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## The Pselaphinae of Madagascar. II. Redescription of the genus *Semiclaviger* Wasmann, 1893 (Coleoptera: Staphylinidae: Pselaphinae: Clavigeritae) and synonymy of the subtribe Radamina Jeannel, 1954

PETER HLAVÁČ<sup>1,5</sup>, PETR BAŇAŘ<sup>1,2</sup> & JOSEPH PARKER<sup>3,4</sup>

<sup>1</sup> Czech University of Life Sciences, Faculty of Forestry and Wood Sciences, Department of Forest Protection and Entomology, Kamýcká 1176, CZ-165 21 Praha 6-Suchbát, Czech Republic. E-mail: [peterclaviger@gmail.com](mailto:peterclaviger@gmail.com)

<sup>2</sup> Email: [petrbanar@seznam.cz](mailto:petrbanar@seznam.cz)

<sup>3</sup> Department of Genetics and Development, Columbia University, 701 West 168th Street, New York, NY 10032, USA.

<sup>4</sup> Division of Invertebrate Zoology, American Museum of Natural History, New York, NY 10024, USA

E-mail: [jp2488@columbia.edu](mailto:jp2488@columbia.edu)

<sup>5</sup> Corresponding author

### Abstract

The enigmatic Madagascan genus *Semiclaviger* Wasmann is among the most morphologically distinct members of the obligately myrmecophilous pselaphine supertribe Clavigeritae. Here, the genus is redescribed, and the lectotype of the type species *S. sikorae* Wasmann is designated. We present a detailed study of the morphology of *Semiclaviger*, which supports its uniqueness among the Clavigeritae. The systematic position of the genus, and the validity of its subtribe Radamina, are discussed leading us to place Radamina in synonymy with Clavigerodina.

**Key words:** Staphylinidae, Pselaphinae, Clavigeritae, Radamina, *Semiclaviger*, redescription, Madagascar

### Introduction

The pselaphine supertribe Clavigeritae is a large group of strictly myrmecophilous genera, distributed in all major biogeographic regions except New Zealand. The taxon reaches a remarkable level of diversity in Madagascar, where 30 genera are found, all except one of which are believed to be endemic. As a group, Clavigeritae show extreme morphological variation, and exhibit numerous adaptive characters for life as highly-integrated symbionts of ant colonies. One Madagascan genus however, *Semiclaviger* Wasmann, is particularly unusual. Unlike other clavigerite genera, it displays an apparent ‘limuloid’ body plan with an enlarged pronotum that extends anteriorly to shield the head. Such morphology is more typical of non-integrated myrmecophiles that employ physical defense to withstand attacks from hosts (Kistner, 1979). Yet, like other Clavigeritae, *Semiclaviger* possesses the trichomes and reduced mouthparts diagnostic of organisms well-assimilated into colony life, and thus presents a seemingly paradoxical array of morphological attributes.

*Semiclaviger* is currently placed in the subtribe Radamina, but examination of its morphology reveals many differences with other genera of Radamina, indicating that the genus may be rightfully placed elsewhere. The availability of newly-collected material from Madagascar has provided us with the opportunity to explore the morphology of the genus with great resolution, enabling us to produce a detailed redescription of the genus, which we present herein. We further discuss the systematic position of the genus, as well as the doubtful monophyly of Radamina. The lectotype of the type species, *Semiclaviger sikorae* Wasmann, is designated.

### Material and methods

Dry-mounted specimens were relaxed in warm water and macerated in 10% NaOH solution at room temperature

for about 24 hours if necessary, washed thoroughly and dissected. Body parts were embedded in Euparal. Dry-mounted specimens were examined with a Leica S8APO stereo-microscope with diffuse lighting at magnifications up to 128x. Colour photographs were made using a Leica MSV266. Drawings of the aedeagus were done using a camera lucida attached to a Zeiss microscope. Electron micrographs were produced using a JEOL 6380 LV scanning electron microscope.

Label data are cited verbatim, with author's notes in square brackets. The following symbols are used: [p], [h] denotes printed or hand-written labels respectively, '/' separates different labels.

Head length was measured from the anterior margin of the pronotum to the anterior margin of the frontal rostrum; head width was measured across the eyes; the elytral length was measured along the suture, the width means maximum width across a given structure. The lengths of tergal and sternal segments refers to their medial lengths. Body length is the combined length of the head, pronotum, elytra and abdomen.

The following acronyms are used in the text:

MNHN	Muséum National d'Histoire Naturelle, Paris (A. Taghavian)
PHPC	private collection of Peter Hlaváč, Prague, Czech Republic
MMBC	Moravian Museum, Brno, Czech Republic (P. Baňář)

Morphological terms follow Chandler (2001) and Jałoszyński (2012, 2013).

### ***Semiclaviger* Wasmann, 1893**

*Semiclaviger* Wasmann, 1893a: 102. Type species: *Semiclaviger sikorae* Wasmann, by monotypy  
*Semiclaviger* Wasmann: Jeannel, 1954: 331; Jeannel, 1960: 209

**Diagnosis.** Small-sized, stout and ovoid clavigerine with four-segmented antennae, scape and pedicel small, both completely hidden in antennal cavity, antennomere III weakly separated from IV which is of medium length, slightly curved and fastigiate to apex, with truncate and setose apex; head very short, strongly transverse, eyes strongly projecting laterad, bisected into two parts by ocular canthi. Occipital constriction and neck region absent dorsally but present ventrally, pronotum and elytra lacking foveae, with even lines of long setae, elytra, abdomen and first visible paratergites with trichomes; composite tergal plate (IV–VI) divided in three sectors by short, trichome-bearing keels.

