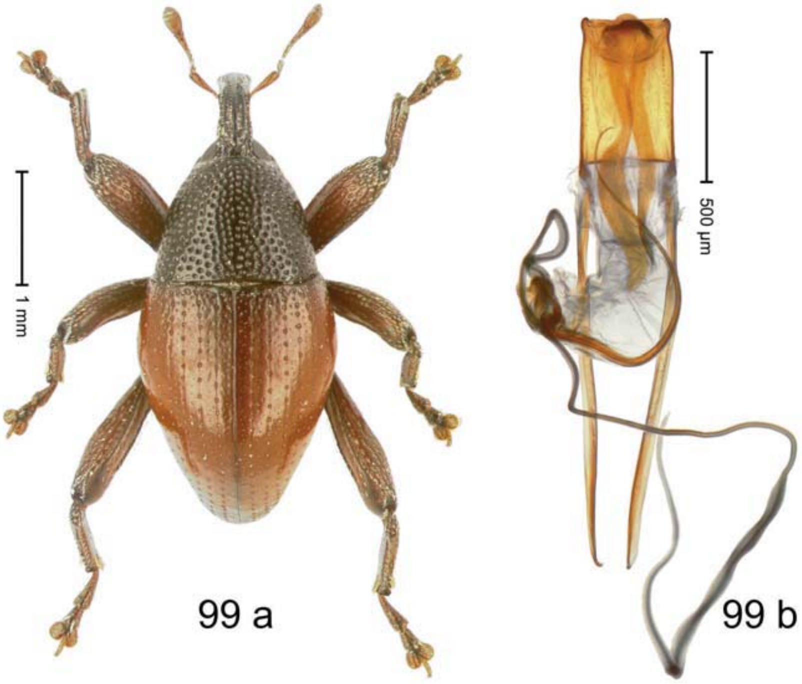


Figure 99. *Trigonopterus wamenaensis* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

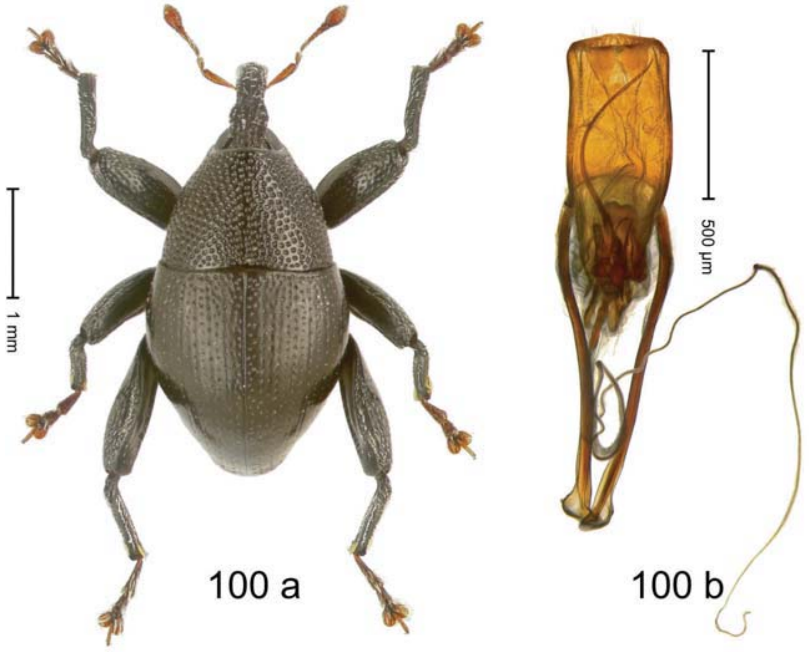


Figure 100. *Trigonopterus wariorum* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

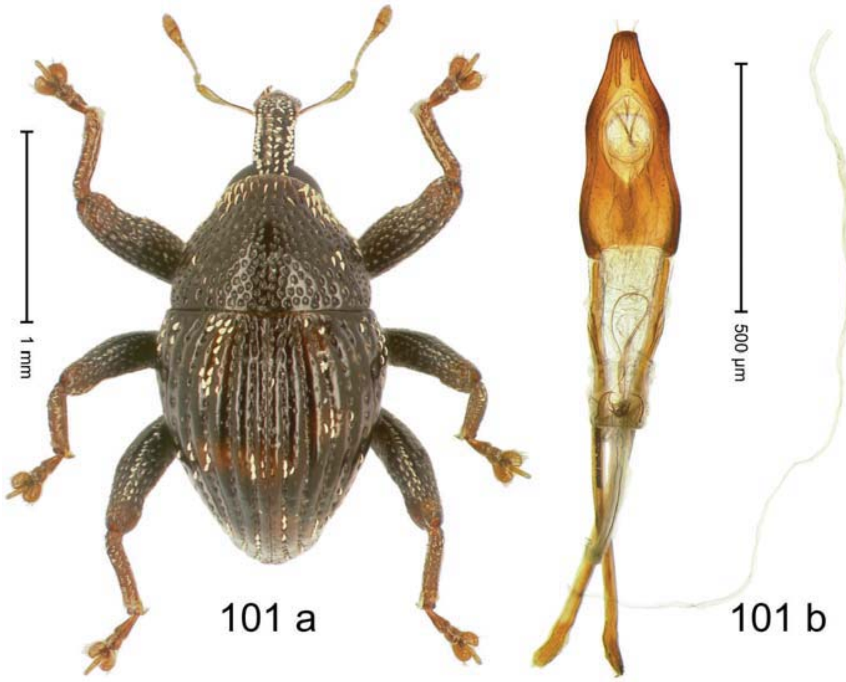


Figure 101. *Trigonopterus zygops* Riedel, sp. n., holotype; (**a**) Habitus (**b**) Aedeagus.

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Integrative taxonomy on the fast track - towards more sustainability in biodiversity research

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Abstract

Background: A so called "taxonomic impediment" has been recognized as a major obstacle to biodiversity research for the past two decades. Numerous remedies were then proposed. However, neither significant progress in terms of formal species descriptions, nor a minimum standard for descriptions have been achieved so far. Here, we analyze the problems of traditional taxonomy which often produces keys and descriptions of limited practical value. We suggest that phylogenetics and phenetics had a subtle and so far unnoticed effect on taxonomy leading to inflated species descriptions.

Discussion: The term "turbo-taxonomy" was recently coined for an approach combining *cox1* sequences, concise morphological descriptions by an expert taxonomist, and high-resolution digital imaging to streamline the formal description of larger numbers of new species. We propose a further development of this approach which, together with open access web-publication and automated pushing of content from journal into a wiki, may create the most efficient and sustainable way to conduct taxonomy in the future. On demand, highly concise descriptions can be gradually updated or modified in the fully versioned wiki-framework we use. This means that the visibility of additional data is not compromised, while the original species description -the first version- remains preserved in the wiki, and of course in the journal version. A DNA sequence database with an identification engine replaces an identification key, helps to avoid synonyms and has the potential to detect grossly incorrect generic placements. We demonstrate the functionality of a species-description pipeline by naming 101 new species of hyperdiverse New Guinea *Trigonopterus* weevils in the open-access journal ZooKeys.

Summary: Fast track taxonomy will not only increase speed, but also sustainability of global species inventories. It will be of great practical value to all the other disciplines that depend on a usable taxonomy and will change our perception of global biodiversity. While this approach is certainly not suitable for all taxa alike, it is the tool that will help to tackle many hyperdiverse groups and pave the road for more sustainable comparative studies, e.g. in community ecology, phylogeography and large scale biogeographic studies.

Keywords: Taxonomic impediment, Integrative taxonomy, DNA barcoding, Taxonomic description

Background

Species hypotheses are the basic currency of comparative biology, yet a major portion of global biodiversity remains unnamed and thus in the dark [1]. Remedies for overcoming the taxonomic impediment include the increased development of human resources and new technological approaches [2,3]. Tools from a taxonomists' wish list ranging from powerful imaging technologies and DNA sequencing to fast and open internet access are now widely available. Nevertheless, significant progress in terms of formal species descriptions has not been achieved to date. Instead, a decline in taxonomic productivity per author has occurred since World War II [4,5]. The reasons for this decline are complex, but often the desire to include as many characters as possible in the original description of a new species increases their average length and decreases their number. Nevertheless, issues of quality control could not be addressed sufficiently in traditional taxonomy because morphological descriptions are difficult to standardize. This leads to the problem of synonymy which requires continued efforts to be fixed [6]. Furthermore, lack of standards also means that extremely

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uninformative descriptions are still being published, which further complicates matters - and does not help to improve the image of the whole discipline.

The practice of taxonomic description

We suggest that the advent of phylogenetic systematics [7] and phenetics [8] had a profound but little-noticed effect on the preparation standards of species descriptions. Since more and more taxonomic revisions incorporated phylogenetic analyses or were at least prepared in parallel with the latter, it was attempted to maximize the number of informative characters. Thus, even characters of little value for species diagnosis were included in the descriptions. Another consequence was that species descriptions within a study were sought to be standardized, best illustrated by the program Delta [9]. Negative character states (i.e. the absence of a character) were often explicitly stated. Thus, the average length of species descriptions increased and their number per author decreased in the past 50 years [4,5]. Often enough, all this time-consuming procedure did not enhance the usability of descriptions for the purpose of diagnosis, but rather inflated them. After all, standardization among different authors was never achieved not to mention the failure to introduce an urgently needed minimum standard.

Taxonomic impediment or impediment to taxonomy?

The "taxonomic impediment" is known as the situation in which biological studies suffer from shortcomings of the taxonomic basis, i.e. the difficulty in safely identifying many species [10]. We propose that the vast number of undescribed species on Earth [11] may not be the biggest problem in this context. A name and a safe diagnosis for a new species can be provided rapidly and with limited resources. The bigger problem is usually the legacy of earlier taxonomic work, i.e. the interpretation of existing names. Many descriptions are inadequate and to clarify matters, the type specimens have to be examined. The revision of a minor taxonomic group may require extensive travel to museums around the world, without a guarantee that the critical characters are actually found on the types. For example, if a diagnosis based on male characters is state of the art, there is little help if some of the species were described based on unique female specimens. One of the oldest principles of nomenclature, i.e. the Principle of Priority apparently promotes "taxonomic mihilism" (from Latin *mihi* – belonging to me) [12]: the taxon's earliest description ensures the name's use, no matter how low the diagnostic value of the associated description is. Authors with a strong mihi-itch have described new taxa based on inadequate material or data, just to secure authorship of the species; the ensuing problems for identification are left to be sorted out by the community. In orphaned taxa without a sufficient number of experts, taxonomic data of heterogeneous quality become a heavy burden rather than a tool for identification. We suggest that these self-inflicted and system-inherent problems are the main reason for the taxonomic impediment, possibly closely followed by a lack of determination of many biodiversity research projects to include a sufficient budget for taxonomic work.

It appears as a sad irony that a part of the taxonomic community [13,14] turns a blind eye on these problems while blaming any constructive criticism from end-users [2,15] as the true impediment to taxonomy. Below we propose that turbo-taxonomy can effectively combine the strengths of both traditional, morphology-based taxonomy and DNA based approaches. We emphasize that a good quality of work always depends on the standards of the persons involved and that the use of DNA sequences is no insurance against over-splitting or other mistakes. But, the combination of morphology and DNA taxonomy will allow to assess and solve such problems more easily than before.

The approach

Examples of turbo-taxonomy

The term "turbo-taxonomy" was coined for an approach combining DNA barcoding with short taxonomic descriptions of morphological characters for hyperdiverse parasitic wasps [16]. We extend this approach by abstaining from laborious, but not necessarily helpful identification keys, and rather adding automated journal-wiki upload (pushing) of data, to reveal and formally describe 101 species of hyperdiverse *Trigonopterus* weevils. Thus, we combine traditional expert taxonomy with DNA sequencing, subrobotic digital imaging (where a machine takes images of different specimen layers and stacks them automatically) and automated content pushing from a journal into a wiki to show explicitly how to sustainably provide species with the attributes that makes them most visible: names anchored in a framework more rapidly produced than currently the case [17]. Concatenated, versioned species pages using the wiki engine offer a continuous opportunity for subsequent enhancement and community participation (Figure 1).

We established the genus *Trigonopterus* as our first target for comparative biodiversity studies because it is highly diverse within a region of great biological interest, both genetically and in terms of species. We collected >6,000 specimens of *Trigonopterus* from across New Guinea and sequenced 1,000 of them, assigned to 279 entities of putative species status [18,19]. We showed that mitochondrial and nuclear DNA entities were indeed fully congruent or compatible with morphologically delineated groups and argue that such widespread congruence within a taxon is the most important prerequisite for an accelerated framework (Figure 1). The judgment of species status was

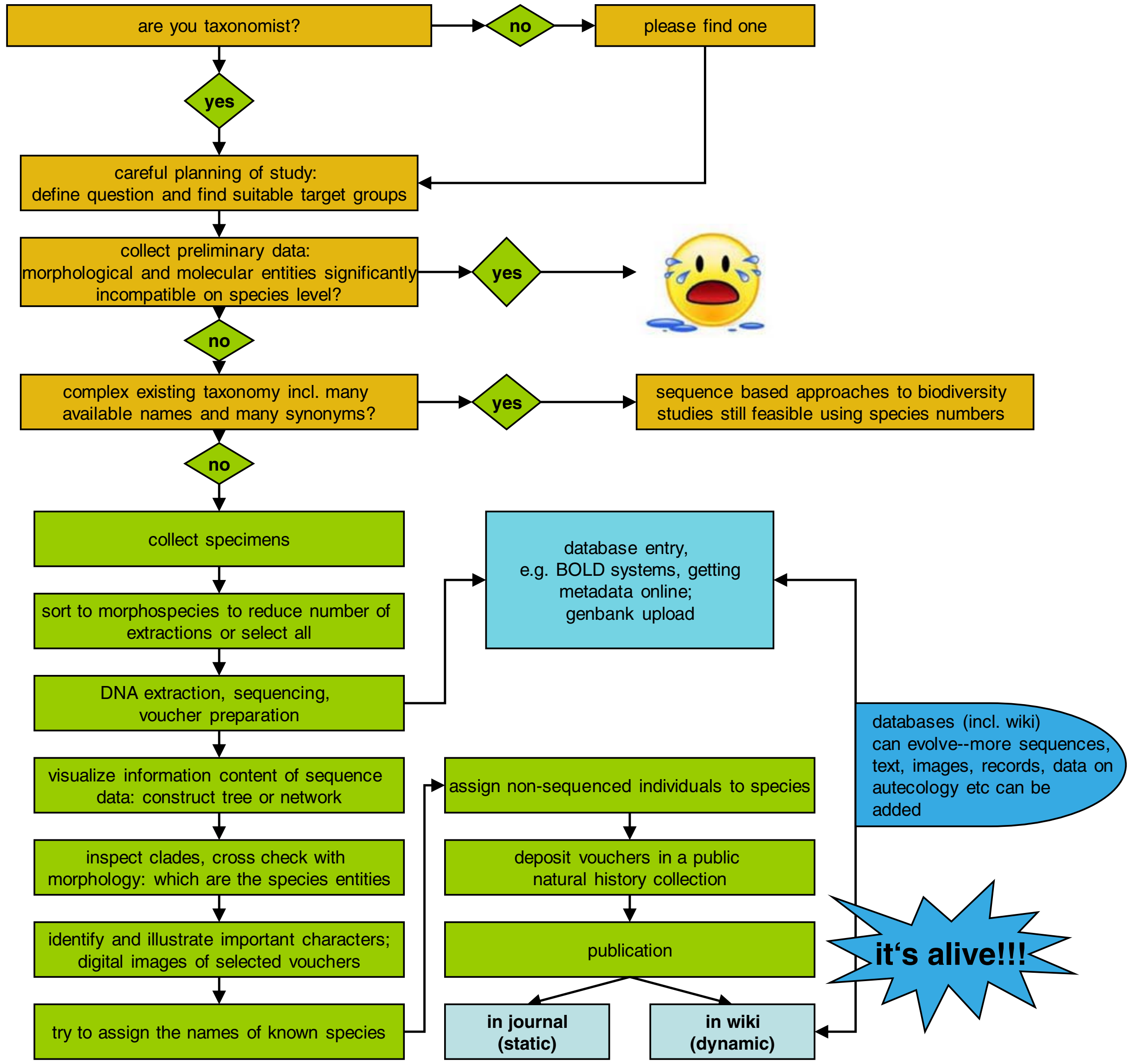


Figure 1 **Flow chart of the turbo-taxonomy approach, from project design to publication.**

mainly based on examination of male genital characters. Morphologically delineated species with high *cox1* divergence were examined a second time, and nuclear DNA markers sequenced to discover potentially diagnostic nDNA characteristics that suggest the existence of "cryptic" species or reveal overlooked species. The final hypotheses incorporate evidence from both morphology and molecules. After a preliminary screening of known *Trigonopterus* types, we here avoided the risk of creating synonyms by excluding the few species that could potentially bear a valid name. Species represented only by females were preliminarily excluded, as additional field work may later discover males which we prefer as holotypes. All 279 species are clearly delineated as can be seen in the maximum likelihood tree based on *cox1* sequences of 1,002 specimens of *Trigonopterus* [link to http://www.plosone.org/article/fetchSingleRepresentation.action?uri = info: doi/10.1371/journal.pone.0028832.s001] [19]. We formalize our findings by describing the first 101 species new to science [20], introducing a condensed format fully embracing technological advances and in accordance with the International Code of Zoological Nomenclature [21,22]. As an example, we include this description from the ZooKeys paper.

Trigonopterus phoenix Riedel

Holotype, male (Figure 2A, http://species-id.net/wiki/Trigonopterus_phoenix. Length 2.63 mm. Beetle black;

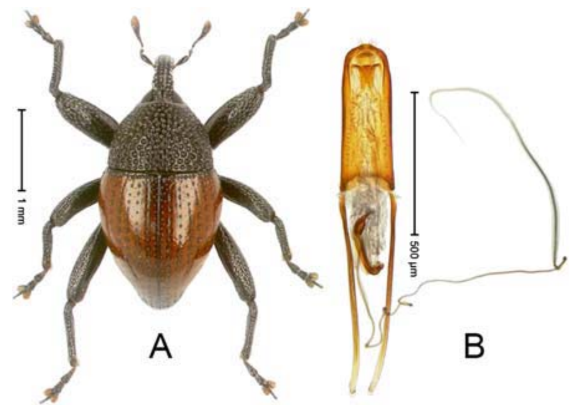


Figure 2 *Trigonopterus phoenix* **Riedel (A) Habitus (B) Aedeagus.**

antennae, tarsi and elytra ferruginous. Body subovate; with weak constriction between pronotum and elytron; in profile evenly convex. Rostrum in basal half with distinct median ridge and pair of submedian ridges, furrows with sparse rows of yellowish scales; apically weakly punctate, sparsely setose. Pronotum coarsely punctate-reticulate. Elytra with distinct striae of small punctures; intervals with row of minute punctures; laterally behind humeri with ridge bordered by 4 deep punctures of stria 9. Femora edentate. Mesofemur and metafemur dorsally squamose with silvery scales. Metafemur with weakly denticulate dorsoposterior edge; subapically with stridulatory patch. Metatibia apically with uncus and minute premucro. Abdominal ventrite 5 coarsely punctate, in apical half with round depression fringed with dense erect scales. Aedeagus (Figure 2B) apically weakly pointed, sparsely setose; transfer-apparatus spiniform; ductus ejaculatorius with bulbus. Intraspecific variation. Length 2.53–2.63 mm. Female rostrum in apical half slender, dorsally subglabrous, with sublateral furrows. Female abdominal ventrite 5 densely punctate, with suberect scales, with median ridge.

Material examined. Holotype (SMNK): ARC1153 (EMBL # HE615781), PAPUA NEW GUINEA, Simbu Prov., Karimui Dist., Haia, Supa, S06° 39.815' E145° 03.169' to S06° 39.609' E145° 03.012', 1240–1450 m, 30-IX-2009. Paratype (NAIC): PAPUA NEW GUINEA, Simbu Prov., ARC1132 (EMBL # HE615761), S06° 40.078' E145° 03.207' to S06° 39.609' E145° 03.012', 1220–1450 m, 02-X-2009.

Notes. This species was coded as "Trigonopterus sp. 207" by Tänzler et al. (2012).

Etymology: From the ancient Greek Φοίνιξ, "the reborn".

This species and 100 additional ones (Figure 3) were described simultaneously in the open-access journal ZooKeys [20]. Holotypes were designated exclusively from sequenced specimens. Photographs of habitus and genitalia were prepared after DNA extraction from holotypes. Thus, potential confusion by type series of mixed species is excluded by providing all relevant data from the holotype.

Discussion

A combination of digital imaging and molecular techniques allows the reduction of formal species descriptions to brief but highly accurate diagnoses. Although none of these tools is novel in itself, the progressive element is their combination and streamlining to produce a large number of usable species descriptions.

