

Eleven new species of Sericostomatoidea from Madagascar (Trichoptera: Helicopsychoidea, Petrothrincidae, Sericostomatidae)

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Abstract

Eleven new Trichoptera species of the superfamily Sericostomatoidea are described from Madagascar. Three species within Helicopsychidae are described as *Helicopsyche (Petrotrichia) ambodiva*, new species, *Helicopsyche (Petrotrichia) sahadika*, new species, and *Helicopsyche (Petrotrichia) ninakosha*, new species; six species within the Petrothrincidae are described as *Petrothrincus tsaratananensis*, new species, *Petrothrincus newidop*, new species, *Petrothrincus dhritaparam*, new species, *Petrothrincus pauliani*, new species, *Petrothrincus andohel*, new species, and *Petrothrincus andring*, new species; and two new species within the Sericostomatidae are described as *Cheimacheramus rossi*, new species, and *Rhoizema mahalevonum*, new species. The genus *Gyrocarisa* Weaver 1997 is synonymized with *Petrothrincus* Barnard 1934, resulting in the new combinations *Petrothrincus steineri* (Weaver 1997), new combination, *Petrothrincus concava* (Weaver 1997), new combination, *Petrothrincus acuta* (Weaver 1997), new combination, *Petrothrincus scottae* (Malm & Johanson 2005), new combination, and *Petrothrincus weaveri* (Malm & Johanson 2005), new combination. A key is presented to males of all Sericostomatoidea species from Madagascar. Distribution maps are given for all new and previously described Madagascar species within the superfamily.

Key words: Trichoptera, Sericostomatoidea, Helicopsychidae, Petrothrincidae, Sericostomatidae, Africa, Madagascar, new species, key, distribution maps

Introduction

The superfamily Sericostomatoidea includes a high proportion of very interesting families and genera that exhibit typically Gondwanan affinities. It is therefore not surprising to find a number of the older branches of this superfamily on Madagascar and also in South Africa, both of which were part of the ancient break-up fragment of Gondwana, together with India, the Seychelles and northern South America, about 140 million years ago. About 120 million years ago, Madagascar, together with the Seychelles and India, separated from mainland Africa and northern South America. Thus the fauna of these areas have experienced a long period of isolation and provide interesting insight into the phylogenetic relationships between these older trichopteran taxa, and the biogeography of

Madagascar.

The Trichoptera fauna of Madagascar, with 79 species recorded (Morse 1999, Johanson 2002, Malm & Johanson 2005) is relatively rich compared to many regions of mainland Africa. In species richness it is surpassed only by the (political) region of South Africa for which nearly 160 species are recorded (Moor 2000), and Ghana with nearly 180 species, of which most are still undescribed (Kjærandsen 2005). With few exceptions, descriptions of Trichoptera from Madagascar generally have been based on only one or very few individuals, suggestive of very low population densities. During this study the low-density phenomenon was also apparent, and, of the 11 species described herein, only one is based on more than a single individual.

Three sericostomatoid families are dealt with here: the Helicopsychidae, Petrothrincidae and Sericostomatidae. With the description of six new species in *Petrothrincus*, the family Petrothrincidae is now represented on Madagascar by 11 described species. Representation of the Helicopsychidae is increased to five species, with three newly described below; and the Sericostomatidae is recorded for Madagascar for the first time, with two genera: *Cheimacheramus* Barnard 1934 and *Rhoizema* Barnard 1934. *Cheimacheramus* was previously known to include only *C. caudalis* Barnard 1934 which is endemic to South Africa. Similarly, *Rhoizema* was also believed to be endemic to South Africa, and represented by four species: *furciferum* Barnard 1934, *montanum* Barnard 1934, *saxiferum* Barnard 1934, and *spinatum* Barnard 1934. Both Sericostomatidae and Petrothrincidae are unique within the Trichoptera in having genera restricted to and shared by both South Africa and Madagascar, thus supporting the hypothesis of shared biogeographical history.

Material and methods

The material upon which the new species are based has two primary sources. Specimens originally deposited at Muséum National d'Histoire Naturelle in Paris (MNHN) were collected between 1954 and 1958 on Madagascar by the scarabid specialist, Prof. Dr Renaud Paulian (1913–2003), and were kindly made available by him for this study. A second, smaller collection made by the tick specialist Dr Harry Hoogstraal (1917–1986) in late 1948, from the south-east of Madagascar, and also originally deposited at MNHN, was studied as well. All newly designated holotypes are in alcohol and deposited at MNHN, and paratypes are deposited at the Swedish Museum of Natural History (NRM) or in the János Oláh collection, Szarvas (JOS), as indicated in the text below. Other depository information mentioned in the text are National Museum of Natural History, Smithsonian Institution), Washington, D. C., USA (USNM), South African Museum, Cape Town, South Africa (SAM), Albany Museum, Grahamstown, South Africa (AMG) and Illinois Natural History Survey, Champaign, Illinois, USA (INHS).

The terminology on genitalia follow Nielsen (1957).

Systematics**Helicopsychidae Ulmer, 1906*****Helicopsyche* von Siebold, 1856**

Type species: *Helicopsyche schuttleworthi* von Siebold, 1856: 38 [subsequently designated by Flint (1964): 69].

***Helicopsyche* (*Petrotrichia*) Ulmer, 1910**

Type species: *Helicopsyche palpalis* (Ulmer, 1910): 44.

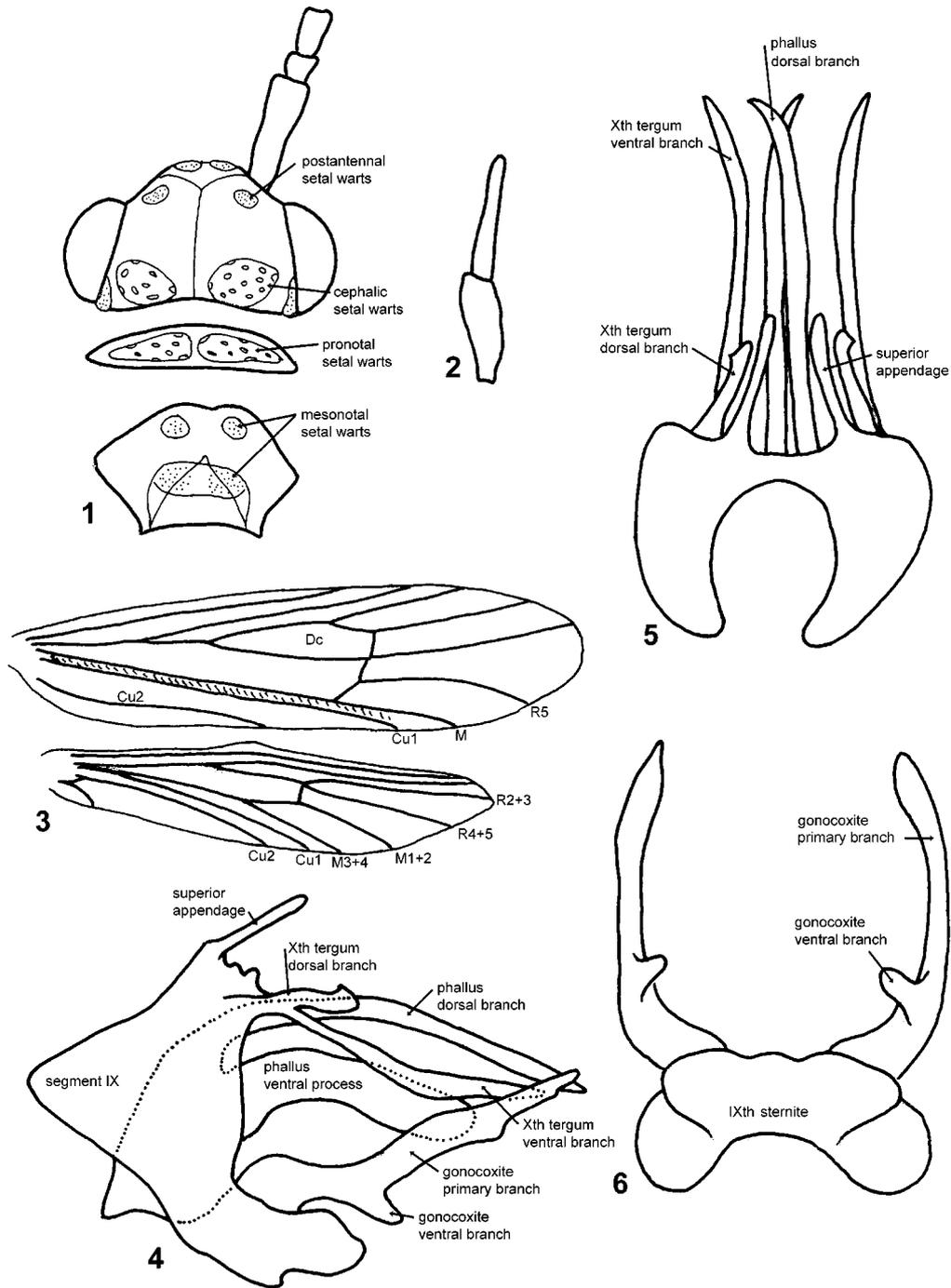
The genus *Petrotrichia* was established for a species described from Mahé Island in the Seychelles, and originally classified within the Hydroptilidae. The species was transferred to *Helicopsyche* by Marlier & Malicky (1979). Johanson (1998) argued for a phylogenetically close relationship between the African species of the genus (Seychelles, Madagascar and East Africa) and referred them to the subgenus *Petrotrichia*. Species of this subgenus are recognized by maxillary palps divided into a short basal and long distal segment, the basal segment bearing strong median setae; interantennal setal warts flat or absent; head tentorium without processes; forewing fork 3 and Cu1b absent, forewing crossvein R3-R4 directed posteriad, hind wing fork 1 longer than its stalk, crossvein M-Cu absent, Cu1 undivided; and abdominal reticulation reduced. The Madagascan species are recognized by having a longitudinal fold in the forewing, with sensillae located between veins M and Cu.

