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FIRST RECORD OF *BRADOPONERA WUNDERLICHI* (HYMENOPTERA, FORMICIDAE) FROM ROVNO AMBER, WITH DESCRIPTION OF THE WORKER CASTE

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First Record of *Bradoponera wunderlichi* (Hymenoptera, Formicidae) from Rovno Amber, with Description of the Worker Caste. Radchenko, A. G., Khomych, M. R. & Kalmer, M. M. — Previously unknown workers of *Bradoponera wunderlichi Baroni* Urbani & De Andrade, 2003 are described, and this extinct species is recorded for the first time in Rovno amber.We show that the lectotype of *Bradoponerameieri* Mayr, 1868 was previously designated by Dlussky (2009) based on a wrong collection number, which is corrected here.

Key words: ants, Bradoponera lectotype, first record, worker description, Late Eocene, palaeontology, taxonomy.

Introduction

The ant fauna of the late Eocene European (i. e., Baltic, Bitterfeld, Scandinavian and Rovno) ambers (Priabonian age, 37.8–33.9 Ma) is the best studied among all fossil myrmecofaunas of the world. To date, more than 18,000 ant specimens belonging to 202 extinct species from 70 genera (40 extinct and 30 extant) of 12 subfamilies (all extant) have been recorded (Dlussky & Rasnitsyn, 2009; Barden, 2017; Radchenko, 2024; Radchenko et al., 2024; Radchenko & Khomych, 2024; Boudinot et al., 2024; our unpublished data).

Mayr (1868) established anew extinct monotypic genus *Bradoponera* with the type species *B. meieri* Mayr, 1868, described based on workers from Baltic

amber. Wheeler (1915) first described a queen of this species. De Andrade & Baroni Urbani (2003) described two more species from Baltic amber, *B. wunderlichi* based on a single queen and *B. electrina* based on a single worker. Finally, Dlussky (2009) designated the lectotype of *B. meieri* (misspelled as *meyeri*), redescribed its workers and queen and described males for the first time, and described a fourth species, *B. similis*, based on a single worker from Bitterfeld amber. We recently found *B. wunderlichi* workers in Rovno amber for the first time. This species is clearly distinguished from other known species of *Bradoponera* by its 9-segmented antennae instead of 12-segmented ones. Since this species was previously known from a single holotype queen, we describe the worker caste for the first time.

Material and Methods

We examined five workers of *B. wunderlichi* and one worker of *B. meieri*f rom five pieces of Rovno amber; they are preserved at the Schmalhausen Institute of zoology of the National Academy of Sciences of Ukraine (SIZK) and the collection of M. Khomych, Ukraine (MKHC).

The original photographs were taken with a Leica Z16 APO stereomicroscope equipped with a Leica DFC 450 camera processed by LAS Core software, and with a SONY ILCE-6000 camera with the use of Helicon Focus 8.2.0 software (Kozub et al., 2023) for stacking of multiple images taken at different focal planes.

The specimens were measured using a Leica MZ6 stereomicroscope with an ocular-micrometre at a maximum magnification × 100. Not all features of the specimens examined were properly visible and measurable, so we measured only well visible details (calculated to an accuracy of 0.01 mm), particularly:

HL — maximum length of the head in dorsal view, measured in a straight line from the anteriormost point of clypeus to the mid-point of occipital margin;

HW — maximum width of the head in dorsal view behind (above) the eyes;

SL — maximum length of the scape measured in a straight line from its apex to the articulation with the condylar bulb;

OL — maximum diameter (length) of the eye;

MdL — length of the mandible;

ML — diagonal length of the mesosoma (seen in profile) from the anterior end of the neck shield to the posterior margin of the propodeal lobes (= Weber's length);

MH — height of the mesosoma, measured from the upper level of promesonotum perpendicularly to the level of lower margin of mesopleuron;

PNW — maximum width of the pronotum from above;

PL — maximum length of the petiole, measured from the posterodorsal margin of the petiole to the articulation with the propodeum;

PH — maximum height of the petiole in profile, measured from the uppermost point of the petiolar node perpendicularly to the lowest point of the petiole;

PW — maximum width of the petiole from above;

HTL — maximum length of the metatibia;

HFL — maximum length of the metafemur.