DNA barcoding

The potential of using a *standard* DNA marker for species identification, also known as "DNA barcoding" or "DNA taxonomy", was recognized almost ten years ago [3,23]. Despite fierce initial and some continued criticism it proved to be a powerful tool. In many animal taxa, the "barcoding" sequence (usually *cox1*) will pinpoint the correct species without additional information [24,25]. In others it may not delineate species unambiguously, but even then it is usually possible to determine a group of e.g. 5–10 species [26]. A non-expert would hardly achieve this level of accuracy within reasonable time using traditional keys on most invertebrate taxa, let alone nematodes, moss mites or rove beetles. After all, *in combination* with a few morphological characters the species can be safely identified in most cases. Furthermore, sequence data can be easily databased, searched, analyzed and accessed anytime from anywhere. The situation with type specimens is quite different: often they are not accessible, or it is very time-consuming to send them around the globe. In many cases they give the only clue what species an insufficient description is referring to, or if the species is placed in the correct genus at all. Such issues are common and could be solved much faster using "DNA barcodes". We strongly believe that the ICZN should make the publication of genetic data obligatory following the example of the "Bacteriological Code" [27] which stipulates taxon-specific requirements for a meaningful and valid description of new extant species. On the downside such a decision would mean that material stored in collections could no longer be used for most taxonomic purposes as soon as its DNA is degraded. However, in many cases it is still possible to extract and sequence DNA from historic specimens [28], and if not, it may be an option to collect fresh material. Surely, this would bring taxonomists more often to the field than is currently the case. On the upside, the new descriptions published would be of greater value and would cause less headache to the community (see above "Taxonomic Impediment or Impediment to Taxonomy?"). Realistically, taking a look at the Code's pace of change,

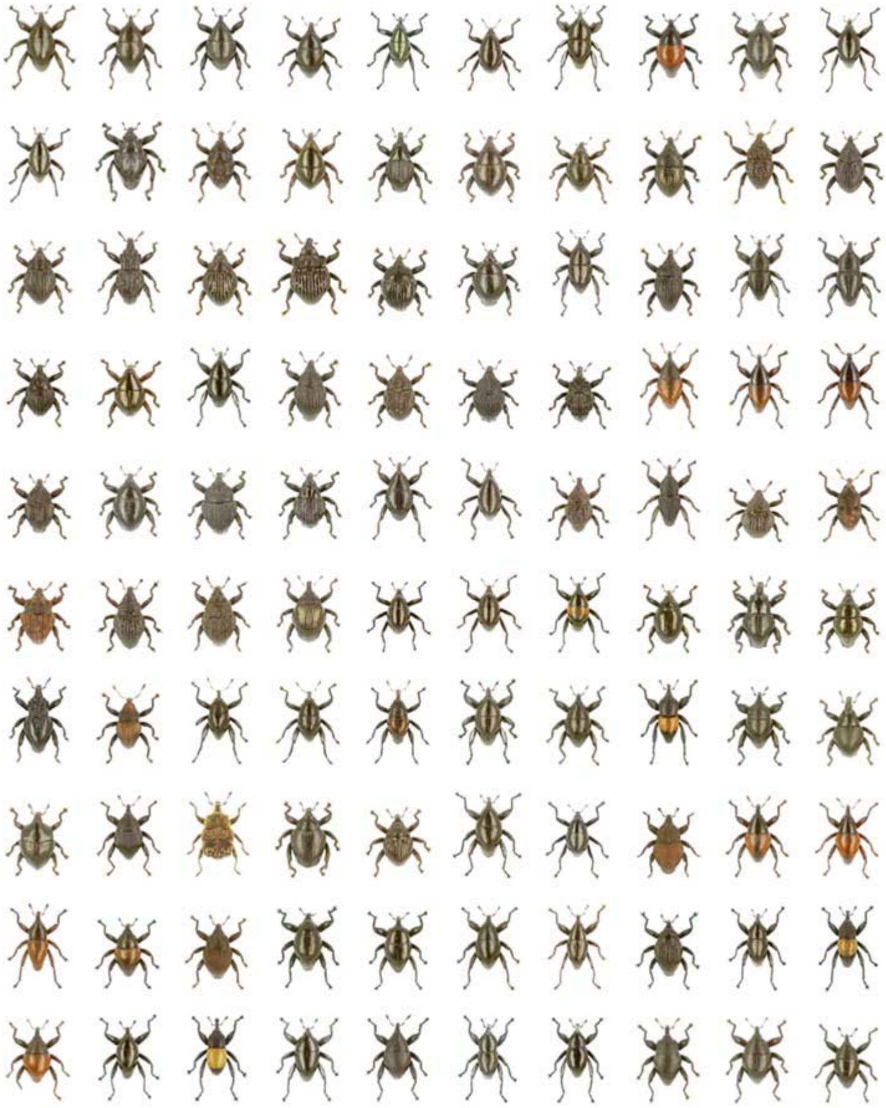
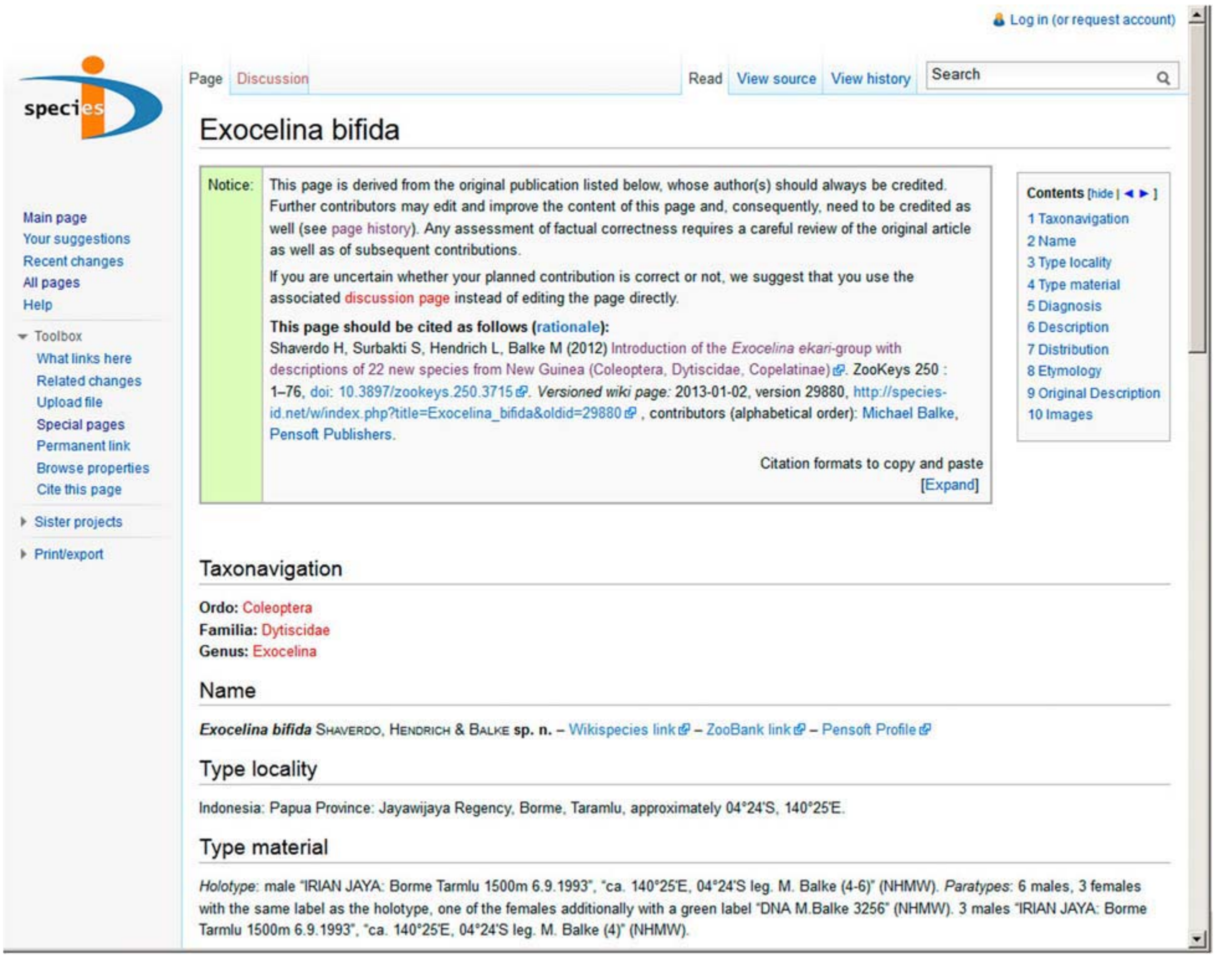


Figure 3 Compilation of 100 new *Trigonopterus* species.

we anticipate that such a decision is still decades away. Until that day, the contest between descriptions containing DNA barcodes and the ones without may give an answer of what data is really needed.

Online databases and wikis

Online wiki databases such as the Species-ID portal [link to http://species-id.net/wiki/] [29] are not recognized as means of publication by the International Code of Zoological Nomenclature [21,22], so their significance requires some explanation here. The open-access journal "ZooKeys" has pioneered a publication format that makes a new name available with a traditional paper publication [30], but simultaneously creates a versioned wiki with the same content [31]. There is a notice field on top of each page (Figure 4) which provides credits and a reference to the original source, and the wiki framework allows monitoring the editing history (Figure 5) [32]. ZooKeys pushes all taxon treatments at genus and species rank to Species-ID. Transferred data include highly resolved illustrations which then can be used to zoom into details. This wiki can be updated later anytime with additional data, be it an elaborate 3D-model or a "quantum contribution" [33] such as a simple collecting record. We currently update our first ca. 30 pages with additional images and DNA sequence data from a phylogenetic study (in the diving beetle genus *Exocelina*). At the time the species becomes formally named there is no urgency to provide the description with all possible data. It should contain a reasonable basis, so that its



Exocelina bifida

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Shaverdo H, Surbakti S, Hendrich L, Balke M (2012) Introduction of the *Exocelina ekari*-group with descriptions of 22 new species from New Guinea (Coleoptera, Dytiscidae, Copelatinae). ZooKeys 250 : 1–76, doi: 10.3897/zookeys.250.3715. *Versioned wiki page:* 2013-01-02, version 29880, http://species-id.net/w/index.php?title=Exocelina_bifida&oldid=29880 , contributors (alphabetical order): Michael Balke, Pensoft Publishers.

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Taxonavigation

Ordo: Coleoptera
Familia: Dytiscidae
Genus: Exocelina

Name

Exocelina bifida SHAVERDO, HENDRICH & BALKE **sp. n.** – Wikispecies link – ZooBank link – Pensoft Profile

Type locality

Indonesia: Papua Province: Jayawijaya Regency, Borme, Taramlu, approximately 04°24'S, 140°25'E.

Type material

Holotype: male "IRIAN JAYA: Borme Tarmlu 1500m 6.9.1993", "ca. 140°25'E, 04°24'S leg. M. Balke (4-6)" (NHMW). *Paratypes*: 6 males, 3 females with the same label as the holotype, one of the females additionally with a green label "DNA M.Balke 3256" (NHMW). 3 males "IRIAN JAYA: Borme Tarmlu 1500m 6.9.1993", "ca. 140°25'E, 04°24'S leg. M. Balke (4)" (NHMW).

Figure 4 Screenshot of the upper part of a Species-ID wiki species page, showing the notice box which contains author credits and full citation of the page.

diagnosis is guaranteed. But most users will later rather consult the online working description, gradually being supplemented with additional data. Thus, the formal species description is like a healthy newborn which is expected to grow into an adult with the help of its environment. In the case of *Trigonopterus*, characters such as the functional morphology of thanatosis or the morphology of the metendosternite, surely of great interest but of little diagnostic value, can be added at a later stage without compromising their visibility - meaning they are attached to the original reference, versioned so that the sequence of text changes remain visible. In general, we believe that the wiki format is the best platform for species pages [34], and purpose-built pages such a Species-ID can easily be linked and connected to wiki species to increase visibility. With billions of page requests per annum, it also appears safe to assume that the wiki environment will not easily disappear.

As apparent from the latest changes of the ICZN regarding online descriptions [22] the official registry of zoological nomenclature ZooBank [link to http://zoobank.org/] [35] may at some stage take a central role in a unitary taxonomy [2]. If taxonomic descriptions could be published within ZooBank as envisioned by Minelli [36] the restrictions of this database-system would also speak for an initial minimalistic description including diagnostic sequence data. The majority of barcoding sequences currently contained in GenBank are not identified to species [37] and environmental sequencing will not improve this situation; also, many of the GenBank entries in general may indeed represent misidentifications [38]. A database with sequences derived mainly from holotypes would necessarily have a much higher reliability. Unless mistakes in the sequencing process or the handling of sequence data are discovered [39], these sequences would not change, just as the original nomenclatural data. Thus, these data

Revision history of "Exocelina bifida"

Diff selection: Mark the radio boxes of the revisions to compare and hit enter or the button at the bottom.

Legend: **(cur)** = difference with latest revision, **(prev)** = difference with preceding revision, **m** = minor edit.

- (cur | prev) ● 11:47, 2 January 2013 Michael Balke (Talk | contribs) m (5,681 bytes) *(Type locality was misspelled, changed to Taramlu by Michael Balke)*
- (cur | prev) ● 10:34, 13 December 2012 ZooKeys (Talk | contribs) m (5,680 bytes) *(1 revision)*
- (cur | prev) ○ 10:34, 13 December 2012 Pensoft Publishers (Talk | contribs) m (5,680 bytes) *(Imported from ZooKeys)*

Figure 5 Screenshot of the revision history feature of a Species-ID wiki species page; here, a first minor edit was made on a newly uploaded page.

would surely fit well into the concept of ZooBank. At a time when the idea of open-source is spreading and researchers begin to see dissemination of their works as their obligation and not as a source of income, the biggest problem towards a unitary taxonomy may have disappeared already. If a suitable infrastructure was provided by ZooBank, a critical mass of researchers would start uploading images, diagnosis-texts and sequences to obtain immediate publication and permanent storage on an Official Database of Zoological Nomenclature. The ICZN should team up together with major natural history museums around the world, provide the necessary cyber-infrastructure and make additional relevant changes to the Code. The BOLD system [link to www.boldsystems.org] [40] could serve as a source of inspiration, because data upload is easy, and each individual can have its own voucher page with images that show what the voucher looks like, maps where it comes from, collecting data, sequences, trace files and most importantly information where the voucher physically IS (e.g. Voucher of *Batrachedra praeangusta* link to http:/www.boldsystems.org/index.php/Public_RecordView?processid=LBCH3416-10.

An integrative fast track approach

It is hard to quantify the amount of time needed for an average description, and to compare the traditional approach with ours. Actual manuscript preparation (i.e. descriptions and photographs, names, and listing of specimens) of the 101 species took about one year which is equivalent to the time needed for a traditional revision of 10–15 species [41,42]. We estimate that our fast track approach leads to an increase of about 5 to 10 times compared to traditional, comprehensive descriptions. This does not include laboratory work associated with DNA extraction, sequencing and sequence analysis. However, such work does not need to be performed by the taxonomist whose time is usually the limiting factor. The processing of about 1000 specimens took about six weeks of laboratory work and subsequent sequence data analysis. Naturally, the precise amount of time saved by the fast track approach depends on the taxonomic group and on the personal style of the taxonomist, but we believe that an acceleration rate of 2–20 times can be achieved for many hyperdiverse taxa.

In the following we discuss seven factors that contribute to a higher effectiveness of turbo taxonomy compared to traditional taxonomic work:

1) Easier sorting process of species by the availability of an underlying molecular phylogeny. Sorting a long number of small specimens belonging to many similar species is like playing a memory matching game of a thousand similar cards with a microscope. If the scaffold of molecular data is at hand, comparison of the morphology can be limited to the specimens of close genetic similarity. Pre-publication “synonyms” leading to the preparation of duplicate data can be avoided in the process. This concerns especially specimens from different localities as the sorting of morphospecies is most effective within a given locality sample.
2) Renouncement on the preparation of a traditional identification key. For a large number of similar species it is time-consuming to prepare keys based on morphological characters. One example of “turbo-taxonomy” [16] contains such a key, but we believe that this is contradictory to the idea of DNA

barcoding or acceleration of taxonomy in hyperdiverse taxa. Usually, it is possible to divide a larger number of species into clear-cut groups. However, closely related species are often distinguished by complex genital characters difficult to describe in words and even more difficult to translate into a dichotomous key. The same applies for subtle differences, e.g. of the surface sculpture. Unless a key is provided with numerous illustrations there remains a high degree of ambiguity, often a serious problem even for an expert of a specific group. Furthermore, the presence of many unknown species to be added to a key later considerably reduces its practical value.

3) Reduction of the description to essential diagnostic characters. Relatively unimportant characters that are often just added to make descriptions formally comparable are omitted.
4) Reduction of the description of "intraspecific variation". Series of length measurements quoting averages and standard deviation are extremely time-consuming and in most cases of no value for the purpose of diagnosis. Usually, it will be sufficient to measure a few specimens representing the extremes known at the time of description.
5) Reduction of the number of illustrations. Highly resolved images retain a lot of detailed information if they are published online, instead of printed relatively small in size. Arrangements of overviews and details as required by printed plates become superfluous. Different aspects of one species would often be desirable, but the added value of such multiple images decreases compared to descriptions of different species. We found that in our case two images per species have the highest information content/time ratio.
6) Comparative diagnoses are redundant: The selection which species are compared side-by-side is highly subjective. Characters differentiating from the species with relatively close genetic similarity should be covered by the morphological description.
7) Tracing and interpreting historic type specimens can be extremely time-consuming. In our case, some of this work was done already, and some could be avoided by our selection of species to be described. To maintain a universal taxonomy, it will be necessary to invest more time and money to provide existing names with DNA barcodes. Once this is done, future taxonomists would need to spend just a fraction of the time and travel funds needed now on tracing and examining type specimens.

This brings us to the main target of our approach - which taxa are most suitable? Turbo-taxonomy will work best if either a high proportion of existing species are present in the sequence database, or, if only a small proportion have been described so far (Figure 1). The latter case we expect in many tropical arthropods. In groups with a long history of study and a wealth (respectively load) of existing taxonomic names the situation is different: the time needed to tag existing species with DNA sequences may outweigh the time saved in the process of describing new species. Nevertheless, a long number of described species is not necessarily an indication that a barcoding approach would not be effective. The genus *Conotrachelus* Dejean 1835 with a staggering number of ca. 1,200 described species still shows a high proportion of undescribed species on a local scale [43]. In such cases it is more a question of how large a drafted project may become with given resources. The expert taxonomist will know best how many new species of a given taxon to expect and what difficulties the tagging of existing species may pose. Based on our own experience we are confident that a significant number of taxa highly suitable for "turbo-taxonomy" will be found.

Conclusion

In 1758, the big bang of zoological taxonomy [44] came with a key to all animal life then known and by providing 2 to 3-line descriptions. We firmly believe that technology provides researchers with suitable tools for completing Linnaeus' work much more rapidly and with more sustainable, better results than those currently obtained. DNA sequences provide the "key element", while web-based illustrations and short diagnoses should be sufficient to define the name and face of a species.

We question the prevailing taxonomic practice of preparing long, time-consuming descriptions of often-irrelevant morphological characters and making great efforts to prepare static identification keys that are often useless to non-experts and that become obsolete after the discovery of additional species. A dynamic (e.g.) *cox1* sequence database with an identification engine efficiently replaces traditional keys and helps to avoid both synonymy and grossly incorrect generic placements (i.e. might stimulate the researcher to re-assess morphological characters), thus contributing to a more sustainable taxonomy.

Our approach shows that traditional taxonomic expertise and new technology are perfectly compatible, creating a taxonomy more transparent and sustainable than ever before. It would at last allow us to tackle groups with an overwhelming diversity of similar species that taxonomists still tend to shy away. This would surely change our perception of global biodiversity and would be of great practical value to all the other disciplines that depend on a usable taxonomy.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MB and AR designed the study. AR, YS and KS performed fieldwork. RT performed the molecular work and analyzed sequences; AR defined the morphospecies and prepared descriptions. All authors participated in manuscript preparation; all have read and approved the final manuscript.

Authors' information

MB, AR and YS are museum curators and have each published many "conventional" species descriptions in the form of revisions over the past two decades. Later in their career they started using molecular data, having learned their lessons.

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Multiple transgressions of Wallace's Line explain diversity of flightless *Trigonopterus* weevils on Bali

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The fauna of Bali, situated immediately west of Wallace's Line, is supposedly of recent Javanese origin and characterized by low levels of endemicity. In flightless *Trigonopterus* weevils, however, we find 100% endemism for the eight species here reported for Bali. Phylogeographic analyses show extensive *in situ* differentiation, including a local radiation of five species. A comprehensive molecular phylogeny and ancestral area reconstruction of Indo-Malayan–Melanesian species reveals a complex colonization pattern, where the three Balinese lineages all arrived from the East, i.e. all of them transgressed Wallace's Line. Although East Java possesses a rich fauna of *Trigonopterus*, no exchange can be observed with Bali. We assert that the biogeographic picture of Bali has been dominated by the influx of mobile organisms from Java, but different relationships may be discovered when flightless invertebrates are studied. Our results highlight the importance of in-depth analyses of spatial patterns of biodiversity.

1. Introduction

The Indonesian island of Bali lies in a critical biogeographic position—on the edge of the Sunda shelf just west of the Lombok strait that demarcates Wallace's Line [1–4]. Yet, the numerous studies of the Indo-Australian fauna usually focus on the larger islands of Borneo and Sulawesi [5–8] and data on the fauna of Bali remain surprisingly scarce and scattered. Bali is essentially an extension of East Java, at the closest point only 2 km apart and repeatedly connected during lower sea levels [9]. This is reflected in Bali's presumably low degree of local endemism and fauna shared with Java.

Work in the first half of the last century focused mainly on lists of vertebrate species summarized by Rensch [10]: he concludes that there is only a single bird endemic to Bali, the now critically endangered Bali myna (*Leucopsar rothschildi* Stresemann). The majority of the remaining Balinese bird species also occur in Java, while only a very few are shared with islands to the East [10,11]. All native frog species except for one are shared with Java [12]. Large Asian mammals such as the banteng (*Bos javanicus* d'Alton) and the tiger (*Panthera tigris* Linnaeus) reached their easternmost area of distribution in Bali although the latter is now extinct on Bali [13]. The notion that the Balinese fauna is derived from Java relatively recently is confirmed by some rather mobile groups of invertebrates [14,15]. There are 14 species of land snails endemic to Bali and the neighbouring island of Nusa Penida [16], but the geographical provenance of their ancestors remains unknown.

There are no modern inventories of Balinese fauna, and molecular phylogenetic methods have never been applied to investigate macro-evolutionary processes explaining faunal origins or phylogeographic patterns within this island. Here, we conducted a comprehensive inventory of an Indo-Malayan–Australasian group of flightless weevils: *Trigonopterus* Fauvel is an ideal group

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for studying the complex biogeographic history of the Indo-Australian archipelago. This genus has a marked tendency towards local species endemism, but despite the inability to fly, *Trigonopterus* has a wide range, from east Sumatra across Melanesia to the Samoan islands. It is hyperdiverse in New Guinea, with more than 300 species recorded [17,18]. Although only a single species has been described from Sulawesi to date, we have more than 100 new species awaiting formal description (A. Riedel 2014, unpublished data). Diversity decreases to the West, but is still substantial with more than 50 species recently discovered in Borneo, Sumatra and Java [19]. Species are confined to wet primary forests where they can be collected by sifting the leaf-litter. Many such habitats have been degraded or were converted to agricultural use as a consequence of the human population explosion on Java and Bali [20]. However, many lowland areas of East Java, Bali and the Lesser Sunda Islands currently support a seasonal type of monsoon forest, according to our experience not a suitable habitat for *Trigonopterus*. Therefore, these weevils are confined to remnants of wet primary forests, typically on mountainsides.

Here, we use molecular phylogenetic data coupled with ancestral area inference to show that *Trigonopterus* weevils have repeatedly colonized Bali from the East, thereby transgressing Wallace's Line. Surprisingly, there are no closer relationships with the fauna of nearby East Java, underpinning the need for comprehensively sampled, phylogeny-driven studies to better understand the region's faunal evolution.

2. Material and methods

(a) Taxon sampling and DNA sequencing

Species for our analysis were selected from a preliminary phylogenetic reconstruction which we performed to identify major clades. This initial analysis contained 138 *Trigonopterus* species with an alignment of 4646 bps consisting of fragments from CO1, 16S rRNA, arginine kinase, CAD, elongation factor 1α, enolase and histone 4. It included all 82 species from Sumatra, Java and the Lesser Sunda Islands found during a total of 212 days of fieldwork (17 days in Sumatra, 120 days in Java, 28 days in Bali, 27 days in Lombok, 12 days in Sumbawa and 8 days in Flores) covering 72 localities and resulting in 354 litter samples (electronic supplementary material, S6). A total of 3812 *Trigonopterus* specimens were available, and a full taxonomic treatment of this material is currently in preparation. All major areas of suitable habitat of the Sunda Arc were sampled. East Java, Bali and Lombok were sampled most intensely; we did not retrieve additional species upon repeated visits to the same localities. Areas of Sumatra, West Java and Flores may harbour additional species, but we are confident that all major clades from these areas have been discovered because additional visits did not reveal new lineages. A single clade containing most Balinese species together with a Lombok species (292) was well supported. Most species from Java and Sumatra, including species 299 and 348, are monophyletic with equally strong support. Eight species of *Trigonopterus* subgenus *Mimidotasia* from Java and Sumatra comprise an early diverging lineage that was omitted from the subsequent analysis because the group is missing from Bali and the Lesser Sunda Islands. The entire clade containing species 328 from Bali and species 317 from East Java was transferred to the subsequent analysis.

Our present dataset contains all Balinese species and their respective sister clades (electronic supplementary material, S3) along with a representative selection of the remaining fauna of the Sunda Arc comprising 40 species. Furthermore, the same number of species was added, representing all major lineages from Borneo, and the hyperdiverse islands of Sulawesi and New Guinea. Four cryptorhynchine species from Australia, New Guinea and Java were included as outgroup representatives (*Critomerus iliacus* (Pascoe); *Microporopterus* cf. *setosus* Voss; *Ouporopterus squamiventris* Lea; *Miocalles* sp.). Some of the *Trigonopterus* species from New Guinea possess a valid name [21], while others are currently being revised and described. Undescribed species are referred to by unique species numbers that will be given in future taxonomic treatments. All the species were monophyletic in a phylogeny using CO1 data of multiple specimens per species, and also well delineated by male genital characters.