**Description.** Body (Figs. 1–3) limuloid, uniformly reddish-brown, entirely glabrous, shiny, with long, abristle setae on head, pronotum, elytra and paratergites. All body faces sparsely covered (studied in gold-plated specimens during SEM photographing) with minute granules, granules possibly of waxy origin (Figs. 11–17). These granules were lost after NaOH treatment.

Head (Figs. 4–9) short, transverse, partly retracted under pronotum, with short, wide, rounded rostrum, dorsally with no indication of occipital constriction or carina, neck region completely absent, posterior margin straight, eyes well-developed, strongly projecting laterad, bisected into two parts, clearly visible dorsally and ventrally, clypeus (Figs. 4–5, *cl*) with few short setae and with anterior margin rounded.

Mouth parts rudimentary but well-developed, completely hidden in buccal cavity (Fig. 4, *bc*) which is transverse, about three times as wide as high. Labrum (Fig. 6, *lb*) small. Maxilla (Fig. 6) reduced, cardo (Fig. 6, *cd*) semi-spherical, basistipes (Fig. 6, *bst*) triangular, bearing one long seta, with one palpomere (Fig. 6, *plp*), expanded in middle, pointed at apex, with several long apical setae, mentum (Fig. 6, *mn*) rectangular, clearly wider than long, with many long setae.

Venter of head (Figs. 5, 6) glabrous, with few setae and large punctures, mentum and submentum fused, lacking parallel carinae, genae oval, head divided by occipital constriction (Fig. 5, *occ*) into larger head capsule and short, smooth gular plate, pre-occipital constriction part with isodiametric sculpture, gular plate (Fig. 5, *gp*) with two largely separated tentorial pits (Fig. 6, *tp*).

Antennae (Figs. 7, 10) with four antennomeres, scape and pedicel minuscule, subequal in length, antennomere III slightly longer, weakly separated from antennomere IV, antennomeres I–III completely hidden in large antennal cavity, antennomere IV (Fig. 10) clearly longest, cylindrical, slightly fastigiate apically, apex truncate, with dense setation.



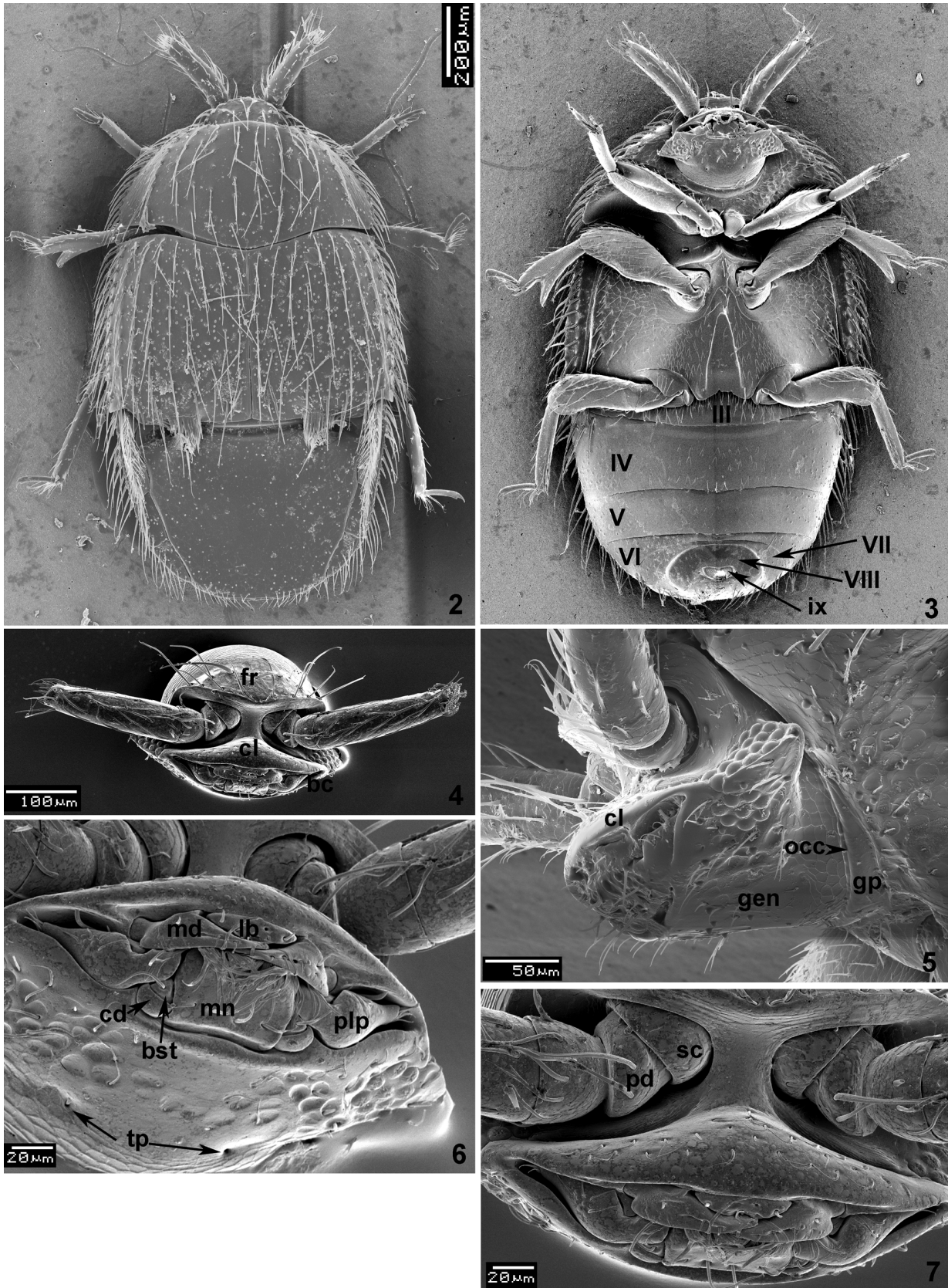
**FIGURE 1.** *Semiclaviger sikorae* Wasmann, 1893, male, total dorsal view. Scale bar 1.0 mm.

