

Synopsis of *Trissepyris* Kieffer, 1905 (Hymenoptera, Bethylidae), an endemic Afrotropical genus, with description of a new species

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Details of *Trissepyris ruficeps* Kieffer, 1905.

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ABSTRACT

The genus *Trissepyris* Kieffer, 1905 (Chrysidoidea, Bethylidae) is revised. A new species from Afrotropical region (Ivory Coast) is described and illustrated: *T. akan* n. sp. It is differentiated from the only other species of this genus, *T. ruficeps* Kieffer, 1905, by having the mandible with five apical teeth, the dorsal pronotal area with small punctures, the notaulus weakly widened posteriorly, the hind wing with five hamuli and the mesoscuto-scutellar fovea inclined anteriorly. An emended diagnosis and a thorough discussion about the morphological diagnostic characters are provided. Additionally, a taxonomic key to the two species is presented.

RÉSUMÉ

Synopsis de Trissepyris Kieffer, 1905 (Hymenoptera, Bethylidae), un genre afrotropical endémique, avec la description d'une nouvelle espèce.

Le genre *Trissepyris* Kieffer, 1905 (Chrysidoidea, Bethylidae) est révisé. Une nouvelle espèce de la région afrotropicale (Côte d'Ivoire) est décrite et illustrée : *Trissepyris akan* n. sp. Elle se différencie de la seule autre espèce de ce genre, *T. ruficeps* Kieffer, 1905, par la présence de cinq dents apicales sur la mandibule, de petites ponctuations sur la partie dorsale du pronotum, d'un faible élargissement postérieur du notaulus, de cinq hamuli sur l'aile postérieure et d'une fovea mésoscuto-scutellaire inclinée vers l'avant. Une diagnose modifiée et une discussion approfondie sur les caractères de diagnose morphologiques sont fournies. De plus, une clé taxonomique des deux espèces est présentée.

KEY WORDS

Chrysidoidea,
Epyrinae,
Democratic Republic
of the Congo,
diagnosis,
Ivory Coast,
new species.

MOTS CLÉS

Chrysidoidea,
Epyrinae,
République
démocratique du Congo,
Côte d'Ivoire,
espèce nouvelle.

INTRODUCTION

The genus *Trissepyris* Kieffer, 1905 is known by a single specimen allocated to a unique Afrotropical species, *T. ruficeps* Kieffer, 1905 (Kieffer 1905). This species was diagnosed by having the trifid claws, the forewing with the 2r-rs&Rs vein inserted at the pterostigmal base and three closed cells, the parapsidal signum percurrent and the mesoscutellum with two oval mesoscuto-scutellar foveae connected by a wide transverse mesoscuto-scutellar sulcus.

After the original description, the genus has not been studied for over 100 years, as the location of the holotype was unknown. Gordh & Móczár (1990) cited the “André Collection” as the type-repository. Currently the Collection Ernest André belongs to the Muséum national d'Histoire naturelle, Paris (MNHN) and the holotype was rediscovered and studied by Azevedo & Alencar (2010).

Azevedo & Alencar (2010) proposed *Trissepyris* as a junior synonym of *Epyris* Westwood, 1832 mainly because, after a detailed reanalysis of the mesoscutellum, they detected that the transverse mesoscuto-scutellar sulcus was thin and almost absent, unlike the original description of Kieffer (1905) and this, in addition to other morphological characters, is compatible with some species of *Epyris*. However, *Epyris* was recovered by some studies as an artificial genus without morphological delimitation (Carpenter 1999; Alencar & Azevedo 2013).

Most recently, Colombo *et al.* (2022) proposed comprehensive phylogenetic study of the Epyrinae Kieffer, 1914, based on morphological and molecular data and were able to identify synapomorphies for *Epyris* for the first time. In this study, *Epyris* was diagnosed, and several junior synonyms were revalidated, including *Trissepyris* (for more details, see Colombo *et al.* [2022]).

While curating the flat-wasp collection of the Africa Museum, Tervuren, formerly Musée royal d'Afrique centrale (MRAC), the first author found a specimen of *Trissepyris* from Ivory Coast collected by J. Decelle in August 1961. This specimen corresponds to a new species. This finding therefore represents an excellent opportunity to describe a new species and to understand the morphology of *Trissepyris*, as well as to compare this genus with the other Epyrinae. That is the main purpose of this paper. Additionally, we propose a taxonomic key for the two species and some comments about the bethylids from the Afrotropical region.