***Helicopsyche* (*Petrotrichia*) *ambodiva*, new species**

Figs 1–6, 58

Helicopsyche. ambodiva is closely related to *H. anomana* Johanson, 2002, especially in the general shape of the gonocoxite involving a short, inwardly oriented ventral branch. *Helicopsyche ambodiva* is distinguished by having the gonocoxite tapering more stepwise and not distally clavate; tergum X characteristically hooked; segment IX with the anterior margin triangular centrally (not dorsally as in *anomana*), and the sternite of segment IX strongly produced posteriorly. In *anomana* segment IX is only slightly produced posteriorly.

Male head and thorax (Figs 1, 2): Antennal scape about 4x as long as wide, slightly longer than diameter of compound eye. Maxillary palp (Fig. 2) 2-segmented, 1st segment broadest, 2nd segment slightly longer than first. Interantennal warts separate from each other. Cephalic setal warts egg-shaped. Postantennal setal warts small, flat, rounded. Postocular setal warts long vertical. Pronotum with one pair of large, wide setal warts. Mesoscutum and mesoscutellum each with one pair of setal warts.



FIGURES 1–6. *Helicopsyche (Petrotrichia) ambodiva*, new species, holotype. 1—head and thorax, dorsal; 2—maxillary palp; 3—right wing pair; 4—genitalia, lateral; 5—genitalia, dorsal; 6—genitalia, ventral.

Male wings (Fig. 3): Forewing length 3 mm, hind wing length 2,7 mm. Denuded wing membrane pale flavous with pale helvus veins. Venation similar to *H. anomana* Johanson and *H. giboni* Johanson. On forewing R5 originating at crossvein R3-R4. M and Cu separate longitudinal fold with sensillae. Discoidal cell long, about one fourth wing length. Abdominal reticulation absent. Sternal process on VI abdominal segment well developed.

Male abdomen and genitalia (Figs 4–6): Segment IX well developed, anteriorly pointed triangularly, exactly in the middle (Fig. 4); central part of posterior margin straight, sternite strongly produced posteriorly and almost rectangular (Fig. 4); in ventral view (Fig. 6) forming a separate ventral unit. Tergum IX very short, narrow in dorsal aspect (Fig. 5). Superior appendage digitate, directed posterodorsally in lateral view (Fig. 4) and slightly medially in dorsal view (Fig. 5). Tergum X forming a pair of bifid elongate processes: mesially a short process, apically slightly hooked dorsally (Fig. 4); laterally a much longer out-curving and tapering ventral branch slightly bending dorsally in latter half (Fig. 4). Gonocoxite simple, a short ventral branch arising near base and generally oriented posterodorsally; main branch undulating, extending beyond ventral branch and narrowing in three steps. Basal plate not conspicuous. Phallic base broad due to the origin of the long dorsal process (Fig. 4) running closely and almost parallel before crossing subapically (Fig. 5); ventral process of phallus about 2x broader than dorsal process. Both dorsal and ventral processes slightly sinuous and down-curving along their lengths (Fig. 4).

Etymology. The name is derived from the local name of the type locality of the species, Ambodivoangy.

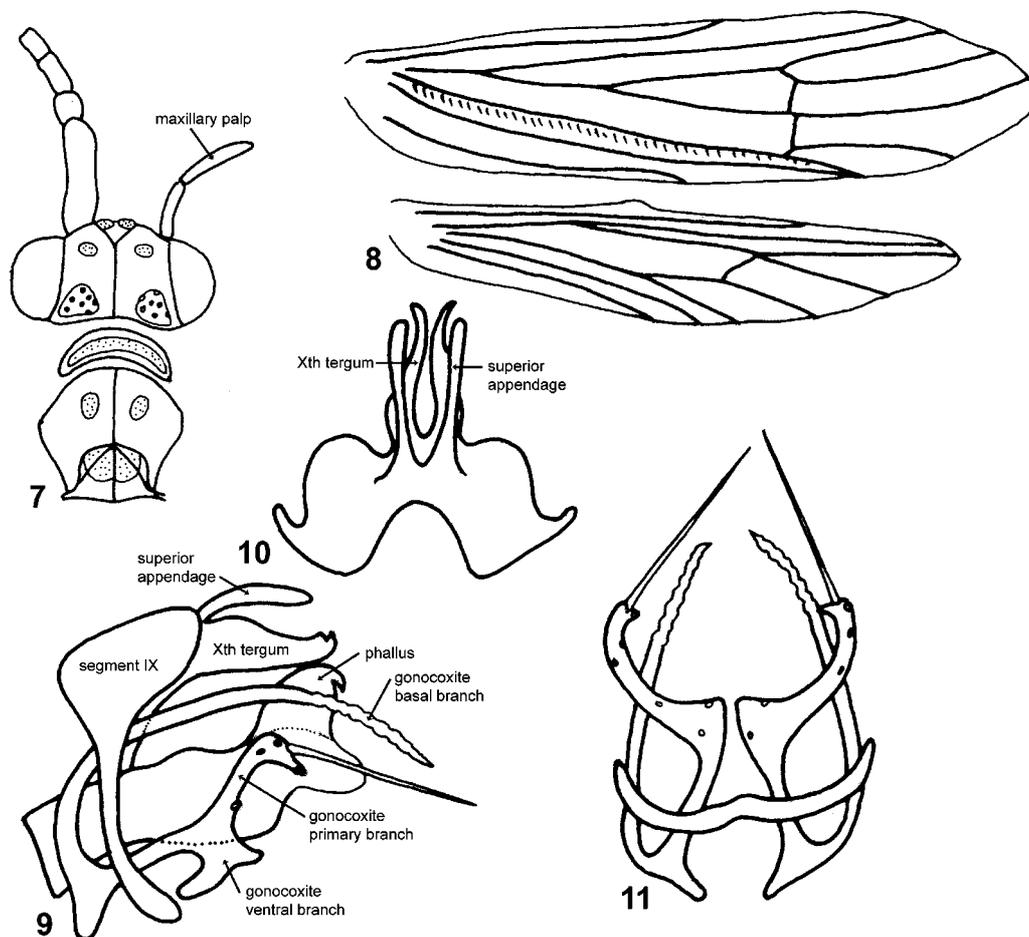
Holotype male: MADAGASCAR: Maroantsetra, Ambodivoangy, iii. 1957 [R. Paulian] (MNHN, in alcohol).

***Helicopsyche (Petrotrichia) sahadika*, new species**

Figs 7–11, 58

This new species is close to *ninakhosa*, new species, sharing the character states of fused pronotal setal warts, and reduced ventral part of segment IX. However, males are easily distinguished from *ninakhosa* by the absence of a prominently modified ventral branch of the gonocoxite, segment IX more rounded, Xth tergum longer, gonocoxites apically bent ventrally and having a long, curved basal branch.

Male head and thorax (Fig. 7): Scape about 3.5x as long as wide, nearly 1.5x longer than eye diameter. Maxillary palp (Fig. 7) 2-segmented, uniformly broad, 2nd segment slightly longer than first. Interantennal warts separate from each other. Cephalic setal warts small, rounded triangular. Postantennal setal warts small, flat, rounded. Postocular setal warts not conspicuous. Pronotum with broad setal warts completely fused medially to form a long, transverse wart. Mesoscutum and mesoscutellum each with one pair setal warts.



FIGURES 7–11. *Helicopsyche (Petrotrichia) sahadika*, new species, holotype. 7—head and thorax, dorsal; 8—right wing pair; 9—genitalia, lateral; 10—genitalia, dorsal; 11—genitalia, ventral.

Male wings (Fig. 8): Forewing length 3 mm, hind wing length 2.6 mm. Denuded wing membrane pale flavous with pale helvus veins. In forewing R5 originating distad of crossvein R3-R4. M and Cu separate; a longitudinal groove with sensilla. Discoidal cell long, about 1/4x the wing length. Abdominal reticulation absent. VIth sternal process well developed.

Male abdomen and genitalia (Figs 9–11): Segment IX strongly modified: extremely narrow, with club-shaped, anterior lobe located at dorsalmost part; the lateral and ventral regions reduced to narrow bands. Superior appendages finger-like, downwardly directed in lateral (Fig. 9), and slightly divergent in dorsal, aspects (Fig. 10). Tergum X forms a pair of sigmoid elongate processes, tapering along its length; narrow in dorsal view (Fig. 10); wide in lateral view (Fig. 9), apex bifid and dorsally directed. Gonocoxite forms a complex of narrow strips, the distal end armed with a strong and elongate subapical spine (Figs 9,

11); apex of primary branch angled 90°, ventral branch oriented ventrally and divided into anterior and posterior lobes (Fig. 9). A pair of very long, slender basal branches of gonocoxite oriented dorsally at basis, curve posteriorly and slightly ventrally near apex, with distal 1/3 annulate. Phallus about as long as basal branch of gonocoxite, forming a wide tube, with undulating dorsal and ventral margins (Fig. 9), subapical flank well sclerotized and, in lateral aspect, ending in a downwardly curving hook (Fig. 9).

Etymology. “*sahadika*”, from Sanscrit, meaning frame, referring to the unique framework of the narrow strip complex of the gonocoxite.

Holotype male: MADAGASCAR: Demongloy, Mananteina Fort, Dauphin District, xii. 1948 [Hoogstraal] (MNHN, in alcohol).

Helicopsyche (Petrotrichia) ninakosha, new species

Figs 12–16, 58

This new species is morphologically close to *H. sahadika*, new species in that the pronotal setal warts are similarly modified into a single, wide wart. In genitalic features, the two species are very similar: both have segment IX highly reduced, forming a very narrow plate ventrally; they have Xth tergum simple, a strong and very long spine apically on the gonocoxite, and the ventral branch of the gonocoxite modified. The last similarity is, however, very differently expressed in the two species and they are easily distinguished from each other by the shape of the ventral branch of the gonocoxite in both lateral and ventral aspects.

Male head and thorax (Fig. 12). Scape about 2.5x longer than wide. Second segment of maxillary palp about 2x longer than basal segment (Fig. 12). Interantennal warts slightly separate from each other, cephalic warts nearly triangular, one pair of postantennal warts small and rounded, and postocular warts not conspicuous. Pronotum with paired setal warts completely fused medially into a single transverse wart. One pair of oval setal warts present on mesoscutum.