Pronotum (Fig. 11) strongly transverse, about twice as wide as long, evenly widened posteriorly, slightly shorter than elytra, lateral parts with isodiametric sculpture, whole lateral margin with long, thick setae, with large median, posterior lobe, lateral corners sharp, lacking foveae or carinae, scutellum not visible.

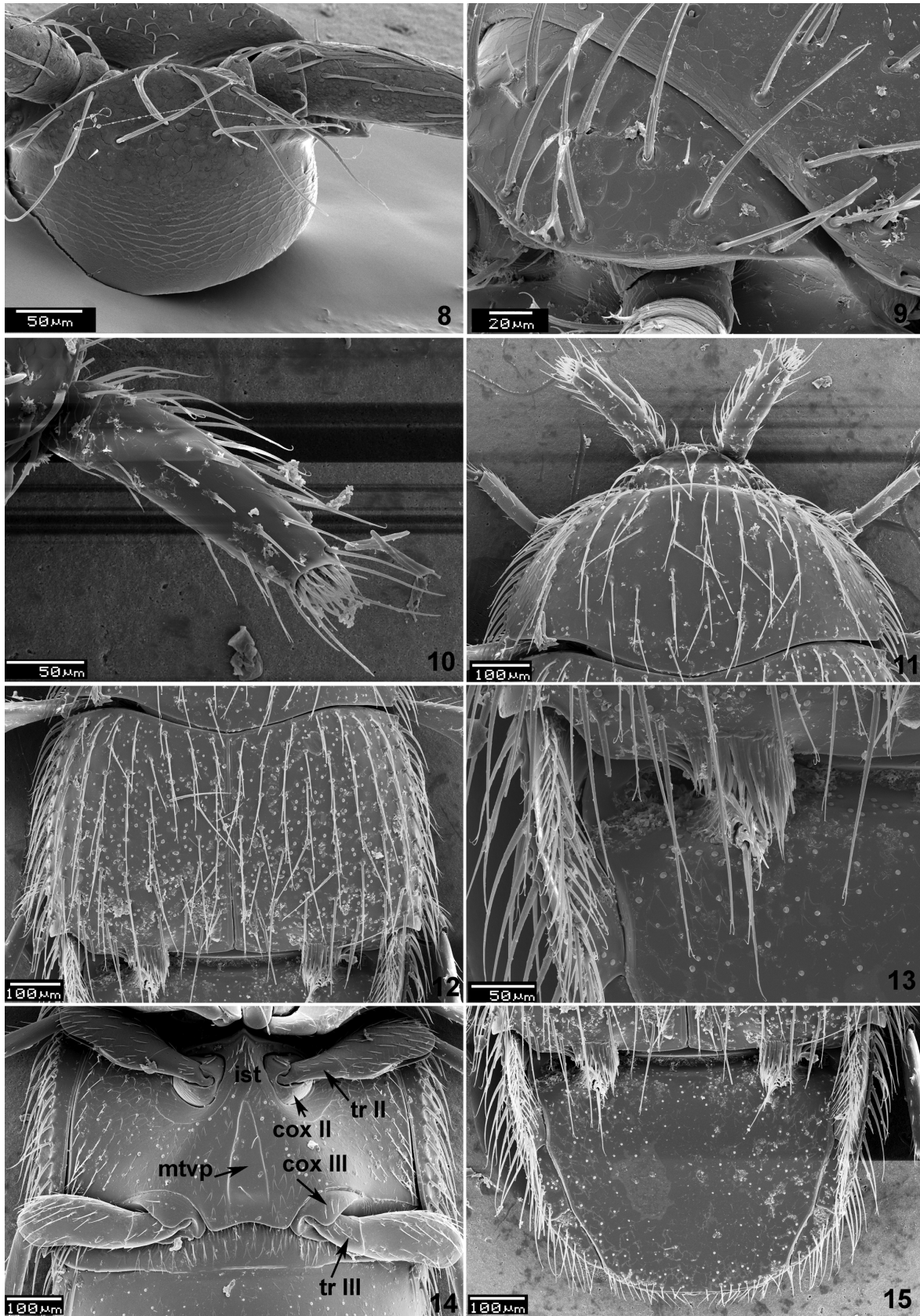
Venter (Figs. 3, 14, 22) entirely glabrous. Prosternum (Fig. 22) about three times shorter than pronotum, with basisternal part (Fig. 22, *bs*) short, demarcated from procoxal cavities (Fig. 22, *pcc*) by distinct carina, procoxal cavities separated in middle by fine prosternal carina (Fig. 22, *psc*), procoxal sockets (Fig. 22, *pcs*) open. Hypomera large, expanded mesally to sharp triangular projection. Mesonotum (Fig. 23) subtriangular in shape, mesoscutum (Fig. 23, *msc*) transverse, with few lateral setae, mesoscutellum (Fig. 23, *msl*) subtriangular with pointed posterior margin. Mesoventrite about three times shorter than metaventrite, fused together, anterior mesoventral process subtriangular, mesocoxae well-separated, isthmus only slightly narrower than diameter of mesocoxae; metaventrite large, much wider than long, glabrous, on sides with sparse setae, with triangular median depression, metacoxae widely separated by wide, short, concave basal metaventral process (Fig. 14, *mtvp*). First visible sternite (III) about half as long as second (IV), second with two well-defined basolateral foveae (Fig. 24, *blf*), third (V) longest, about 1.5 times as long as second (IV), fourth (VI) shorter than second (IV), all sternites glabrous, sternite III-IV with long lateral setae, pygidium (Fig. 25, *IX*), small, ovoid.