MATERIAL AND METHODS

The holotype of *Trissepyris ruficeps* is deposited in the Muséum national d'Histoire naturelle, Paris (MNHN, curator Bernardo F. Santos), while the holotype of *Trissepyris akan* n. sp. belongs to Africa Museum (formerly MRAC, curator Didier Van den Spiegel).

The operational criteria used to delimit the species in this study follows Cronquist (1978) in which a species is interpreted and delimited as the smallest group that is consistently and persistently morphologically distinct from similar ones.

The nomenclature for the integumental sculpture follows Harris (1979), general terminology follows Lanes *et al.* (2020) and mesopleural terminology follows Brito *et al.* (2021).

The classification of Epyrinae and the interpretation about the mesoscuto-scutellar suture follows Colombo *et al.* (2022).

The holotype of *T. ruficeps* was photographed under a Leica M125 C stereomicroscope, fit with a Leica Flexacam C3 video camera (Leica Microsystems, Germany) at the MNHN. The pictures were produced from stacks of images and combined into a single image using Leica LAS X Microsystems by Leica (Switzerland) Limited. The Figure 1A, C, D and F were adapted from Azevedo & Alencar (2010) and Colombo *et al.* (2022).

The holotype of *T. akan* n. sp. was photographed under a Leica MZ16A stereomicroscope, fit with a Leica DFC 500 video camera (Leica Microsystems, Germany) at the MRAC. The pictures were produced from stacks of images and combined into a single image using Leica LAS Microsystems by Leica (Switzerland) Limited.

For both holotypes, we used a scalable and modular LED illumination dome for microscopic scientific photography as described by Kawada & Buffington (2016).

RESULTS

Family BETHYLIDAE Ashmead, 1893

Subfamily EPYRINAE Kieffer, 1914

Genus *Trissepyris* Kieffer, 1905

Trissepyris Kieffer, 1905: 117.

TYPE SPECIES. — *Trissepyris ruficeps* Kieffer, 1905.

DIAGNOSIS OF FEMALE. — **Colour.** Head rufous castaneous; mesosoma and metasoma black; clypeus castaneous with margin black; mandible castaneous with margins of teeth nearly black; antenna and palpi castaneous; eye and ocelli black; legs rufous castaneous, coxae slightly darker; tegula dark castaneous.

Head. Head subtriangular in lateral view. Mandible robust apically. Clypeus with rounded median lobe, longer than lateral ones, anterior margin angled in anterior view. Antenna with 11 flagellomeres, first flagellomere never ring-shaped. Eye glabrous. Occipital carina incomplete ventrally. Ocellar triangle very compact, far from vertex.

Mesosoma. Dorsal pronotal area ecarinate. Prosternum small. Mesoscuto-scutellar suture with foveae not connected by sulcus, elliptical, distant from each other by at least 5.0× total size of foveae. Metapectal-propodeal disc with transverse anterior, transverse posterior carinae. Propodeal spiracle long, dorsal, elliptical. Mesopleuron with mesopleural pit small, displaced posterior-dorsally.

Wings. Forewing with distinct 2r-rs&Rs vein, about 2× as long as pterostigma. Hind wing with more than five hamuli.

Trissepyris ruficeps Kieffer, 1905
(Fig. 1)

Trissepyris ruficeps Kieffer, 1905: 117 (description), plate I, figs 5, 14; 1908: 20 (list), plate I (figs 13 and 16), plate II (fig. 10); 1914: 420 (description) fig. 157. — Medler 1980: 470 (list). — Gordh &