Fig. 1. Photographs of worker of *Bradoponera wunderlichi*, specimen No. F-828 (MKHC): *a* — body, dorso-lateral view; *b* — head, dorsal view. Scale bars: *a* — 0.5 mm, *b* — 0.25 mm (photos by A. Radchenko)

The approximate total length (TL) is calculated as the sum of HL+ML+PL+length of the gaster.

For simplicity, we give ratios of various measurements (e. g., HL/HW) rather than naming and abbreviating various indices (e. g., CI — cephalic index).

First description of workers of *B. wunderlichi*

Material examined. Ukraine, Rivne Prov., Varas'ky Distr., vil. Kuhitska Volya, Riv. Veselukha, No.F-931 (MKHC); Ukraine, Rivne Reg., No. F-773 (MKHC); Ukraine, Volyn' Reg., Kamin'-Kashyrsky Distr., village Lisove, No. F-828 (MKHC); No. K-4248 (SIZK).

Workers (Fig. 1, *a*, *b*). Body length 2.35–2.80 mm. Head relatively long compared to other species of *Bradoponera*, HL/HW 1.24–1.25 vs. <1.15 in others, gradually widened posteriorly, with feebly convex sides and widely rounded occipital corners, occipital margin flat to slightly convex. Clypeus convex, moderately protruding anteriorly, its anterior margin gradually convex. Frontal carinae almost straight, diverging posteriorly; frontal lobes very feebly extended laterally so that antennal sockets almost fully exposed. Antennae 9-segmented, scape stout and short, slightly surpassing posterior margin of eyes. First funicular segment barrel-shaped, second segment subsquare, 3rd to 7th segments transversal, increased in width toward apex, terminal segment very large, subequal to total length of 1st to 7th segments, ca. 1.7 times as long as wide. Eyes located distinctly behind midlength of sides of head, medium-size, oval, 0.16–0.18 times as long as head, with ca. 30 big, bulging ommatidia. Mandibles robust, subtriangular, ca. 0.4 times as long as head, masticatory margin edentate, with "brush" of coarse bristles. Palp formula 5, 4.

Mesosoma short and robust, 1.26–1.30 times as long as high, subequal to head length, somewhat compressed laterally, its dorsum evenly convex, forming regular arch, promesonotal suture dorsally vestigial, metanotal suture and groove absent. Declivous surface of propodeum slightly concave, distinctly separated

from dorsal and lateral faces, but not delineated by ridge. Posterolateral angles of propodeum form wide, blunt tubercles. Propodeal lobes widely rounded. Petiole relatively narrow, 1.62–1.75 times as wide as long and 0.35–0.47 times as wide as head. Petiolar node subcuneiform, its anterior and posterior surfaces very feebly convex, dorsum quite narrowly rounded. Ventral process of petiole well-developed and widely rounded. Structure of gaster typical for *Bradoponera*. Legs short, hind tibiae inflated, 0.46–0.47 times as long as mesosoma. Meso- and metatibiae with a single pectinate or barbulate spur; pretarsal claws simple, arolia well-developed.

Head and mesosoma with numerous piligerous foveae, distance between them smaller than their diameter; spaces between foveae densely punctated. First gastral segment with sparser and smaller foveae. Remaining gastral segments with scattered pits and punctures, appendages with similar sculpture.

Standing setae absent, entire body and appendages with dense decumbent pilosity.

Males unknown.

Measurements (in mm) and ratios:

Specimen F-608: TL 2.80, HL 0.74, HW0.60, OL0.12, ML0.75, MH0.60, PnW0.48, PL0.17, PW0.27, HTL0.35, HFL0.44;

HL/HW 1.24, OL/HL 0.16, OL/HW 0.20, PW/PL1.62, PL/HL0.23, PW/HW0.46, ML/MH1.26, ML/PnW1.57, HTL/ML0.47, HFL/ML0.59;

Specimen F-773: TL 2.34, HL 0.62, HW0.52, OL0.10, ML0.64, PnW0.42, PL0.10, PW0.18, HTL0.30;