DNA was extracted non-destructively using the DNeasy and NucleoSpin 96 Tissue kits (Qiagen, Hilden; Macherey-Nagel, Düren, Germany). For PCR amplification (electronic supplementary material, S1), we used standard protocols (http://zsm-entomology.de/wiki/The_Beetle_D_N_A_Lab). Sequences were edited using SEQUENCHER v. 4.10.1 (GeneCodes Corp., Ann Arbor, MI, USA).

(b) Alignment and data matrices

Twelve fragments representing nine genes were sequenced (electronic supplementary material, S2 and S7). Alignments were performed with MUSCLE [22] and reading frames checked in MESQUITE v. 2.75 (http://mesquiteproject.org). Alignment length was 6800 bps (two assembled fragments of CO1 (1416 bps), 16S (579 bps), 18S (584 bp), 28S (534 bps), arginine kinase (720 bps), CAD1 (462 bp), CAD2 (594 bps), CAD3 (663 bps), elongation factor 1α (372 bps), enolase (663 bps) and histone 4 (213 bps)).

(c) Phylogenetic inferences

We used maximum likelihood (ML) as well as Bayesian inference (BI) to reconstruct the relationships among *Trigonopterus* species. ML analyses were performed in RAxML [23] with 1000 thorough bootstrap replicates using five different partitioning strategies: no partitioning, one partition for each gene, one partition for each genome (mitochondrial versus nuclear), one partition for each type (coding versus non-coding genes) and one partition for each codon position (for non-coding genes, one partition for each). The same strategies were used for BI analyses carried out in MRBAYES v. 3.2 [24] (electronic supplementary material, S4). We sampled 30 million generations of two independent runs consisting of eight Markov chain Monte Carlo (MCMC) sampling every 1000th generation. A burn-in of 5000 trees was chosen after investigation of split-frequencies and log-likelihood curves in TRACER v. 1.5 [25]. A 50% majority rule consensus tree was constructed afterwards based on the remaining trees. The best-fitting partitioning strategy for BI was selected using Bayes factors [26] tests based on marginal likelihoods estimated through stepping-stone sampling [27]. The most appropriate substitution model for each partition was selected using the Bayesian information criterion as implemented in jMODELTEST v. 2.1.3 [28].

(d) Dating and ancestral area reconstruction

Divergence times were estimated with the Bayesian relaxed clock method implemented in BEAST v. 1.8.0 [29]. The only time-calibrated tree of Curculionidae available [30] did not recover Cryptorhynchinae as monophyletic, perhaps because more than 30% of the data was missing. The scant fossil record of this subfamily does not offer a taxon to which *Trigonopterus* could be safely attributed. As a result, we were not able to use a secondary calibration for the *Trigonopterus* radiation. In a first calibration, several substitution rates of Coleoptera have been used (calculated for the COI marker using multiple fossils and geological evidences [31–33]—see [34] for a rationale on the use of this interval). The early diversification of *Trigonopterus* would have taken place more than 60 Ma which appears significantly too old. The age of flightless *Galapaganus* weevils older than the islands they inhabit was attributed to earlier, sunken islands [35]. In the case of *Trigonopterus*, no such land areas can be expected based on geological reconstructions of the New Guinea area more than 60 Ma [36,37]. The high interspecific divergences (mean 20% for CO1) previously reported for *Trigonopterus* [17] from supposedly young geological terranes might indicate accelerated molecular evolution, which has recently been linked to flightlessness [38]. Loss of flight in beetles not only promotes speciation, but also those flightless species retain a higher genetic differentiation on population level and show deeper genetic branching than flying species [39]. A life history that requires little movement is an equally important factor [40]. In *Trigonopterus*, both factors are given: these weevils, as well as all the other members of the subtribe Tylodina are fully wingless, and their habitat, the leaf-litter of humid forests, is a highly stable and relatively uniform resource. Groups of groundwater- and cave-dwelling Crustacea are also known for markedly accelerated evolutionary rates related to their fragmented populations and the frequent occurrence of bottlenecks [41].

Therefore, in order to obtain divergence time estimates, we used a geological calibration. We constrained the root of the tree not to be older than 30 Myr as a conservative estimate, because the early lineages in our phylogeny (figure 1) were all Papuan *Trigonopterus*. Present-day New Guinea has a highly complex orogenic history, but the most recent geological reconstructions of the region [36,37] suggest that at most small and low-lying islands were emergent before 30 Ma. If some land did exist before 30 Ma, it was lacking the horizontal and vertical dimension required to facilitate lineage diversification; habitats fully explaining the observed diversification patterns are more recent and likely of Miocenic age ([34]; R. Hall 2013, personal communication). This was reflected in empirical studies (birds [42], rainbow fishes [43], diving beetles [34]) which estimate the onset of Papuan lineage diversification around 30 Ma or more recent. Thus, our calibration is likely to be conservative and may yield slightly overestimated ages. Using more recent root calibration dates (20 Ma and 10 Ma) had no impact on the biogeographic scenario inferred for Bali. The analyses were performed under a *Speciation: Birth–Death Incomplete Sampling* [44] using an estimated relaxed clock rate (uncorrelated lognormal) because the hypothesis of a strict molecular clock was tested and rejected (p-value < 0.001) in PAUP* [45]. The MCMC parameters were fixed to 30 million generations with sampling every 1000th generation and discarding 5000 trees as burn-in. In order to reduce the computational time and the parameter space to explore, we fixed the best BI topology from which we removed all outgroups by manually editing the .xml file created in BEAUTI v. 1.8.0 [29]. A 50% majority rule consensus tree was created in TREEANNOTATOR v. 1.8.0.

Ancestral areas were inferred using the dispersal–extinction–cladogenesis (DEC) model in Lagrange [46,47] based on our BEAST topology. We defined seven areas: Bali, Kalimantan, Flores + Lombok + Sumbawa, Java, New Guinea, the Philippines and Sulawesi. No species of *Trigonopterus* occurred in more than one area. Palaeogeographic changes through time [36,37,48] were accommodated by two time slices encompassing the past 30 Myr. Rates of dispersal were based on distances between areas and geographical barriers (see the electronic supplementary material, S5). The maximum number of possible regions for each node was limited to three. We enforced all possible combinations of areas at the root and conducted likelihood comparisons to select the most likely ancestral area. A difference between potential combinations equal or greater than 2 log-likelihood units was considered significant [46,47].

(e) Phylogeography

We analysed the phylogeographic pattern for the eight Balinese species by producing a haplotype network derived from 70 specimens, using the 5′ CO1, 16S and CAD datasets. The sequences were collapsed into haplotypes using DNASP v. 5.10 software [49], and networks were inferred with HAPSTAR v. 0.7 [50] based on connection lengths calculated in ARLEQUIN v. 3.11 [51].

3. Results

(a) Molecular phylogenetics

Phylogenetic inference using ML and BI recovered highly congruent topologies for the species of the Sunda Arc (figure 1); some differences exist at the backbone formed by New Guinea species. For BI analyses, the high ESS (effective sample size) values indicated convergence for all runs. Bayes factor analyses suggested that the best-fit partitioning strategy was the one comprising one partition for each genome (electronic supplementary material, S4).

(b) Faunal evolution and biogeography

Balinese *Trigonopterus* are not monophyletic but belong to three separate lineages, each with its closest relatives outside of Bali. One clade comprises five species (sp. 285, sp. 334, sp. 289, sp. 340 and sp. 286), with its sister species found in Sumbawa (sp. 287); the second clade comprises the sibling species (sp. 280 + sp. 327) with its sister species in Lombok (sp. 282); the third clade represented by a single species (sp. 328) whose sister species is from Sumbawa (sp. 326).

(c) Dating and ancestral area reconstruction

High ESS values indicated that all dating analyses reached convergence. *Trigonopterus* had a median age of 22.59 Ma (95% HPD 18.04–29.16 Ma). For Balinese clades 1, 2 and 3, we estimate the following ages: 3.33 Ma (95% HPD 2.16–5.09), 2.24 Ma (95% HPD 1.69–3.19) and 1.15 Ma (95% HPD 0.73–1.86).

The AAR (figure 1) suggests that the early evolution of *Trigonopterus* was restricted to New Guinea until the Late Miocene. The New Guinea character state for the root was significantly recovered ($\ln = -127.3$ against the second best root character state Sulawesi with $\ln = -137.9$). Our results highlight a dispersal event towards Sulawesi at this period followed by the colonization out of this area of surrounding islands by the end of the Miocene and throughout the Neogene. Few lineages of basal clades reach Sulawesi, respectively, Sumbawa, another one the Philippines and Borneo. The Philippines might have served as a stepping stone for the colonization of Borneo from New Guinea as illustrated in the reconstruction (figure 1). All other species found on Borneo, Sumatra, Java and the Lesser Sunda Islands belong to one clade which also has a few Sulawesi endemics; the clade is completely absent from New Guinea. Evidence that the three clades of Balinese species have reached Bali coming from the Lesser Sunda Islands was found to be significant.

(d) Phylogeography

The CO1-based network was the most informative one and fully compatible with the slightly less resolved 16S-based network; the one based on CAD fragment 3 was hardly resolved as that marker was not informative at this hierarchical level. All Balinese species of *Trigonopterus* weevils were genetically distinctive (1.7–24.3% smallest interspecific CO1 p-distance,

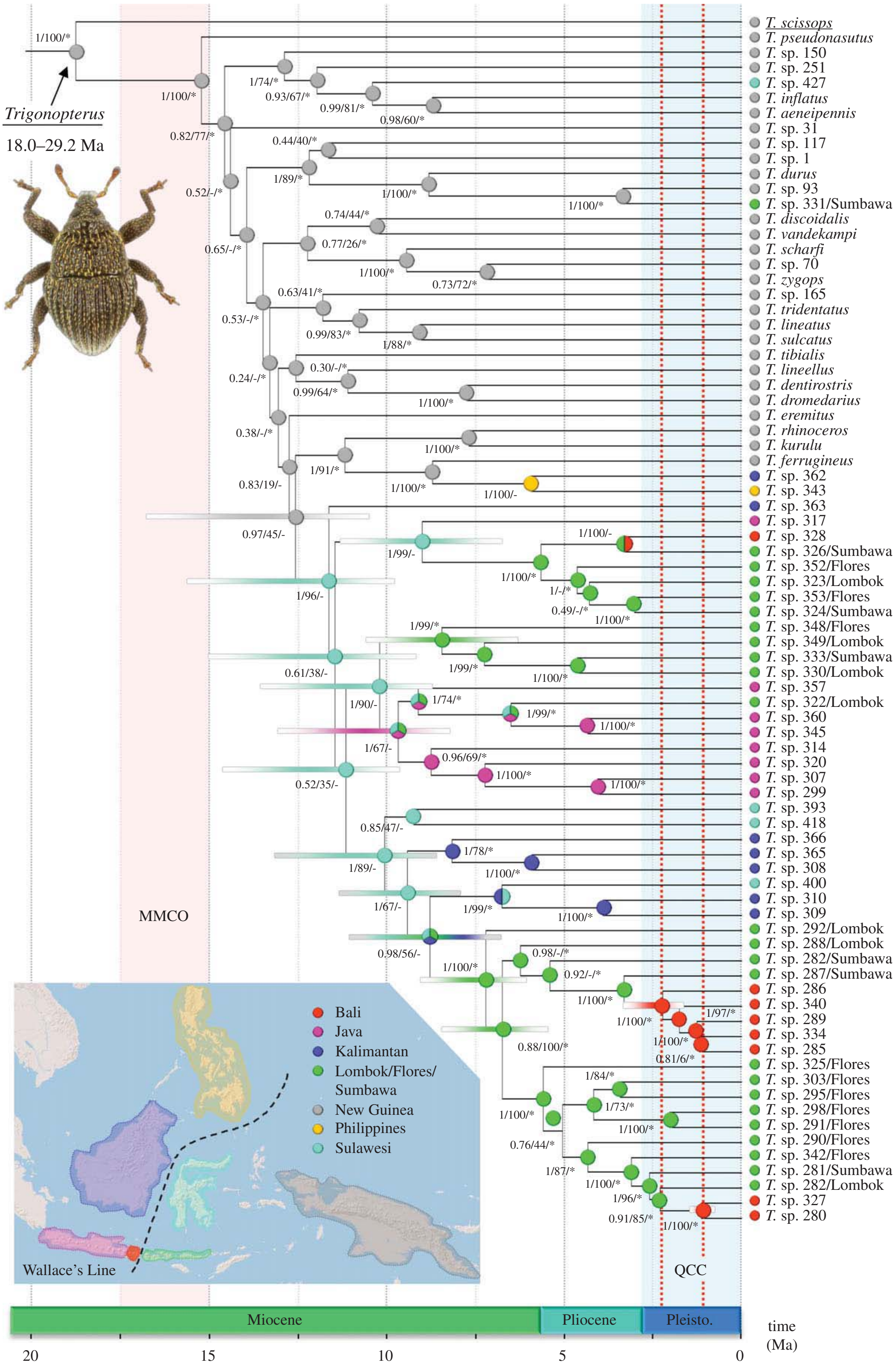

Figure 1. Bayesian phylogenetic relationships and historical biogeography of Australasian flightless *Trigonopterus* weevils. Values at each node (a/b/c) are (a) posterior probability of BI analysis, (b) Bootstrap support value of ML analysis (a hyphen indicates that this node is not found in the ML-based topology) and (c) relative probability of splits. Values above 95% are indicated by an asterisk, values below by a hyphen. A 2.5-Myr timescale is provided at the bottom of the chronogram spanning the epochs since 20 Ma. Horizontal bars indicate the 95% credibility interval of the divergence times. The bottom-left corner map represents the Australasian region along with the biogeographic regions used in the DEC analysis. Present-day distribution of the species is given at the tips of the topology. Coloured pastilles at each node correspond to the most likely ancestral area recovered by the DEC model. The mid-Miocene climatic optimum (MMCO) and quaternary climatic change (QCC) are illustrated with vertical coloured bars. The red vertical bars indicate independent colonization of Bali.

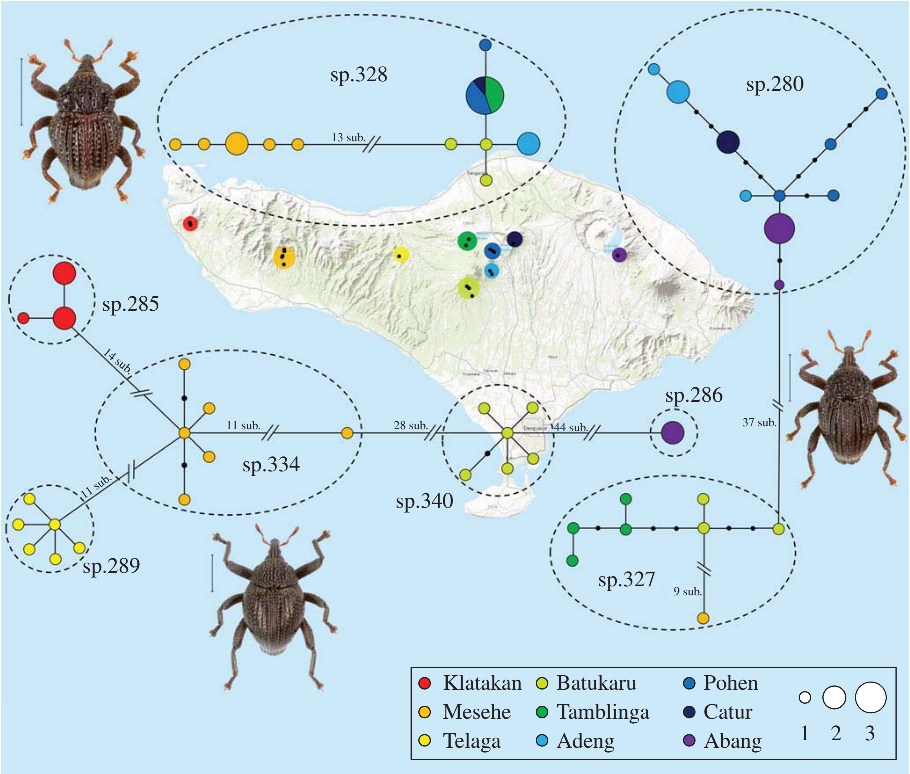

Figure 2. Haplotype networks based on the CO1 dataset of 71 *Trigonopterus* specimens from Bali. Substitutions (sub.) are marked by black dots between the haplotypes. More than two substitutions are stated as numbers above the respective branches. For colour code of localities, see inset. Scale bar of specimens = 1 mm.

only 0.1–1.1% intraspecific mean *p*-distance; figure 2). Most species are micro-endemics, i.e. to date only retrieved from a single locality each, with all haplotypes of a given species unique to a single locality. The clade containing five species shows a marked geographical east–west sequence, with, for example, the easternmost species (286) is more closely related to the central species (340) than to the western ones. Similarly, species 285, 334 and 289 are more closely related to each other than to the central (340) and eastern (286) species. Interestingly, individuals of species 289, 334 and 340 all had different haplotypes.

The other putative species occur in multiple localities and exhibit a more complex haplotype structure especially in the central region of the island where populations are not clearly delineated geographically.

Species 280 and 327 each occur in more than one locality and exhibit a marked haplotype structure. Species 280 is restricted to the east and eastern centre of Bali and is immediately replaced by species 327 from the western centre of Bali towards the West; the species are allopatric, but nearest localities are merely 6 km separated from each other.

Species 328, in its own clade, has a clear east/west separation of its populations but the eastern part of its distribution presents a less structured pattern as highlighted by a shared haplotype found in different localities. This species was found in all central localities. A high number (13) of CO1 substitutions distinguish specimens from the central localities and those from western Mt. Mesehe, but no other evidence for the presence of cryptic species could be found based on external and genital morphology.

4. Discussion

Here, we empirically show that comprehensive phylogenetic studies can reveal complex evolutionary histories of organisms in the geologically equally complex Indo-Australian archipelago. Using a densely sampled molecular phylogeny, we shed light on the origin of Bali's indigenous fauna, especially the origins of the little-known endemics which may not be as sparse as hitherto believed. Counterintuitively, the flightless weevils we studied arrived from east of Bali and east of Wallace's line rather than from the much closer East Java.

Based on present-day geography, a sea-level lowering of 50 m would result in a land connection between Bali and East Java [9]. Such conditions have likely prevailed at times during the Pleistocene allowing the influx of mobile terrestrial organisms from Java [52]. However, Bali remained insular throughout more than 50% of its Pleistocene history [9]. More importantly, during periods of connectivity, the lowlands of East Java and Bali were most likely dominated by savannah vegetation [53], an unsuitable habitat for *Trigonopterus* weevils, as well as most other forest-adapted taxa. Even at times when Bali and Java formed one landmass, the fauna of ever-wet rainforests was confined to the upper elevations of mountains, just as it is today [54]. Thus, an insular evolution persisted for forest species at all times.

Flightless, edaphic weevils fall into the category of less dispersive taxa [55]. Their chances to be lifted up by strong winds should be negligible. Ocean currents as a means of dispersal, maybe as part of or contained in flotsam, appear as a more plausible cause of dispersal. In this particular case, the general scenario does not look favourable, either: the Indonesian throughflow [56] passing from north to south would form a barrier carrying organisms into the Indian Ocean instead of helping them to cross the straits from east to west.

Under these circumstances, colonization of Bali from the Lesser Sunda Islands by a group of flightless weevils appears to be unusual. However, this happened at least three times independently, and the conspicuous absence of any colonization event from the West, notwithstanding the rich presence of *Trigonopterus* in Java, is more than unexpected and highlights the need for comprehensively sampled phylogenetic analyses if we are to unravel the complexities of faunal evolution of a given area. While we cannot rule out the possible discovery of East Javanese sister species of one Balinese species, this appears highly unlikely for all three lineages.

Within Bali, on the contrary, the observed population-level pattern reflects the expected clear geographical structure for flightless organisms between different tropical mountain ranges [57–59]. This confirms the very limited dispersal abilities of *Trigonopterus* weevils and questions chance as an explanation for the multiple transgression of Wallace's Line by *Trigonopterus*. Once other taxa of poor dispersers are examined with appropriate methods, a general pattern may emerge that paints a more accurate picture of the early zoogeographic history of Bali, when land connections or ocean currents might have been very different from how we see them today. Taxa worth a comprehensive study may be some genera of snails (i.e. *Asperitas* Gray, *Sasakina* Rensch [60]) and weevils of Celeuthetini (i.e. *Syntrophus* Marshall [61]) that have distributions suggesting close relationships between Bali and islands to the East instead of Java, but no phylogenetic data are available for these yet.

Our study of Balinese *Trigonopterus* provides the first robust phylogeny and state-of-the-art biogeographic analysis for any Balinese taxon. The early evolution of *Trigonopterus* apparently took place in the area of present-day New Guinea, most likely in an archipelagic setting, before the formation of the main New Guinean landmass [36,37]. The Sunda-arc and the Sunda shelf were colonized from the East by rather derived lineages (figure 1). Thus, the possible centre of origin of *Trigonopterus* apparently coincides with its centre of diversity [62] in New Guinea/Australia. *Trigonopterus* was probably among the early groups to diversify on the proto-Papuan arc which was formed *ca* 30 Ma [36,63], a pattern also shown by some songbirds [42] and rainbow fish [43]. *Delias*, a diverse genus of butterflies, apparently also first diversified in the area of New Guinea and Wallacea, mainly during the Miocene [15,64].

The observed unexpected distribution patterns of *Trigonopterus* stress the importance of fine-grained and comprehensively sampled surveys in this biogeographic highly complex region. Relatively recent, largely Pleistocene processes of faunal exchange generated distribution patterns that include Bali along with Java as parts of the Sunda shelf contributing to what we perceive as Wallace's Line today [4]. However, the islands along the Sunda Arc from Sumatra to Flores are geologically heterogeneous and most likely emerged from the sea at very different times. Even Java is composed of a number of geologically distinct units [65]. The detailed study of less dispersive taxa undergoing endemic radiations during the Caenozoic will allow us to gain new insights into the development of a seemingly uniform chain of islands. Our present work highlights macro-evolutionary processes governing the biota of Bali and paves the way for future investigation of this frequently studied but still not fully understood area of the Indo-Australian Archipelago using molecular tools.

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Data accessibility. DNA sequences: European Nucleotide Archive (accession nos. FN429126 - FN429350, HE613858–613921; 615156–616164). Phylogenetic data: TreeBASE accession no. 15388. Final DNA sequence assembly uploaded as the electronic supplementary material.

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7 Synthesis

The evaluation of biodiversity becomes more and more important in times of rapid environmental destruction. Many groups of animals, especially invertebrates, are still largely unknown. Only through the discovery of biodiversity hotspots wise designation of conservation areas can be possible. Therefore species discovery and the formal description of new species are still important tasks. The description and naming of a species allows for further investigations and standardises references to these taxonomic data, lastly it gives the undescribed biodiversity “a face”.