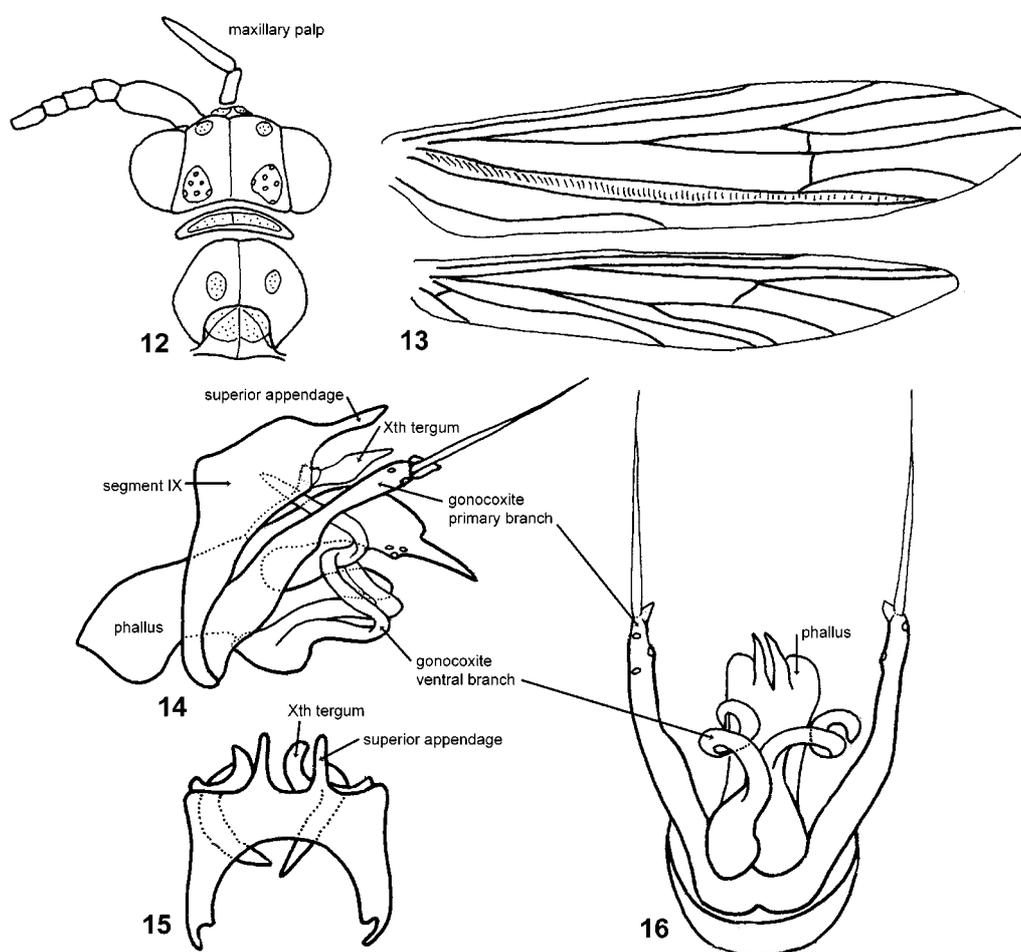
Male wings (Fig. 13). Forewing length 2.7 mm, hind wing length 2.2 mm. Denuded wing membrane pale flavous with veins pale helvus. Venation similar to *H. anomana* Johanson and *H. giboni* Johanson. On forewing R5 originating immediately distally to crossvein R3-R4. M and Cu separate a longitudinal groove containing sensilla and reaching the wing margin. Discoidal cell about 1/5 the wing length.

Male abdomen and genitalia (Fig. 14–16). Abdominal reticulation absent. VIth sternal process well developed. Segment IX strongly narrowed anteroposteriorly and slightly thicker at dorsal half (Fig. 14); anterior margin with short, slightly pointed dorsal anterior lobe; posterior margin slightly produced into triangle opposite to anterior lobe; narrow in ventral (Fig. 16) and dorsal view (Fig. 15). Superior appendage fused with tergum IX and originating at posterodorsal corner of segment IX, finger-like, straight and oriented posterodorsad. Tergum X forms a pair of diverging, falciform plates, well separated in

dorsal view (Fig. 15), inner lobe tapering in lateral aspect (Fig. 14). Gonocoxite primary branch forms a simple, weakly curving rod, its distal end armed with a subapical strong and long spine. The ventral branch of the gonocoxite forms a long, parallel-sided process, spiralling strongly towards and above phallus (Figs 14, 16). Phallus basally broad, divided into a nearly uniformly thick ventral process and a dorsal branch that is about 2x broader than the ventral process and has three subapical setae below the spinose apex (Fig. 14).

Etymology. Named after the very specialised, spiralling shape of the ventral branch of gonocoxite. In Sanscrit, “ninakosha” means spiral.

Holotype male: MADAGASCAR: Demongloy, Mananteina Fort, Dauphin District. Xii. 1948 [Hoogstraal] (MNHN, in alcohol).



FIGURES 12–16. *Helicopsyche (Petrotrichia) ninakosha*, new species, holotype. 12—head and thorax, dorsal; 13—right wing pair; 14—genitalia, lateral; 15—genitalia, dorsal; 16—genitalia, ventral.

Petrothrincidae Scott, 1985***Petrothrincus* Barnard, 1934: 323, 325.**

Gyrocarisa Weaver, 1997: 467–468. **New synonym**

Type species: *Petrothrincus circularis* Barnard, 1934: 325–327.

The Madagascan genus *Gyrocarisa* Weaver was separated from the South African genus *Petrothrincus* on the basis of dorsal posterolateral setal warts of the head reniform in both male and female, and forewing with a short discal cell in both male and female. Evidence from the new species from Madagascar, suggests that the shape and pattern of the setal warts on the head and thorax are not very stable. Also, the length of discal cell varies between 1x and 3x its width in the species described here. Moreover, in number of segments, and ratios of length and shape of the male maxillary palp vary to a very great extent. The basic patterns of the genitalia structures as well as forewing venation are very similar and stable between the species. Based on these new findings, division of the species referred to Petrothrincidae into different genera is indefensible. In this paper, *Gyrocarisa* is therefore synonymized with *Petrothrincus*.

***Petrothrincus circularis* Barnard, 1934**

Fig. 59

Petrothrincus circularis Barnard, 1934: 325 [Type locality: western Cape Province, Table Mountain, Echo Valley, Cape Town, February–April [K.H. Barnard]; SAM; male lectotype selected and designated by Scott & de Moor (1993), from Barnard's syntypes in SAM].

***Petrothrincus triangularis* (Hagen, 1864)**

Fig. 59

Molanna triangularis Hagen, 1864: 225 [Type locality: Swellendam, western Cape Province; material lost; larval case].

Petrothrincus triangularis (Hagen) Barnard, 1934: 325, 327.

Petrothrincus triangularis (Hagen); Scott & de Moor, 1993: neotype male: from specimens collected by Hans Malicky (AMG).

The type material of *P. triangularis* on which the original description of this species was based on has never been found and is considered lost (Scott & de Moor 1993). A male neotype was designated by Scott (1993).

***Petrothrincus demoori* Scott, 1993**

Fig. 59

Petrothrincus demoori Scott & de Moor, 1993: 322–328 [Type locality: southern Cape, Plaat River, tributary of the Karatara River, at Klein Plaat se Brug, 33.5320°S, 22.5045°E, altitude c 280 m; AMG; male].

***Petrothrincus steineri* (Weaver, 1997), new combination**

Fig. 59

Gyrocarisa steineri Weaver, 1997: 468–470 [Type locality: Madagascar. Fianarantsoa Prov.: 7 km W Ranomafan, 900 m, 8–13.iii.1990 [W.E. Steiner], malaise trap across stream in rain forest; NMNH; male].

***Petrothrincus concava* (Weaver, 1997), new combination**

Fig. 59

Gyrocarisa concava Weaver, 1997: 470–472 [Type locality: Madagascar. Fianarantsoa Prov.: 7 km W Ranomafan, 900 m, 20–31.i.1990 [W.E. Steiner], rain forest, black light trap; NMNH; male].

***Petrothrincus acuta* (Weaver, 1997), new combination**

Fig. 59

Gyrocarisa acuta Weaver, 1997: 472–473 [Type locality: Madagascar. Fianarantsoa Prov.: 7 km W Ranomafan, 900 m, 20–31.i.1990 [W.E. Steiner] rain forest, black light trap; NMNH; male].

***Petrothrincus scottae* (Malm & Johanson, 2005), new combination**

Fig. 59

Gyrocarisa scottae Malm & Johanson, 2005: 16–17 [Type locality: Madagascar. Fianarantsoa Prov.: Ranomafan, malaise trap near river in tropical forest, 12–20.xii.1999, 1150 m, 21.2554°S, 47.4552°E [M.E. Irwin and E.I. Schlinger]; INHS; male].

***Petrothrincus weaveri* (Malm & Johanson, 2005), new combination**

Fig. 59

Gyrocarisa weaveri Malm & Johanson, 2005: 18–19 [Type locality: Madagascar. Fianarantsoa Prov.: Ranomafan, Malaise trap near river in tropical forest, 12–20.xii.1999, 1150 m, 21.2554°S, 47.4552°E [M.E. Irwin and E.I. Schlinger]; INHS; male].

Petrothrincus tsaratananensis, new species

Figs 17–19, 28–31, 59

This new species is very close to *P. steineri*, *P. weaveri*, *P. newidop*, new species, and *P. andring*, new species, in genitalia, especially in having a 3-branched gonocoxite. *P. tsaratananensis* is, however, unique and easily distinguished from the others by having interantennal setal warts on the head slightly produced; IXth tergum well defined but short; apex of apical lobe of Xth tergum well developed, short, and not bifid; gonocoxite branches of characteristic shape; and, in ventral view, the median margins of the gonocoxite running parallel; the three pairs of spine-shaped phallic sclerites approximately equal in length; the phallus slightly more angled; and the posterior apex of the phallic guide more rectangular and with incisions on the posterior apex.

Male head and thorax (Figs 17–19). Scape about 3x as long as wide (Fig. 17). Maxillary palp (Fig. 18) 5-segmented, 1st segment 2x longer than wide, 2nd segment about as long as 3rd segment and as long as wide, 3rd segment shortest, 4th segment 2x longer than 1st segment, 5th segment as long as 3rd and 4th together. Labial palp (Fig. 19) about as long as maxillary palp segments 1–4 together. Interantennal warts close to each others and slightly produced anteriorly (Fig. 17), cephalic warts reniform, postocular warts long vertical. Pronotum narrow with small, oval lateral setal warts and median setal warts about 2x longer than lateral setal warts.