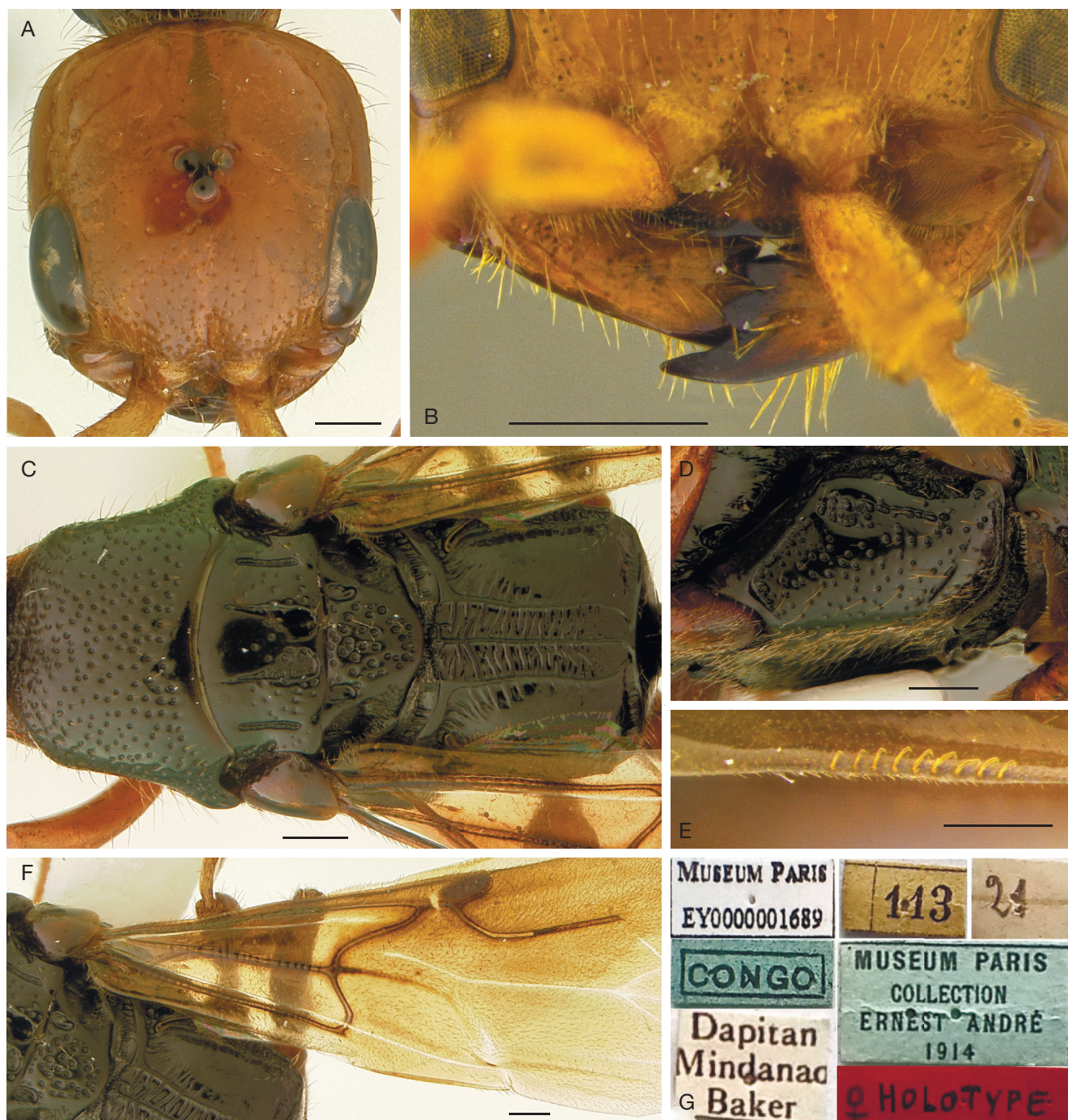


FIG. 1. — *Trissepyris ruficeps* Kieffer, 1905, holotype: **A**, head, dorsal view; **B**, head and mandible, frontal view; **C**, mesosoma, dorsal view; **D**, mesopleura, lateral view; **E**, hamuli, dorsal view; **F**, mesosoma in part and wings, dorsal view; **G**, labels. Scales-bars: A-D, 0.5 mm, E, 0.25 mm; F, 4.0 mm.

Móczár 1990: 170 (catalog). — Azevedo & Alencar 2010: 1 (redescription and synonymisation with *Epyris*). — Colombo *et al.* 2022: 21 (genus revalidation and redescription), fig. 6F, 8I.

