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A new genus of Encyrtidae (Hymenoptera: Chalcidoidea), the first known hymenopteran in amber from Lower Lusatia (Germany)

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Abstract

Waninka haikowielandi Simutnik **gen. et sp. nov.** is described and illustrated based on a female specimen from amber found in Lower Lusatia (Germany). This parasitic wasp is the first known record of a hymenopteran discovered in amber from Lower Lusatia and is believed to be from the late Eocene. The new genus is characterized by very long postmarginal and stigmal veins, the first funicular segment ring-like and conspicuously smaller than the second one, and the eye not reaching the occipital margin. The taxonomic position of the new genus is *incertae sedis* within the subfamily Encyrtinae. An updated key to the genera of late Eocene encyrtids of the subfamily Encyrtinae is provided. The “Baltic river” as the route of amber redeposition to Lower Lusatia is discussed.

Keywords: Eocene, Eridanos, parasitic wasp, key to fossil genera, filum spinosum

Introduction

Within the Chalcidoidea superfamily, Encyrtidae is one of the largest extant families with 5,100 described species (Noyes, 2023). The earliest known members of the family are found in middle Eocene Sakhalinian amber (Simutnik, 2014, 2021; Simutnik *et al*., 2021b). To date, some 20 species in 18 extinct genera of Encyrtidae have been described from late Eocene Baltic, Danish, and Rovno ambers (Simutnik *et al*., 2021a, 2022c, 2023a; Simutnik & Perkovsky, 2023). Of these, eight species in eight extinct genera belong to the subfamily Encyrtinae. One more extinct genus and species of Encyrtinae are described and illustrated here based on a female specimen found in amber from the Lower Lusatia region in Germany.

Material and methods

The amber piece containing the holotype was found in the vicinity of Wanninchen, near a post-mining lake Schlabendorfer See, in the area of the town of Luckau, the municipality of Heideblick, district of Dahme-Spreewald, and in the south of the federal state of Brandenburg, Lower Lusatia region, Germany (see details in Drohojowska *et al*., 2024). The encyrtid described in this article is the first known hymenopteran from this locality.

The specimen was examined using the techniques illustrated in Simutnik *et al*. (2022a). Photographs were taken using a Leica Z16 APO stereomicroscope equipped with a Leica DFC 450 camera and processed with LAS Core and Adobe Photoshop software (brightness and contrast only). Some standard measurements and ratios given in the description may not be precise or could not be obtained due to the effect of light refraction in the amber and the effect of perspective, or the inaccessibility of the necessary viewing angles. Only body lengths are given in millimeters; all other measurements are relative, taken from the divisions of a linear scale of an ocular micrometer (one micrometer division = 0.014 mm).

Terminology and abbreviations follow Gibson (1997) and Noyes (2023). We use the following abbreviations: fs = filum spinosum; F1, F2, *etc*. = funicular segments 1, 2, *etc*.; OOL = minimum distance between eye margin and the adjacent posterior ocellus. Other abbreviations are explained in the figure captions.

The studied specimen is housed in the collection of the Geological-Paleontological Institute and Museum of the University of Hamburg, Germany (GPIH).

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Systematic palaeontology

Superfamily Chalcidoidea Latreille, 1817
Family Encyrtidae Walker, 1837
Subfamily Encyrtinae Walker, 1837

Genus *Waninka* Simutnik gen. nov.

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Type species. *Waninka haikowielandi* Simutnik **sp. nov.**; by present designation.

Species composition. Monotypic.

Etymology. Waninki is the old Slavic name of Wanninchen, a district of the town of Luckau, in the vicinity of which the holotype was found. The genus name is feminine.

Diagnosis. Female. Body mainly dark brown, compact, not flattened, mesoscutum reddish-brown when illuminated from below; antenna unicolorous, clavate; scape about 4× as long as broad; all funicular segments broader than long, F1 ring-shape, conspicuously smaller than F2; antennal toruli located about at level of lower eye margin; clypeal margin almost straight, ventrolateral angles of clypeus not prominent; eye not reaching occipital margin, separated by nearly diameter of facet; notauli short but distinct, located anteriorly (Fig. 1D: n); basal half of forewing slightly infuscated, yellowish brown, but without darkened areas below marginal vein and parastigma; filum spinosum and row of covering setae on basal margin of linea calva well developed; postmarginal vein very long, ~2.5× as long as marginal vein and 1.7× as long as stigmal vein; marginal vein ~3.0× as long as broad; parastigma only slightly thickened but distinct; cerci located in apical third of metasoma; apex of hypopygium not reaching apex of last gastral tergum; gonostyli movably articulated with second valvifers; ovipositor stylet very thin.