Elytra (Figs. 2, 12) shiny, at suture about as long as abdomen and slightly longer than pronotum, with long setae arranged in even lines, humeri with sharp, slightly prominent angles, posterior elytral corners with short, sharp projections; lacking basal foveae and striae, each elytron with well-defined median trichome (Fig. 13).

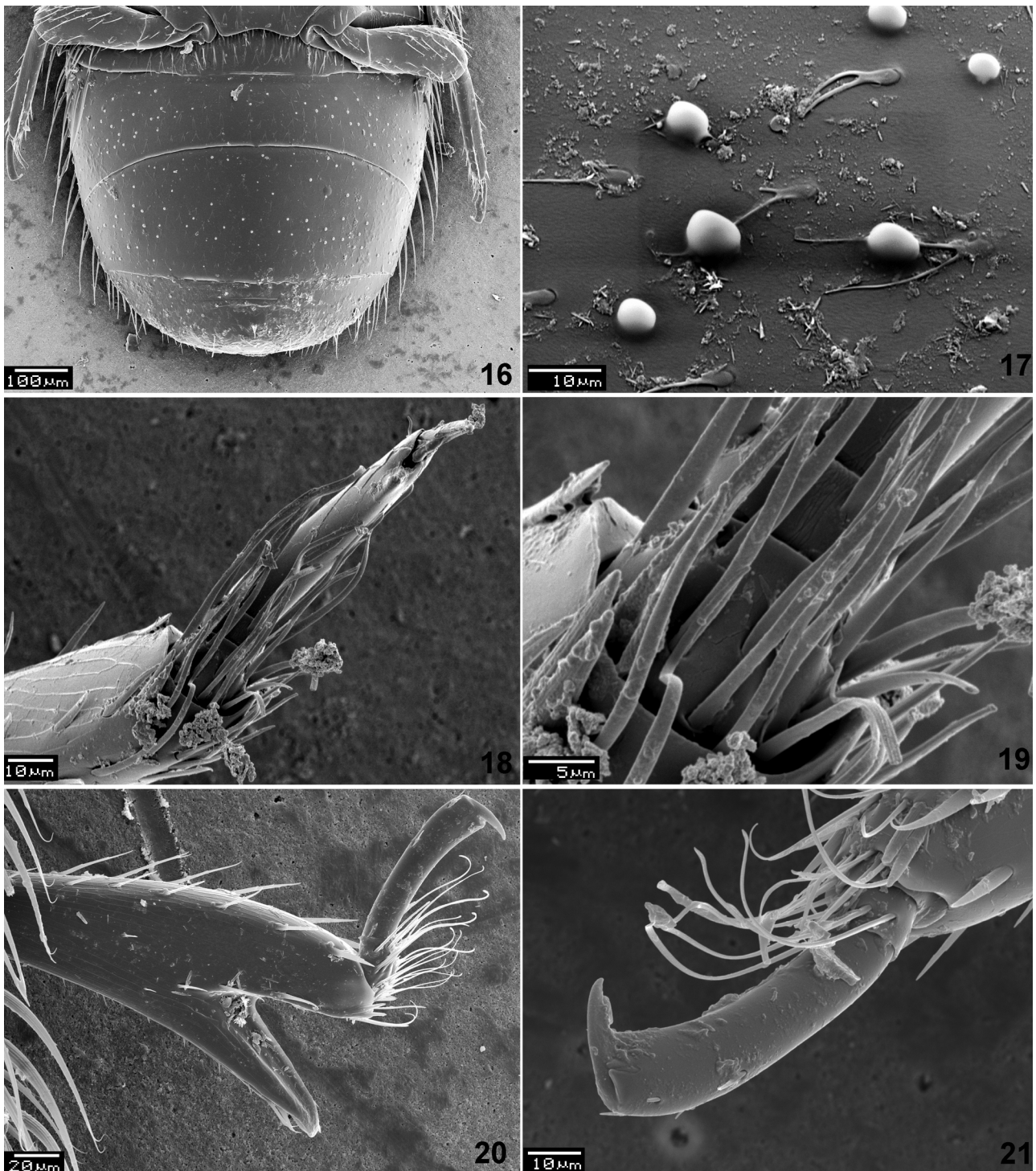
Abdomen (Figs. 13, 15) shiny, glabrous, lacking setae, with pair of prebasal keels bearing trichomes that divide composite tergal plate (IV–VI) into three sectors, each sector with slight prebasal depression; tergites VII and VIII very short, not visible in dorsal view; paratergites IV–VI well-defined, large, with long setae on sides, paratergite IV on surface with dense, trichome like setation.



**FIGURES 2–7.** *Semiclaviger sikorae* Wasmann, 1893. 2–3 male; 4–7 female. 2—dorsal habitus; 3—ventral habitus (III–IX—abdominal segments III–IX); 4—head, anterior view (*bc*—buccal cavity, *cl*—clypeus, *fr*—frons); 5—head, ventro-lateral view (*cl*—clypeus, *gen*—gena, *gp*—gular plate, *occ*—occipital constriction); 6—trophi, antero-ventral view (*bst*—basistipes, *cd*—cardo, *lb*—labrum, *md*—mandibula, *mn*—mentum, *plp*—palpomere, *tp*—tentorial pit); 7—basis of antennae, anterior view (*pd*—pedicel, *sc*—scape).