DIAGNOSIS OF FEMALE. — Body length *c.* 15.0 mm. Head subtrapezoidal in lateral view, subquadrate in dorsal view. Malar space shorter than proximal mandibular width. Mandible robust, with three distal teeth. Clypeus trilobate, with subtrapezoidal median lobe, as long as lateral ones, lobe delimitation distinct, anterior margin angled in anterior view; median carina high, straight in profile; apical margin thick. Antenna with 11 flagellomeres, subfiliform-filiform; pedicel

chalice-shaped, longer than flagellomere I. Eye glabrous, oval, not touching mandibular base. Frons coriaceous, with very sparse punctures. Frontal line shorter than scape, conspicuous. Ocellar triangle very compact, less than individual ocellus diameter; anterior ocellus almost crossing to supraocular line; posterior ocelli very distant from vertex. Palpal formula apparently 6:3. Hypostomal carina emarginate, rounded medially. Occipital carina present. Mesosoma. Pronotal flange conspicuous; dorsal pronotal area ecarinate, slightly depressed forward, weakly coriaceous, strongly punctate. Prosternum small. Notaulus complete, well impressed, progressively wider posterad. Parapsidal signum complete. Mesoscuto-scutellar

foveae not connected by conspicuous sulcus, oval, parallel, deep. Metapectal-propodeal disc with transverse anterior, metapostnotal median, transverse posterior, paraspircular and lateral carinae; lateral margins straight, subparallel. Metapectal-propodeal declivity with median carina complete. Propodeal spiracle dorsal, elliptical, wide. Mesopleuron with mesopleural pit very small, displaced posterior-dorsally. Wings amber, veins dark castaneous. Forewing with anterior margin straight, R cell longer than 1Cu cell. Pterostigma wide, oval; 2r-rs&Rs vein tubular, curved, straight posteriorly. Hind wing with nine hamuli equally spaced. Metasomal tergum I polished; other terga weakly coriaceous. Metasomal apical segments oriented downward.

MATERIAL EXAMINED. — **Holotype.** Democratic Republic of Congo • ♀; 21, 113, Dapitan Mindanao Baker; Collection Ernest André, 1914; MNHN-EY-EY1689.

DISTRIBUTION. — DR Congo.

REMARKS

Described from a single female. This single specimen is currently pinned with several labels (Fig. 1G), two of them are related to the locality, “Congo” and “Dapitan Mindanao”. Considering that Dapitan is a famous locality of Mindanao in the Philippines, we have to assume that one of them was misattached to the specimen. In the original description, Kieffer (1905: 118) stated only Congo as its locality, and posteriorly Azevedo & Alencar (2010) also stated only Congo. Furthermore, the label of Congo is the first pinned label that comes below the specimen. Thus, it is more reasonable to assume that this is an Afrotropical species rather than an Oriental one. Furthermore, the new species here described was collected in Ivory Coast, a locality very close to Congo, which supports our conclusion.

Trissepyris akan n. sp. (Fig. 2)

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MATERIAL EXAMINED. — **Holotype.** Ivory Coast • ♀; *Divi*; E. d'Aboisso; VIII.1961; J. Decelle leg.; MRAC; BE_RMCA_INS. Hym.047924.

ETYMOLOGY. — The epithet *akan* refers to the Akan, the major cultural group of the Ivory Coast.

DISTRIBUTION. — Ivory Coast.

DESCRIPTION OF FEMALE

Body length
13.2 mm.

Head

Head subtrapezoidal in lateral view, subquadrate in dorsal view. Malar space shorter than proximal mandibular width. Mandible robust, with five distal teeth. Clypeus trilobate, with subtrapezoidal median lobe, as long as lateral ones, lobe delimitation distinct, anterior margin angled in anterior view; median carina high, straight in profile; apical margin thick. Antenna with 11 flagellomeres, subfiliform-filiform; pedicel chalice-shaped, as long as flagellomere I. Eye glabrous, oval, not touching mandibular base. Frons coriaceous, with very sparse punctures. Frontal line

shorter than scape, conspicuous. Ocellar triangle compact, as wide as individual ocellus diameter; anterior ocellus posterior to supraocular line; posterior ocelli very distant from vertex. Palpal formula apparently 6:3. Hypostomal carina emarginate, rounded medially. Occipital carina present.

Mesosoma

Pronotal flange conspicuous; dorsal pronotal area ecarinate, slightly depressed forward, weakly coriaceous, weakly punctate. Prosternum small. Notaulus complete, well impressed, slightly wider posterad. Parapsidal signum complete. Mesoscuto-scutellar foveae not connected by conspicuous sulcus, oval, inclined anteriorly, deep. Metapectal-propodeal disc with transverse anterior, metapostnotal median, transverse posterior, paraspircular and lateral carinae; lateral margins straight, subparallel. Metapectal-propodeal declivity with median carina complete. Propodeal spiracle dorsal, elliptical, wide. Mesopleuron with mesopleural pit small, displaced posterior-dorsally. Wings hyaline, veins dark castaneous. Forewing with anterior margin straight, R cell longer than 1Cu cell. Pterostigma wide, oval; 2r-rs&Rs vein tubular, angled, straight posteriorly. Hind wing with six hamuli equally spaced.