Male wings. Forewing length 5 mm, hind wing length 3.8 mm. Denuded wing membrane pale flavous with pale helveus veins. Venation typical. Discoidal cell 1.7x longer than wide. Subcosta and, particularly, radius on forewing and subcosta on hind wing strongly thickened. Pterostigmal area enlarged and well pigmented.

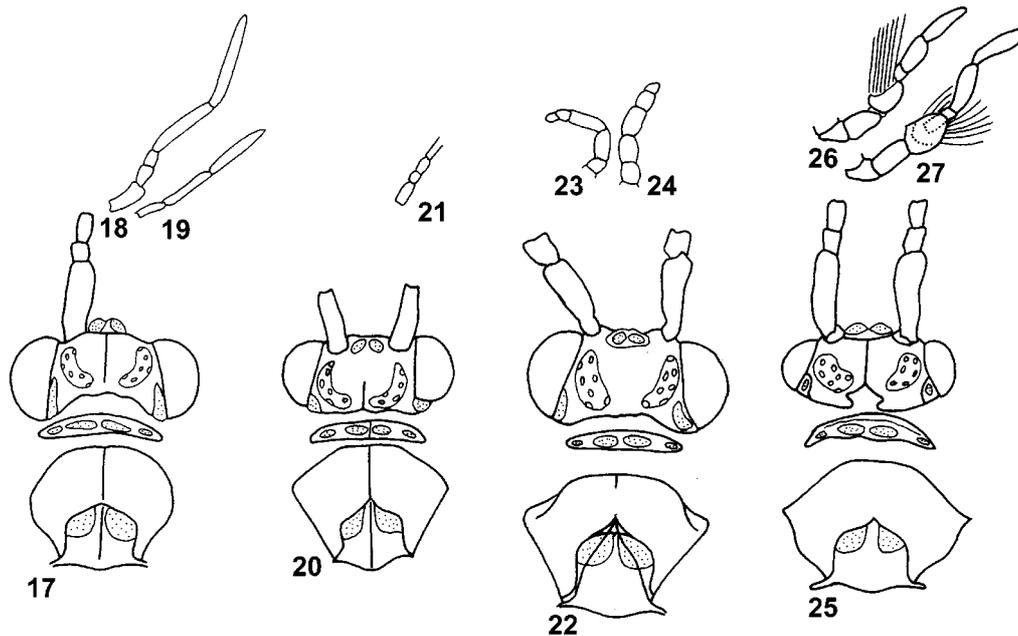
Male genitalia (Figs 28–31). Anterior margin of segment IX (Fig. 28) bluntly triangular, almost semicircular, anterodorsal and anteroventral margins about equally strongly concave, posterior margin concave with a triangular upper lobe in lateral aspect (Fig. 28). IXth tergum very short (Fig. 28). Xth tergum, dorsal view (Fig. 29) triangular basally, a short apical lobe with rounded apex and 2 short apical setae; lateral view (Fig. 28) apical lobe curving slightly downward. Superior appendage of segment X broader towards truncate apex, digitate with large tubercles along posterior margin (Fig. 28) and with long setae basally supported by a wide, dorsal plate (Fig. 29). Gonocoxite tripartite distally and generally oriented dorsally (Fig. 28), dorsal branch slightly curving posteriorly and with rounded apex; middle branch longer than dorsal branch, more strongly pointed apically and bent ventrally; ventral branch short, wide and rounded apically; in ventral view (Fig. 31) with long median margin of gonocoxite. Phallic guide posteriorly slender in lateral view (Fig. 28); in ventral view (Fig. 31) generally wide along its length, apex broadly and deeply divided forming pair of incised lateral projections directed laterally. Phallus, lateral view (Fig. 28) with basal one third equally wide and widens before midway before tapering towards apex. In ventral view (Fig. 30) with basal one third narrowest. Phallic sclerites form 3 pairs, the anterior pair slightly shorter than the

other pairs (Figs 28, 30).

Etymology. The species is named after the type locality, Mt Tsaratanana on Madagascar.

Holotype male: MADAGASCAR: Mt Tsaratanana, 500 m, no date [R. Paulian].

Paratypes: MADAGASCAR: Mt D'Ambre, Les Roussettes. [B. Stuckenberg] — 5 males, 2 females (NRM alcohol); ditto, except — 4 males, 2 females (JOS alcohol); MADAGASCAR: Andohahela, i. 1954 [R. Paulian] — 1 male, 1 female (NRM).



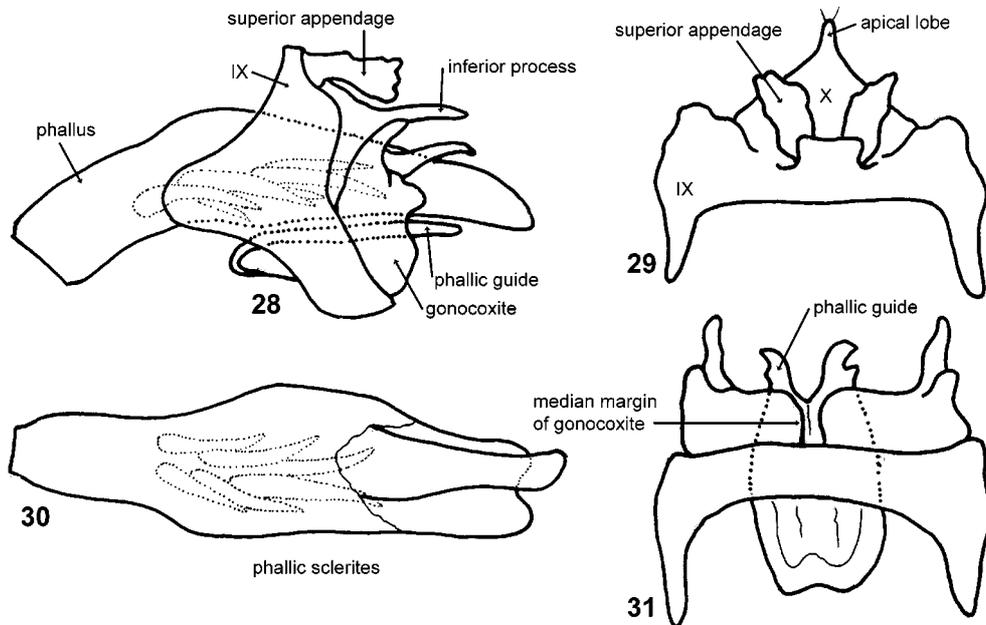
FIGURES 17–27. *Petrothrincus* spp. Male head and thorax: 17–19. *Petrothrincus tsaratananensis*, new species, holotype. 17—head and thorax, dorsal; 18—maxillary palp; 19—labial palp. 20–21. *Petrothrincus pauliani*, new species, holotype. 20—head and thorax, dorsal; 21—maxillary palp (broken). 22–24. *Petrothrincus andohel*, new species, holotype. 22—head and thorax; 23—maxillary palp lateral; 24—maxillary palp, dorsal. 25–27. *Petrothrincus andring*, new species, holotype. 25—head and thorax, dorsal; 26—maxillary palp, dorsal; 27—maxillary palp, lateral.

***Petrothrincus newidop*, new species**

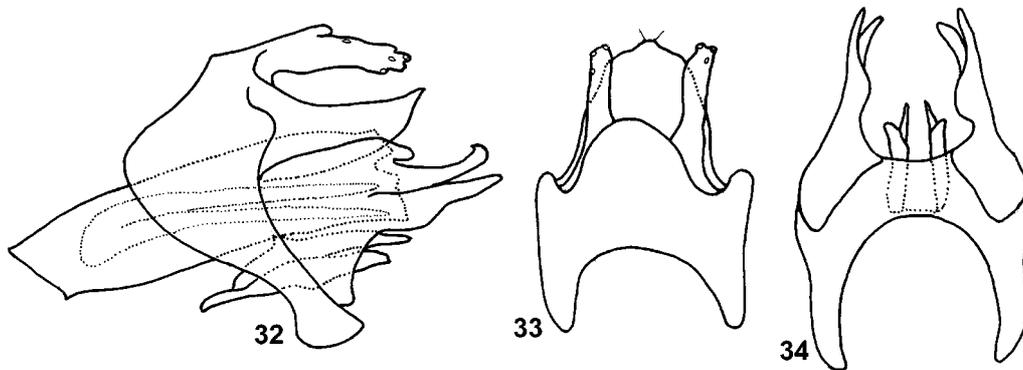
Figs 32–34, 59

The genitalia of this new species resemble those of *P. steineri*, *P. scottae*, *P. tsaratananensis* and *P. andring* in the tripartite division of the gonocoxite. *P. newidop* is separated by the basally higher and knife-shaped Xth tergum, the phallic guide divided into 2 pairs of rod-shaped plates, the up-turned apex of the gonocoxal median lobe, and the dorsal, tongue-shaped expansion of the IXth tergum. In *scottae* the phallus also has 1 pair

of long phallic sclerites but has shorter expansion of the IXth tergum, short and thick ventral phallic guide, slightly down-turned median branch of gonocoxite, and more slender Xth tergum. The length ratios of the segments of the maxillary palp also differ from other similar species.



FIGURES 28–31. *Petrothrincus tsaratananensis*, new species, holotype. Male genitalia: 28—genitalia, lateral; 29—genitalia, dorsal; 30—genitalia, ventral; 31—phallus, ventral.



FIGURES 32–34. *Petrothrincus newidop*, new species, holotype. Male genitalia: 32—genitalia, lateral; 33—genitalia, dorsal; 34—genitalia, ventral.

Male head and thorax. Antennal scape about 3x as long as wide. Maxillary palp 5-segmented, 1st segment 4x longer than wide, 2nd segment about 1/3x the length of 1st, 3rd segment shortest, only 1/4 as long as first, 4th and 5th segments as long as 1st. The 3-

segmented labial palp almost as long as maxillary palp. Interantennal warts close to each others, cephalic setal warts reniform, postocular.

Male wings. Forewing length 5.0 mm, hind wing length 3.8 mm. Denuded wing membrane pale flavous with pale helveus veins. Venation typical except discoidal cell 1.7x longer than wide. Subcosta and particularly radius on forewing and subcosta on hind wing strongly thickened. Pterostigmal area enlarged and well pigmented.