Male. Unknown.

Remarks. The placement of *Waninka* in the subfamily Encyrtinae is supported by the presence of a filum spinosum on the linea calva (Fig. 1F), the apex of the hypopygium not reaching the gastral apex (Fig. 1B, C: hyp), and gonostyli movably articulated with second valvifers (Fig. 1C: g). However, the taxonomic position of the new genus is treated as *incertae sedis* within the Encyrtinae.

The new genus habitually somewhat resembles some representatives of the extant tribe Microteryini Hoffer, 1955 (sensu Trjapitzin, 1989), but differs, in particular, in the very long postmarginal and stigmal veins (Fig. 1F) and the absence of enlarged seta marking the apex of the postmarginal vein of the forewing (the seta is as long as others on this vein). The new genus is in many ways similar to the extinct genus *Dencyrtus* Simutnik, 2018 (Simutnik & Perkovsky, 2018). Some of the differences are given in the key.

Key to European amber genera of Encyrtinae (females)

1 (4) Postmarginal vein shorter than marginal vein.
2 (3) Hypopygium extending past apex of syntergum ....*Protaphycus* Simutnik, 2022
3 (2) Hypopygium not extending apex of syntergum .... *Electrocerus* Simutnik, 2023
4 (1) Postmarginal vein not shorter than marginal vein.
5 (6) Row of filum spinosum double, consisting of 9 setae .... *Efesus* Simutnik, 2020
6 (5) Row of filum spinosum single, consisting of 2–6 setae.
7 (10) Funicle as long as clava. All funicle segments wider than long.
8 (9) F2 as long as F1; apex of clava sharp; eyes reaching occipital margin; ventrolateral angles of clypeus prominent.................................*Dencyrtus* Simutnik, 2018
9 (8) F2 3× as long as F1; apex of clava rounded; eyes not reaching occipital margin; ventrolateral angles of clypeus not prominent........................ *Waninka* Simutnik **gen. nov.**
10 (7) Funicle longer than clava. At least some funicle segments longer than wide.
11 (12) Mesoscutum with large, deep, rare punctures .... *Ektopicercus* Simutnik, 2020
12 (11) Mesoscutum without large punctures.
13 (14) Antenna thin, filiform. Clava about 5.5× as long as wide... .... *Protocopidosoma* Simutnik, 2017
14 (13) Antenna not filiform, clavate. Clava about 3× as long as wide ....*Rovnosoma* Simutnik, 2015

The key does not include the genus *Glaesus* Simutnik, 2014, which is known only from a male specimen. Its postmarginal vein also is longer than the marginal vein but its eyes reach the occipital margin (Simutnik *et al.*, 2014).

Waninka haikowielandi Simutnik sp. nov.

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(Fig. 1)

Material. Holotype GPIH 5216, 1 ♀, the vicinity of the Wanninchen district of the town of Luckau, Lower Lusatia region, Germany. The inclusion is in a transparent, clear, yellowish piece of amber (*ca.* 16 × 13 × 5 mm).

Syninclusions: Stellate hairs, undetermined plant inclusion.

Etymology. The new species is named in honor of Haiko Wieland, who found the specimen and kindly sent it to the first author for description.

Description. Female (holotype). Habitus as in Fig. 1A–C. Body length 1.2 mm, not including the ovipositor.

Coloration. Body mainly dark brown; face with faint green sheen (visible only from some, but not all, viewing