**FIGURES 8–15.** *Semiclaviger sikorae* Wasmann, 1893. 8, 14 female; 9–13, 15 male. 8—head, antero-dorsal view; 9—dorsal face of head, dorso-lateral view; 10—right antenna, dorsal view; 11—head and pronotum, dorsal view; 12—elytra, dorsal view; 13—apex of left elytron with trichome, dorsal view; 14—meso and metaventrite (*cox II*—mesocoxa, *cox III*—metacoxa, *ist*—isthmus, *mtvp*—metaventral process, *tr II*—mesotrochanter, *tr III*—metatrochanter); 15—abdomen, dorsal view.



**FIGURES 16–21.** *Semiclaviger sikorae* Wasmann, 1893. 16–17, 21 female; 18–20 male. 16—abdomen, ventral view; 17—detail of surface of abdomen, ventral view; 18—right fore tarsus, ventral view; 19—basis of right fore tarsus, ventral view; 20—right middle tibia, postero-dorsal view; 21—right middle tarsus, anterior view.

Legs short, femora clavate, ventral part of femora with deep channels for accomodation of tibiae, tibiae stick-like, about as long as femora, with long apical setae, mesotibiae with long and sharp preapical spur (Fig. 20). Tarsi (Figs. 18–21) 3-segmented, tarsomere I rudimentary, almost invisible, considerably shorter than II, tarsomere III very long, more than 5 times as long as II, tarsomeres I-II with long setae.

Aedeagus (Figs. 26, 27) elongate, parameres completely fused to median lobe, apical lobe with four setae, not separated from basal bulb, dorsal diaphragm present, circular.

**Sexual dimorphism.** Female with simple mesotibiae, lacking long preapical spur.

**Differential diagnosis:** *Semiclaviger* is readily separated from all other genera of Clavigeritae by the ovoid, limuloid, compact shape of the body and by the eyes strongly projecting laterad and bisected into two parts.

### *Semiclaviger sikorae* Wasmann, 1893

(Figs. 1–27)

*Semiclaviger sikorae* Wasmann, 1893: 103

*Semiclaviger sikorae* Wasmann: Jeannel, 1954: 332; Jeannel, 1960: 209

**Material studied:** **LECTOTYPE**, 1 ♂, present designation: (h) Madagascar (Sikora) / (h) b. *Crematogaster Schenki* Fr. / (p) red label TYPE / (h) *Semiclaviger Sikorae* Wasm, Type / (p) blue label MUSÉUM PARIS, 1952, COLL. R. OBERTHÜR / (p) red label Lectotype *Semiclaviger sikorae* Wasmann, P. Hlaváč & P. Baňar det., 2013. MNHN. **PARALECTOTYPE**, 1 ♂: (h) Madagasc. (Sikora) / (p) red label TYPE / (p) blue label MUSÉUM PARIS, 1952, COLL. R. OBERTHÜR / (p) red label Paralectotype *Semiclaviger sikorae* Wasmann, P. Hlaváč & P. Baňar det., 2013. MNHN. **Other material:** 3 ♂♂, 1 ♀: ABT/Sept.2011/04 **MADAGASCAR, AMBOHITANTELY** Spec. Res., S18°11'46.4"E47°17'09.9", 1570m, 1.ix.2011 / sifting forest litter under *Pandanus*, Winkler app. extraction / L.S. Rahanitriniaina lgt. / *Semiclaviger sikorae* Wasmann, P. Hlaváč & P. Baňar det., 2013 (PHPC, MMBC); 1 ♀: ABT/Sept.2011/12 **MADAGASCAR, AMBOHITANTELY** Spec. Res.; 3.ix.2011, S18°10'58.2"E47°17'22.9", 1522m / sifting forest litter by river, Winkler app. extraction, L.S. Rahanitriniaina lgt. / *Semiclaviger sikorae* Wasmann, P. Hlaváč & P. Baňar det., 2013 (MMBC), specimen gold-plated for SEM study; ; 3 ♂♂, 1 ♀: ABT/Nov.2011/11 **MADAGASCAR, AMBOHITANTELY** Spec. Res., 1497m, S18°10'52.6"E47°17'22.5", 18.xi.2011 / sifting forest litter, Winkler app. extraction, L.S. Rahanitriniaina lgt. / *Semiclaviger sikorae* Wasmann, P. Hlaváč & P. Baňar det., 2013 (PHPC, MMBC); 1 ♂: ABT/Nov.2011/18 **MADAGASCAR, AMBOHITANTELY** Spec. Res., 1614m, S18°11'48.7"E47°17'11.3", 22.xi.2011 / sifting litter under group of palm trees, Winkler app. extraction, L.S. Rahanitriniaina lgt. / *Semiclaviger sikorae* Wasmann, P. Hlaváč & P. Baňar det., 2013 (MMBC), specimen gold-plated for SEM study.

**Lectotype designation:** Redescription of this species below is based on two male specimens deposited in MNHN having syntype status. Wasmann (1893) mentioned four specimens (3 males, 1 female) in his original description from the following locality: Andrangoloaka, O.-S.-O. von Annanarivo, Madagascar. The locality labels of both specimens from Paris bear the following hand written text: 'Madagascar (Sikora)', lacking Andrangoloaka. Wasmann commonly provided type localities that were only communicated to him verbally. Because both specimens were collected by Sikora, we are of the opinion that they can be treated as syntypes. One male is here designated lectotype, the second male is paralectotype, in order to ensure the stability of the nomenclature and to provide a unique name-bearing type for *Semiclaviger sikorae*.