Metasoma

Metasomal tergum I polished; other terga weakly coriaceous. Metasomal apical segments oriented downward.

REMARKS

This species is morphologically similar to *Trissepyris ruficeps* by having the colour of head rufous castaneous, the ocellar triangle very compact, the occipital carina ventrally incomplete, the mesoscuto-scutellar suture with elliptical foveae, the propodeal spiracle long, elliptical, and dorsally placed, and the hind wings with more than five distal hamuli. However, *T. akan* n. sp. has the mandible with five teeth, the distance between the ocelli is as wide as individual ocellus diameter, the notauli are weakly widened posteriorly, the mesopleuron has the mesopleural pit small, but distinct from the punctures and, the hind wings have six distal hamuli; whereas *T. ruficeps* has the mandible with three teeth, the distance between the ocelli less than the individual ocellus diameter, the notauli strongly widened posteriorly, the mesopleuron with the mesopleural pit very small, undistinguished from the punctures, and the hind wings with nine distal hamuli.

DISCUSSION

The genus *Trissepyris* is an enigmatic and peculiar genus since Kieffer (1905). The diagnosis of *Trissepyris* proposed by Colombo *et al.* (2022) and all previous studies (Kieffer 1905; Azevedo & Alencar 2010) was based only on one species and one specimen, as no other specimen or species were known to date. Probably due to the difficulty of finding new specimens of *Trissepyris*, the identity of the genus was questioned and synonymized with *Epyris* by Azevedo & Alencar (2010) and later its status was revalidated by Colombo *et al.* (2022).