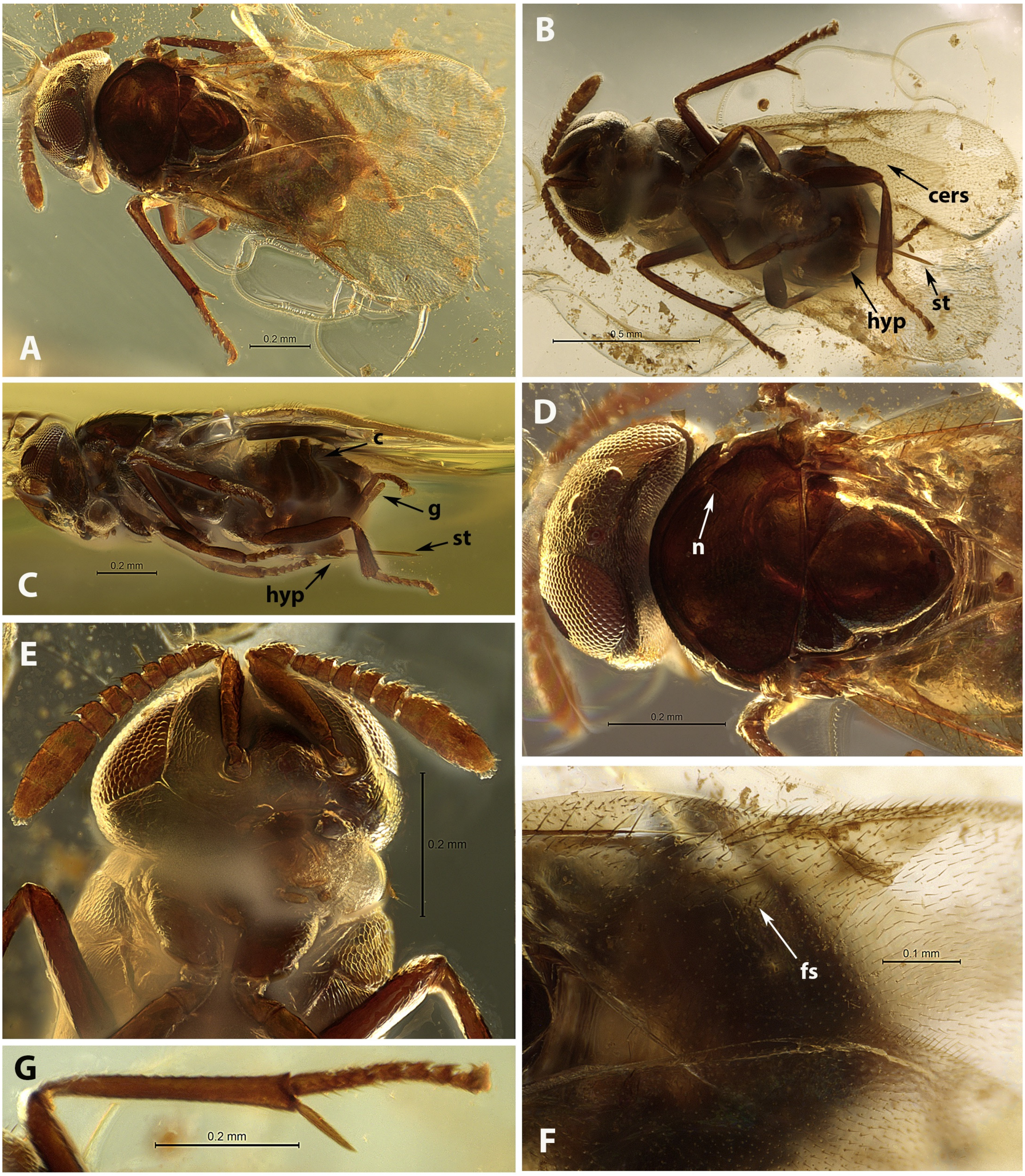

FIGURE 1. *Waninka haikowielandi* **gen. et sp. nov.**, holotype female. **A**, Body, dorsal view. **B**, Body, ventral view (cers—cercal seta, hyp—hypopygium, st—ovipositor stylet). **C**, Body, lateral view (c—cercus, g—gonostylus). **D**, Head and mesosoma, dorsal view (n—notaular line). **E**, Head and antennae, ventral view. **F**, Part of forewing venation and linea calva (fs—filum spinosum). **G**, Mid tibia and tarsus.

angles); mesonotum and scutellum brown with reddish bronze shine, axillae and lateral margins of scutellum with a slightly noticeable, faint green metallic reflection; antenna unicolorous, light brown; eyes, wing venation, tarsi and ovipositor stylet light brown; tegula brown; basal half of forewing slightly infuscate; legs dark brown; gaster dark brown with light brown base, gonostylus brown.

Head dark (head of holotype covered with a thin layer of air that hides the colour), hypognathous, not flattened, as wide as mesosoma in dorsal view, about 2.5×

as wide as frontovertex, in profile about 1.7× as high as deep; frontovertex with polygonally reticulate sculpture of mesh size slightly smaller than diameter of eye facet; occipital margin round (Fig. 1D); eyes bare, not reaching occipital margin, separated very nearly by diameter of facet; ocelli forming almost right triangle (90°); malar sulcus distinct; posterior ocelli equidistant from eye and occipital margin (Fig. 1D); OOL about equal to posterior ocellar diameter; antennal scrobes as in Fig. 1E, not extended to anterior ocellus (Fig. 1D), in dorsal view anterior ocellus about equidistant from upper margin of scrobal depression and occipital margin; interantennal prominence slightly protuberant, as in Fig. 1E; antennal toruli located about at level of lower eye margin, separated from mouth margin by distance equal to their own width; distance between toruli slightly greater than distance between torulus and eye; clypeal margin weakly concave, almost straight; mandible rather tridentate. Some standard measurements and ratios of the head cannot be given due to the unavailability of the necessary viewing angles.