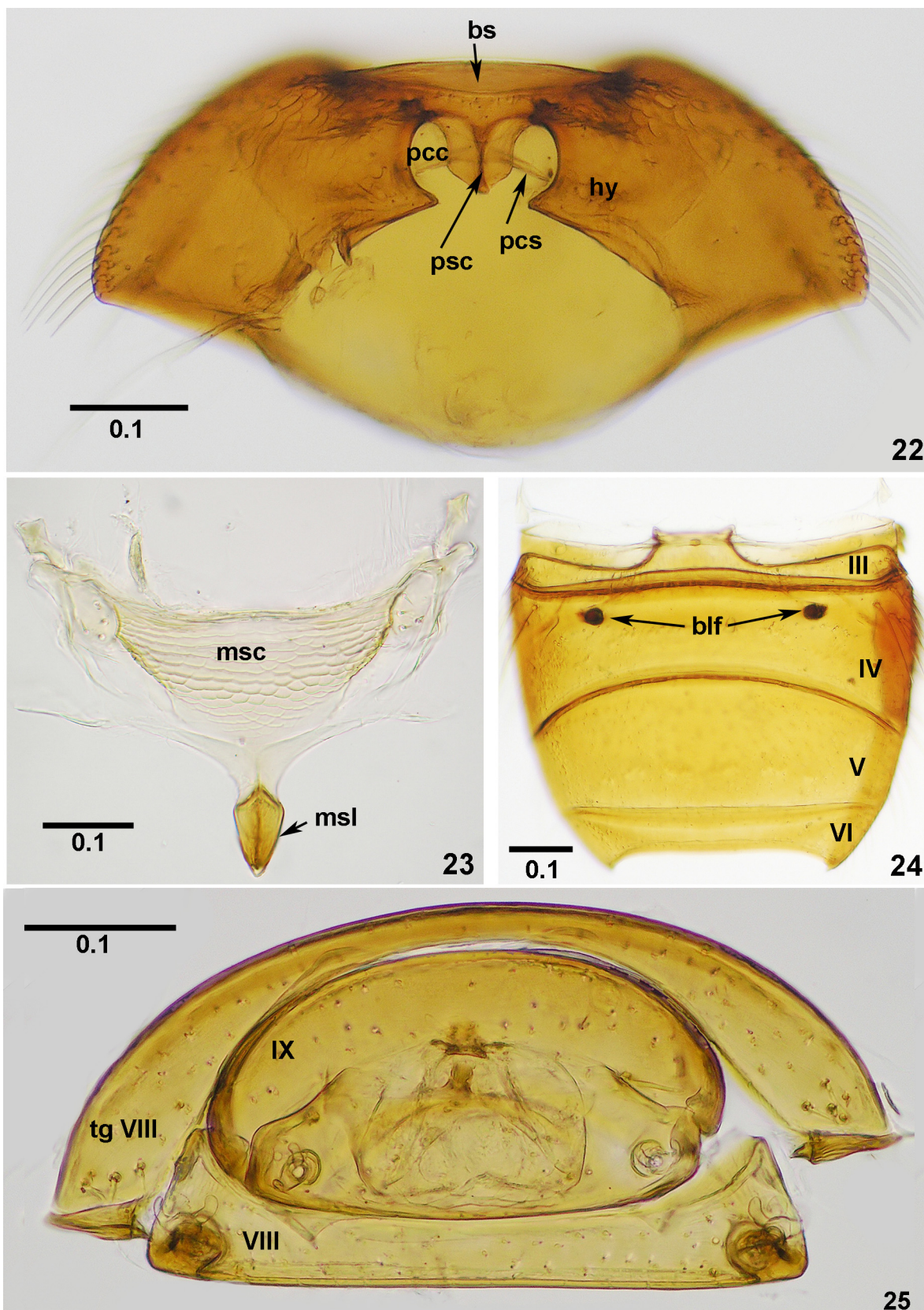
**Description.** Body length 1.20–1.30 mm, maximum width in posterior corners of elytra, about 0.75 mm. Long setae arranged in lines on pronotum and lateral part of elytra, elytral disc almost lacking setae. Visible part of head (in dorsal view) six times as wide as long, Pronotum slightly more than twice as wide as long and five times as long as head. Elytra about 1.90 times as wide as long and 1.35 times as long as pronotum. Abdomen about as long as elytra, only composite tergal plate visible dorsally, median distance between prebasal tergal keels slightly more than twice the distance of keel to lateral margin of paratergite.