Male genitalia (Figs 32–34). Anterior margin of abdominal segment IX ellipsoid, almost semicircular, anterodorsal margin shallowly concave, anteroventral margin deeply concave ventrally, posterior margin with rounded triangular upper lobe in lateral aspect (Fig. 32). Tergum IX strongly produced backwards into a wide semicircular lobe (Fig. 33). Sternum short and clavate (Figs 32, 34). Superior appendage digitate with produced setal tubercles, slightly curved ventrally. Tergum X as long as superior appendage, curving dorsally and strongly tapering along its length (Fig. 32); in dorsal view (Fig. 33) wide along its length, except slightly narrowing towards apical lobe; apical lobe minute, apically undivided, with 1 pair setae. Gonocoxite basally wide, distal half divided into 3 lobes (Fig. 32); dorsal lobe short, slightly oriented ventrally, median lobe long, up-turned at apex, ventral lobe straight, tapering, with undulating ventral margin (Fig. 32). Phallic guide composed of 2 pairs equally long, elongate rods (Figs 32, 34), upper pair wider than ventral pair, slightly curving laterally toward apex (Fig. 34), ventral pair posteriorly narrower than upper pair (Fig. 34). Phallus broad along its length, slightly bent ventrally at $\frac{3}{4}$ its length, with 1 pair of spines nearly as long as phallus (Fig 32).

Etymology. This new species is named for the first impression upon discovery of its identity as a *Petrothrincus*. In Sanscrit, “newidopa” means identical.

Holotype male: MADAGASCAR: Mt Tsaratanana, 500 m [R. Paulian].

***Petrothrincus dhritaparam*, new species**

Figs 35–37, 59

This new species is separated from other congeners by the bipartite up-curving gonocoxite, the slender pair of phallic guide plates, and the short phallus.

Male head and thorax. Antennal scape about 3x as long as wide. Maxillary palp 5-segmented (5th segment broken), 1st segment 2x longer than wide, 2nd and 3rd segments similar, 4th segment almost twice as long as the first three. Interantennal setal warts small, rounded, situated close to each other. Cephalic setal warts reniform. Postocular setal warts long, vertical. Two pairs of pronotal setal warts: median pair long, lateral pair small.

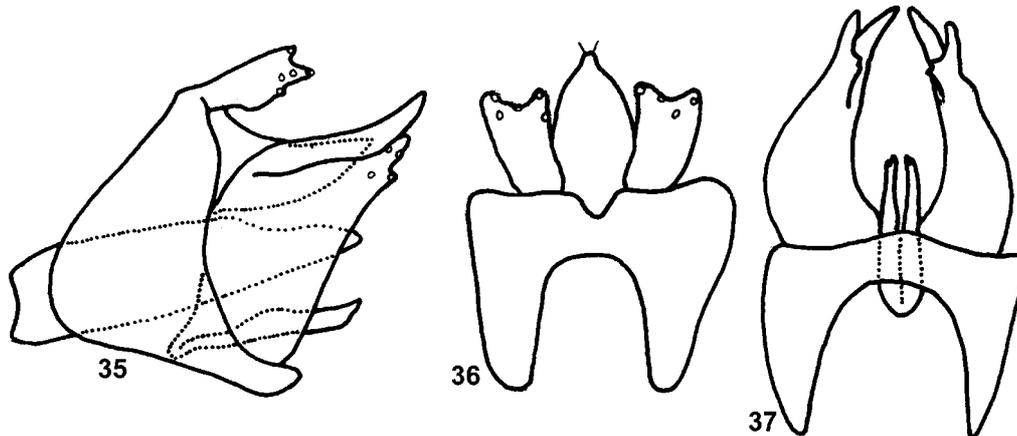
Male wings. Forewing length 4.0 mm, hind wing length 3.0 mm. Denuded wing membrane very pale veins also colourless. Venation typical, except discoidal cell twice as long as wide.

Male genitalia (Figs 35–37). Anterior margin of abdominal segment IX uniformly hyperboloid, anterodorsal and anteroventral margins nearly straight (Fig. 35); posterior

margin concave, without upper lobe (Fig. 35). Tergum IX very short (Figs 35, 36). Sternum IX short and strongly produced posteriorly (Fig. 35). Superior appendages long, but shorter than Xth tergum, nearly quadrangular in lateral and dorsal aspects, apically incised (Fig. 35), with long setae. Xth tergum narrowly egg-shaped, with short apical lobe armed with two small setae (Fig. 36); in lateral view (Fig. 35) slightly curved up-ward, knife-shaped. Gonocoxite distally bipartite (Fig. 35), dorsal lobe longest, up-curving and without setae, lower lobe slightly bifid subapically and bearing setae. Phallic guide forms 1 pair of slender rods with undulating dorsal margin in lateral view (Fig. 35) running very close and parallel in ventral view (Fig. 37), apices slightly bifid (Fig. 37). Phallus short, about equally wide in lateral view, except tapering from posterior 2/3 (Fig. 35).

Etymology. Named after it was found hidden among small psychomyiid specimens during sorting. In Sanscrit, “dhrítaparam” means hidden..

Holotype male: MADAGASCAR: Perinet, P. Viette, ix 1954 [R. Paulian].



FIGURES 35–37. *Petrothrincus dhrítaparam*, new species, holotype. Male genitalia: 35—genitalia, lateral; 36—genitalia, dorsal; 37—genitalia, ventral.

***Petrothrincus pauliani*, new species**

Figs 20–21, 38–40, 59

Described from a single male, this species is unique in the genus in having the anterior margin of abdominal segment IX sharply triangular, the superior appendages short, divided distally to form 3 distinct lobes, the phallic guides hooked distally, and the phallus with two pairs of sclerites in the form of stout spines.

Male head and thorax (Figs 20–21). Antennal scape about 3x as long as wide. Maxillary palp (Fig. 21) probably 5-segmented, 1st segment 2x longer than wide, 2nd about 1/3x the first, 3rd segment 1.5x longer than 2nd, (4th and 5th segments broken).

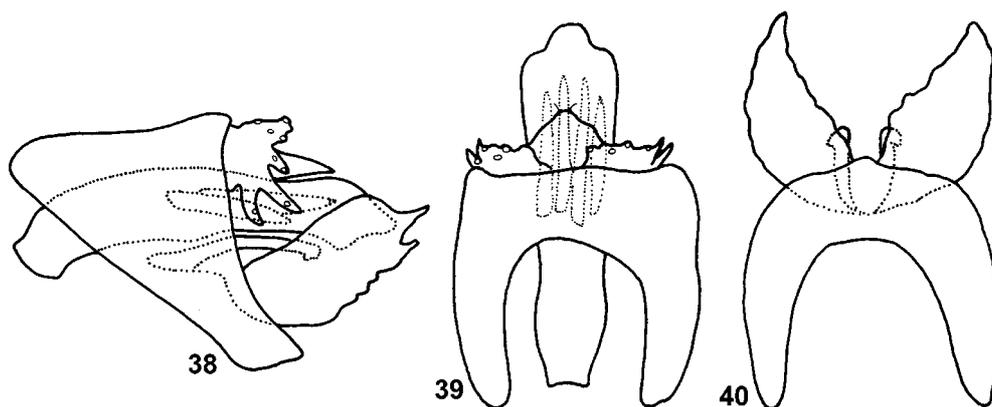
Interantennal setal warts situated close to each other. Cephalic setal warts not reniform, rather falciform (Fig. 20), postocular setal warts long, vertical. Two pairs pronotal setal warts, median pair of warts slightly longer than lateral pair.

Male wings. Forewing length 4.8 mm, hind wing length 3.5 mm. Denuded wing membrane pale with pale helveus veins. Venation typical, except discoidal cell 2.3x longer than wide, subcosta and, particularly, radius on forewing and subcosta on hind wing strongly thickened. Pterostigmal area enlarged and well pigmented.

Male genitalia (Figs 38–40). Anterior margin of abdominal segment IX sharply triangular, apex located dorsally; posterior margin shallowly concave, vertical, sternum directed posteroventrad in lateral aspect (Fig. 38). Tergum posterior margin about straight in dorsal aspect (Fig. 39). Superior appendages in form of short, broad plate in both lateral and dorsal aspects (Figs 38, 39), with three finger-like lateral lobes directed downwards in lateral aspect (Fig. 38), surfaces covered with small tubercles-like bases of long setae. Xth tergum slightly longer than superior appendage, widely triangular in dorsal view (Fig. 39) and narrowly pointing posteriorly in lateral view (Fig. 38); apical lobe reduced, bearing 1 pair of apical setae (Fig. 39). Gonocoxite nearly rectangular in lateral view (Fig. 38), at posterior apex bearing 2 small, pointed lobes, upper lobe 2x longer than lower lobe; ventral margin undulating; dorsal margin nearly straight; in ventral view (Fig. 40) slightly sigmoid and posteriorly pointed. Phallic guide forms 1 pair of elongate rods, slightly bent posteriorly at midway, with short, downward apical hooks visible in both lateral and ventral aspects (Figs 38, 40). Phallus about equally wide along its length in lateral aspect (Fig. 38), slightly concave ventral margin; in dorsal view (Fig. 39) widening posteriorly towards small, knob-shaped apex (Fig. 39); with 2 pairs strong, spine-shaped internal sclerites, the lateral pair slightly shorter than median pair.

Etymology. This species is named after the collector, Prof. R. Paulian.

Holotype male: MADAGASCAR: Mt Tsaratanana, 1500 m [R. Paulian].



FIGURES 38–40. *Petrothrincus pauliani*, new species, holotype. Male genitalia: 38—genitalia, lateral; 39—genitalia, dorsal; 40—genitalia, ventral.