Antenna as in Fig. 1E, with six funicular segments and 3-segmented clava; radicle 1.3× as long as broad; scape slightly broadened and flattened, about 4× as long as broad (including radicle 17:4); pedicel 2.0× as long as wide, conical, as long as first 3 funicular segments combined, longer than any funicular; all funicular segments transverse, F1 very small, ring-like, F2 3× as long as F1; distal segments broadest; clava as long as funicle, 2.6× as long as broad, slightly wider than F6, with rounded apex and very small sensory area at apical segment only, sutures complete, parallel; pedicel and flagellum clothed with short setae, each about as long as half width of flagellomere. Pedicel 4:2; F6 2.5:4; clava 12:4.5; funicle 12.

Mesosoma. Pronotum short, almost vertical (in lateral view); mesoscutum broader than long in dorsal view (32:19), notauli as in Fig. 1D (n); axillae meeting; scutellum slightly convex, apically rounded, as long as mesoscutum; sculpture shallow polygonally reticulate as in Fig. 1D; mesopleuron enlarged posteriorly; metapleuron triangular, narrow, without visible setation; propodeum bare, touching metacoxa.

Wings. Fully developed, forewing slightly infuscate, yellowish brown, with a lighter apical part, about 2.0× as long as broad (75:35); venation pale brown; linea calva with filum spinosum consisting of a row of 4 setae, with a well-developed line of long setae alongside basal margin (Fig. 1F); speculum absent; parastigma weakly thickened, but distinct; postmarginal vein very long, ~2.5× as long as marginal vein and 1.7× as long as stigmal vein; marginal vein ~3× as long as broad, stigmal vein with long narrow uncus consisting of row of 4 uncal sensilla; enlarged seta marking apex of postmarginal vein of forewing absent (seta as long as others on this vein); fringe setae short. Hind wing about 3.5× as long as broad; costal cell without line of long setae; spur vein not visible. Fore wing 75:35, hind wing 52:15, parastigma length 7, marginal vein 5, postmarginal vein 12, stigmal vein 7.

Legs. Unicolorous, brown; all coxae brown; protibia with long, straight, curved only at apex, bifurcate calcar; strigil and basitarsal comb absent (Fig. 1B); midtibial spur long and straight but slightly shorter than a very long mid basitarsus (7:8), tarsi 5-segmented. Mid tibia length 26, mid tarsus 20, hind femur 22:5.

Metasoma shorter than mesosoma (33: 40) (lateral view); cerci in apical third of metasoma (Fig. 1C: c), with long setae (Fig. 1B: cers); syntergum (Mt8 + Mt9) v-shaped, no longer than 0.3 of metasoma; hypopygium not reaching apex of syntergum (Fig. 1C: hyp); lateral margin of hypopygium not serrated, without row of setae; ovipositor extended beyond apex of gaster, gonostylus free, shorter than mesobasitarsus (6.5:8); stylet thin, its protruding part 18 (Fig. 3A).

Male. Unknown.

Measurements. Body length 86 × 0.014 mm = 1.204 mm; head width 33, minimum width of the frontovertex 13; distance between toruli 8; mesosoma 40:32; mesoscutum 19:32; scutellum 18:18; gaster (ventr.) 30:35; mesotibia 26; mesotibial spur 6; basitarsus 8. Antenna: pedicel 4:2; flagellum 23; F6 2.5:4; clava 11:5; funicle 12. Forewing 75:35, hind wing 52:15.

Male. Unknown.

Discussion

This specimen is the first known hymenopteran in amber from Lusatia. The piece is transparent, light yellow, not brittle, and most likely it is succinite. Succinites from the Lower Lusatia region come from Miocene sediments (Drohojowska *et al*., 2024 and references therein), but the actual resin is probably older, *i.e*., Priabonian (see below). Moreover, the long veins of the forewing of the new taxon, especially its stigmal and postmarginal veins, short radicle, and absence of the enlarge seta at the apex of the postmarginal vein, are characteristic of most known encyrtids from late Eocene Rovno, Baltic, and Danish ambers and are rarely noted in extant ones (Simutnik, 2021; Simutnik *et al*., 2022b, d; 2023a). Common encyrtids have been found in Baltic, Danish, and Rovno ambers (Simutnik *et al*., 2014, 2021a, 2023b). In addition, the studied late European ambers have revealed too many common species from other groups to have different ages (*e.g*., Dlussky & Rasnitsyn, 2009; Perkovsky 2016, 2017, 2018; Radchenko & Perkovsky, 2021; Perkovsky *et al*., 2024; Melnitsky *et al*., 2024). For example, based on its general features and venation pattern, the aleyrodine genus