7.1 Tackling the hyperdiverse and mostly undescribed fauna of New Guinea

The hyperdiverse genus *Trigonopterus* shows a high α- and γ-diversity across the island of New Guinea as well as a very high ß-diversity. An even denser sampling across the island (compared to Riedel et al. 2009) has been done but still a comparably deep branching pattern between species can be found, with a range of interspecific cox1 divergence of 12–24%. Molecular biodiversity assessment using cox1 data is feasible, with error rates of approximately 15–20% when the number of molecular entities is compared to the number of morphospecies (refined & final dataset). The outcomes of clustering local versus regional datasets might differ with slight significance, depending on the threshold chosen. Some species showed a pronounced geographical structure which resulted in a lower agreement and taxonomic accuracy (125%, error=25% overestimation respectively 80.6%, error=19.4% underestimation) when adjacent localities were merged into one area (distance of 7-52km). Otherwise, the performance of local and regional clustering showed mostly equal agreement and taxonomic accuracy using both 3% threshold clustering and GMYC. This implies that ß-diversity studies will probably suffer from slightly higher error rates when closer localities are studied, compared to studies of large-scale patterns of diversity.

The localities within the Balim and Eastern Highlands are equidistant so the differences in their biodiversity have to be explained elsewise. Differences in both the geographical barriers and in vegetation could be a possible explanation for the differences seen in ß-diversity. The mountain ranges bordering the Balim Valley are largely covered with montane cloud forests dominated by *Nothofagus*. The valley bottom could promote isolation but still allow colonisation of localities that have a similar set of species. On the other hand the mountains of the Eastern Highlands are more complex, and most localities are located north of a watershed (except Haia and Supa). Haia and Supa support lower and mid-montane forests, while mid- and upper montane forests dominate the localities in the North. Aiyura, Goroka, and Okapa have Sørensen indices similar to the localities in the Balim area. Only two of the seven species shared between them, had intraspecific p-distances above 2%. However, five of the eight allopatric species in Balim had high intraspecific p-distances (2.05–8.79%), resulting in a lower success rate from clustering. Another important factor could be the ecology of the species. The mountains bordering the Balim Valley were largely untouched by human activities until quite recently. In contrast the primary forests around Aiyura, Okapa and Goroka were reduced to patches surrounded by dominant grasslands and gardens long before the arrival of Western civilisation. To these conditions adapted species could be promoted and also retain the potential for relatively recent dispersal, resulting in a lower degree of genetic structure. For the 13 species found in more than one terrane, it is difficult to make generalities about their distribution patterns from only a few widespread localities. Species 001 and 015 had to be split into cryptic species which reduced their distributions markedly. For the remaining species, the majority are restricted to the three areas in Papua New Guinea and include a number of montane species (spp. 133, 150, 161, 205, 228, 229, 244, 261). Others were shared between the more distant areas in West New Guinea, belonging to the ‘‘lowland species’’ groups, such as spp. 018, 028, and 192. An investigation of the lowland forests’ ß-diversity, either in the Mamberamo-Sepik basin, or Southern platform would presumably find a larger ß-diversity compared to the highlands.

Change in the number of morphospecies from the initial sorting, to the final species hypotheses, was a result of the combined morphological and molecular evidence. Although the absolute numbers between the initial sorting and the refined morphospecies count changed only slightly (from 274 to 270 morphospecies), the taxonomic changes were significant. Some species were over split in the analyses. However some superficially similar species failed to be recognized which compensated the initial inflation of the species count. For the final species hypotheses one had to rethink species boundaries resulting in nine cryptic species that raised the total number to 279 species.

The high number of morphologically similar species makes the sorting of morphospecies across different localities very difficult. When samples from different areas are sorted at different times, the number of ‘‘synonyms’’ is more frequent than samples sorted at the same time. For this purpose the addition of DNA sequence data makes work more reliable (Caesar et al. 2006, Dexter et al. 2010).

Even for the localities already sampled not all the species have been discovered. If new localities are investigated many more than the current inventory of 279 species can be expected. In the Cyclops Mountains and the Balim Valley, old museum specimens represent additional sources from which new species can be expected. Also most of the 13 divergent clades are represented by females. These could probably be added to the species count if males with diagnostic characters are found. Thus, the number of species is likely to increase with additional sampling effort, ending up with a total of more than 1000 *Trigonopterus* species Riedel (2010). It is nearly impossible to compare specimens side by side when one is dealing with so many similar species. DNA barcodes have big advantages in this context as is already demonstrated in the hyperdiverse weevil genus *Conotrachelus* (Pinzón-Navarro et al. 2010), in a survey of ants in Madagascar (Smith et al. 2008) and in Chironomidae (Ekrem et al. 2010).

Cox1 also contains valuable phylogenetic information but this is somewhat limited in *Trigonopterus* because of a very high saturation rate. However the results of the GMYC analysis are not affected by this, as the program relies on the topologies and branch lengths of closely related species and their intraspecific patterns. Hence an incorrect node at the basal position is irrelevant. In some species groups there are indications of a high degree of in situ diversification. Species 210–214 (bootstrap, BS, 86%), 231–233 (BS 95%), 039, 109 and 278 (BS 94%) are endemic to the Balim area, Arfak Mountains and Cyclops Mountains respectively. For some other species dispersal between separate terrains seems to be involved (species 147–149; BS 97%). This occurs between the Eastern Highlands area and on the Huon peninsula. To resolve deeper nodes in the phylogeny more conservative markers would be necessary. Investigation of the extent of endemism in geological terrains in New Guinea could give new insights into the evolution of this hyperdiverse genus.

Trigonopterus Cox1 sequence data provides a solid starting point for further studies on biodiversity patterns, such as ß-diversity assessment (Valentini et al. 2009). Clustering at 3% and GMYC analyses would overestimate species diversity by about 16-17%. A more intensive sampling and a focus on population genetics would be needed to arrive at a proper taxonomic conclusions. However if there are 50 or more *Trigonopterus* species involved, species counts and diagnoses based on DNA barcoding become more accurate than based on morphology by a parataxonomist.

7.2. Turbo taxonomy

For many decades it has been a common practice to revise monophyletic groups with all the known species, to prepare detailed descriptions with every tiny character from a phylogenetic analysis, and to make laborious identification keys based on these characters. Therefore hyperdiverse taxa such as the genus *Trigonopterus* are usually avoided, as it is nearly impossible to get this task finished during a lifetime. To avoid these issues the so called “mass-describers” describe species without sufficient diagnostic characters and usually publish their work in journals without peer-review. Later other scientists have to deal with the issues of incorrectly described species which in turn exacerbates the situation in such “difficult” taxa. In such a case, taxonomic information becomes more a burden than a benefit. Two components are of fundamental importance, i.e. online wiki databases and molecular systematics (Riedel et al. 2013) to stop this vicious circle. The significance of the online wiki databases such as the Species-ID portal (http://species-id.net/wiki/Main_Page) needs some explanation, as they are not recognized as a publication by the International Code of

Zoological Nomenclature (1999). When a new species is described in addition to the traditional paper publication, a wiki with the same content is created simultaneously. While the content of the paper publication is fixed, the wiki can be updated with additional data later at any time. The description should contain a reasonable basis for identifying the species but there is no urgency in providing all the possible data. This can be done at a later stage with the wiki. For *Trigonopterus*, characters such as the functional morphology of thanatosis, or the morphology of the metendosternite, both surely of great interest but of little diagnostic value, can be added later without affecting their visibility. In this approach, features of numerous other initiatives like the Encyclopedia of Life (eol.org) can be aggregated. Molecular systematics has a twofold impact on species descriptions and can be divided into reconstruction of species relationships and attempts to diagnose species.

If one looks back in time when phylogenetic systematics (Hennig 1966) and phenetics (Sneath and Sokal 1973) were established, a profound but little-noticed effect on the preparation of species descriptions can be noticed. Phylogenetic analyses became more and more common and therefore the number of informative characters was increased, no matter the value it has for the species diagnosis. In addition, species descriptions within a study were sought to be standardized and negative character states (i.e. the absence of a character) were often explicitly stated. The usability of descriptions has suffered from these “innovations”. There is still a need for phylogenies based on morphological data, especially when one want to incorporate fossils. However in the last decade purely molecular phylogenies have become much more common.

For *Trigonopterus*, molecular data seems to produce a very stable phylogeny as well, even without morphological data. Therefore there is no need to describe every character of a species so taxonomists should adjust procedures and streamline descriptions to the purpose of diagnosis. The potential of DNA barcoding was recognized almost ten years ago (Hebert et al. 2003) and despite some initial criticism it has proved to be a reliable tool. As shown in the first paragraph of the discussion the “barcoding” sequence will determine the correct species without additional information (Hebert et al. 2010, Hausmann et al. 2011) for many animal taxa. Of course, there are also exceptions for which delineation of species is ambiguous (Hendrich et al. 2010), but a non-expert would still not achieve a better result within a reasonable time using traditional keys. In combination with a few morphological characters the species can still be safely identified in most cases. Sequence data can be easily databased, searched, analyzed and accessed anytime from anywhere which is quite different for type specimens. Types are often not accessible or it is very time-consuming to borrow them. If they are needed in case of an insufficient description, DNA barcodes would be a much faster and easier solution. Genetic data should be made obligatory by the ICZN following the example of the “Bacteriological Code” (Lapage et al. 1992) which stipulates taxon-specific requirements for a meaningful and valid description of new extant species. Although such a decision would mean that degraded DNA material stored in collections could no longer be used, in most cases ancient DNA can still be sequenced (Strutzenberger et al. 2012) and in the rare cases for which this is not possible, fresh material can still be collected. Taking a look at the Code's current pace of change, there is little chance that this will happen within the next few years, notwithstanding the greater value of the publications. Meanwhile the "contest" between descriptions with and without DNA barcodes can already be decided by their number. At some stage the official registry of zoological nomenclature ZooBank (http:// zoobank.org/) must make a decision about whether to mandate DNA based data in descriptions, when one is aiming for a unitary taxonomy (Godfray 2002). This is apparent from the latest changes to the ICZN regarding online descriptions (ICZN 2012). Publishing taxonomic descriptions within the restricted database-system of ZooBank would also speak for an initial minimalistic description, including diagnostic sequence data. To date many barcoding sequences in GenBank are not identified to the species level (Shiyang et al. 2012) or even misidentified (Bridge et al. 2003). The increasing use of environmental sequencing will not improve this situation. If sequences are derived from holotypes, a database based on these data would be of much higher value and reliability. Like the original nomenclatural data, these sequences would never change unless mistakes were made during the handling of the sequence data (Forster 2003). Thus, these data would fit well into the concept of ZooBank. The upload of images, diagnosis-texts and sequences to a suitable infrastructure provided by ZooBank would allow researchers to obtain immediate publication and permanent storage on an Official Database of Zoological Nomenclature. The ICZN should cooperate with major natural history museums around the world in this effort. It should also provide the necessary cyber-infrastructure and make additional relevant changes to the ICZN Code. In terms of data handling, the BOLD system (http://www.boldsystems.org) would be a good example. It allows the user to easily upload data, each specimens gets its own voucher page including images, maps, collecting data, sequences, trace files as well as the physical location of where the specimen is deposited.

The time needed for preparation of a diagnostic description is hard to quantify and compare with the traditional approach. The manuscript preparation of the 101 species in this thesis took approximately one year, whereas only 10-15 species could be described within this time preparing traditional descriptions, (Riedel 2001, 2002). Thus, this fast track approach could accelerate species descriptions 5 to 10 times faster, compared to traditional comprehensive descriptions. Although time for laboratory work is not included, such work is not necessarily carried out by the taxonomist whose time is usually the limiting factor. The 1000 specimens used here in have been processed within six weeks of laboratory work and the following sequence data analysis. Additionally the time for laboratory work is considerably reduced by an increasingly automatized workflow and new methods like NGS which enable sequencing of more species at once in a shorter period of time. The saved time depends also on the examined taxonomic group and on the personal style of the taxonomist but for most hyperdiverse taxa a 2 to 20-fold accelerated description could be achieved. There are seven factors contributing to a higher effectivity of turbo taxonomy compared to traditional taxonomy:

1) The simplification of sorting species with the help of a molecular phylogeny. When sorting many specimens of similar species it is hard to remember all of them and to avoid "synonyms". With the molecular data available for comparison the morphological study can be limited to the specimens of close genetic similarity. Therefore pre-publication "synonyms" leading to the preparation of duplicate data can be avoided in this process which is most critical when sorting specimens from different localities.

2) Elimination of a traditional identification key. Identification keys based on morphological data for large quantities of species are time-consuming in preparation and can be very confusing unless numerous illustrations are provided. Closely related species are often distinguished by complex genital characters difficult to describe in words and therefore even more difficult to translate into a dichotomous key. Often a high degree of ambiguity remains. Furthermore, the addition of new species is very difficult or even impossible.

3) Minimising the content of the description to the essential diagnostic characters. The content is focused on the characters relevant for species diagnosis and unimportant characters that are often just added to make descriptions formally comparable are omitted.

4) Minimising "intraspecific variations". Length measurements are extremely time-consuming and in most cases of comparatively low practical value. They can be reduced to a minimum by just measuring a few specimens which represent the extremes within a species.

5) Smaller number of illustrations. If printed images are of a relatively small size and many are required to show all the necessary details. Online published images are of much higher resolution and therefore contain a lot of detailed information. For *Trigonopterus* two images per species have been found to give the highest information content/time ratio.

6) Comparative diagnoses become dispensable. Usually the choice of species compared side-by-side is highly subjective. Only characters differentiating genetically similarity sets of species should be covered by the morphological description.

7) Describing and interpreting historic type specimens can be time-consuming. In order to find type specimens scattered in museums around the world a lot of time and money is needed. Much of this money could be saved if DNA Barcodes are provided for the corresponding species.

This brings up the question – which taxa are used best for the DNA barcoding approach? The group under investigation should already have either a large number of existing sequences or a relatively low amount of previously described species (which is usually the case in most tropical arthropods). If the focal group already contains plenty of described species one then has to consider whether producing DNA sequences for existing species may outweigh the time saved in the process of describing new species. The expert taxonomists of the particular group have to decide in such cases. They will know best how many species can be expected in a given taxon and what problems could come up when tagging the species that already exist. Again the genus *Conotrachelus* represents a good example for the successful use of DNA Barcoding within a group already containing a huge amount of species (more than 1200 described species). Experience shows that a large number of suitable taxa for “turbo-taxonomy” can and will be found in the future.

7.3. Multiple transgressions of Wallace´s Line – an unexpected distribution pattern in *Trigonopterus*

As our species are well defined from the previous integrative taxonomic work we can then proceed with phylogeographic studies. Comprehensive phylogeographic studies of *Trigonopterus* reveal the complex evolutionary histories of this organisms in the equally complex Indo-Australian archipelago. With the help of a densely sampled molecular phylogeny the origin of Bali’s indigenous fauna can be revealed, especially of the poorly understood endemics which may not be as rare as previously believed. In *Trigonopterus* an unexpected distribution pattern was observed. The lineages arrived on the island of Bali from the east and not from the much closer East Java, which is a very unusual pattern especially for a flightless group. Taking the present-day geography into account, lowering the sea-level by 50m would result in a land connection between Bali and East Java (Voris 2000). Therefore during the Pleistocene, connections between these two islands are more than likely and an influx of mobile terrestrial organisms from Java could have taken place (Miller et al. 2005). However, suitable vegetation growing on these connections would still be necessary for an exchange of species. In this case, the lowlands of East Java and Bali were most likely dominated by savannah habitats (Bird et al. 2005) and therefore most likely unsuitable for *Trigonopterus* weevils, as well as for most other forest-adapted taxa. The fauna of ever-wet rainforests was restricted to higher elevations, just as it is today (Flenley 1998). Thus, forest species remained insular at all times.

Trigonopterus is not a vagile taxa as they are small, edaphic and wingless (Gillespie et al. 2012). They are unlikely to become uplifted by strong winds. It is more likely for them to be dispersed by ocean currents as part of flotsam. Therefore, ocean currents have to act as dispersal pathways which is not the case between Bali and Lombok. The Indonesian throughflow (Gordon & Fine 1996) passing from north to south between the two islands is more likely forming a barrier than connecting them. This makes a colonization of Bali from the Lesser Sunda Islands by a group of flightless weevils highly unlikely. All the more surprising is that Bali was colonized at least three times independently and lacks any colonization event from the West. This combined with the abundant presence of *Trigonopterus* species in Java, highlights the need for comprehensively sampled phylogenetic analyses. It may still be possible to find a Javanese sister species for one of the Balinese species, but it seems very unlikely for all three lineages. When looking at the species occurring on Bali, the observed population-level pattern reflects the expected clear geographical structure for flightless organisms between different tropical mountain ranges (Hewitt 2004, Chatzimanolis & Caterino 2008, Kajtoch 2011). The limited dispersal abilities of *Trigonopterus* seem to be confirmed by this fact and questions chance as an explanation for the multiple transgression of Wallace´s Line. Examination of other poor dispersing taxa could give a more accurate picture of the early zoogeographic history of Bali. There are various other taxa worth investigation, i.e. some genera of snails such as *Asperitas* Gray, *Sasakina* Rensch (Hausdorf 1995) and weevils of the genus *Syntrophus* Marshall (Marshall 1956). No phylogenetic data are available for these yet but their distribution suggests a nearby relationship between Bali and the islands to the East and not with Java. This study of Balinese *Trigonopterus* provides the first robust phylogeny and state-of-the-art biogeographic analysis for any Balinese taxon. *Trigonopterus* apparently originated near to contemporary New Guinea, most likely in an archipelagic setting, before the main landmass of New Guinea formed (Hall 2009, 2012). Colonization of the Sunda-arc and the Sunda shelf occurred from the East by rather derived lineages which indicate matching centers of origin and diversity in New Guinea / Australia for *Trigonopterus*. The genus probably diversified on the proto-Papuan arc which was formed ca 30 Ma (Hall 2009, 2011). This is also known for some songbirds (Jønsson et al. 2011), rainbow fish (Unmack 2013) and butterflies of the genus *Delias* (Braby & Pierce 2007, Müller et al. 2013). The importance of comprehensive surveys in this highly complex biogeographic region is highlighted by the unexpected distribution pattern of *Trigonopterus.* Investigations of faunal exchanges relying on recent Pleistocene processes contribute to what we perceive as Wallace´s Line today. These Pleistocene processes delineate the barriers between Bali, Java and parts of the Sunda shelf for large mammals (Lohman et al. 2011). Parameters like the geological composition, which can vary greatly and the point of emergence from the sea are important and need to be considered as well. Java for example is composed of a number of geologically distinct units (Pacey et al. 2013). Further studies of endemic radiations of less dispersive taxa during the Cenozoic will give new insights into this apparently uniform archipelago. This work points out the complex processes and the need for additional examinations of the biota of Bali and the whole Indo-Australian archipelago with the use of molecular phylogenetics.

7.4 Conclusion

I have shown which steps are necessary to rapidly establish new taxa for a largely unexplored fauna, building on DNA sequencing and expert taxonomic knowledge. *Trigonopterus* is a widespread, easily diagnosed and is a prominent member of the fauna in all major terrestrial habitats of Melanesia. Most of the species possess clear morphological characters and only a few had to be classified afterwards as cryptic. Both objective clustering and the GMYC analysis outperform parataxonomists. The performance of DNA barcoding on *Trigonopterus* species was excellent at the local and supraregional scale. A slight drop in performance could be observed when nearby localities where included. Hence, this tool allows researchers to overcome the taxonomic impediment in hyperdiverse groups, such as *Trigonopterus*. There are several advantages of weevils over butterflies or vertebrates which are commonly used in rapid biodiversity assessment (RAP) surveys. Collecting weevils is relatively easy in most primary forests of Melanesia, from sea level to subalpine grasslands. They occur in large quantities even in forest remnants of limited size. They show high levels of endemism, which gives a high probability to find many of endemic species in isolated, forested areas. In terms of environmental protection, *Trigonopterus* represents a valuable part of the biodiversity of Melanesia, both in numbers of species and in terms of quality as an indicator.

Furthermore, here in I propose a pipeline for describing large numbers of species in a relatively short time. Descriptions are reduced to a minimum containing just DNA barcodes as the “key element” as well as web based illustrations and short diagnoses. It is questionable if the preparation of long and time-consuming traditional descriptions, with often irrelevant morphological characters is still up to date and efficient. Traditional taxonomic keys are replaced by dynamic cox1 databases which help to avoid both synonymy and grossly incorrect generic placements. Both, traditional taxonomic expertise and new technology together create a more transparent and reproducible taxonomy. This allows us to tackle groups with an overwhelming diversity of morphologically similar species that taxonomists have avoided so far. This should result in a change of global biodiversity estimates and also support many other disciplines which rely on taxonomy as their foundation.

Finally, with all the new described species at hand, a surprising biogeographic pattern in *Trigonopterus* has been discovered. For the eight endemic species on the island of Bali an Eastern origin was revealed. This is surprising as Bali is situated immediately west of Wallace´s Line, additionally the fauna of Bali is supposedly of recent Javanese origin and characterized by low levels of endemism. Extensive in situ differentiation is shown by phylogeographic analyses as well as by a local radiation of five species. A comprehensive molecular phylogeny and an ancestral area reconstruction of the archipelago revealed a highly complex colonization patterns. It was found that the three Balinese lineages all arrived from the East and therefore crossed the Wallace´s Line three times. However, no exchange of species with the rich fauna of East Java could be observed. Mobile animal groups from Java show a high influence on the fauna of Bali but when poorly dispersing groups are investigated different relationships may be discovered. The results highlight the importance of detailed analyses of spatial biodiversity patterns.

8 Outlook

Although nearly 200 species of the genus *Trigonopterus* have been described within just two publications in a comparatively short time (Riedel et al. 2013b, 2014) the majority of species still need to be discovered and named. Approximately 450 additional species are already numbered serially and are awaiting their formal description in our voucher drawers. It would not be surprising if more than 1,000 species belong to this genus. Many cryptic species have already been found and many more can be expected. For further investigations population genetics tools will be needed to delimit these, possibly in combination with GIS modelling.

Our knowledge of *Trigonopterus* is still very fragmentary. Almost nothing is known about their life-cycle, their host plants or their development. Longer observations in the field (e.g. by local students) could obtain new insight into the biology of these insects. Also the investigation of the gut content could be a promising approach.

More comprehensive phylogenetic and biogeographic investigations are already in preparation. One aim is to analyse the distribution of *Trigonopterus* in SE Asia and especially in the Sunda arc. Further studies will explain the colonization of New Caledonia and New Guinea. Another aim is to find the sister group of *Trigonopterus* which still seems to be a challenging task.

It is easy to see that working on this genus will take several more decades and there will be many more exciting and unexpected future insights.

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It has been a great time at the ZSM and I hope more years will follow.

The (incomplete) ZSM soccer team. From the left: Vinicius Padula, Rene Tänzler, Andreas Dunz, Jerome Moriniere, Axel Hausmann, Emmanuel Toussaint and Ulf Buchsbaum.