**Sexual dimorphism.** Female with simple mesotibiae, lacking long preapical spur.

**Host ant:** *Crematogaster (Crematogaster) schencki* Forel, 1891

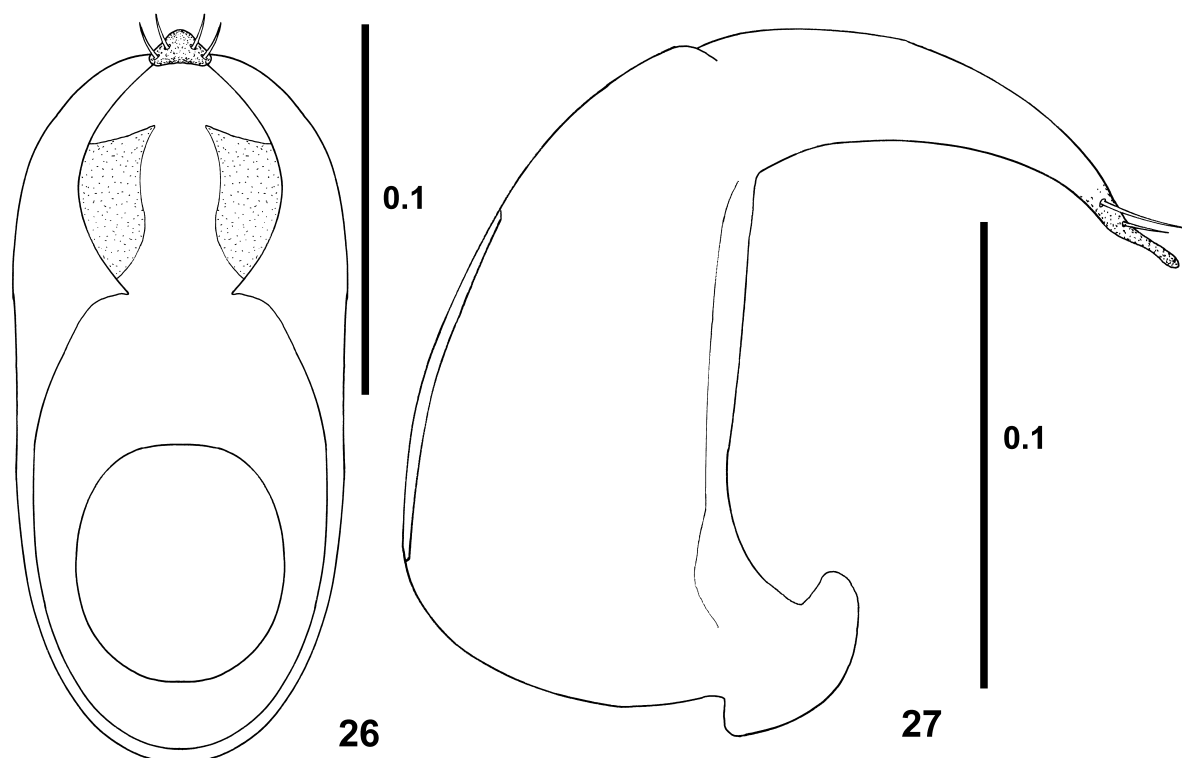
**Bionomics.** All newly collected specimens were sifted from leaf litter in primary forest in Ambohitantely Special Reserve in central Madagascar, with subsequent extraction via a Winkler apparatus.

**Distribution.** The species was described based on four specimens from Andrangoloaka [Andrangoloaka], O.-S.-O. [west-south-west] von Annanarivo [Antananarivo] (Madagascar). The second locality is Gorge de la Mandraka, 1000 m (Jeannel, 1954: 332). The new record is from Ambohitantely Special Reserve, just to the north of Antananarivo. So far all known localities are in central Madagascar, close to Antananarivo, on the Central Plateau of the island (Fig. 28).



**FIGURES 22–24.** *Semiclaviger sikorae* Wasmann, 1893, female. 22—prothorax (*bs*—basisternal part, *hy*—hypomera, *pcc*—procoxal cavity, *psc*—procoxal socket, *psc*—prosternal carina); 23—mesonotum (*msc*—mesoscutum, *msl*—mesoscutellum); 24 – abdomen, ventral view (*blf*—basolateral fovea, *III–VI*—sternites); 25 – terminalia, sternites VIII (*VIII*) and IX (*IX*) (pygidium) and tergite VIII (*tg VIII*). Scale bar in mm.





FIGURES 26–27. *Semiclaviger sikorae* Wasmann, 1893, male, aedeagus. 25—dorsal view; 26—lateral view. Scale bar in mm.