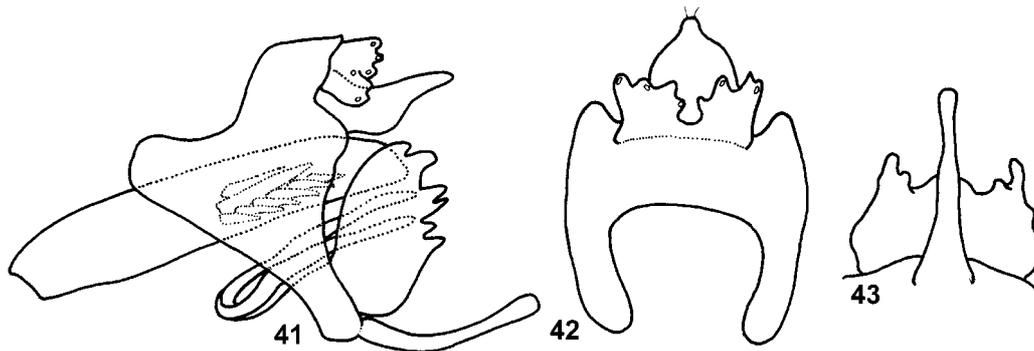
Petrothrincus andohel, new species

Figs 22–24, 41–43, 59

This species is the only one having IXth sternum elongate and apparently articulated with the main body of the segment. The broad and multilobed distal margins of the superior appendages and gonocoxites are unique in the family.

Male head and thorax (Figs 22–24). Antennal scape about 3x longer than wide. Maxillary palp 5-segmented and greatly shortened (Figs 23, 24), 1st, 4th and 5th segments about equal in length, 2nd and 3rd about 1.5x and 2x longer than 1st, respectively. Labial palp almost as long as maxillary palp. Interantennal setal warts nearly tangential, cephalic setal warts reniform, postocular setal warts long, vertical. Pronotum with 2 pairs of setal warts, median pair about 2x wider and longer than lateral pair.

Male wings. Forewing length 5.0 mm, hind wing length 3.9 mm. Denuded wing membrane pale with pale flavous veins. Venation typical, except discoidal cell short, almost as long than wide. Subcosta and, particularly, radius on forewing and subcosta on hind wing strongly thickened. Pterostigmal area strongly enlarged and well pigmented.



FIGURES 41–43. *Petrothrincus pauliani*, new species, holotype. Male genitalia: 41—genitalia, lateral; 42—genitalia, dorsal; 43—genitalia, ventral.

Male genitalia (Figs 41–43). Anterior margin of segment IX with a prominent rectangular anterior lobe, anterodorsal margin nearly right-angled concave, anteroventral margin shallowly concave; posterior margin uniformly and shallowly concave, with a small, blunt upper lobe in lateral aspect (Fig. 41); IXth tergum slightly elongate posteriorly in lateral aspect (Fig. 41). Main body of sternum short and parallel-sided in lateral view; with very long ventral process originating from and apparently articulated with posterior sternal apex, parallel-sided, slightly up-curving and apically rounded in lateral view (Fig. 41), undulating and tapering in ventral view (Fig. 43). Superior appendages form broad plates both in lateral and dorsal aspect, with 4–5 small distal ‘lobes’, the enlarged setal protuberances that are united anteromedially in a common base. Xth tergum about 2x longer than superior appendages; in lateral view dorsal margin slightly concave, ventral

margin strongly convex at midway, tapered to apex (Fig. 41); in dorsal view (Fig. 42) long, ellipsoid, with short apical lobe bearing 1 pair of short apical setae. Gonocoxite oriented dorsally, with convex anterodorsal and ventral margins; sharply undulating posterior margin (Fig. 41) forming 3 pairs of bifid lobes. Phallic guide forms two elongate rods (Fig. 41). Phallus broad, nearly straight, forming a parallel-sided tube along its whole length, with phallic sclerites in form of 2 long and 6 shorter stout spines visible in lateral aspect (Fig. 41).

Etymology. This species is named after the local name of the type locality.

Holotype male: MADAGASCAR: Andohahela, 1800 m [R. Paulian].

***Petrothrincus andring*, new species**

Figs 25–27, 44–46, 59

This new species is close to *P. scottae*, but differs in having the superior appendages more slender and oriented upward, the shape of the IXth segment and Xth tergum in both lateral and dorsal views, the gonocoxite with a deeper apical incision, and phallic sclerites absent.

Male head and thorax (Figs 25–27). Antennal scape about 4x as long as wide (Fig. 25). Maxillary palp apparently 6-segmented, segmentation or articulations of 3rd segment not clear (see remarks below). 1st segment shortest, 2nd, 4th and 5th of about equal length, 3rd broadened by 2.5x, bearing a tuft of long modified setae and seems subdivided by false joint centrally on wide part (Figs 26–27). Interantennal setal warts tangential to each other, cephalic setal warts broad reniform, postocular warts small, oval, present dorsally on head. Pronotum with 2 pairs of setal warts, median pair of warts egg-shaped, about 2x longer and wider than lateral setal warts.

Male wings. Forewing length 4.5 mm, hind wing length 3.4 mm. Denuded wing membrane pale with pale flavous veins. Venation typical, except discoidal cell nearly 3x longer than wide. Subcosta and particularly radius on forewing and subcosta on hind wing strongly thickened. Thickening also present on M3+4, Cu1 and A1 in forewing. Pterostigmal area strongly enlarged and well pigmented.

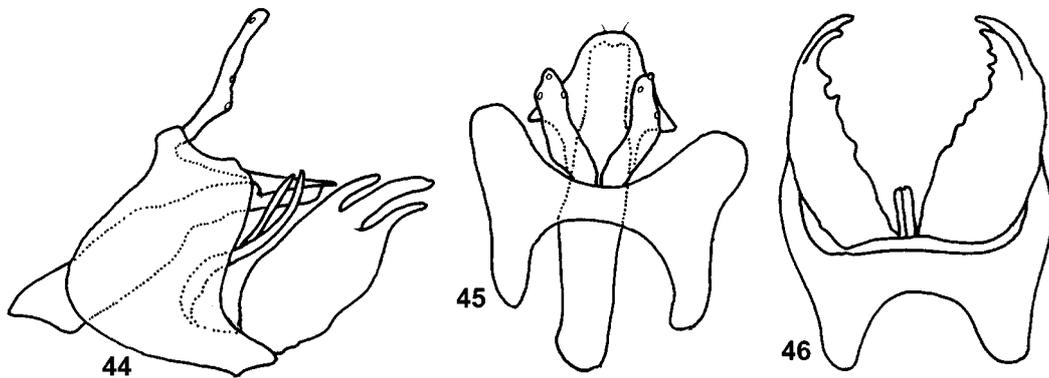
Male genitalia (Figs 44–46). Anterior margin of segment IX with anterior lobe ellipsoid; posterior margin broadly incised at ventral part, dorsal part produced posterodorsally (Fig. 44), IXth tergum H-shaped in dorsal aspect (Fig. 45). Sternum short and directed posteriorly in lateral aspect (Fig. 44). Superior appendage long finger-like in lateral view (Fig. 44), directed upward, with widely triangular ventral protuberance at 1/3; in dorsal view closely adpressed at base, divergent distally (Fig. 45). Xth tergum lanceolate in lateral view (Fig. 44); in dorsal view (Fig. 45) basally narrow, at midway expanded laterally into pair of triangular processes, apex with short, wide apical lobe armed with 2 small setae. Gonocoxite long, directed posterodorsally, strongly excised into 3 long, slender lobes at distal 3rd; in ventral view (Fig. 45) median margin irregularly serrated, apex curved inward. Phallic guide forms 1 pair of elongate, slender up-curving

rods (Fig. 44); in ventral view (Fig. 46) adpressed and parallel between gonocoxites. Phallus basal half about 2x broader than distal half in lateral view (Fig. 44), slightly bent posteriorly at midway, without phallic sclerites.

Etymology. Name derived from the local name for the type locality of this interesting species.

Holotype male: MADAGASCAR: Andringitra, Soanindrano, 2070 m, 15.i 1958 [collector unknown].

Remarks. The maxillary palps appear to comprise 6 segments probably due to subdivision of segment 3 into a broad basal part and a slender distal part.



FIGURES 44–46. *Petrothrincus andring*, new species, holotype. Male genitalia: 44—genitalia, lateral; 45—genitalia, dorsal; 46—genitalia, ventral.

Sericostomatidae Stephens, 1836

Cheimacheramus Barnard, 1934

According to Barnard (1934) the males of this genus can be recognized by, among other more doubtful characters, having spurs 224; ocelli absent; antennae slightly shorter than the forewing; forewing forks 1 and 2 present; hind wing forks 1, 2, and 5 present; and forewing discoidal cell present or absent. Previously, only one species, *C. caudalis* Barnard, 1934, was recorded from South Africa.

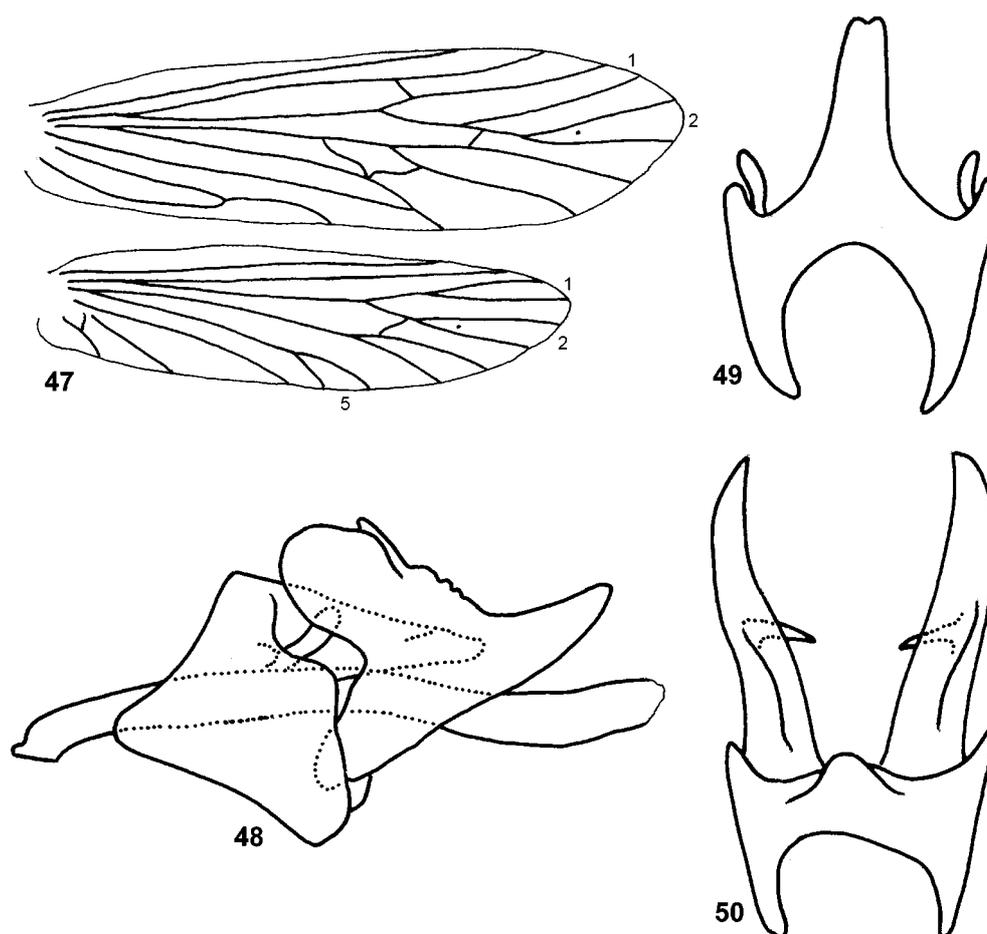
Cheimacheramus rossi, new species

Figs 47–50, 60

This new species is close to *C. caudalis* from which it is easily separated by having the antennal scape longer, almost 2x longer than broad; wings narrower; and in the male genitalia IXth sternum less strongly produced posteriorly, and tergum X shorter, straight

and less deeply bifurcate at apex.