11 Appendix

Gene	Location	Primer name	Direction	Primer sequence (5' -> 3')
	mitochondrial			
Cytochrome c oxidase 1; 5´end		LCO1490-JJ	FOR	CHACWAAYCATAAAGATATYGG
		HCO2198-JJ	REV	AWACTTCVGGRTGVCCAAARAATCA
Cytochrome c oxidase 1; 3´ end		Jerry	FOR	CAACATTTATTTTGATTTTTTGG
		Pat	REV	TCCAATGCACTAATCTGCCATATTA
16S		1472-JJ	FOR	AGATAGAAACCRACCTGG
		ar-JJ	REV	CRCCTGTTTATTAAAAACAT
18S	nuclear	18S 5'	FOR	GACAACCTGGTTGATCCTGCCAGT
		18S b5.0	REV	TAACCGCAACAACTTTAAT
CAD1		CD439F	FOR	TTCAGTGTACARTTYCAYCCHGARCAYAC
		CD688R	REV	TGTATACCTAGAGGATCDACRTTYTCCATRTTRCA
CAD2		CD667F	FOR	GGATGGAAGGAAGTDGARTAYGARGT
		CD851R	REV	GGATCGAAGCCATTHACATTYTCRTCHACCAT
CAD3		CD821F	FOR	AGCACGAAAATHGGNAGYTCNATGAARAG
		CD1098R2	REV	GCTATGTTGTTNGGNAGYTGDCCNCCCAT
Enolase		EN37F	FOR	GACTCTCGTGGNAAYCCNACNGTNGAGGT
		EN731R	REV	CTTGTAGAACTCNGANGCNGCNACRTCCAT
28S		28SJJ-a	FOR	ATGGATGGCGCTGAAGCGTCGT
		28SJJ-b	REV	CCGACGAACTCTCTTGCGAGG
Arginine kinase		AK183F	FOR	GATTCTGGAGTCGGNATYTAYGCNCCYGAYGC
		AK939R	REV	GCCNCCYTCRGCYTCRGTGTGYTC
Elongation factor 1α		efs372	FOR	CTGGTGAATTTGAAGCYGGTA
		efa754	REV	CCACCAATTTTGTAGACATC
Histone 4		H4F2s	FOR	TSCGIGAYAACATYCAGGGIATCAC
		H4F2er	REV	CKYTTIAGIGCRTAIACCACRTCCAT

Gene	PCR protocol	References
Cytochrome c oxidase 1; 5´end	D:94°C for 30 sec; A:47(52)°C for 40 sec; E:72°C for 60 sec	Astrin & Stüben, 2008
	5 cycles 47°C, 30 cycles 52°C	Astrin & Stüben, 2008
Cytochrome c oxidase 1; 3´ end	D:94°C for 30 sec; A:47(52)°C for 40 sec; E:72°C for 60 sec	Simon et al., 1994
	5 cycles 47°C, 30 cycles 52°C	Simon et al., 1994
16S	D:94°C for 30 sec; A:47(52)°C for 40 sec; E:72°C for 60 sec	Astrin & Stüben, 2008
	5 cycles 47°C, 30 cycles 52°C	Astrin & Stüben, 2008
18S	D:94°C for 30 sec; A:47(52)°C for 40 sec; E:72°C for 60 sec	Shull et al., 2001
	5 cycles 47°C, 30 cycles 52°C	Shull et al., 2001
CAD1	D:94°C for 30 sec; A:53°C for 30 sec; E:72°C for 60 sec	Wild & Maddison, 2008
	35 cycles	Wild & Maddison, 2008
CAD2	D:94°C for 30 sec; A:53°C for 30 sec; E:72°C for 60 sec	Wild & Maddison, 2008
	35 cycles	Wild & Maddison, 2008
CAD3	D:94°C for 30 sec; A:53°C for 30 sec; E:72°C for 60 sec	Wild & Maddison, 2008
	35 cycles	Wild & Maddison, 2008
Enolase	D:94°C for 30 sec; A:53°C for 30 sec; E:72°C for 60 sec	Wild & Maddison, 2008
	35 cycles	Wild & Maddison, 2008
28S	D:94°C for 30 sec; A:48°C for 30 sec; E:72°C for 60 sec	Astrin & Stüben, 2008
	35 cycles	Astrin & Stüben, 2008
Arginine kinase	D:94°C for 30 sec; A:53°C for 30 sec; E:72°C for 60 sec	Wild & Maddison, 2008
	35 cycles	Wild & Maddison, 2008
Elongation factor 1α	D:94°C for 30 sec; A:58-42°C for 30 sec; E:72°C for 60 sec	McKenna et al., 2005
	ΔT -2°C every 3 cycles (58-44°C); 18 cycles 42°C	Normark et al., 1999
Histone 4	D:94°C for 30 sec; A:49°C for 30 sec; E:72°C for 60 sec	Pineau et al., 2004
	35 cycles	Pineau et al., 2004

Table A1 Table of primers and PCR programs used. D= Denaturation, A= Annealing, E= Elongation.

Specimen	Genus	Species	Locality	Elevation	Specimen	Genus	Species	Locality	Elevation
ARC0183	*Trigonopterus*	*halimunensis*	Java	1550m	ARC0493	*Trigonopterus*	sp. 13	West Papua	600-900m
ARC0219	*Trigonopterus*	sp. 92	West Papua	200m	ARC0494	*Trigonopterus*	sp. 28	West Papua	600-900m
ARC0220	*Trigonopterus*	*uniformis*	West Papua	200m	ARC0495	*Trigonopterus*	*pseudonasutus*	West Papua	600-900m
ARC0221	*Trigonopterus*	*uniformis*	West Papua	200m	ARC0496	*Trigonopterus*	*armatus*	West Papua	600-900m
ARC0222	*Trigonopterus*	sp.	West Papua	200m	ARC0497	*Trigonopterus*	*nasutus*	West Papua	600-900m
ARC0245	*Trigonopterus*	sp. 167	West Papua	1900m	ARC0498	*Trigonopterus*	*armatus*	West Papua	600-900m
ARC0246	*Trigonopterus*	sp. 82	West Papua	1900m	ARC0499	*Trigonopterus*	*nasutus*	West Papua	300-400m
ARC0247	*Trigonopterus*	sp. 246	West Papua	1900m	ARC0500	*Trigonopterus*	*politoides*	West Papua	545-700m
ARC0248	*Trigonopterus*	sp. 177	West Papua	1900m	ARC0501	*Trigonopterus*	*politoides*	West Papua	545-700m
ARC0251	*Trigonopterus*	*gedensis*	Java	2006m	ARC0502	*Trigonopterus*	*nasutus*	West Papua	545-700m
ARC0254	*Trigonopterus*	*vulcanicus*	Java	1584 m	ARC0503	*Trigonopterus*	*politoides*	West Papua	700-900m
ARC0301	*Trigonopterus*	*relictus*	Java	1575m	ARC0504	*Trigonopterus*	sp. 26	West Papua	700-900m
ARC0317	*Mecopus*	*bispinosus*	Lampung		ARC0505	*Trigonopterus*	sp. 19	West Papua	900-1100m
ARC0326	*Trigonopterus*	sp. 427	Sulawesi		ARC0506	*Trigonopterus*	sp. 19	West Papua	860-1150m
ARC0330	*Trigonopterus*	sp. 418	Sulawesi		ARC0508	*Trigonopterus*	*sulcatus*	West Papua	710m
ARC0341	*Trigonopterus*	sp. 393	Sulawesi	1480m	ARC0509	*Trigonopterus*	*sulcatus*	West Papua	710m
ARC0349	*Trigonopterus*	sp. 400	Sulawesi	750m	ARC0510	*Trigonopterus*	*lineatus*	West Papua	710m
ARC0351	*Trigonopterus*	*nangiorum*	Papua New Guinea	1670m	ARC0511	*Trigonopterus*	*simulans*	West Papua	710m
ARC0352	*Trigonopterus*	*nangiorum*	Papua New Guinea	1670m	ARC0512	*Trigonopterus*	*dromedarius*	West Papua	710m
ARC0353	*Trigonopterus*	sp. (unique female)	Papua New Guinea	1670m	ARC0513	*Trigonopterus*	*simulans*	West Papua	710m
ARC0354	*Trigonopterus*	*ragaorum*	Papua New Guinea	1670m	ARC0514	*Trigonopterus*	*subglabratus*	West Papua	710m
ARC0355	*Trigonopterus*	sp. 167	West Papua	1900m	ARC0515	*Trigonopterus*	sp. 46	West Papua	710m
ARC0356	*Trigonopterus*	sp. 167	West Papua	1900m	ARC0516	*Trigonopterus*	*zygops*	West Papua	710m
ARC0357	*Trigonopterus*	sp. 167	West Papua	1900m	ARC0517	*Trigonopterus*	*zygops*	West Papua	710m
ARC0358	*Trigonopterus*	sp. 82	West Papua	1900m	ARC0518	*Trigonopterus*	*simulans*	West Papua	785m
ARC0383	*Trigonopterus*	sp. 101	West Papua	1890m	ARC0519	*Trigonopterus*	*lineatus*	West Papua	785m
ARC0384	*Trigonopterus*	sp. 101	West Papua	1890m	ARC0520	*Trigonopterus*	*lineatus*	West Papua	785m
ARC0385	*Trigonopterus*	sp. 170	West Papua	1890m	ARC0521	*Trigonopterus*	sp. 34	West Papua	785m
ARC0386	*Trigonopterus*	*pulchellus*	West Papua	1400-1800m,	ARC0522	*Trigonopterus*	sp. 46	West Papua	785m
ARC0387	*Trigonopterus*	sp. 245	West Papua	1400-1800m,	ARC0523	*Trigonopterus*	*basalis*	West Papua	785m
ARC0388	*Trigonopterus*	sp. 245	West Papua	1400-1800m,	ARC0524	*Trigonopterus*	*basalis*	West Papua	785m
ARC0389	*Trigonopterus*	sp. 101	West Papua	1440m	ARC0525	*Trigonopterus*	sp. 36	West Papua	785m
ARC0390	*Trigonopterus*	sp. 101	West Papua	1440m	ARC0526	*Trigonopterus*	sp. 36	West Papua	785m
ARC0391	*Trigonopterus*	*nasutus*	West Papua	200m	ARC0527	*Trigonopterus*	*parumsquamosus*	West Papua	785m
ARC0418	*Trigonopterus*	sp. 1	West Papua	900-1150m	ARC0528	*Trigonopterus*	*parumsquamosus*	West Papua	785m
ARC0419	*Trigonopterus*	*punctulatus*	West Papua	900-1150m	ARC0529	*Trigonopterus*	*parumsquamosus*	West Papua	785m
ARC0420	*Trigonopterus*	*monticola*	West Papua	900-1150m	ARC0530	*Trigonopterus*	*aeneipennis*	West Papua	785m
ARC0421	*Trigonopterus*	sp. 9	West Papua	900-1150m	ARC0531	*Trigonopterus*	*aeneipennis*	West Papua	785m
ARC0422	*Trigonopterus*	*lineellus*	West Papua	1200-1420m	ARC0532	*Trigonopterus*	*basalis*	West Papua	365m
ARC0423	*Trigonopterus*	*cyclopensis*	West Papua	1200-1420m	ARC0533	*Trigonopterus*	*zygops*	West Papua	365m
ARC0424	*Trigonopterus*	*punctulatus*	West Papua	1200-1420m	ARC0534	*Trigonopterus*	*dromedarius*	West Papua	1150m
ARC0425	*Trigonopterus*	*eremitus*	West Papua	1420-1520 m	ARC0535	*Trigonopterus*	*scharfi*	West Papua	1150m
ARC0426	*Trigonopterus*	*eremitus*	West Papua	1420-1520 m	ARC0536	*Trigonopterus*	*scharfi*	West Papua	1065m
ARC0427	*Trigonopterus*	*eremitus*	West Papua	1420-1520 m	ARC0537	*Trigonopterus*	*scharfi*	West Papua	1065m
ARC0428	*Trigonopterus*	*tibialis*	West Papua	1420-1520 m	ARC0538	*Trigonopterus*	*dentirostris*	West Papua	1065m
ARC0429	*Trigonopterus*	*tibialis*	West Papua	1420-1520 m	ARC0539	*Trigonopterus*	*plicicollis*	West Papua	1065m
ARC0430	*Trigonopterus*	*tibialis*	West Papua	1420-1520 m	ARC0540	*Trigonopterus*	*plicicollis*	West Papua	1065m
ARC0431	*Trigonopterus*	*monticola*	West Papua	1420-1520 m	ARC0541	*Trigonopterus*	*taenzleri*	West Papua	1065m
ARC0432	*Trigonopterus*	sp. 30	West Papua	1420-1520 m	ARC0542	*Trigonopterus*	*simulans*	West Papua	960m
ARC0433	*Trigonopterus*	*viridescens*	West Papua	1420-1520 m	ARC0543	*Trigonopterus*	*plicicollis*	West Papua	960m
ARC0434	*Trigonopterus*	*viridescens*	West Papua	1420-1520 m	ARC0544	*Trigonopterus*	*dentirostris*	West Papua	960m
ARC0435	*Trigonopterus*	*viridescens*	West Papua	1420-1520 m	ARC0545	*Trigonopterus*	*dentirostris*	West Papua	945m
ARC0436	*Trigonopterus*	sp. 9	West Papua	545-700m	ARC0546	*Trigonopterus*	*strombosceroides*	West Papua	945m
ARC0437	*Trigonopterus*	sp. 10	West Papua	545-700m	ARC0547	*Trigonopterus*	*strombosceroides*	West Papua	945m
ARC0438	*Trigonopterus*	sp. 10	West Papua	545-700m	ARC0548	*Trigonopterus*	*strombosceroides*	West Papua	945m
ARC0439	*Trigonopterus*	sp. 13	West Papua	545-700m	ARC0549	*Trigonopterus*	*dromedarius*	West Papua	945m
ARC0440	*Trigonopterus*	sp. 13	West Papua	545-700m	ARC0550	*Trigonopterus*	*aeneipennis*	West Papua	945m
ARC0441	*Trigonopterus*	*granum*	West Papua	545-700m	ARC0551	*Trigonopterus*	*taenzleri*	West Papua	1095m
ARC0442	*Trigonopterus*	*granum*	West Papua	545-700m	ARC0552	*Trigonopterus*	*taenzleri*	West Papua	1095m
ARC0443	*Trigonopterus*	*granum*	West Papua	545-700m	ARC0553	*Trigonopterus*	*signicollis*	West Papua	1275m
ARC0444	*Trigonopterus*	*augur*	West Papua	1010m	ARC0554	*Trigonopterus*	*rhinoceros*	West Papua	1510m
ARC0445	*Trigonopterus*	*augur*	West Papua	1010m	ARC0555	*Trigonopterus*	*rhinoceros*	West Papua	1510m
ARC0446	*Trigonopterus*	sp. 19	West Papua	1200-1420m	ARC0556	*Trigonopterus*	*amplipennis*	West Papua	1510m
ARC0447	*Trigonopterus*	sp. 20	West Papua	1200-1420m	ARC0557	*Trigonopterus*	*amplipennis*	West Papua	1510m
ARC0448	*Trigonopterus*	sp. 28	West Papua	465m	ARC0558	*Trigonopterus*	*amplipennis*	West Papua	1510m
ARC0449	*Trigonopterus*	sp. 1	West Papua	850-1000m	ARC0559	*Trigonopterus*	*amplipennis*	West Papua	1510m
ARC0450	*Trigonopterus*	*monticola*	West Papua	850-1000m	ARC0560	*Trigonopterus*	*signicollis*	West Papua	1265m
ARC0451	*Trigonopterus*	sp. 23	West Papua	850-1000m	ARC0561	*Trigonopterus*	*signicollis*	West Papua	1265m
ARC0452	*Trigonopterus*	sp. 23	West Papua	850-1000m	ARC0562	*Trigonopterus*	*rhinoceros*	West Papua	1510m
ARC0453	*Trigonopterus*	sp. 23	West Papua	850-1000m	ARC0563	*Trigonopterus*	sp. 36	West Papua	785m
ARC0454	*Trigonopterus*	*monticola*	West Papua	850-1000m	ARC0564	*Trigonopterus*	*aeneipennis*	West Papua	785m
ARC0455	*Trigonopterus*	*angustus*	West Papua	1200-1420m	ARC0568	*Trigonopterus*	sp. 26	West Papua	545-700m
ARC0456	*Trigonopterus*	*angustus*	West Papua	1200-1420m	ARC0569	*Trigonopterus*	sp. 10	West Papua	600-900m
ARC0457	*Trigonopterus*	*pseudonasutus*	West Papua	545-700m	ARC0570	*Trigonopterus*	*armatus*	West Papua	700-900m
ARC0458	*Trigonopterus*	*nasutus*	West Papua	545-700m	ARC0576	*Trigonopterus*	*baliensis*	Bali	1405m
ARC0459	*Trigonopterus*	*vandekampi*	West Papua	545-700m	ARC0584	*Trigonopterus*	*pararugosus*	Bali	1310m
ARC0460	*Trigonopterus*	*vandekampi*	West Papua	545-700m	ARC0586	*Trigonopterus*	*rugosus*	Bali	1690m
ARC0461	*Trigonopterus*	*vandekampi*	West Papua	545-700m	ARC0589	*Trigonopterus*	*kintamanensis*	Bali	1440m
ARC0462	*Trigonopterus*	*vandekampi*	West Papua	600-900m	ARC0595	*Trigonopterus*	*klatakanensis*	Bali	545m
ARC0463	*Trigonopterus*	sp. 1	West Papua	600-900m	ARC0600	*Cryptops*	sp.	West Papua	1420-1520m
ARC0464	*Trigonopterus*	*armatus*	West Papua	600-900m	ARC0602	*Telaugia*	sp.	West Papua	1420-1520m
ARC0465	*Trigonopterus*	*lineellus*	West Papua	600-900m	ARC0603	*Trigonopterus*	*striatus*	West Papua	220m
ARC0466	*Trigonopterus*	*lineellus*	West Papua	600-900m	ARC0604	*Trigonopterus*	*striatus*	West Papua	220m
ARC0469	*Trigonopterus*	sp. 19	West Papua	900-1100m	ARC0605	*Trigonopterus*	*striatus*	West Papua	220m
ARC0470	*Trigonopterus*	sp. 30	West Papua	1420-1520m	ARC0606	*Trigonopterus*	*tridentatus*	West Papua	220m
ARC0471	*Trigonopterus*	sp. 30	West Papua	1420-1520m	ARC0607	*Trigonopterus*	*tridentatus*	West Papua	220m
ARC0472	*Trigonopterus*	sp. 30	West Papua	1420-1520m	ARC0608	*Trigonopterus*	sp. 66	West Papua	1520m
ARC0473	*Trigonopterus*	sp. 30	West Papua	1420-1520m	ARC0609	*Trigonopterus*	sp. 66	West Papua	1520m
ARC0475	*Trigonopterus*	*ferrugineus*	West Papua	1420-1520m	ARC0615	*Trigonopterus*	*zygops*	West Papua	365m
ARC0476	*Trigonopterus*	*ferrugineus*	West Papua	1420-1520m	ARC0617	*Trigonopterus*	*zygops*	West Papua	365m
ARC0477	*Trigonopterus*	*ferrugineus*	West Papua	1420-1520m	ARC0618	*Trigonopterus*	*zygops*	West Papua	1065m
ARC0478	*Trigonopterus*	*cyclopensis*	West Papua	1420-1520m	ARC0619	*Trigonopterus*	*zygops*	West Papua	1065m
ARC0479	*Trigonopterus*	*angustus*	West Papua	1200-1420m	ARC0620	*Trigonopterus*	*zygops*	West Papua	1065m
ARC0480	*Trigonopterus*	sp. 28	West Papua	1200-1420m	ARC0621	*Trigonopterus*	*lineellus*	West Papua	600-900m
ARC0481	*Trigonopterus*	sp. 17	West Papua	1200-1420m	ARC0622	*Trigonopterus*	*lineellus*	West Papua	600-900m
ARC0482	*Trigonopterus*	*punctulatus*	West Papua	1200-1420m	ARC0623	*Trigonopterus*	*lineellus*	West Papua	900-1100m
ARC0483	*Trigonopterus*	*cyclopensis*	West Papua	1200-1420m	ARC0624	*Trigonopterus*	*lineellus*	West Papua	1000-1200m
ARC0484	*Trigonopterus*	*monticola*	West Papua	1200-1420m	ARC0625	*Trigonopterus*	*lineellus*	West Papua	1000-1200m
ARC0485	*Trigonopterus*	sp. 4	West Papua	1200-1420m	ARC0626	*Trigonopterus*	*angustus*	West Papua	350-620 m
ARC0486	*Trigonopterus*	sp. 4	West Papua	1200-1420m	ARC0627	*Trigonopterus*	*angustus*	West Papua	350-620 m
ARC0487	*Trigonopterus*	*monticola*	West Papua	1200-1420m	ARC0630	*Trigonopterus*	*angustus*	West Papua	350-620 m
ARC0488	*Trigonopterus*	*agilis*	West Papua	850-1000m	ARC0631	*Trigonopterus*	*angustus*	West Papua	1200-1420 m
ARC0489	*Trigonopterus*	*agilis*	West Papua	850-1000m	ARC0632	*Trigonopterus*	*sulcatus*	West Papua	575 m
ARC0490	*Trigonopterus*	*agilis*	West Papua	850-1000m	ARC0633	*Trigonopterus*	*subglabratus*	West Papua	575 m
ARC0491	*Trigonopterus*	sp. 27	West Papua	850-1000m	ARC0634	*Trigonopterus*	*subglabratus*	West Papua	575 m
ARC0492	*Trigonopterus*	*pseudonasutus*	West Papua	850-1000m	ARC0635	*Trigonopterus*	sp. 46	West Papua	710 m