HL/HW1.25, SL/HL0.60, SL/HW0.73, OL/HL0.17, OL/HW0.20, PW/PL1.75, PL/HL0.17, PW/HW0.35, ML/PnW1.53, HTL/ML0.47;

Specimen F-828: TL 2.77, HL0.78, HW0.65, SL0.42, OL0.14, MdL0.29, ML0.73, MH0.56, PL0.21, PH0.27, PW0.36, HTL0.34;

HL/HW1.25, SL/HL0.53, SL/HW0.64, OL/HL0.18, OL/HW0.22, MdL/HL0.37, PL/PH0.76, PW/PL1.75, PL/HL0.27, PW/HW0.47, ML/MH1.30, HTL/ML0.46.

Comparative diagnosis. Gynes and workers of *B. wunderlichi* are clearly distinguished from all their congeners by the 9-segmented antennae instead of 12-segmented ones. In addition, the head of *B. wunderlichi* workers appears to be relatively longer than that of other species: HL/HW 1.24–1.25 vs. < 1.15 (based on DeAndrade & Baroni Urbani, 2003, and personal investigations).

Discussion

Among the 70 genera and 202 species of ants known from Late Eocene European ambers, representatives of the poneromorph subfamilies (e. g., Amblyoponinae, Ectatomminae, Ponerinae and Proceratiinae) are comparatively rare both in the number of taxa and the number of specimens collected: they contain 10 genera, 25 species and about 220 specimens (i. e., less than 1.5% of the total number of collected specimens) (our data).

The Proceratiinae genus *Bradoponera* is relatively abundant: 54 specimens have been collected to date. The most important thing is that almost all of them are workers (42) and dealate queens (seven), and only five males are known.

On the contrary, among other poneromorphs, winged individuals absolutely prevailed. Thus, for *Hypoponera atavia* (Mayr, 1868) 68 gynes and males and only four workers are known. Similarly, of the 59 specimens of *Cryptopone succinea* (Mayr, 1868), 58 are alate gynes and males, and only recently we found the first worker; among 20 specimens of *Gnamptogenys europaea* (Mayr, 1868) two are alate gynes, 17 are males and only one worker is known; seven poneromorphspecies have been described solely based on winged gynes or males (Wheeler, 1915; Dlussky, 2009; Dlussky & Rasnitsyn, 2009; with our additions). Such a clear predominance of winged individuals in amber suggests that representatives of these genera, like many modern poneromorphs, lived in the soil or leaf litter and their workers did not climb on trees. On the other hand, species of *Bradoponera* were most likely arboreal and probably nested in natural cavities, in detritus accumulated on epiphytes, etc.

The most common *Bradoponera* species is *B. meieri*: 33 workers, five males and two queens are known to date (Mayr, 1868; André, 1895; Wheeler, 1915; Kielbach, 1982; De Andrade &Baroni Urbani, 2003; Dlussky & Rasnitsyn, 2009; Dlussky, 2009; with our additions).

Three other species were known from the holotype specimen each, and no additional material of *B. electrina* and *B. similis* has been collected since their description. However, *B. wunderlichi* turned out to be not so rare and more widespread than previously thought: we found five workers of this species in Rovno amber; Vincent Perrichot located its queen from Baltic amber in the collection of Axel Nigelloh (Germany) (see AntWeb, specimen AN26). Then, a worker from Baltic amber, stored at the Universidade Federal de Viçosa (Brazil) and identified by Julio Chaul as *B. meieri*, has 9-segmented antennae and undoubtedly belongs to *B. wunderlichi* (see AntWeb CASENT1038933). Dlussky (2009) recorded a queen from Baltic amber from the collection of the Muzeum Ziemi of the Polish Academy of Sciences, Warsaw (MZ) with collection number 15 444 and identified it as *B. meieri.* He depicted 12-segmented antennae on this specimen (loc. cit., p. 1067, Fig. 9, b), but the original photographs of this queen from the Dlussky's archive show that it has 9-segmented antennae, and actually it is also *B. wunderlichi* (see Fig. 2, *a*, *b*). Dlussky (2009) identified a worker from Rovno amber with collection number K-4248 (stored in SIZK) as *B. meieri*, but in fact it is *B. wunderlichi*.