Body pale brown. Antennal scape about 2x longer than wide. Maxillary palp with 1 segment, slender, falciform, cylindrical. Head interantennal setal warts absent, cephalic setal warts long reniform, postocular setal warts long. Pronotum with 1 pair long setal warts, mesoscutum with and 1 pair small rounded setal warts, mesoscutellum with 1 pair long longitudinal setal warts.



FIGURES 47–50. *Cheimacheramus rossi*, new species, holotype. Male genitalia: 47—right wings; 48—genitalia, lateral; 49—genitalia, dorsal; 50—genitalia, ventral.

Male wings (Fig. 47). Forewing length 5.0 mm, hind wing length 4.0 mm. Denuded wing membrane pale with pale flavous veins. Both forewings and hind wings without discoidal cell, anterior and posterior margins of both wings nearly parallel-sided along their lengths.

Male genitalia (Figs 48–50). Segment IX nearly as long as high, anterior lobe nearly hyperboloid with shallowly concave dorsal and ventral margins (Fig. 48), posterior margin straight, except deeply concave dorsally above superior appendage, sternum IX short with

backwardly directed mesial lobe (Fig. 50). Xth tergum sharply triangular in lateral view (Fig. 48), with straight dorsal and ventral margins, nearly as long as segment IX; in dorsal view slightly tapering toward shallowly bifid apex (Fig. 49). Superior appendage base hidden behind segment IX in lateral view (Fig. 48), nearly tuboid; in dorsal view (Fig. 49) weakly curving laterally. Gonocoxite divided into broad dorsal lobe and conical posterior lobe (Fig. 48), ventral margin nearly straight; in lateral view, dorsal lobe oriented anterodorsally, apically rounded with posterior spine; in ventral aspect (Fig. 50) gonocoxite weakly sinusoidal, gradually narrowing toward slightly inward pointed apex; median spine of dorsal lobe directed inward at right angle to length of gonocoxite (Fig. 50). Phallus forming a very long tube of uniform diameter throughout length, slightly down-curving distally, basal part more strongly sclerotized than distal part.

Etymology. In a handwritten letter Prof. R. Paulian wrote that originally the material he collected in Madagascar was sent to Prof. Herbert H. Ross before his demise. The name of this new species is dedicated to Ross, who was unable to work on the material.

Holotype male: MADAGASCAR: Sa Mandraka, Province Tamatave, x. 1956 [R. Paulian] (MNHN, in alcohol).

***Rhoizema* Barnard, 1934**

Recognition of *R. mahalevonum*, new species expands our understanding of the morphological variation within the genus. This new species from Madagascar differs in wing shape, wing venation, shape of the maxillary palp, and male genitalic form when compared to the South African species. Thus, Barnard's (1934) original diagnosis of males of the genus is modified as follows:

The males are recognized by having spur formula 224; ocelli absent; maxillary palps 1–2 segmented; antennae slightly longer than the forewing; forks 1 and 2 present in the forewing, fork 5 present in some species; forks 1, 2, and 5 present in the hind wing; forewing discoidal cell short, thyridial cell present or absent; in genitalia, sternum IX strongly produced posteriorly; gonocoxite club-shaped and medially bifurcate; and phallus long, slender and simple, without sclerotized processes.

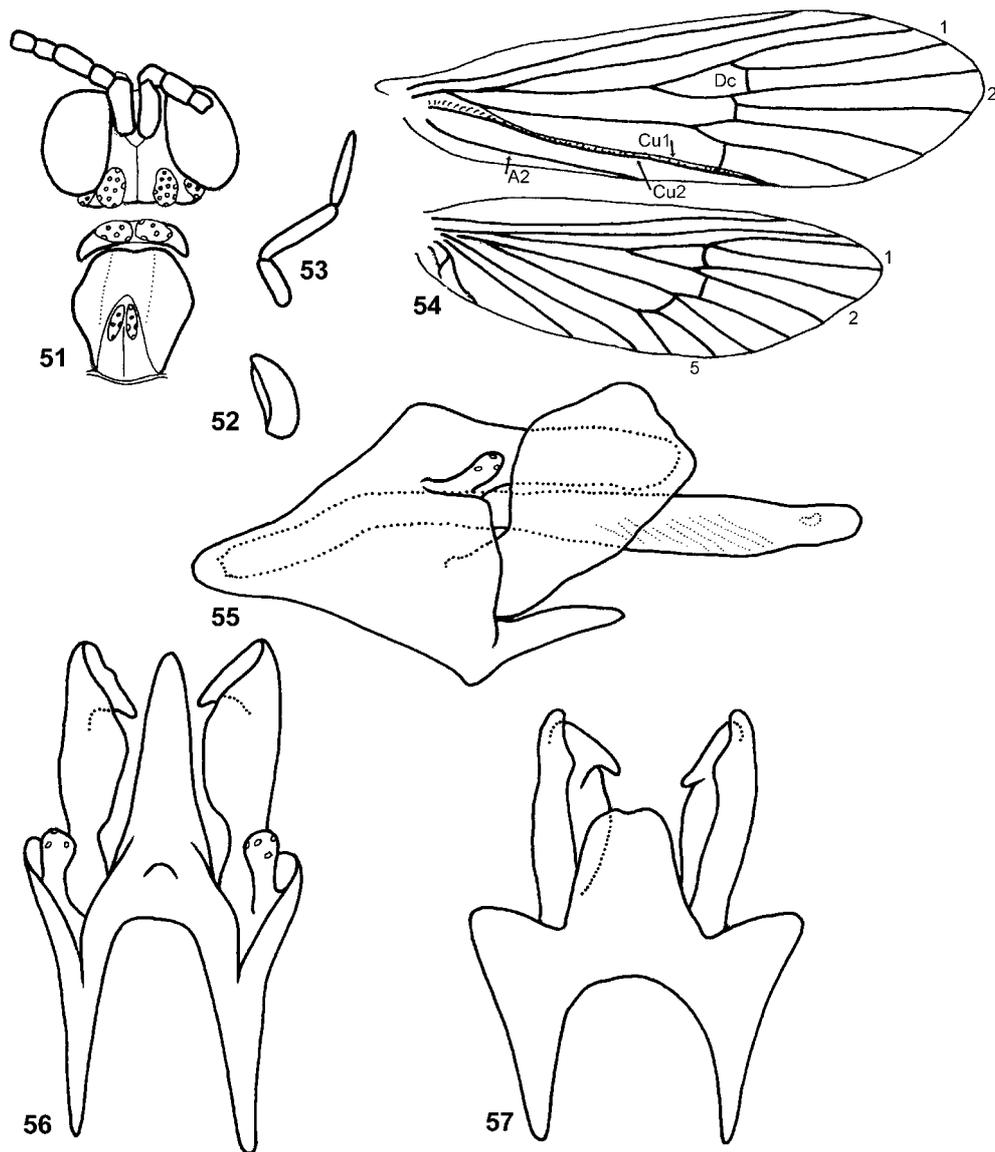
***Rhoizema mahalevonum*, new species**

Figs 51–57, 60

This new species is close to the South African *R. saxiferum*, but is characteristic in having simple maxillary palps without additional processes, wings are more slender and have hyperboloid apices, the forewing discoidal cell is located more centrally, in both wings fork 1 originating more distally on the discoidal cell, in the forewing fork 5 is absent; the IXth sternum is simple (cf bi-lobed in *saxiferum*); the gonocoxite has a median hook

oriented anteriorly, and the corners of gonocoxite are more strongly angled. The species is separated from other *Rhoizema* species by the broader gonocoxite.

Body pale brown. Male head and thorax (Figs 51–53). Head dark. Antennal scape about 2x longer than wide (Fig. 51). Maxillary palp (Fig. 52) 1-segmented, about as long as the second segment of the labial palp (Fig. 53). Head (Fig. 51) without interantennal setal warts; cephalic setal warts oval, located near posterior margin of head; postocular warts rounded. Pronotum (Fig. 51) with 1 pair of large, rounded setal warts nearly tangential medially; mesoscutellum with 1 pair of long longitudinal warts.



FIGURES 51–57. *Rhoizema mahalevonum*, new species, holotype. Male genitalia: 51—head and thorax, dorsal; 52—maxillary palp; 53—labial palp; 54—right wings; 55—genitalia, lateral; 56—genitalia, dorsal; 57—genitalia, ventral.



FIGURE 58. Map of Madagascar showing distributions of *Helicopsyche* spp. (Helicopsychidae): *H. ambodiva* (circle); *H. ninakosha* and *H. sahadika* (rectangle); *H. giboni* (diamond); and *H. anomana* (triangle).



FIGURE 59. Map of Madagascar showing distributions of *Petrothrincus* spp. (Petrothrincidae): *P. newidop*, *P. pauliani* and *P. tsaratananensis* (circle); *P. dhritaparam* (rectangle); *P. andring* (diamond); *P. scottae*, *P. weaveri*, *P. steineri*, *P. acuta* and *P. concava* (cross); and *P. andohel* and *P. tsaratananensis* (triangle).



FIGURE 60. Map of Madagascar showing distributions of Sericostomatidae spp.: *Rhoizema mahalevonum* (rectangle); and *Cheimacheramus rossi* (circle).