Specimen	Genus	Species	Locality	Elevation
ARC0638	*Trigonopterus*	*subglabratus*	West Papua	365 m
ARC0643	*Trigonopterus*	*zygops*	West Papua	575 m
ARC0644	*Trigonopterus*	*zygops*	West Papua	575 m
ARC0645	*Trigonopterus*	sp. 23	West Papua	575 m
ARC0646	*Trigonopterus*	*vandekampi*	West Papua	515 m
ARC0647	*Trigonopterus*	*vandekampi*	West Papua	515 m
ARC0648	*Trigonopterus*	*zygops*	West Papua	515 m
ARC0650	*Trigonopterus*	sp. 10	West Papua	600-620m
ARC0651	*Trigonopterus*	sp. 10	West Papua	600-620m
ARC0652	*Trigonopterus*	sp. 23	West Papua	350-620m
ARC0653	*Trigonopterus*	*granum*	West Papua	350-620m
ARC0654	*Trigonopterus*	*parumsquamosus*	West Papua	1065m
ARC0655	*Trigonopterus*	*parumsquamosus*	West Papua	1065m
ARC0656	*Trigonopterus*	*lineatus*	West Papua	960m
ARC0657	*Trigonopterus*	*parumsquamosus*	West Papua	945m
ARC0658	*Trigonopterus*	*augur*	West Papua	800-860 m
ARC0659	*Trigonopterus*	*nasutus*	West Papua	800-860 m
ARC0660	*Trigonopterus*	*vandekampi*	West Papua	800-860 m
ARC0661	*Trigonopterus*	*vandekampi*	West Papua	800-860 m
ARC0662	*Trigonopterus*	sp. 10	West Papua	800-860 m
ARC0663	*Trigonopterus*	sp. 27	West Papua	800-860 m
ARC0664	*Trigonopterus*	*punctulatus*	West Papua	630-800 m
ARC0665	*Trigonopterus*	sp. 9	West Papua	860-1150 m
ARC0666	*Trigonopterus*	*augur*	West Papua	900-1100 m
ARC0667	*Trigonopterus*	*augur*	West Papua	900-1100 m
ARC0668	*Trigonopterus*	*zygops*	West Papua	1095 m
ARC0669	*Trigonopterus*	sp. 1	West Papua	1000-1200 m
ARC0670	*Trigonopterus*	sp. 1	West Papua	1000-1200 m
ARC0673	*Trigonopterus*	*augur*	West Papua	1200-1420 m
ARC0674	*Trigonopterus*	*cyclopensis*	West Papua	1200-1420 m
ARC0675	*Trigonopterus*	*cyclopensis*	West Papua	1200-1420 m
ARC0676	*Trigonopterus*	sp. 4	West Papua	1200-1420 m
ARC0677	*Trigonopterus*	*taenzleri*	West Papua	1420 m
ARC0678	*Trigonopterus*	*scharfi*	West Papua	1420 m
ARC0679	*Trigonopterus*	*scharfi*	West Papua	1420 m
ARC0680	*Trigonopterus*	*punctulatus*	West Papua	1420-1520 m
ARC0681	*Trigonopterus*	*punctulatus*	West Papua	1420-1520 m
ARC0682	*Trigonopterus*	*signicollis*	West Papua	1510 m
ARC0683	*Trigonopterus*	*signicollis*	West Papua	1510 m
ARC0684	*Trigonopterus*	*scharfi*	West Papua	1510 m
ARC0685	*Trigonopterus*	*scharfi*	West Papua	1510 m
ARC0686	*Trigonopterus*	*monticola*	West Papua	1510 m
ARC0687	*Trigonopterus*	*zygops*	West Papua	710 m
ARC0688	*Trigonopterus*	*zygops*	West Papua	710 m
ARC0689	*Semiathe*	sp.	West Papua	545-700 m
ARC0690	*Trigonopterus*	*pseudonasutus*	West Papua	545-700 m
ARC0691	*Trigonopterus*	*pseudonasutus*	West Papua	545-700 m
ARC0692	*Trigonopterus*	sp. 23	West Papua	545-700 m
ARC0693	*Trigonopterus*	sp. 23	West Papua	545-700 m
ARC0694	*Trigonopterus*	sp. 31	West Papua	545-700 m
ARC0695	*Trigonopterus*	sp. 31	West Papua	545-700 m
ARC0696	*Trigonopterus*	*punctulatus*	West Papua	545-700 m
ARC0697	*Trigonopterus*	sp. 26	West Papua	700-900 m
ARC0698	*Trigonopterus*	*nasutus*	West Papua	300-400 m
ARC0699	*Trigonopterus*	*nasutus*	West Papua	300-400 m
ARC0700	*Trigonopterus*	*pseudonasutus*	West Papua	300-400 m
ARC0701	*Trigonopterus*	*pseudonasutus*	West Papua	300-400 m
ARC0702	*Trigonopterus*	sp. 23	West Papua	300-400 m
ARC0703	*Trigonopterus*	sp. 23	West Papua	300-400 m
ARC0704	*Trigonopterus*	*vandekampi*	West Papua	300-400 m
ARC0705	*Trigonopterus*	*vandekampi*	West Papua	300-400 m
ARC0706	*Trigonopterus*	sp. 26	West Papua	300-400 m
ARC0714	*Trigonopterus*	*sebelas*	Borneo	30 m
ARC0722	*Trigonopterus*	sp. 309	Borneo	80 m
ARC0733	*Trigonopterus*	*kurulu*	West Papua	1875 m
ARC0734	*Trigonopterus*	*kurulu*	West Papua	1875 m
ARC0735	*Trigonopterus*	*kurulu*	West Papua	1875 m
ARC0736	*Trigonopterus*	*sordidus*	West Papua	1875 m
ARC0737	*Trigonopterus*	*edaphus*	West Papua	1875 m
ARC0738	*Trigonopterus*	*edaphus*	West Papua	1875 m
ARC0739	*Trigonopterus*	*edaphus*	West Papua	1875 m
ARC0740	*Trigonopterus*	*edaphus*	West Papua	1875 m
ARC0741	*Trigonopterus*	*edaphus*	West Papua	1875 m
ARC0742	*Trigonopterus*	*edaphus*	West Papua	1875 m
ARC0743	*Trigonopterus*	*verrucosus*	West Papua	1875 m
ARC0744	*Trigonopterus*	*wamenaensis*	West Papua	1875 m
ARC0745	*Trigonopterus*	sp. 183	West Papua	1875 m
ARC0746	*Trigonopterus*	sp. 183	West Papua	1875 m
ARC0747	*Trigonopterus*	sp. 183	West Papua	1875 m
ARC0748	*Trigonopterus*	sp. 182	West Papua	1875 m
ARC0749	*Trigonopterus*	sp. 182	West Papua	1875 m
ARC0750	*Trigonopterus*	sp. 182	West Papua	1875 m
ARC0751	*Trigonopterus*	sp. 93	West Papua	1920-1950 m
ARC0752	*Trigonopterus*	*balimensis*	West Papua	1920-1950 m
ARC0753	*Trigonopterus*	*balimensis*	West Papua	1920-1950 m
ARC0754	*Trigonopterus*	*balimensis*	West Papua	1920-1950 m
ARC0755	*Trigonopterus*	*mimicus*	West Papua	2245-2290 m
ARC0756	*Trigonopterus*	*crassicornis*	West Papua	2245-2290 m
ARC0757	*Trigonopterus*	*crassicornis*	West Papua	2245-2290 m
ARC0758	*Trigonopterus*	*crassicornis*	West Papua	2245-2290 m
ARC0759	*Trigonopterus*	*scabrosus*	West Papua	220 m
ARC0760	*Trigonopterus*	*scabrosus*	West Papua	220 m
ARC0761	*Trigonopterus*	*scabrosus*	West Papua	220 m
ARC0762	*Trigonopterus*	*ixodiformis*	West Papua	220 m
ARC0763	*Trigonopterus*	*ixodiformis*	West Papua	220 m
ARC0764	*Trigonopterus*	*ixodiformis*	West Papua	220 m
ARC0765	*Trigonopterus*	*tridentatus*	West Papua	220 m
ARC0766	*Trigonopterus*	*costatus*	West Papua	220 m
ARC0767	*Trigonopterus*	*costatus*	West Papua	220 m
ARC0768	*Trigonopterus*	*costatus*	West Papua	220 m
ARC0769	*Trigonopterus*	*uniformis*	West Papua	220 m
ARC0770	*Trigonopterus*	*uniformis*	West Papua	220 m
ARC0771	*Trigonopterus*	*uniformis*	West Papua	220 m
ARC0772	*Trigonopterus*	*ixodiformis*	West Papua	685 m
ARC0773	*Trigonopterus*	sp. 116	West Papua	685 m
ARC0774	*Trigonopterus*	*pseudogranum*	West Papua	685 m
ARC0775	*Trigonopterus*	*euops*	West Papua	1385 m
ARC0776	*Trigonopterus*	*euops*	West Papua	1385 m
ARC0777	*Trigonopterus*	*myops*	West Papua	1385 m
ARC0778	*Trigonopterus*	*myops*	West Papua	1385 m
ARC0779	*Trigonopterus*	sp. 197	West Papua	1385 m
ARC0780	*Trigonopterus*	*irregularis*	West Papua	1385 m
ARC0781	*Trigonopterus*	*echinus*	West Papua	1520 m
ARC0782	*Trigonopterus*	*echinus*	West Papua	1520 m
ARC0783	*Trigonopterus*	*echinus*	West Papua	1520 m
ARC0784	*Trigonopterus*	*euops*	West Papua	1520 m
ARC0785	*Trigonopterus*	sp. 66	West Papua	1520 m
ARC0786	*Trigonopterus*	*nothofagorum*	West Papua	1520 m
ARC0787	*Trigonopterus*	*nothofagorum*	West Papua	1520 m
ARC0788	*Trigonopterus*	*nothofagorum*	West Papua	1520 m
ARC0789	*Trigonopterus*	*nothofagorum*	West Papua	1520 m
ARC0790	*Trigonopterus*	sp. 73	West Papua	1520 m
ARC0791	*Trigonopterus*	sp. 73	West Papua	1520 m
ARC0792	*Trigonopterus*	sp. 73	West Papua	1520 m
ARC0793	*Trigonopterus*	sp. 197	West Papua	1520 m
ARC0794	*Trigonopterus*	sp. 167	West Papua	1520 m
ARC0795	*Trigonopterus*	sp. 167	West Papua	1520 m
ARC0796	*Trigonopterus*	sp. 170	West Papua	1520 m
ARC0797	*Trigonopterus*	sp. 101	West Papua	1520 m
ARC0798	*Trigonopterus*	sp. 101	West Papua	1520 m
ARC0799	*Trigonopterus*	*myops*	West Papua	1535 m
ARC0800	*Trigonopterus*	sp. 90	West Papua	1530 m
ARC0801	*Trigonopterus*	sp. ARC801	West Papua	1530 m
ARC0802	*Trigonopterus*	sp. ARC801	West Papua	1530 m
ARC0803	*Trigonopterus*	sp. 191	West Papua	1530 m
ARC0804	*Trigonopterus*	*irregularis*	West Papua	1530 m
ARC0805	*Trigonopterus*	sp. 255	West Papua	1530 m
ARC0806	*Trigonopterus*	sp. 116	West Papua	1500 m
ARC0807	*Trigonopterus*	sp. 82	West Papua	1490-1555 m
ARC0808	*Trigonopterus*	sp. 82	West Papua	1490-1555 m
ARC0809	*Trigonopterus*	sp. 82	West Papua	1490-1555 m
ARC0810	*Trigonopterus*	sp. 246	West Papua	1490-1555 m
ARC0811	*Trigonopterus*	sp. 246	West Papua	1490-1555 m
ARC0812	*Trigonopterus*	sp. 246	West Papua	1490-1555 m
ARC0813	*Trigonopterus*	sp. 245	West Papua	1490-1555 m
ARC0814	*Trigonopterus*	sp. 245	West Papua	1490-1555 m
ARC0815	*Trigonopterus*	sp. 245	West Papua	1490-1555 m
ARC0816	*Trigonopterus*	sp. 90	West Papua	1490-1555 m
ARC0817	*Trigonopterus*	sp. 90	West Papua	1490-1555 m
ARC0818	*Trigonopterus*	sp. 90	West Papua	1490-1555 m
ARC0819	*Trigonopterus*	sp. 255	West Papua	1490-1555 m
ARC0820	*Trigonopterus*	sp. 255	West Papua	1490-1555 m
ARC0821	*Trigonopterus*	sp. 255	West Papua	1490-1555 m
ARC0822	*Trigonopterus*	sp. 116	West Papua	1490-1555 m
ARC0823	*Trigonopterus*	sp. 167	West Papua	1490-1555 m
ARC0824	*Trigonopterus*	sp. 167	West Papua	1490-1555 m
ARC0825	*Trigonopterus*	sp. 108	West Papua	1490-1555 m
ARC0826	*Trigonopterus*	sp. 115	West Papua	1490-1555 m
ARC0827	*Trigonopterus*	sp. 115	West Papua	1490-1555 m
ARC0828	*Trigonopterus*	sp. 115	West Papua	1490-1555 m
ARC0829	*Trigonopterus*	sp. 126	West Papua	1490-1555 m
ARC0830	*Trigonopterus*	sp. 126	West Papua	1490-1555 m
ARC0831	*Trigonopterus*	sp. ARC801	West Papua	1870 m
ARC0833	*Trigonopterus*	*parvulus*	West Papua	1870 m
ARC0834	*Trigonopterus*	*parvulus*	West Papua	1870 m
ARC0835	*Trigonopterus*	*scissops*	West Papua	1870 m
ARC0836	*Trigonopterus*	*scissops*	West Papua	1870 m
ARC0837	*Trigonopterus*	*scissops*	West Papua	1870 m
ARC0838	*Trigonopterus*	sp. 191	West Papua	1870 m
ARC0839	*Trigonopterus*	sp. 191	West Papua	1870 m
ARC0840	*Trigonopterus*	sp. 163	West Papua	1870 m
ARC0841	*Trigonopterus*	sp. 210	West Papua	1870 m
ARC0842	*Trigonopterus*	sp. 177	West Papua	1795-1820 m
ARC0843	*Trigonopterus*	sp. 177	West Papua	1795-1820 m
ARC0844	*Trigonopterus*	sp. 167	West Papua	1580-1750 m
ARC0845	*Trigonopterus*	sp. 167	West Papua	1580-1750 m
ARC0846	*Trigonopterus*	sp. 108	West Papua	1580-1750 m
ARC0847	*Trigonopterus*	sp. 108	West Papua	1580-1750 m
ARC0848	*Trigonopterus*	sp. 83	West Papua	1580-1750 m
ARC0849	*Trigonopterus*	sp. 246	West Papua	1580-1750 m
ARC0850	*Trigonopterus*	sp. 246	West Papua	1580-1750 m
ARC0851	*Trigonopterus*	*irregularis*	West Papua	1580-1750 m
ARC0852	*Trigonopterus*	sp. 246	West Papua	1750-1900 m
ARC0853	*Trigonopterus*	sp. 246	West Papua	1750-1900 m
ARC0854	*Trigonopterus*	sp. 279	West Papua	1900-1920 m
ARC0855	*Trigonopterus*	sp. 93 ??	West Papua	1900-1920 m
ARC0856	*Trigonopterus*	sp. 227	West Papua	165 m
ARC0857	*Trigonopterus*	sp. 227	West Papua	165 m
ARC0858	*Trigonopterus*	sp. 63	West Papua	165 m
ARC0859	*Trigonopterus*	sp. 63	West Papua	165 m
ARC0860	*Trigonopterus*	sp. 221	West Papua	165 m
ARC0861	*Trigonopterus*	sp. 221	West Papua	165 m
ARC0862	*Trigonopterus*	sp. 221	West Papua	165 m
ARC0863	*Trigonopterus*	sp. 223	West Papua	165 m
ARC0864	*Trigonopterus*	sp. 223	West Papua	165 m
ARC0865	*Trigonopterus*	sp. 223	West Papua	165 m
ARC0866	*Trigonopterus*	sp. 201	West Papua	165 m
ARC0867	*Trigonopterus*	sp. 201	West Papua	165 m
ARC0868	*Trigonopterus*	sp. 193	West Papua	165 m
ARC0869	*Trigonopterus*	sp. 192	West Papua	165 m
ARC0870	*Trigonopterus*	sp. 189	West Papua	165 m
ARC0871	*Trigonopterus*	sp. 188	West Papua	165 m
ARC0872	*Trigonopterus*	sp. 188	West Papua	165 m
ARC0873	*Trigonopterus*	sp. 250	West Papua	165 m
ARC0874	*Trigonopterus*	sp. 198	West Papua	165 m
ARC0875	*Trigonopterus*	sp. 198	West Papua	165 m
ARC0876	*Trigonopterus*	sp. 198	West Papua	165 m
ARC0877	*Trigonopterus*	sp. 184	West Papua	165 m
ARC0878	*Trigonopterus*	sp. 184	West Papua	165 m
ARC0879	*Trigonopterus*	sp. 180	West Papua	165 m
ARC0880	*Trigonopterus*	sp. 180	West Papua	165 m
ARC0881	*Trigonopterus*	sp. 180	West Papua	165 m