Pudrica Drohojowska & Szwedo, 2024 from Wanninchen is similar to *Snotra* Drohojowska & Szwedo, 2016 (Drohojowska *et al*., 2024). *Snotra* (the single Palaeogene genus of Aleyrodinae) is known from the "Gulf of Gdańsk area (secondary deposit)" (Szwedo & Drohojowska, 2016: p. 2), and at least one specimen of a second species of *Snotra, Snotra herczeki* Drohojowska & Szwedo, 2023 (Drohojowska *et al*., 2023), is known only from Yantarny (Carsten Gröhn, 2024, pers. com.). The Priabonian age of Baltic amber now is well-proven (Iakovleva, 2023). That is why we suppose that the succinites from Lower Lusatia are Priabonian as well.

Drohojowska *et al*. (2024) indicated that the amber from Lower Lusatia (Germany) presents a challenge to current ideas about European amber redeposition outside of Gdańsk Bay. The catchment of the Miocene Baltic river system included much of Fennoscandia, the Baltic states, and westernmost Russia (Gibbard & Lewin, 2016; Drohojowska *et al*., 2024: fig. 1). The Priabonian river system, named Eridanos and believed to be the primary transporter of Baltic amber deposits, had a very different catchment, *i.e*., the eastern part of Fennoscandia in present-day Europe. During this time, the Polish bay and Pripyat Strait in Eastern Europe were still part of the shallow Subparathetys sea (Popov *et al*., 2009; Ivanov *et al*., 2016: fig. 1), while amber-producing resins were forming more northward in Russo-Scandia ("Baltia" on fig. 1 of Drohojowska *et al*., 2024). The mouth of the Priabonian Eridanos river was in modern Sambia (Gdańsk Bay) in Yantarny (Palmnicken), Kaliningrad Oblast, Russia, the site of the world's most prolific amber deposits. In contrast, the Miocene Baltic River had its mouth in Germany and Denmark. During this time, at least one of the main sources of sediments was the west coast of Russo-Scandia. That is why the Miocene Baltic River might have transferred amber from the southwestern part of Russo-Scandia to Germany and Denmark. In contrast, Gdańsk Bay became a depot of the amber deposits delivered by the Eridanos River, with its Priabonian mouth eastward at the coast of Russo-Scandia (in Sambia) and its catchment in more eastern and northern Russo-Scandia. Thus, the Priabonian deposits of Gdańsk Bay could not be a source of the amber redeposited in Germany and Denmark.

In fact, Priabonian amber could not have been redeposited in Germany and Denmark before the Parathetys sea separated completely from the North Sea in the Miocene (Popov *et al*., 2009: Plate 22), which permitted the mouth of the Baltic River to reach these places. This means, among other things, that only Rovno amber originated on the south coast of Subparathetys (in contrast to what was mentioned in our earlier papers, *e.g*., Lyubarsky *et al*., 2023). It is worth noting that among Encyrtidae, the new genus described here is closest to the one known from Danish amber. Danish amber itself was supposedly redeposited from Miocene lignites of Jutland (Larsson, 1978), where it was already redeposited from a Priabonian source possibly located somewhere in the south or southwest of modern Sweden (Drohojowska *et al*., 2024: fig. 1), that is, in southwest Russo-Scandia. Farther to the north and east, the Baltic amber river (Eridanos) redeposited the Priabonian succinites to the south. Comparative study of the local amber faunas (*e.g*., each of those forming ambers from Denmark and Gdańsk Bay) could help illuminate the differences in these biotas. For example, only half of the Danish amber hymenopteran genera are known from the much better documented Gdańsk Bay amber (Belokobylskij *et al*., 2024 and references therein). Understanding how amber was redeposited in the Miocene could elucidate reasons for these differences, so the comparative study of German amber inclusions from Brandenburg and Saxony-Anhalt could be very enlightening. Of course, any important specimens found should be photographed and described as quickly as possible. Amber samples extracted from the ground get noticeably darkened and become fragile after several decades of storage in collections, with small polished pieces starting to become reddish in two decades (Legalov *et al*., 2024). As more of these specimens are documented, the relationships of fossil taxa of encyrtids will undoubtedly be revised, and the taxonomic position of the new genus documented here will be clarified. With more described representatives of the family and new data on their morphology, the boundaries of extinct tribes will be clearer, and their phylogenetic relationships with extant taxa will be better understood.

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