Male wings (Fig. 54). Forewing length 6.0 mm, hind wing length 4.7 mm. Denuded wing membrane pale with pale flavous veins. Forewing slender, apex hyperboloid, forks 1 and 2 present; discoidal cell situated near middle of wing; thyridial cell absent; Cu1 and Cu2 run parallel forming a longitudinal fold between wing basis and posterior wing margin.

Male abdomen. VIIth sternal process short, broad, with rounded apex.

Male genitalia (Figs 55–57). Segment IX strongly produced anteriorly into a triangular lobe with slightly concave dorsal and ventral margins (Fig. 55), posterior margin forms lateral plate starting immediately ventral to superior appendage; IXth sternum strongly produced posteriorly and in lateral view (Fig. 55) forms a conical lobe angled about 90° to anterodorsal and posterior margins of segment IX; in ventral view tongue-shaped with slightly bilobed apex (Fig. 57). Xth tergum about horizontal with nearly parallel dorsal and ventral margins, nearly as long as segment IX (Fig. 55); in dorsal view (Fig. 56) sharply triangular. Superior appendage up-turned, tuboid (Fig. 55); in dorsal view slightly club-shaped (Fig. 56). Gonocoxite simple, large, spatulate in lateral aspects (Fig. 55) and with a median, large subapical hook, directed anteriorly (Figs 56, 57). Phallus forming a very long tube, basally oriented posterodorsad, bending posteriorly at basal 1/3 of length, basal part more strongly sclerotized than distal part. Endophallus decorated with a row of oblique lines.

Etymology. The species is named after the type locality of the species.

Holotype male: MADAGASCAR: Maroantsetra, Mahalevona, ii. 1958 [R. Paulian] (MNHN, in alcohol). Paratypes: MADAGASCAR: Maroantsetra, Sahasoa, iii. 1958 [R. Paulian] — 1 male (NRM); ditto, except — 1 male (JOS).

Key to male Sericostomatoidea of Madagascar

- 1 Forewing fork 3 present.....Petrothrincidae...2
- Forewing fork 3 absent 12
- 2(1) In genitalia Xth tergum shorter or as long as superior appendage (Figs 32, 44) ... 3
- In genitalia Xth tergum longer than superior appendage (Figs 28, 41) 5
- 3(2) In genitalia Xth tergum slightly curving dorsally (Fig. 32); superior appendage slightly curving ventrally (Fig. 32) *Petrothrincus newidop* **n. sp.**
- In genitalia Xth tergum and superior appendage straight (Fig. 44) 4
- 4(3) In genitalia superior appendage slender, about 5x longer than broad (Fig. 44)
Petrothrincus andring **n. sp.**
- In genitalia superior appendage thick, about 3x longer than wide
Petrothrincus scottae (Malm & Johanson)
- 5(2) In genitalia superior appendage wider than long in lateral view (Figs 38, 41) 6
- In genitalia superior appendage longer than wide in lateral view (Figs 28, 35) ... 7
- 6(5) In genitalia segment IX with deeply concave dorsal margin (Fig. 41); segment IX

- with long posteriorly oriented sternal lobe (Figs 41, 43); superior appendage with short posteroventral lobes (Fig. 41); phallus with many spinose sclerites (Fig. 41) *Petrothrincus andohel* **n. sp.**
- In genitalia segment IX with shallowly concave dorsal margin (Fig. 38); segment IX with no sternal lobe (Figs 38, 39); superior appendage with long posteroventral lobes (Fig. 38); phallus with 2 pairs spinose sclerites (Figs 38, 39) *Petrothrincus pauliani* **n. sp.**
- 7(5) Maxillary palp 2-segmented .. *Petrothrincus concava* (Weaver)
- Maxillary palp 5-segmented .. 8
- 8(7) In genitalia IXth segment with convex or straight anterodorsal and anteroventral margins (Fig. 35) 9
- In genitalia IXth segment with concave anterodorsal and anteroventral margins (Fig. 28) 10
- 9(8) In genitalia Xth tergum dorsal margin deeply concave (Fig. 35) ... *Petrothrincus dhrataparam* **n. sp.**
- In genitalia Xth tergum dorsal margin straight *Petrothrincus acuta* (Weaver)
- 10(8) In genitalia gonocoxite with 2 posterior lobes..... *Petrothrincus weaveri* (Malm & Johanson)
- In genitalia gonocoxite with 3 posterior lobes 11
- 11(10) In genitalia gonocoxite with 2 long and 1 short posterior lobes (Fig. 28) *Petrothrincus tsaratananensis* **n. sp.**
- In genitalia gonocoxite with 3 short posterior lobes *Petrothrincus steineri* (Weaver)
- 12(1) Maxillary palp distal segment tuboid .. *Helicopsychidae* 13
- Maxillary palp distal segment distinctly swollen . *Sericostomatidae* 17
- 13(12) In genitalia gonocoxite angled dorsally at distal part . 14
- In genitalia gonocoxite almost straight at distal part .. 15
- 14(13) In genitalia gonocoxite strongly angled anterodorsally at 2/3 its length *Helicopsyche (Petrotrichia) giboni* Johanson
- In genitalia gonocoxite weakly angled dorsally at 3/4 its length..... *Helicopsyche (Petrotrichia) anomana* Johanson
- 15(12) In genitalia gonocoxite ventral branch very long, forming a dorsad spiral (Fig. 14) *Helicopsyche (Petrotrichia) ninakosha* **n. sp.**
- In genitalia gonocoxite ventral branch short (Figs 4, 9) 16
- 16(15) In genitalia segment IX short, laterally and ventrally reduced to a narrow band, dorsally club-shaped (Fig. 9); gonocoxite ventral branch broad, slightly bi-lobed (Fig. 9) *Helicopsyche (Petrotrichia) sahadika* **n. sp.**
- In genitalia segment IX long, anteriorly triangular (Fig. 4); gonocoxite ventral branch short, slender, simple (Fig. 4)..... *Helicopsyche (Petrotrichia) ambodiva* **n. sp.**

- 17(12) Forewing discoidal cell present (Fig. 54); in genitalia segment IX with sternite produced posteriorly (Figs 55, 57); gonocoxite nearly rectangular distally, simple (Fig. 55) *Rhoizema mahalevonum* **n. sp.**
- Forewing discoidal cell absent (Fig. 47); in genitalia sternite of segment IX not produced (Fig. 48); gonocoxite divided into posterior and anterodorsal lobes (Fig. 48) *Cheimacheramus rossi* **n. sp.**

Acknowledgements

Without the enthusiastic collecting by Prof. Dr. Renaud Paulian (1913–2003) and his kindness in making his and other Madagascar material present in Museum National d'Histoire Naturelle in Paris available for us, this work could never be carried out. The manuscript was improved by 2 anonymous referees.

References

- Barnard, K.H. (1934) South African Caddis-flies (Trichoptera). *Transactions of the Royal Society of South Africa*, 21(4), 291–394.
- Flint, O. S., Jr. (1964) The caddisflies (Trichoptera) of Puerto Rico. *University of Puerto Rico Agricultural Experiment Station Technical Paper*, 40, 1–80.
- Johanson, K.A. (1997) Description of *Helicopsyche giboni* sp.n. from Madagascar (Trichoptera: Helicopsychidae), *Braueria*, 24, 5–6.
- Johanson, K.A. (1998) Phylogenetic and biogeographic analysis of the family Helicopsychidae (Insecta: Trichoptera). *Entomologica Scandinavica, Supplement*, 53, 1–172.
- Johanson, K.A. (2002) A new primitive *Helicopsyche* from Madagascar (Trichoptera: Helicopsychidae), with phylogenetic analysis of Afrotropical species. *Tijdschrift voor Entomologie*, 145, 9–17.
- Kjærandsen, J. (2005) Species assemblages and community structure of adult caddisflies along a headwater stream in southeastern Ghana (Insecta: Trichoptera). *Biodiversity and Conservation*, 14, 1–43.
- Malm, T. & Johanson, K.A. (2005) Descriptions of two new species of *Gyrocarisa* (Trichoptera: Petrothrincidae) from Madagascar. *Zootaxa*, 1009, 15–20.
- Marlier, G. & Malicky, H. (1979) A new *Helicopsyche* from the Seychelles (Trichoptera, Helicopsychidae). *Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen*, 30, 110–112.
- Moor, F.C. de (2000) The caddisflies (Trichoptera) of South Africa. (<http://www.ru.ac.za/academic/departments/zoento/martin/trichoptera.html>) effective 1 January 2000.
- Morse, J. C. (1999) Trichoptera World Checklist (<http://entweb.clemson.edu/database/trichopt/index.htm>) effective 22 May 1999, updated 28 July 2000, 8 January 2001.
- Nielsen, A. (1957) A comparative study of the genital segments and their appendages in male Trichoptera. *Biologiske Skrifter* 8 (5): 1–159.
- Scott, K.M.F. (1985) Order Trichoptera. In: Scholtz, C.H. & Holm, E. (Eds.) *Insect of Southern Africa*. Durban: Bitterworths, pp. 327–340.
- Scott, K.M.F & Moor, F.C. de (1993). Three recently erected Trichoptera families from South Africa, the Hydrosalpingidae, Petrothrincidae and Barbarochthonidae (Integripalpia: Sericostomatoidea).

- matoidea). *Annals of the Cape Provincial Museums Natural History*, 18(14), 293–354.
- Siebold, C.T.E. von (1856) *Wahre Parthenogenesis bei Schmetterlingen und Bien*, Wilhelm Engelmann, Leipzig, 144 pp.
- Ulmer, G. (1906) Neuer Beitrag zur Kenntnis aussereuropäischer Trichopteren. *Notes from the Leyden Museum*, 28, 1–116.
- Ulmer, G. (1912) Die Trichopteren des Baltischen Bernsteins. *Beitrage zur Naturkunde Preussens*, 10, 1–380.
- Weaver III, J.S. (1997) A new genus of Petrothrincidae (Trichoptera) from Madagascar with specialized modifications in the female terminalia for carrying the eggmass. *In: Holzenthal, R.W. & Flint, O.S., Jr. (Eds.), Proceedings of the 8th International Symposium on Trichoptera*, Ohio Biological Survey, Columbus, Ohio, pp. 467–474.