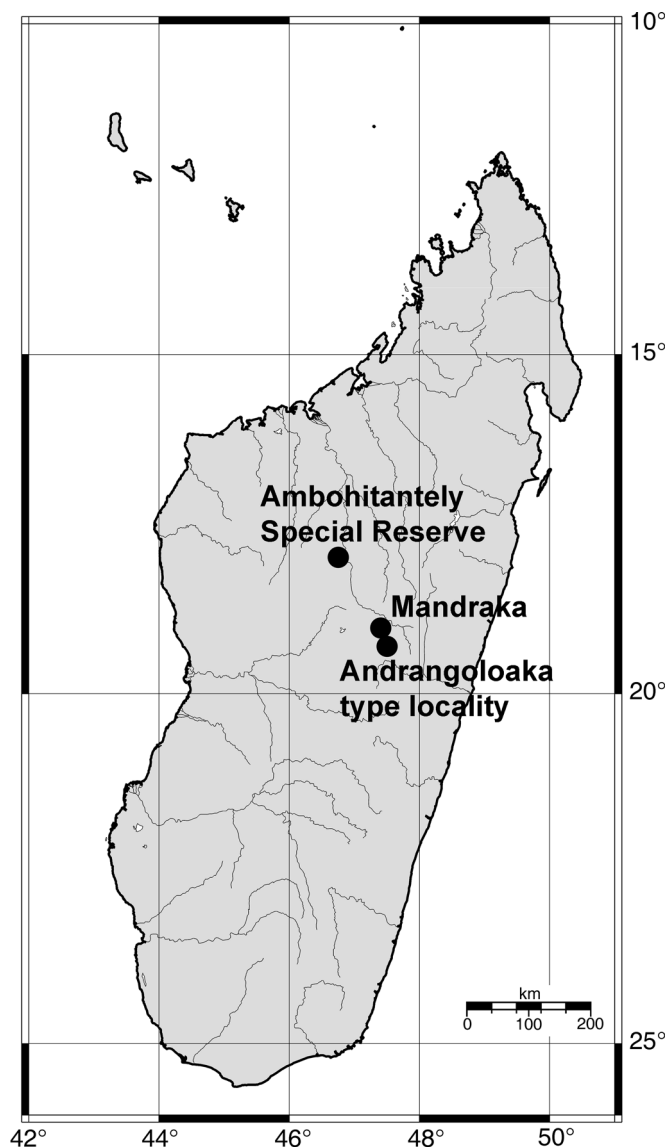
## Discussion

*Semiclaviger* was included by Jeannel in his new tribe Radamini (Jeannel, 1954: 331), recently downgraded to the subtribe Radamina (Besuchet, 1990), without giving supporting arguments other than the aedeagus being of the same type as that of *Radamides* Wasmann, 1897 (with the exception that the apical lobe is not separated from the basal bulb, but rather gathered together). Radamini was established for five genera from Madagascar, namely *Radama* Raffray, 1883, *Radamellus* Raffray, 1904, *Radamides* Wasmann, 1897, *Imerina* Raffray, 1896, and *Semiclaviger*. Later, two new genera were described by Dajoz (1982): *Madara* Dajoz, 1982 and *Pseudomadara* Dajoz, 1982. *Imerina*, due to the preoccupation of the name, was renamed to *Merinia* Newton & Chandler, 1989, and *Pseudomadara* was synonymized with *Radama* by Besuchet (2008: 65). The genus *Radamira* Reichensperger, 1915 from South Africa (Kwazulu-Natal) was originally not included by Jeannel (1954: 320) in Radamini, but was subsequently placed there by Jeannel (1964: 214). Consequently, Radamina now contains seven genera and 16 species occurring in Madagascar, and two genera and two species in South Africa (with *Radamides* occurring in both places).

The definition of the tribe Radamini given by Jeannel (1954: 319) is a combination of the following characters, which as we discuss in parentheses are problematic or are of questionable systematic utility:

- 1) very small species (a largely meaningless character);
- 2) dorsum covered by long, backward-pointing setae;
- 3) pronotum widened posteriorly (this character is apparent only for *Semiclaviger* and *Madara*; *Radamira* has the pronotum only slightly widened posteriorly and *Radama*, *Radamellus*, and *Radamides* have the pronotal margins parallel or convergent posteriorly);
- 4) antennae short, 4-segmented (many unrelated clavigerine genera possess such antennae);
- 5) composite tergal plate divided into three sectors by two trichomes (absent in *Madara*, *Radamellus*, *Radamira* and *Semiclaviger*);
- 6) mesoventrite glabrous and with keel (the keel is present in *Radamides* and *Merinia*; *Radama* and *Semiclaviger* lack the keel)
- 7) apex of apical lobe of aedeagus short and obtuse (it is difficult to understand what Jeannel meant by this

character; the aedeagi of *Radama fimbriata* Wasmann, *Radama inflata* Raffray (Jeannel, 1954: 324, Figs. 182, 183) and *Merinia breviceps* Raffray (Jeannel, 1954: 330, Figs. 192), all figured in his 1954 monograph, have the apical lobe pointed. Regardless, a short and obtuse apical lobe is not exceptional in clavigerine aedeagi and occur also elsewhere).



**FIGURE 28.** Distribution of *Semiclaviger sikorae* Wasmann, 1893 in Madagascar.

Hence, the only character shared by all genera of Radamina is the dorsum covered by long, backward-pointing setae, which across genera are of different sizes, densities and positions, with only those on the elytra being present on all taxa. Yet, even these setae are of dubious value, since they too can be seen in other clavigerines: for example, *Antalaha betschii* Dajoz, 1982 possesses backward-facing setae on the elytral ribs. None of the characters listed by Jeannel therefore appear to be genuine synapomorphies that could support the monophyly of Radamina. The subtribe is far from ‘homogenous’, as stated by Jeannel (1954: 319, 1964: 214); in reality, it contains taxa with very different head, antennal, thoracic, and abdominal morphologies, encompassing substantial variation in the form of the composite tergal plate and metaventricle, the position and number of trichomes, and even the structure of the aedeagus. Therefore, we see no reason for maintaining the subtribe Radamina and propose the following formal procedure:

Radamina Jeannel, 1954—junior synonym of Clavigerodina Schaufuss, 1882, **syn. nov.**

*Semiclaviger* has several features that are very unusual among genera of Clavigeritae, most notably the limuloid shape of the body with an enlarged pronotum, which thus far has not been found elsewhere in

Clavigeritae, and the unique, transverse head shape, which dorsally lacks both a neck and an occipital constriction. The form of the occipital constriction has long been used as an important character to separate subtribes of Clavigerini. A neck region, clearly separated from the head capsule by an occipital constriction or carina is always present in Clavigeritae (with the exception of *Kurbatoviella* Hlaváč, 2010, where there is no constriction or carina but the neck region is very long and expanded posteriorly). The absence of a neck-region thus may represent a plesiomorphic character shared with no other Clavigeritae, but may just as likely reflect an autapomorphy of *Semiclaviger*. The absence of the neck has also been recently described and discussed in the aenictopecheid bug *Ulugurocoris grebennikovi* Štys & Baňář, 2013 (Heteroptera: Enicocephalomorpha: Aenictopecheidae), a member of the basalmost clade of Heteroptera. The Authors of that paper assumed that the absence of the neck may represent symplesiomorphy shared with some other non-heteropteran Hemiptera (Štys & Baňář, 2013). The structure of the aedeagus of *Semiclaviger*, with the apical lobe not separated from the basal bulb, is also very rare in Clavigeritae, but again, it is unclear whether this is evidence of the phylogenetic separation of *Semiclaviger* from other Clavigeritae, or merely represents a derived character state. The availability of fresh material from Madagascar has allowed us to extract DNA from multiple clavigerine genera, including *Semiclaviger*. Our provisional analysis based on four loci (to be published elsewhere) supports the inclusion of *Semiclaviger* among a monophyletic radiation of Madagascan genera. Although the exact placement within this assemblage is currently unclear, such a position nonetheless argues against a basal position for *Semiclaviger* within Clavigeritae. Rather, we believe the remarkable morphology of *Semiclaviger* should be considered derived, with the taxon representing a radical departure from the typical clavigerine body plan.

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