Mayr (1868) described *B. meieri* based on five workers: two from the Königliche Bernsteinsammlung des Geologischen Instituts of Königsberg ("In der phys.-ökon. Ges." according to Mayr, 1868), one from the private collection of Meier from Königsberg, one from the collection of Menge from Gdańsk, and one from his own collection (i. e., from Naturhistorisches Museum in Wien, NHMW). The Königsberg amber collection was largely lost during World War II, but a small part of it is currently stored in the collection of the Institut und Museum für Geologie und Paläontologie der Universität Göttingen (Germany). Unfortunately, according to the Göttingen Museum's database of fossil ants, there is not a single *Bradoponera* specimen there. The current location of the Menge's and Meier's collections, and whether they have survived anywhere at all, is unknown.

Ponomarenko & Schultz (1978, p. 29) listed as the type of *B. meieri* a specimen from the Naturhistorisches Museum in Wien with collection number

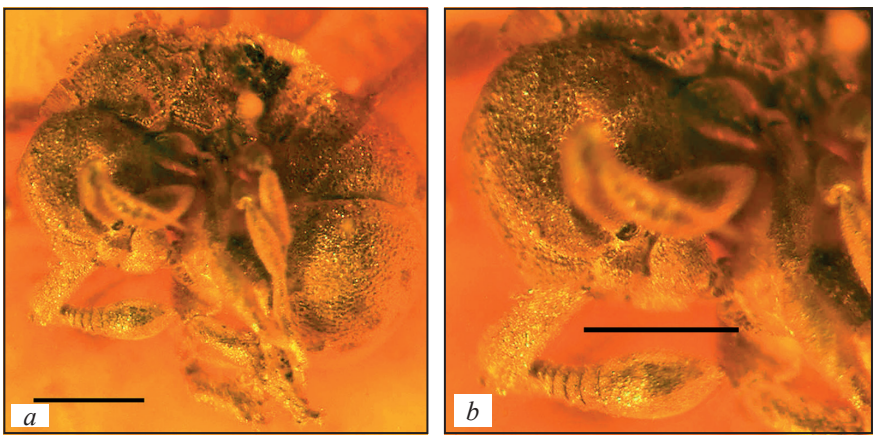

Fig. 2. Photographs of queen of *Bradoponera wunderlichi*, specimen No.15444 (MZ): *a* — body, lateral view; *b* — head, dorso-lateral view. Scale bars: *a* — 0.5 mm, *b* — 0.25 mm (photos from archive of G. M. Dlussky)

1984/31/356. Following this information, Dlussky (2009) designated this worker as the lectotype of *B. meieri* and gave its label data as "ST *Bradyponera meyeri* Mayr, 1868. Eozän. Baltischer Bernstein. Kollektion Handlirsch". However, this designation seems to be erroneous for the following reasons: asmentioned above, Mayr recorded only one syntype specimen of *B. meieri* from his own collection (i. e., from the NHMW). Recently, Vincent Perrichot found a worker within Mayr's collection in the Naturhistorisches Museum in Wien, with the collection number 1984/31/256, and labelled both as 'Holotypus' and 'Syntyp' (see https://www.antweb.org/specimen/NHMW1984-31-256). These labels are from a reformatting of the NHMW insect fossil collection made in 1984, with attribution of new numbers1984/31/xx for Mayr's specimens, and 1984/32/xx to Handlirsch's specimens; moreover, as the NHMW amber collection labelled 1984/31/xx does not exceed number 1984/31/261 (Vincent Perrichot, personal communication, 2025), the number 1984/31/356 is definitely a typo. Specimen 1984/31/256 fully matches Mayr's description, and is obviously his syntype of *B. meieri*, and therefore the lectotype while specimen 1984/31/356, as published by Ponomarenko and Schultz (1988) and Dlussky (2009), was simply misspelled and does not exist.

Thus, we **provide here the correct lectotype** specimen number as NHMW**1984/31/256**(1984/0031/0256), from Mayr's collection at the Naturhistorisches Museum in Wien.

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