Specimen	Genus	Species	Locality	Elevation
ARC0882	*Trigonopterus*	sp. 227	West Papua	180 m
ARC0883	*Trigonopterus*	*inflatus*	West Papua	180 m
ARC0914	*Trigonopterus*	sp.	West Papua	545-700 m
ARC0933	*Trigonopterus*	sp. 61	Papua New Guinea	700-800m
ARC0934	*Trigonopterus*	sp. 61	Papua New Guinea	700-800m
ARC0935	*Trigonopterus*	sp. 141	Papua New Guinea	700-800m
ARC0936	*Trigonopterus*	sp. 133	Papua New Guinea	700-800m
ARC0937	*Trigonopterus*	sp. (unique female)	Papua New Guinea	700-800m
ARC0938	*Trigonopterus*	sp. 263	Papua New Guinea	700-800m
ARC0939	*Trigonopterus*	sp. 263	Papua New Guinea	700-800m
ARC0940	*Trigonopterus*	sp. 264	Papua New Guinea	700-800m
ARC0941	*Trigonopterus*	sp. 264	Papua New Guinea	700-800m
ARC0942	*Trigonopterus*	*glaber*	Papua New Guinea	700-800m
ARC0943	*Trigonopterus*	*glaber*	Papua New Guinea	700-800m
ARC0944	*Trigonopterus*	sp. 152	Papua New Guinea	700-800m
ARC0945	*Trigonopterus*	sp. 152	Papua New Guinea	700-800m
ARC0946	*Trigonopterus*	sp. 104	Papua New Guinea	700-800m
ARC0947	*Trigonopterus*	sp. 106	Papua New Guinea	700-800m
ARC0948	*Trigonopterus*	sp. 185	Papua New Guinea	700-800m
ARC0949	*Trigonopterus*	sp. 114	Papua New Guinea	700-800m
ARC0950	*Trigonopterus*	sp. 114	Papua New Guinea	700-800m
ARC0951	*Trigonopterus*	sp. 133	Papua New Guinea	500-600m
ARC0952	*Trigonopterus*	sp. 144	Papua New Guinea	500-600m
ARC0953	*Trigonopterus*	sp. 144	Papua New Guinea	500-600m
ARC0954	*Trigonopterus*	sp. 263	Papua New Guinea	500-600m
ARC0955	*Trigonopterus*	sp. 263	Papua New Guinea	500-600m
ARC0956	*Trigonopterus*	sp. 261	Papua New Guinea	500-600m
ARC0957	*Trigonopterus*	sp. 261	Papua New Guinea	500-600m
ARC0958	*Trigonopterus*	sp. 238	Papua New Guinea	500-600m
ARC0959	*Trigonopterus*	sp. 135	Papua New Guinea	500-600m
ARC0960	*Trigonopterus*	*glaber*	Papua New Guinea	500-600m
ARC0961	*Trigonopterus*	*glaber*	Papua New Guinea	500-600m
ARC0962	*Trigonopterus*	*velaris*	Papua New Guinea	500-600m
ARC0963	*Trigonopterus*	*velaris*	Papua New Guinea	500-600m
ARC0964	*Trigonopterus*	sp. 152	Papua New Guinea	500-600m
ARC0965	*Trigonopterus*	sp. 152	Papua New Guinea	500-600m
ARC0966	*Trigonopterus*	sp. 151	Papua New Guinea	500-600m
ARC0967	*Trigonopterus*	sp. 150	Papua New Guinea	500-600m
ARC0968	*Trigonopterus*	sp. 150	Papua New Guinea	500-600m
ARC0969	*Trigonopterus*	sp. 150	Papua New Guinea	500-600m
ARC0970	*Trigonopterus*	sp. 151	Papua New Guinea	500-600m
ARC0971	*Trigonopterus*	sp. 151	Papua New Guinea	500-600m
ARC0972	*Trigonopterus*	sp. 151	Papua New Guinea	500-600m
ARC0973	*Trigonopterus*	sp. 106	Papua New Guinea	500-600m
ARC0974	*Trigonopterus*	sp. 106	Papua New Guinea	500-600m
ARC0975	*Trigonopterus*	sp. 229	Papua New Guinea	500-600m
ARC0976	*Trigonopterus*	sp. 229	Papua New Guinea	500-600m
ARC0977	*Trigonopterus*	sp. 238	Papua New Guinea	500-600m
ARC0978	*Trigonopterus*	sp. 114	Papua New Guinea	500-600m
ARC0979	*Trigonopterus*	sp. 114	Papua New Guinea	500-600m
ARC0980	*Trigonopterus*	sp. 133	Papua New Guinea	500-565m
ARC0981	*Trigonopterus*	sp. 144	Papua New Guinea	500-565m
ARC0982	*Trigonopterus*	sp. 135	Papua New Guinea	500-565m
ARC0983	*Trigonopterus*	sp. 135	Papua New Guinea	500-565m
ARC0984	*Trigonopterus*	sp. 127	Papua New Guinea	500-565m
ARC0985	*Trigonopterus*	sp. 127	Papua New Guinea	500-565m
ARC0986	*Trigonopterus*	sp. 127	Papua New Guinea	500-565m
ARC0987	*Trigonopterus*	sp. 261	Papua New Guinea	500-565m
ARC0988	*Trigonopterus*	sp. 261	Papua New Guinea	500-565m
ARC0989	*Trigonopterus*	sp. 98	Papua New Guinea	500-565m
ARC0990	*Trigonopterus*	sp. 141	Papua New Guinea	650-820m
ARC0991	*Trigonopterus*	*glaber*	Papua New Guinea	650-820m
ARC0992	*Trigonopterus*	sp. 80	Papua New Guinea	650-820m
ARC0993	*Trigonopterus*	sp. 152	Papua New Guinea	650-820m
ARC0994	*Trigonopterus*	sp. 152	Papua New Guinea	650-820m
ARC0995	*Trigonopterus*	sp. 185	Papua New Guinea	650-820m
ARC0996	*Trigonopterus*	sp. 185	Papua New Guinea	650-820m
ARC0997	*Trigonopterus*	sp. 185	Papua New Guinea	650-820m
ARC0998	*Trigonopterus*	sp. 229	Papua New Guinea	650-820m
ARC0999	*Trigonopterus*	sp. 229	Papua New Guinea	650-820m
ARC1000	*Trigonopterus*	sp. 146	Papua New Guinea	650-820m
ARC1001	*Trigonopterus*	sp. 114	Papua New Guinea	650-820m
ARC1002	*Trigonopterus*	sp. 114	Papua New Guinea	650-820m
ARC1003	*Trigonopterus*	sp. 62	Papua New Guinea	820-920m
ARC1004	*Trigonopterus*	sp. 61	Papua New Guinea	820-920m
ARC1005	*Trigonopterus*	sp. 140	Papua New Guinea	820-920m
ARC1006	*Trigonopterus*	sp. 140	Papua New Guinea	820-920m
ARC1007	*Trigonopterus*	sp. 134	Papua New Guinea	820-920m
ARC1009	*Trigonopterus*	sp. 143	Papua New Guinea	820-920m
ARC1010	*Trigonopterus*	sp. (unique female)	Papua New Guinea	820-920m
ARC1011	*Trigonopterus*	sp. 244	Papua New Guinea	820-920m
ARC1012	*Trigonopterus*	sp. 264	Papua New Guinea	820-920m
ARC1013	*Trigonopterus*	sp. 80	Papua New Guinea	820-920m
ARC1014	*Trigonopterus*	sp. 150	Papua New Guinea	820-920m
ARC1015	*Trigonopterus*	sp. 229	Papua New Guinea	820-920m
ARC1016	*Trigonopterus*	sp. 229	Papua New Guinea	820-920m
ARC1017	*Trigonopterus*	sp. 146	Papua New Guinea	820-920m
ARC1018	*Trigonopterus*	sp. 146	Papua New Guinea	820-920m
ARC1019	*Trigonopterus*	sp. 75	Papua New Guinea	820-920m
ARC1021	*Trigonopterus*	sp. 238	Papua New Guinea	820-920m
ARC1022	*Trigonopterus*	sp. 238	Papua New Guinea	820-920m
ARC1023	*Trigonopterus*	sp. 114	Papua New Guinea	820-920m
ARC1024	*Trigonopterus*	sp. 114	Papua New Guinea	820-920m
ARC1025	*Trigonopterus*	sp. 141	Papua New Guinea	650-920m
ARC1026	*Trigonopterus*	sp. 141	Papua New Guinea	650-920m
ARC1027	*Trigonopterus*	sp. 28	Papua New Guinea	650-920m
ARC1028	*Trigonopterus*	sp. 143	Papua New Guinea	650-920m
ARC1029	*Trigonopterus*	sp. 143	Papua New Guinea	650-920m
ARC1030	*Trigonopterus*	sp. 258	Papua New Guinea	650-920m
ARC1031	*Trigonopterus*	sp. 258	Papua New Guinea	650-920m
ARC1032	*Trigonopterus*	sp. 244	Papua New Guinea	650-920m
ARC1033	*Trigonopterus*	sp. 244	Papua New Guinea	650-920m
ARC1034	*Trigonopterus*	sp. 106	Papua New Guinea	650-920m
ARC1035	*Trigonopterus*	sp. 146	Papua New Guinea	650-920m
ARC1036	*Trigonopterus*	sp. 146	Papua New Guinea	650-920m
ARC1037	*Trigonopterus*	sp. 56	Papua New Guinea	535-700m
ARC1038	*Trigonopterus*	sp. 61	Papua New Guinea	535-700m
ARC1039	*Trigonopterus*	sp. 28	Papua New Guinea	535-700m
ARC1040	*Trigonopterus*	sp. 89	Papua New Guinea	535-700m
ARC1041	*Trigonopterus*	sp. 144	Papua New Guinea	535-600m
ARC1042	*Trigonopterus*	sp. 143	Papua New Guinea	535-600m
ARC1043	*Trigonopterus*	sp. 80	Papua New Guinea	535-600m
ARC1044	*Trigonopterus*	sp. 80	Papua New Guinea	535-600m
ARC1045	*Trigonopterus*	sp. 98	Papua New Guinea	535-600m
ARC1046	*Trigonopterus*	sp. 89	Papua New Guinea	535-600m
ARC1047	*Trigonopterus*	sp. 258	Papua New Guinea	535-600m
ARC1048	*Trigonopterus*	sp. 258	Papua New Guinea	535-600m
ARC1049	*Trigonopterus*	sp. 258	Papua New Guinea	535-600m
ARC1050	*Trigonopterus*	sp. 258	Papua New Guinea	535-600m
ARC1051	*Trigonopterus*	*katayoi*	Papua New Guinea	2150-2250m
ARC1052	*Trigonopterus*	*katayoi*	Papua New Guinea	2150-2250m
ARC1053	*Trigonopterus*	*katayoi*	Papua New Guinea	2150-2250m
ARC1054	*Trigonopterus*	*montivagus*	Papua New Guinea	2150-2250m
ARC1055	*Trigonopterus*	*montivagus*	Papua New Guinea	2150-2250m
ARC1056	*Trigonopterus*	*montivagus*	Papua New Guinea	2150-2250m
ARC1057	*Trigonopterus*	*tialeorum*	Papua New Guinea	2150-2250m
ARC1058	*Trigonopterus*	sp. 244	Papua New Guinea	780m
ARC1059	*Trigonopterus*	sp. 244	Papua New Guinea	780m
ARC1060	*Trigonopterus*	sp. 244	Papua New Guinea	780m
ARC1061	*Trigonopterus*	sp. 120	Papua New Guinea	780m
ARC1062	*Trigonopterus*	sp. 120	Papua New Guinea	780m
ARC1063	*Trigonopterus*	sp. 130	Papua New Guinea	780m
ARC1064	*Trigonopterus*	sp. 130	Papua New Guinea	780m
ARC1065	*Trigonopterus*	sp. 261	Papua New Guinea	800-960m
ARC1066	*Trigonopterus*	sp. 261	Papua New Guinea	800-960m
ARC1067	*Trigonopterus*	sp. 111	Papua New Guinea	800-960m
ARC1068	*Trigonopterus*	sp. 111	Papua New Guinea	800-960m
ARC1069	*Trigonopterus*	sp. 111	Papua New Guinea	800-960m
ARC1070	*Trigonopterus*	sp. 85	Papua New Guinea	800-960m
ARC1071	*Trigonopterus*	sp. 85	Papua New Guinea	800-960m
ARC1072	*Trigonopterus*	sp. 249	Papua New Guinea	800-960m
ARC1073	*Trigonopterus*	sp. 249	Papua New Guinea	800-960m
ARC1074	*Trigonopterus*	sp. 244	Papua New Guinea	800-960m
ARC1075	*Trigonopterus*	sp. 244	Papua New Guinea	800-960m
ARC1076	*Trigonopterus*	sp. 275	Papua New Guinea	800-960m
ARC1077	*Trigonopterus*	sp. 276	Papua New Guinea	800-960m
ARC1078	*Trigonopterus*	sp. 276	Papua New Guinea	800-960m
ARC1079	*Trigonopterus*	*velaris*	Papua New Guinea	800-960m
ARC1080	*Trigonopterus*	*velaris*	Papua New Guinea	800-960m
ARC1081	*Trigonopterus*	sp. 120	Papua New Guinea	800-960m
ARC1082	*Trigonopterus*	*taurekaorum*	Papua New Guinea	800-960m
ARC1083	*Trigonopterus*	*kanawiorum*	Papua New Guinea	800-960m
ARC1085	*Trigonopterus*	sp. 71	Papua New Guinea	800-960m
ARC1086	*Trigonopterus*	*oviformis*	Papua New Guinea	960m
ARC1087	*Trigonopterus*	sp. 161	Papua New Guinea	965m
ARC1088	*Trigonopterus*	*angulatus*	Papua New Guinea	965m
ARC1089	*Trigonopterus*	*aeneus*	Papua New Guinea	915m
ARC1090	*Trigonopterus*	*aeneus*	Papua New Guinea	915m
ARC1091	*Trigonopterus*	*aeneus*	Papua New Guinea	915m
ARC1092	*Trigonopterus*	*oviformis*	Papua New Guinea	915m
ARC1093	*Trigonopterus*	sp. 168	Papua New Guinea	915m
ARC1094	*Trigonopterus*	*costicollis*	Papua New Guinea	915m
ARC1096	*Trigonopterus*	*variabilis*	Papua New Guinea	1135m
ARC1097	*Trigonopterus*	*variabilis*	Papua New Guinea	1135m
ARC1098	*Trigonopterus*	*angulatus*	Papua New Guinea	1135m
ARC1099	*Trigonopterus*	sp. 67	Papua New Guinea	1135m
ARC1100	*Trigonopterus*	sp. 67	Papua New Guinea	1135m
ARC1101	*Trigonopterus*	sp. 72	Papua New Guinea	1135m
ARC1102	*Trigonopterus*	*variabilis*	Papua New Guinea	1135m
ARC1103	*Trigonopterus*	*variabilis*	Papua New Guinea	1135m
ARC1104	*Trigonopterus*	*squamirostris*	Papua New Guinea	1090m
ARC1105	*Trigonopterus*	*aeneus*	Papua New Guinea	1090m
ARC1106	*Trigonopterus*	sp. 130	Papua New Guinea	750-915m
ARC1107	*Trigonopterus*	sp. 237	Papua New Guinea	750-915m
ARC1108	*Trigonopterus*	*lekiorum*	Papua New Guinea	750-915m
ARC1109	*Trigonopterus*	sp. (unique female)	Papua New Guinea	750-915m
ARC1110	*Trigonopterus*	sp. 104	Papua New Guinea	750-915m
ARC1111	*Trigonopterus*	sp. 104	Papua New Guinea	750-915m
ARC1112	*Trigonopterus*	sp. 85	Papua New Guinea	1075-1240m
ARC1113	*Trigonopterus*	*squamirostris*	Papua New Guinea	1220-1450m
ARC1114	*Trigonopterus*	*squamirostris*	Papua New Guinea	1220-1450m
ARC1115	*Trigonopterus*	*ancoruncus*	Papua New Guinea	1220-1450m
ARC1116	*Trigonopterus*	*lekiorum*	Papua New Guinea	1220-1450m
ARC1117	*Trigonopterus*	*lekiorum*	Papua New Guinea	1220-1450m
ARC1118	*Trigonopterus*	*squamirostris*	Papua New Guinea	1220-1450m
ARC1119	*Trigonopterus*	*squamirostris*	Papua New Guinea	1220-1450m
ARC1120	*Trigonopterus*	*squamirostris*	Papua New Guinea	1220-1450m
ARC1121	*Trigonopterus*	*squamirostris*	Papua New Guinea	1220-1450m
ARC1122	*Trigonopterus*	sp. 260	Papua New Guinea	1220-1450m
ARC1123	*Trigonopterus*	sp. 85	Papua New Guinea	1220-1450m
ARC1124	*Trigonopterus*	sp. 249	Papua New Guinea	1220-1450m
ARC1125	*Trigonopterus*	sp. (unique female)	Papua New Guinea	1220-1450m
ARC1126	*Trigonopterus*	sp. (unique female)	Papua New Guinea	1220-1450m
ARC1127	*Trigonopterus*	*ovatus*	Papua New Guinea	1220-1450m
ARC1128	*Trigonopterus*	*ovatus*	Papua New Guinea	1220-1450m
ARC1129	*Trigonopterus*	*taurekaorum*	Papua New Guinea	1220-1450m
ARC1130	*Trigonopterus*	*taurekaorum*	Papua New Guinea	1220-1450m
ARC1131	*Trigonopterus*	sp. (unique female)	Papua New Guinea	1220-1450m
ARC1132	*Trigonopterus*	*phoenix*	Papua New Guinea	1220-1450m
ARC1133	*Trigonopterus*	*kanawiorum*	Papua New Guinea	1220-1450m
ARC1134	*Trigonopterus*	*kanawiorum*	Papua New Guinea	1220-1450m
ARC1135	*Trigonopterus*	sp. 260	Papua New Guinea	1220-1320m
ARC1136	*Trigonopterus*	*apicalis*	Papua New Guinea	1220-1320m
ARC1137	*Trigonopterus*	*apicalis*	Papua New Guinea	1220-1320m
ARC1138	*Trigonopterus*	*apicalis*	Papua New Guinea	1220-1320m
ARC1140	*Trigonopterus*	sp. 137	Papua New Guinea	1220-1320m
ARC1141	*Trigonopterus*	sp. 218	Papua New Guinea	1220-1320m
ARC1142	*Trigonopterus*	*kanawiorum*	Papua New Guinea	1075-1240m
ARC1143	*Trigonopterus*	sp. 218	Papua New Guinea	1075-1240m
ARC1144	*Trigonopterus*	sp. 74	Papua New Guinea	1075-1240m
ARC1145	*Trigonopterus*	sp. 276	Papua New Guinea	1075-1220m
ARC1146	*Trigonopterus*	sp. 91	Papua New Guinea	1075-1220m

Specimen	Genus	Species	Locality	Elevation
ARC1147	*Trigonopterus*	sp. 218	Papua New Guinea	1075-1220m
ARC1148	*Trigonopterus*	sp. 218	Papua New Guinea	1075-1220m
ARC1149	*Trigonopterus*	*kanawiorum*	Papua New Guinea	1075-1220m
ARC1150	*Trigonopterus*	*kanawiorum*	Papua New Guinea	1075-1220m
ARC1151	*Trigonopterus*	*taurekaorum*	Papua New Guinea	1220-1320m
ARC1152	*Trigonopterus*	*taurekaorum*	Papua New Guinea	1220-1320m
ARC1153	*Trigonopterus*	*phoenix*	Papua New Guinea	1220-1450m
ARC1154	*Trigonopterus*	*ovatus*	Papua New Guinea	970-1135m
ARC1155	*Trigonopterus*	*ovatus*	Papua New Guinea	970-1135m
ARC1156	*Trigonopterus*	*ovatus*	Papua New Guinea	970-1135m
ARC1157	*Trigonopterus*	sp. 159	Papua New Guinea	970-1135m
ARC1158	*Trigonopterus*	sp. 159	Papua New Guinea	970-1135m
ARC1159	*Trigonopterus*	sp. 159	Papua New Guinea	970-1135m
ARC1160	*Trigonopterus*	sp. 228	Papua New Guinea	970-1135m
ARC1161	*Trigonopterus*	sp. 228	Papua New Guinea	970-1135m
ARC1162	*Trigonopterus*	sp. 228	Papua New Guinea	970-1135m
ARC1163	*Trigonopterus*	sp. 65	Papua New Guinea	970-1135m
ARC1164	*Trigonopterus*	sp. 65	Papua New Guinea	970-1135m
ARC1165	*Trigonopterus*	*velaris*	Papua New Guinea	970-1135m
ARC1166	*Trigonopterus*	sp. 91	Papua New Guinea	970-1135m
ARC1167	*Trigonopterus*	*taurekaorum*	Papua New Guinea	970-1135m
ARC1168	*Trigonopterus*	*kanawiorum*	Papua New Guinea	970-1135m
ARC1169	*Trigonopterus*	*taurekaorum*	Papua New Guinea	900-1005m
ARC1170	*Trigonopterus*	sp. 249	Papua New Guinea	1020-1135m
ARC1171	*Trigonopterus*	sp. 220	Papua New Guinea	1020-1135m
ARC1172	*Trigonopterus*	*hitoloorum*	Papua New Guinea	1570m
ARC1173	*Trigonopterus*	sp. 69	Papua New Guinea	1570m
ARC1174	*Trigonopterus*	sp. 69	Papua New Guinea	1570m
ARC1175	*Trigonopterus*	*discoidalis*	Papua New Guinea	1570m
ARC1176	*Trigonopterus*	*hitoloorum*	Papua New Guinea	1670m
ARC1177	*Trigonopterus*	sp. 69	Papua New Guinea	1670m
ARC1178	*Trigonopterus*	sp. 69	Papua New Guinea	1670m
ARC1179	*Trigonopterus*	*discoidalis*	Papua New Guinea	1670m
ARC1180	*Trigonopterus*	*discoidalis*	Papua New Guinea	1670m
ARC1181	*Trigonopterus*	sp. 234	Papua New Guinea	1670m
ARC1182	*Trigonopterus*	sp. 112	Papua New Guinea	1500-1650m
ARC1183	*Trigonopterus*	sp. 112	Papua New Guinea	1500-1650m
ARC1184	*Trigonopterus*	sp. 110	Papua New Guinea	1500-1650m
ARC1185	*Trigonopterus*	sp. 110	Papua New Guinea	1500-1650m
ARC1186	*Trigonopterus*	sp. 239	Papua New Guinea	1500-1650m
ARC1187	*Trigonopterus*	sp. 239	Papua New Guinea	1500-1650m
ARC1188	*Trigonopterus*	*strigatus*	Papua New Guinea	1500-1650m
ARC1189	*Trigonopterus*	*strigatus*	Papua New Guinea	1500-1650m
ARC1190	*Trigonopterus*	*strigatus*	Papua New Guinea	1500-1650m
ARC1191	*Trigonopterus*	*montivagus*	Papua New Guinea	1500-1650m
ARC1192	*Trigonopterus*	*montivagus*	Papua New Guinea	1500-1650m
ARC1193	*Trigonopterus*	*montivagus*	Papua New Guinea	1500-1650m
ARC1194	*Trigonopterus*	sp. 148	Papua New Guinea	1500-1650m
ARC1195	*Trigonopterus*	sp. 148	Papua New Guinea	1500-1650m
ARC1196	*Trigonopterus*	sp. 178	Papua New Guinea	1500-1650m
ARC1197	*Trigonopterus*	sp. 178	Papua New Guinea	1500-1650m
ARC1198	*Trigonopterus*	sp. 173	Papua New Guinea	1500-1650m
ARC1199	*Trigonopterus*	sp. 173	Papua New Guinea	1500-1650m
ARC1200	*Trigonopterus*	sp. 173	Papua New Guinea	1500-1650m
ARC1201	*Trigonopterus*	sp. 173	Papua New Guinea	1500-1650m
ARC1202	*Trigonopterus*	sp. 236	Papua New Guinea	1500-1650m
ARC1203	*Trigonopterus*	sp. 236	Papua New Guinea	1500-1650m
ARC1204	*Trigonopterus*	sp. 161	Papua New Guinea	1500-1650m
ARC1205	*Trigonopterus*	sp. 239	Papua New Guinea	1500-1670m
ARC1206	*Trigonopterus*	sp. 158	Papua New Guinea	1500-1670m
ARC1207	*Trigonopterus*	sp. 158	Papua New Guinea	1655m
ARC1208	*Trigonopterus*	sp. 158	Papua New Guinea	1655m
ARC1209	*Trigonopterus*	sp. 95	Papua New Guinea	1670-1710m
ARC1210	*Trigonopterus*	sp. 138	Papua New Guinea	480-740m
ARC1211	*Trigonopterus*	sp. 28	Papua New Guinea	480-740m
ARC1212	*Trigonopterus*	sp. 113	Papua New Guinea	480-740m
ARC1213	*Trigonopterus*	sp. 154	Papua New Guinea	480-740m
ARC1214	*Trigonopterus*	sp. 154	Papua New Guinea	480-740m
ARC1215	*Trigonopterus*	sp. 105	Papua New Guinea	480-740m
ARC1216	*Trigonopterus*	sp. 257	Papua New Guinea	480-740m
ARC1217	*Trigonopterus*	sp. 262	Papua New Guinea	480-740m
ARC1218	*Trigonopterus*	sp. 262	Papua New Guinea	480-740m
ARC1219	*Trigonopterus*	sp. 270	Papua New Guinea	480-740m
ARC1220	*Trigonopterus*	sp. 139	Papua New Guinea	1170-1225m
ARC1221	*Trigonopterus*	sp. 139	Papua New Guinea	1170-1225m
ARC1222	*Trigonopterus*	sp. 139	Papua New Guinea	1170-1225m
ARC1223	*Trigonopterus*	sp. 138	Papua New Guinea	1170-1225m
ARC1224	*Trigonopterus*	sp. 129	Papua New Guinea	1170-1225m
ARC1225	*Trigonopterus*	sp. 112	Papua New Guinea	1170-1225m
ARC1226	*Trigonopterus*	sp. 113	Papua New Guinea	1170-1225m
ARC1227	*Trigonopterus*	sp. 113	Papua New Guinea	1170-1225m
ARC1228	*Trigonopterus*	sp. 133	Papua New Guinea	1170-1225m
ARC1229	*Trigonopterus*	sp. 56 ?	Papua New Guinea	1170-1225m
ARC1230	*Trigonopterus*	sp. 257	Papua New Guinea	1170-1225m
ARC1231	*Trigonopterus*	sp. 240	Papua New Guinea	1170-1225m
ARC1232	*Trigonopterus*	sp. 240	Papua New Guinea	1170-1225m
ARC1233	*Trigonopterus*	sp. 240	Papua New Guinea	1170-1225m
ARC1234	*Trigonopterus*	sp. 165	Papua New Guinea	1170-1225m
ARC1235	*Trigonopterus*	sp. 165	Papua New Guinea	1170-1225m
ARC1236	*Trigonopterus*	sp. 99	Papua New Guinea	1170-1225m
ARC1237	*Trigonopterus*	sp. 153	Papua New Guinea	1170-1225m
ARC1238	*Trigonopterus*	sp. 161	Papua New Guinea	1170-1225m
ARC1239	*Trigonopterus*	sp. 161	Papua New Guinea	1170-1225m
ARC1240	*Trigonopterus*	*anthracinus*	Papua New Guinea	1170-1225m
ARC1241	*Trigonopterus*	*anthracinus*	Papua New Guinea	1170-1225m
ARC1242	*Trigonopterus*	sp. 178	Papua New Guinea	1170-1225m
ARC1243	*Trigonopterus*	*montivagus*	Papua New Guinea	1170-1225m
ARC1244	*Trigonopterus*	*montivagus*	Papua New Guinea	1170-1225m
ARC1245	*Trigonopterus*	*montivagus*	Papua New Guinea	1170-1225m
ARC1246	*Trigonopterus*	sp. 128	Papua New Guinea	1225-1340m
ARC1247	*Trigonopterus*	sp. 133	Papua New Guinea	1225-1340m
ARC1248	*Trigonopterus*	sp. 142	Papua New Guinea	1225-1340m
ARC1249	*Trigonopterus*	sp. 186	Papua New Guinea	1225-1340m
ARC1250	*Trigonopterus*	sp. 270	Papua New Guinea	1225-1340m
ARC1251	*Trigonopterus*	sp. 153	Papua New Guinea	1225-1340m
ARC1252	*Trigonopterus*	sp. 269	Papua New Guinea	1225-1340m
ARC1253	*Trigonopterus*	sp. 99	Papua New Guinea	1225-1340m
ARC1254	*Trigonopterus*	sp. 148	Papua New Guinea	1225-1340m
ARC1255	*Trigonopterus*	sp. 161	Papua New Guinea	1225-1340m
ARC1256	*Trigonopterus*	sp. 228	Papua New Guinea	1225-1340m
ARC1257	*Trigonopterus*	sp. 228	Papua New Guinea	1225-1340m
ARC1258	*Trigonopterus*	sp. 138	Papua New Guinea	750-880m
ARC1259	*Trigonopterus*	sp. 138	Papua New Guinea	750-880m
ARC1260	*Trigonopterus*	sp. 28	Papua New Guinea	750-880m
ARC1261	*Trigonopterus*	sp. 28	Papua New Guinea	750-880m
ARC1262	*Trigonopterus*	sp. 113	Papua New Guinea	750-880m
ARC1263	*Trigonopterus*	sp. 113	Papua New Guinea	750-880m
ARC1264	*Trigonopterus*	sp. 60	Papua New Guinea	750-880m
ARC1265	*Trigonopterus*	sp. 60	Papua New Guinea	750-880m
ARC1266	*Trigonopterus*	sp. 270	Papua New Guinea	750-880m
ARC1267	*Trigonopterus*	sp. 229	Papua New Guinea	750-880m
ARC1268	*Trigonopterus*	sp. 229	Papua New Guinea	750-880m
ARC1269	*Trigonopterus*	sp. 150	Papua New Guinea	750-880m
ARC1270	*Trigonopterus*	sp. 150	Papua New Guinea	750-880m
ARC1271	*Trigonopterus*	sp. 154	Papua New Guinea	750-880m
ARC1272	*Trigonopterus*	sp. 257	Papua New Guinea	750-880m
ARC1273	*Trigonopterus*	sp. 257	Papua New Guinea	750-880m
ARC1274	*Trigonopterus*	sp. 257	Papua New Guinea	750-880m
ARC1275	*Trigonopterus*	sp. 262	Papua New Guinea	750-880m
ARC1276	*Trigonopterus*	sp. 262	Papua New Guinea	750-880m
ARC1277	*Trigonopterus*	sp. 100	Papua New Guinea	750-880m
ARC1278	*Trigonopterus*	*anthracinus*	Papua New Guinea	750-880m
ARC1279	*Trigonopterus*	*anthracinus*	Papua New Guinea	750-880m
ARC1280	*Trigonopterus*	sp. 105	Papua New Guinea	750-880m
ARC1281	*Trigonopterus*	sp. 52	Papua New Guinea	750-880m
ARC1282	*Trigonopterus*	sp. 52	Papua New Guinea	750-880m
ARC1283	*Trigonopterus*	sp. 240	Papua New Guinea	750-880m
ARC1284	*Trigonopterus*	sp. 154	Papua New Guinea	750-880m
ARC1285	*Trigonopterus*	sp. 154	Papua New Guinea	750-880m
ARC1286	*Trigonopterus*	sp. 119	Papua New Guinea	750-880m
ARC1287	*Trigonopterus*	sp. 119	Papua New Guinea	750-880m
ARC1288	*Trigonopterus*	sp. 119	Papua New Guinea	750-880m
ARC1289	*Trigonopterus*	sp. 133	Papua New Guinea	670-880m
ARC1290	*Trigonopterus*	sp. 150	Papua New Guinea	670-880m
ARC1291	*Trigonopterus*	sp. 64	Papua New Guinea	670-880m
ARC1292	*Trigonopterus*	sp. 64	Papua New Guinea	670-880m
ARC1293	*Trigonopterus*	sp. 64	Papua New Guinea	670-880m
ARC1294	*Trigonopterus*	sp. 103	Papua New Guinea	670-880m
ARC1295	*Trigonopterus*	sp. 103	Papua New Guinea	670-880m
ARC1296	*Trigonopterus*	sp. 103	Papua New Guinea	670-880m
ARC1297	*Trigonopterus*	sp. 105	Papua New Guinea	670-880m
ARC1298	*Trigonopterus*	sp. 240	Papua New Guinea	670-880m
ARC1299	*Trigonopterus*	sp. 131	Papua New Guinea	965-1015m
ARC1300	*Trigonopterus*	sp. 133	Papua New Guinea	965-1015m
ARC1301	*Trigonopterus*	sp. 153	Papua New Guinea	965-1015m
ARC1302	*Trigonopterus*	sp. 153	Papua New Guinea	965-1015m
ARC1303	*Trigonopterus*	sp. 154	Papua New Guinea	965-1015m
ARC1304	*Trigonopterus*	sp. 174	Papua New Guinea	965-1015m
ARC1305	*Trigonopterus*	sp. 174	Papua New Guinea	965-1015m
ARC1306	*Trigonopterus*	sp. 174	Papua New Guinea	965-1015m
ARC1307	*Trigonopterus*	sp. 99	Papua New Guinea	965-1015m
ARC1308	*Trigonopterus*	sp. 236	Papua New Guinea	965-1015m
ARC1309	*Trigonopterus*	sp. 236	Papua New Guinea	965-1015m
ARC1310	*Trigonopterus*	sp. 186	Papua New Guinea	965-1015m
ARC1311	*Trigonopterus*	sp. 105	Papua New Guinea	670-750m
ARC1312	*Trigonopterus*	sp. 129	Papua New Guinea	670-870m
ARC1313	*Trigonopterus*	sp. 119	Papua New Guinea	670-870m
ARC1314	*Trigonopterus*	sp. 192	Papua New Guinea	810m
ARC1315	*Trigonopterus*	sp. 187	Papua New Guinea	810m
ARC1316	*Trigonopterus*	sp. 219	Papua New Guinea	810m
ARC1317	*Trigonopterus*	*micros*	Papua New Guinea	810m
ARC1318	*Trigonopterus*	*micros*	Papua New Guinea	810m
ARC1319	*Trigonopterus*	*micros*	Papua New Guinea	810m
ARC1320	*Trigonopterus*	*micros*	Papua New Guinea	810m
ARC1321	*Trigonopterus*	sp. 187	Papua New Guinea	810m
ARC1322	*Trigonopterus*	sp. 190	Papua New Guinea	810m
ARC1323	*Trigonopterus*	sp. 155	Papua New Guinea	810m
ARC1324	*Trigonopterus*	sp. 192	Papua New Guinea	750m
ARC1325	*Trigonopterus*	sp. 187	Papua New Guinea	750m
ARC1326	*Trigonopterus*	sp. 187	Papua New Guinea	750m
ARC1327	*Trigonopterus*	sp. 190	Papua New Guinea	750m
ARC1328	*Trigonopterus*	sp. 200	Papua New Guinea	750m
ARC1329	*Trigonopterus*	sp. 199	Papua New Guinea	750m
ARC1330	*Trigonopterus*	sp. 203	Papua New Guinea	750m
ARC1360	*Camptorhinus*	cf. dorsalis	Papua New Guinea	480-740m
ARC1361	*Perissops*	cf. apicalis	Papua New Guinea	1200m
ARC1386	*Trichacalles*	*longipilis*	Papua New Guinea	750m
ARC1391	*Microporopterus*	cf. setosus	Papua New Guinea	810m
ARC1413	*Trigonopterus*	sp. 87	Papua New Guinea	2179-2800m
ARC1414	*Trigonopterus*	sp. 253	Papua New Guinea	2179-2800m
ARC1415	*Trigonopterus*	*ptolycoides*	Papua New Guinea	2179-2800m
ARC1416	*Trigonopterus*	*ptolycoides*	Papua New Guinea	2179-2800m
ARC1417	*Trigonopterus*	*ptolycoides*	Papua New Guinea	2179-2800m
ARC1422	*Trigonopterus*	*kalimantanensis*	Borneo	190 m
ARC1437	*Trigonopterus*	*schulzi*	Philippines	500-700 m
ARC1458	*Trigonopterus*	*lombokensis*	Lombok	1195 m
ARC1461	*Trigonopterus*	*dentipes*	Lombok	1195 m
ARC1462	*Trigonopterus*	*aeneomicans*	Lombok	1195 m
ARC1466	*Trigonopterus*	*disruptus*	Lombok	1240 m
ARC1470	*Trigonopterus*	*rinjaniensis*	Lombok	1245 m
ARC1481	*Trigonopterus*	*sasak*	Lombok	615 m
ARC1497	*Trigonopterus*	*punctatoseriatus*	Sumbawa	1310 m
ARC1499	*Trigonopterus*	*sembilan*	Sumbawa	1310 m
ARC1509	*Trigonopterus*	*sinuatus*	Sumbawa	1305 m
ARC1516	*Trigonopterus*	*sumbawensis*	Sumbawa	1305 m
ARC1529	*Trigonopterus*	*saltator*	Sumbawa	1385 m
ARC1534	*Trigonopterus*	*pauxillus*	Sumbawa	1490 m
ARC1548	*Trigonopterus*	sp. 261	Papua New Guinea	1075-1220m
ARC1549	*Trigonopterus*	sp. 261	Papua New Guinea	1075-1220m
ARC1550	*Trigonopterus*	sp. 260	Papua New Guinea	1075-1220m
ARC1551	*Trigonopterus*	sp. 260	Papua New Guinea	1075-1220m
ARC1552	*Miocalles*	sp.	Java	1025 m