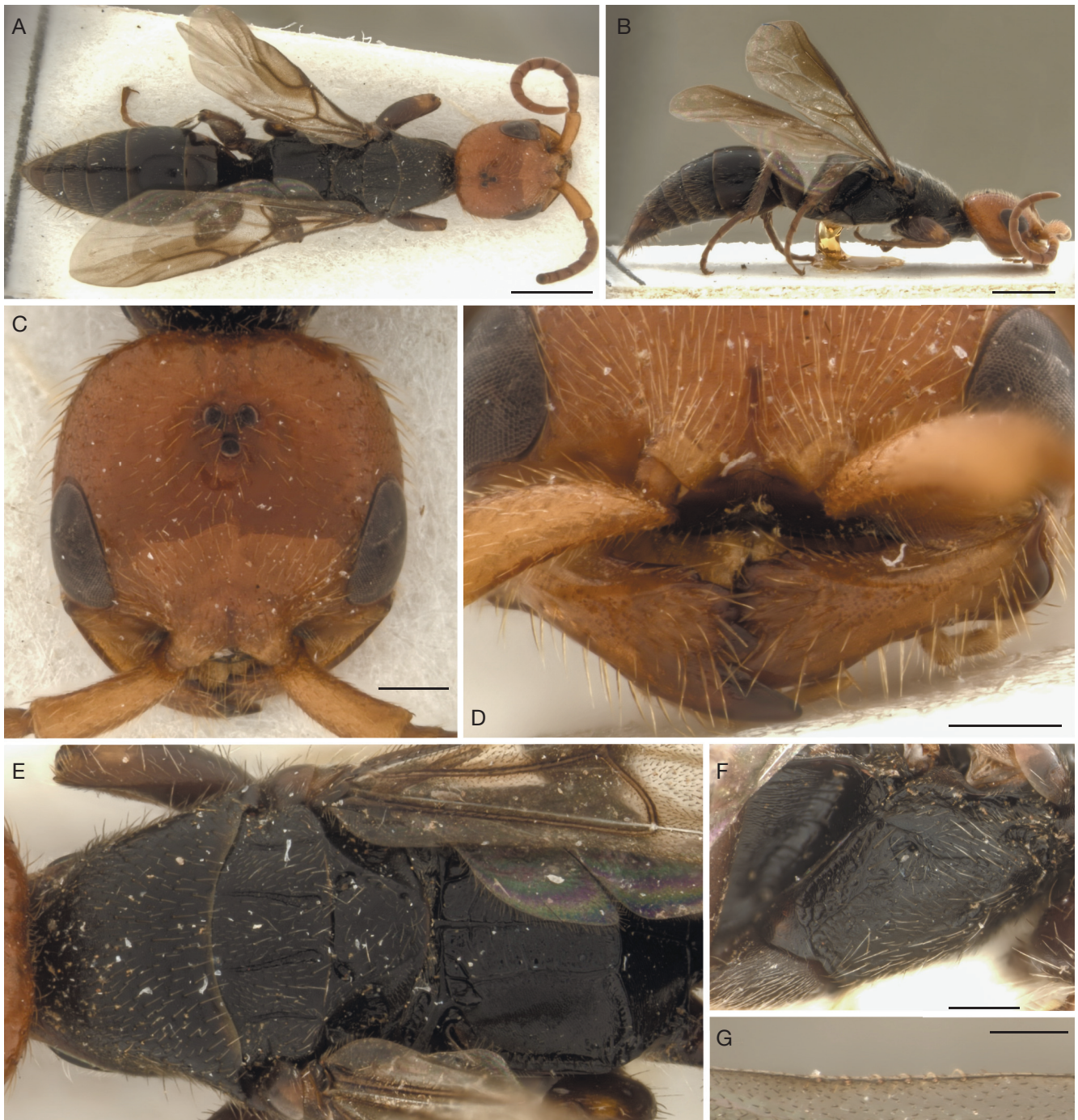


FIG. 2. — *Trissepyris akan* n. sp., holotype: **A**, habitus, dorsal view; **B**, habitus, lateral view; **C**, head, dorsal view; **D**, head and mandible, frontal view; **E**, mesosoma, dorsal view; **F**, mesopleura, lateral view; **G**, hamuli, dorsal view. Scales-bars: A, B, 2.0 mm; C-F, 0.5 mm; G, 0.25 mm.

In general, the diagnostic characters proposed for the genus were: 1) the large size (about 15.0 mm long); 2) the ocellar triangle very compact, with the distance among the ocelli being less than their individual diameters; 3) the occipital carina missing at the median part on the ventral side; 4) the posterior half of the notauli wide; and 5) the hindwing with nine distal hamuli. These diagnostics characters apply perfectly to *T. ruficeps* and to the new species described here, with some differences.

Both species are known by unusual large specimens: 13–15 mm long. In general, epyrine specimens are at most 6.0–7.0 mm long, with some exceptions in *Calyoza* Hope, 1837 and *Dolus* Motschulsky, 1863. In Bethylidae, *Pristocera* Klug, 1808 is the genus that shows the largest specimens, at most 30 mm long, mainly in the Afrotropical region. As reported by Azevedo & Alencar (2010), our personal observation about the Afrotropical species, is that they are usually larger than other species from other regions of the world.

The ocellar triangle is very compact, with the distance among the ocelli varying from less than their individual diameter in *T. ruficeps* to as wide as the diameter of ocellus in *T. akan* n. sp. In other epyrines, the ocelli are usually distant one from another by at least 1.2× their own diameters. In fact, this character is unique to *Trissepyris* and very useful to identify its species.

The occipital carina is missing at the median part on the ventral side, whereas the pattern of all Epyrinae is complete. Usually, the sclerodermine species are those which show the occipital carina totally absent or partially absent ventrally, such as *Nothepyrus* Evans, 1973 and *Alloplastanoxus* Terayama, 2006, for example. Indeed, the complete occipital carina is so conserved in Epyrinae, that it was used in the taxonomic key of the subfamilies of Bethyridae by Azevedo *et al.* (2018) to separate Epyrinae from Scleroderminae.

The posterior half of the notauli is very widened in *T. ruficeps* and weakly widened in *T. akan* n. sp., but in both species the enlargement is conspicuous and evident. However, this feature is not exclusive to *Trissepyris*. Other epyrine genera, such as *Aspidepyris* Evans, 1964, *Calyzoa* and *Calyzina* Enderlein, 1912, for example, show the same condition. In this way, the progressively widened posteriorly notauli is not a good diagnostic character for *Trissepyris*.

There is an asymmetry in the number of hamuli of the hind wing of *T. ruficeps* as noticed by Azevedo & Alencar (2010): the right wing has eight apical hamuli, while the left wing has nine; in *T. akan* n. sp., both hind wings have five distal hamuli. Hamuli are hook-like setae on the anterior margin of the hind wing which interlock with the recurved posterior edge of the fore wing in the Hymenoptera during flight, making them functionally two winged (for more details, see Basibuyuk & Quicke [1997]). In Bethyridae, there are usually four or fewer distal hamuli. However, it has often been claimed that there is a correlation between the number of hamuli and the size of the insect (Riek 1970; Quicke 1981). In fact, the largest bethylids, such as *Pristocera gigantea* Arlé, 1930, c. 20 mm long, has ten distal hamuli and *Trissepyris ruficeps*, c. 15 mm long, has nine distal hamuli, whereas species of *Laelius* Ashmead, 1893 at most 4.0 mm long have only three distal hamuli. However, this size-dependency cannot be applied to all hymenopter taxa. For example, many members of megalyrid, ichneumonoid and aculeate wasps which are much larger in size have few distal hamuli (four or fewer) while small species in some other families, such as Evanidae Latreille, 1802 and Trigonalidae Krieger, 1894, can have considerably more than four hamuli (Basibuyuk & Quicke 1997). So, the number of hamuli is not a reliable diagnostic character of *Trissepyris*.

Another evident characteristic of *Trissepyris* not cited by Colombo *et al.* (2022) and commented by Azevedo & Alencar (2010) as not being a useful diagnostic feature is the head rufous castaneous, while the rest of the body is black or at least dark castaneous. For Azevedo & Alencar (2010), the holotype of *T. ruficeps* has presumably been collected shortly after its emergence from the cocoon, and this is common for bethylids, mainly *Pristocera* specimens. However, when we

find a second specimen, which belongs to a second species as aforementioned, with this characteristic, in addition to all the other diagnostic characters, which fits perfectly in *Trissepyris*, it is therefore probably the final colour of the adult specimens and is not related to the time of emergence from the cocoon. It can be considered as a generic character, since both species have it.

The mesoscuto-scutellar foveae of both species of *Trissepyris* are not connected by an evident and conspicuous sulcus and are oval. However, in *T. ruficeps* the mesoscuto-scutellar foveae are parallel, whereas in *T. akan* n. sp. they are inclined. These structures have been interpreted in different ways by previous studies. Kieffer (1905) cited that *T. ruficeps* has the mesoscuto-scutellar foveae connected by an evident sulcus; Azevedo & Alencar (2010), on the other hand, conclude that the mesoscuto-scutellar sulcus is very narrow, resembling a suture. Lastly, Colombo *et al.* (2022) cited that the mesoscuto-scutellar sulcus is fully absent. This character is extremely important for the taxonomy of Epyrinae, being used in several genera taxonomic keys (see Azevedo *et al.* 2018; Colombo *et al.* 2022). In fact, some species of *Calyzoa* and *Muellerella* Saussure, 1892 [1890] have mesoscuto-scutellar foveae connected by a very narrow line, like a suture. This condition is difficult to define and for this reason has caused many problems of interpretation. Here, we follow the classification proposed by Colombo *et al.* (2022), but more studies of this structure are necessary to correctly identify the homologies and terminologies.

The Afrotropical region is a hotspot for new species of Bethyridae and its diversity is severely understood. Recently, some taxonomic studies about the biodiversity of Bethyridae were published, such as Azevedo & van Noort (2019) for *Glenosema* Kieffer, 1905; Azevedo & Colombo (2022) for *Pristonesia* Alencar & Azevedo, 2018 (in Alencar *et al.* 2018) and have demonstrated how the African Bethyridae fauna is unknown. In addition, the revision of Afrotropical *Dissomphalus* Ashmead, 1893 already has more than 100 new species awaiting formal descriptions (Colombo *et al.* in prep.). In this way, we highlight here the importance of studies in this region for the understanding of monotypic genera, as was *Pristonesia* and now, *Trissepyris*.

Finally, *Trissepyris* presents compelling characteristics to be maintained as a valid genus, as highlighted by Colombo *et al.* (2022) and now confirmed by the description of a second species. A next step would be to obtain its genetic sequences and thus carry out molecular analysis, which together with the morphological data, will be able to elucidate its phylogenetic position in Epyrinae, since its morphology is quite distinct and unique in Bethyridae.

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