Specimen	Genus	Species	Locality	Elevation
ARC1675	*Ouroporopterus*	*squamiventris*	Australia	
ARC1684	*Trigonopterus*	*dromedarius*	West Papua	490m
ARC1685	*Trigonopterus*	*dromedarius*	West Papua	490m
ARC1686	*Trigonopterus*	*talpa*	West Papua	490m
ARC1687	*Trigonopterus*	*talpa*	West Papua	490m
ARC1688	*Trigonopterus*	*agathis*	West Papua	490m
ARC1689	*Trigonopterus*	*agathis*	West Papua	490m
ARC1690	*Trigonopterus*	*dentirostris*	West Papua	490m
ARC1691	*Trigonopterus*	*dentirostris*	West Papua	490m
ARC1692	*Trigonopterus*	sp. 30	West Papua	450-520m
ARC1693	*Trigonopterus*	*angustus*	West Papua	450-520m
ARC1694	*Trigonopterus*	*insularis*	West Papua	50-100m
ARC1695	*Trigonopterus*	*insularis*	West Papua	50-100m
ARC1696	*Trigonopterus*	sp. 84	West Papua	50-100m
ARC1697	*Trigonopterus*	*imitatus*	West Papua	50-100m
ARC1698	*Trigonopterus*	*imitatus*	West Papua	50-100m
ARC1699	*Trigonopterus*	*imitatus*	West Papua	50-100m
ARC1707	*Trigonopterus*	sp. 93	West Papua	1875-1990m
ARC1708	*Trigonopterus*	sp. 93	West Papua	1875-1990m
ARC1709	*Trigonopterus*	sp. 94	West Papua	1875-1990m
ARC1710	*Trigonopterus*	sp. 94	West Papua	1875-1990m
ARC1711	*Trigonopterus*	*balimensis*	West Papua	1875-1990m
ARC1712	*Trigonopterus*	*balimensis*	West Papua	1875-1990m
ARC1713	*Trigonopterus*	*wamenaensis*	West Papua	1875-1990m
ARC1714	*Trigonopterus*	*rhomboidalis*	West Papua	1875-1990m
ARC1715	*Trigonopterus*	*sordidus*	West Papua	1875-1990m
ARC1716	*Trigonopterus*	*kurulu*	West Papua	2330m
ARC1717	*Trigonopterus*	*kurulu*	West Papua	2330m
ARC1718	*Trigonopterus*	sp. 181	West Papua	2330m
ARC1719	*Trigonopterus*	sp. 182	West Papua	2330m
ARC1720	*Trigonopterus*	sp. 182	West Papua	2330m
ARC1721	*Trigonopterus*	sp. 156	West Papua	2330m
ARC1722	*Trigonopterus*	sp. 70	West Papua	2330m
ARC1723	*Trigonopterus*	sp. 70	West Papua	2330m
ARC1724	*Trigonopterus*	*constrictus*	West Papua	2330m
ARC1725	*Trigonopterus*	sp. 181	West Papua	2410m
ARC1729	*Trigonopterus*	sp. 70	West Papua	2410m
ARC1730	*Trigonopterus*	sp. 70	West Papua	2410m
ARC1731	*Trigonopterus*	*constrictus*	West Papua	2410m
ARC1732	*Trigonopterus*	sp. 117	West Papua	2410m
ARC1733	*Trigonopterus*	sp. 93	West Papua	1875m
ARC1734	*Trigonopterus*	sp. 94	West Papua	1875m
ARC1735	*Trigonopterus*	*wamenaensis*	West Papua	1875m
ARC1736	*Trigonopterus*	*rubiginosus*	West Papua	2285-2345m
ARC1737	*Trigonopterus*	*rubiginosus*	West Papua	2285-2345m
ARC1738	*Trigonopterus*	*rubiginosus*	West Papua	2285-2345m
ARC1739	*Trigonopterus*	sp. 214	West Papua	2285-2345m
ARC1740	*Trigonopterus*	sp. 214	West Papua	2285-2345m
ARC1741	*Trigonopterus*	sp. 214	West Papua	2260-2410 m
ARC1742	*Trigonopterus*	sp. 214	West Papua	2260-2410 m
ARC1743	*Trigonopterus*	*mimicus*	West Papua	2620-2715 m
ARC1744	*Trigonopterus*	*mimicus*	West Papua	2620-2715 m
ARC1745	*Trigonopterus*	sp. 252	West Papua	2260-2410 m
ARC1746	*Trigonopterus*	sp. 368	West Papua	2285-2345m
ARC1747	*Trigonopterus*	sp. 368	West Papua	2285-2345m
ARC1748	*Trigonopterus*	sp. 368	West Papua	2260-2410 m
ARC1749	*Trigonopterus*	sp. 368	West Papua	2260-2410 m
ARC1750	*Trigonopterus*	sp. 368	West Papua	2620-2715 m
ARC1751	*Trigonopterus*	sp. 368	West Papua	2620-2715 m
ARC1752	*Trigonopterus*	*rhomboidalis*	West Papua	2620-2715 m
ARC1753	*Trigonopterus*	*rhomboidalis*	West Papua	2260-2410 m
ARC1754	*Trigonopterus*	sp. 368	West Papua	2260-2410 m
ARC1755	*Trigonopterus*	*rhomboidalis*	West Papua	2260-2410 m
ARC1756	*Trigonopterus*	*rubiginosus*	West Papua	2260-2410 m
ARC1757	*Trigonopterus*	sp. 241	West Papua	2260-2410 m
ARC1758	*Trigonopterus*	sp. 241	West Papua	2260-2410 m
ARC1759	*Trigonopterus*	sp. 241	West Papua	2260-2410 m
ARC1760	*Trigonopterus*	sp. 122	West Papua	2260-2410 m
ARC1761	*Trigonopterus*	sp. 122	West Papua	2260-2410 m
ARC1762	*Trigonopterus*	sp. 122	West Papua	2260-2410 m
ARC1763	*Trigonopterus*	sp. 156	West Papua	2260-2410 m
ARC1764	*Trigonopterus*	*rufibasis*	West Papua	2620-2715 m
ARC1765	*Trigonopterus*	*rufibasis*	West Papua	2620-2715 m
ARC1766	*Trigonopterus*	*rufibasis*	West Papua	2620-2715 m
ARC1767	*Trigonopterus*	*ascendens*	West Papua	2620-2715 m
ARC1768	*Trigonopterus*	*ascendens*	West Papua	2620-2715 m
ARC1769	*Trigonopterus*	*ascendens*	West Papua	2620-2715 m
ARC1770	*Trigonopterus*	sp. 94	West Papua	2620-2715 m
ARC1771	*Trigonopterus*	sp. 94	West Papua	2620-2715 m
ARC1772	*Trigonopterus*	sp. 252	West Papua	2620-2715 m
ARC1773	*Trigonopterus*	sp. 252	West Papua	2620-2715 m
ARC1774	*Trigonopterus*	sp. 252	West Papua	2620-2715 m
ARC1775	*Trigonopterus*	*violaceus*	West Papua	2620-2715 m
ARC1776	*Trigonopterus*	*gonatocerus*	West Papua	1655-1700 m
ARC1777	*Trigonopterus*	*gonatocerus*	West Papua	1655-1700 m
ARC1778	*Trigonopterus*	*gonatocerus*	West Papua	1655-1700 m
ARC1779	*Trigonopterus*	sp. 211	West Papua	1655-1700 m
ARC1780	*Trigonopterus*	sp. 211	West Papua	1655-1700 m
ARC1781	*Trigonopterus*	sp. 212	West Papua	1655-1700 m
ARC1782	*Trigonopterus*	sp. 212	West Papua	1655-1700 m
ARC1783	*Trigonopterus*	sp. 211	West Papua	1705-1710 m
ARC1784	*Trigonopterus*	sp. 211	West Papua	1705-1710 m
ARC1785	*Trigonopterus*	*crassicornis*	West Papua	1655-1700 m
ARC1786	*Trigonopterus*	*crassicornis*	West Papua	1655-1700 m
ARC1787	*Trigonopterus*	sp. 212	West Papua	1655-1700 m
ARC1788	*Trigonopterus*	*crassicornis*	West Papua	1705-1710 m
ARC1789	*Trigonopterus*	*crassicornis*	West Papua	1705-1710 m
ARC1790	*Trigonopterus*	*durus*	West Papua	1705-1710 m
ARC1791	*Trigonopterus*	*durus*	West Papua	1705-1710 m
ARC1792	*Trigonopterus*	*durus*	West Papua	1705-1710 m
ARC1793	*Trigonopterus*	*durus*	West Papua	1655-1700 m
ARC1794	*Trigonopterus*	*conformis*	West Papua	1705-1710 m
ARC1795	*Trigonopterus*	*conformis*	West Papua	1705-1710 m
ARC1796	*Trigonopterus*	sp. 274	West Papua	1655-1700 m
ARC1797	*Trigonopterus*	sp. 242	West Papua	1655-1700 m
ARC1798	*Trigonopterus*	sp. 242	West Papua	1655-1700 m
ARC1799	*Trigonopterus*	sp. 242	West Papua	1705-1710 m
ARC1800	*Trigonopterus*	sp. 242	West Papua	1705-1710 m
ARC1801	*Trigonopterus*	sp. 268	West Papua	1655-1700 m
ARC1802	*Trigonopterus*	sp. 268	West Papua	1655-1700 m
ARC1803	*Trigonopterus*	sp. (unique female)	West Papua	1655-1700 m
ARC1804	*Trigonopterus*	sp. 94	West Papua	1655-1700 m
ARC1805	*Trigonopterus*	*fusiformis*	West Papua	1655-1700 m
ARC1806	*Trigonopterus*	*rhomboidalis*	West Papua	1655-1700 m
ARC1807	*Trigonopterus*	*fusiformis*	West Papua	1705-1710 m
ARC1808	*Trigonopterus*	*mimicus*	West Papua	2520 m
ARC1809	*Trigonopterus*	*mimicus*	West Papua	2520 m
ARC1810	*Trigonopterus*	*mimicus*	West Papua	2770 m
ARC1811	*Trigonopterus*	*mimicus*	West Papua	2770 m
ARC1812	*Trigonopterus*	*violaceus*	West Papua	2520 m
ARC1813	*Trigonopterus*	*violaceus*	West Papua	2520 m
ARC1814	*Trigonopterus*	*violaceus*	West Papua	2520 m
ARC1815	*Trigonopterus*	*rhomboidalis*	West Papua	2520 m
ARC1816	*Trigonopterus*	*rhomboidalis*	West Papua	2520 m
ARC1817	*Trigonopterus*	sp. 368	West Papua	2520 m
ARC1818	*Trigonopterus*	sp. 368	West Papua	2520 m
ARC1819	*Trigonopterus*	sp. 368	West Papua	2770 m
ARC1820	*Trigonopterus*	sp. 368	West Papua	2770 m
ARC1821	*Trigonopterus*	sp. 243	West Papua	2770 m
ARC1822	*Trigonopterus*	sp. 243	West Papua	2770 m
ARC1823	*Trigonopterus*	sp. 125	West Papua	2770 m
ARC1824	*Trigonopterus*	*tialeorum*	Papua New Guinea	1911 m
ARC1825	*Trigonopterus*	*tialeorum*	Papua New Guinea	1911 m
ARC1826	*Trigonopterus*	*tialeorum*	Papua New Guinea	2169 m
ARC1827	*Trigonopterus*	*tialeorum*	Papua New Guinea	2169 m
ARC1828	*Trigonopterus*	*tialeorum*	Papua New Guinea	2169 m
ARC1829	*Trigonopterus*	*tialeorum*	Papua New Guinea	1940 m
ARC1830	*Trigonopterus*	*helios*	Papua New Guinea	1911 m
ARC1831	*Trigonopterus*	*helios*	Papua New Guinea	1911 m
ARC1832	*Trigonopterus*	*helios*	Papua New Guinea	1911 m
ARC1833	*Trigonopterus*	*rubripennis*	Papua New Guinea	1891-2131 m
ARC1834	*Trigonopterus*	*rubripennis*	Papua New Guinea	1911-2131 m
ARC1835	*Trigonopterus*	*rubripennis*	Papua New Guinea	1911-2131 m
ARC1836	*Trigonopterus*	*katayoi*	Papua New Guinea	1911-2131 m
ARC1837	*Trigonopterus*	*katayoi*	Papua New Guinea	1911-2131 m
ARC1838	*Trigonopterus*	*katayoi*	Papua New Guinea	1911 m
ARC1839	*Trigonopterus*	*cuneipennis*	Papua New Guinea	2169 m
ARC1840	*Trigonopterus*	*maculatus*	Papua New Guinea	2169 m
ARC1841	*Trigonopterus*	*maculatus*	Papua New Guinea	2169 m
ARC1842	*Trigonopterus*	*maculatus*	Papua New Guinea	1891-2131 m
ARC1843	*Trigonopterus*	sp. 157	Papua New Guinea	1891-2131 m
ARC1844	*Trigonopterus*	sp. 157	Papua New Guinea	1891-2131 m
ARC1845	*Trigonopterus*	sp. 157	Papua New Guinea	1891-2131 m
ARC1846	*Trigonopterus*	*koveorum*	Papua New Guinea	1891-2131 m
ARC1847	*Trigonopterus*	*koveorum*	Papua New Guinea	1891-2131 m
ARC1848	*Trigonopterus*	*koveorum*	Papua New Guinea	1891-2131 m
ARC1849	*Trigonopterus*	*cuneipennis*	Papua New Guinea	1891-2131 m
ARC1850	*Trigonopterus*	sp. 160	Papua New Guinea	1891-2131 m
ARC1851	*Trigonopterus*	sp. 160	Papua New Guinea	1891-2131 m
ARC1852	*Trigonopterus*	sp. 76 ??	Papua New Guinea	1891-2131 m
ARC1853	*Trigonopterus*	*wariorum*	Papua New Guinea	1891-2131 m
ARC1854	*Trigonopterus*	*wariorum*	Papua New Guinea	1891-2131 m
ARC1855	*Trigonopterus*	*wariorum*	Papua New Guinea	1911 m
ARC1856	*Trigonopterus*	*wariorum*	Papua New Guinea	1911 m
ARC1857	*Trigonopterus*	*soiorum*	Papua New Guinea	2169 m
ARC1858	*Trigonopterus*	*soiorum*	Papua New Guinea	2169 m
ARC1859	*Trigonopterus*	*soiorum*	Papua New Guinea	1940 m
ARC1860	*Trigonopterus*	*soiorum*	Papua New Guinea	1940 m
ARC1861	*Trigonopterus*	sp. (unique female)	Papua New Guinea	1911 m
ARC1862	*Trigonopterus*	*moreaorum*	Papua New Guinea	1940 m
ARC1863	*Trigonopterus*	*moreaorum*	Papua New Guinea	1940 m
ARC1864	*Trigonopterus*	*moreaorum*	Papua New Guinea	1940 m
ARC1865	*Trigonopterus*	*nangiorum*	Papua New Guinea	2169 m
ARC1866	*Trigonopterus*	*nangiorum*	Papua New Guinea	2169 m
ARC1867	*Trigonopterus*	*nangiorum*	Papua New Guinea	2169 m
ARC1868	*Trigonopterus*	sp. 215	Papua New Guinea	1940 m
ARC1869	*Trigonopterus*	sp. 215	Papua New Guinea	1940 m
ARC1870	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC1871	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC1872	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC1873	*Trigonopterus*	*montivagus*	Papua New Guinea	2169 m
ARC1874	*Trigonopterus*	*montivagus*	Papua New Guinea	2169 m
ARC1875	*Trigonopterus*	*montivagus*	Papua New Guinea	2169 m
ARC1876	*Trigonopterus*	*ragaorum*	Papua New Guinea	2169 m
ARC1877	*Trigonopterus*	*ragaorum*	Papua New Guinea	2169 m
ARC1878	*Trigonopterus*	*ragaorum*	Papua New Guinea	2169 m
ARC1879	*Trigonopterus*	*ragaorum*	Papua New Guinea	2169 m
ARC1880	*Trigonopterus*	*ragaorum*	Papua New Guinea	2169 m
ARC1881	*Trigonopterus*	*ragaorum*	Papua New Guinea	2169 m
ARC1882	*Trigonopterus*	*wariorum*	Papua New Guinea	1911-2131 m
ARC1883	*Trigonopterus*	*wariorum*	Papua New Guinea	1911-2131 m
ARC1884	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC1885	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC1886	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC1887	*Trigonopterus*	sp. 215	Papua New Guinea	2169 m
ARC2189	*Trigonopterus*	*florensis*	Flores	1320m
ARC2192	*Trigonopterus*	*empat*	Flores	1320m
ARC2198	*Trigonopterus*	*ranakensis*	Flores	2205m
ARC2212	*Trigonopterus*	*fissitarsis*	Flores	1215m
ARC2213	*Trigonopterus*	*micans*	Flores	955m
ARC2231	*Trigonopterus*	*tujuh*	Flores	975m
ARC2242	*Trigonopterus*	*delapan*	Flores	525m
ARC2243	*Trigonopterus*	*tiga*	Flores	525m
ARC2245	*Trigonopterus*	*roensis*	Flores	525m
ARC2247	*Trigonopterus*	*mesehensis*	Bali	840m
ARC2256	*Trigonopterus*	*fulgidus*	Lombok	900m
ARC2302	*Trigonopterus*	*batukarensis*	Bali	835m
ARC2314	*Trigonopterus*	*telagensis*	Bali	625m
ARC2326	*Trigonopterus*	*alaspurwensis*	Java	25m
ARC2458	*Trigonopterus*	*argopurensis*	Java	1457m
ARC2483	*Trigonopterus*	*acuminatus*	Java	1379m
ARC2504	*Trigonopterus*	*cahyoi*	Java	1314m

Specimen	Genus	Species	Locality	Elevation
ARC2526	*Trigonopterus*	*wallacei*	Borneo	496m
ARC2531	*Trigonopterus*	*trigonopterus*	Borneo	275m
ARC2538	*Trigonopterus*	*sepuluh*	Borneo	652m
ARC2542	*Trigonopterus*	*attenboroughi*	Borneo	652m
ARC2588	*Trigonopterus*	*enam*	Flores	965m

Table A2 List of all specimens used in this thesis.