

Pheidole schoedli sp.n. (Hymenoptera: Formicidae), a subterranean species found from North Borneo

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Abstract

Pheidole schoedli sp.n. is described from North Borneo. The present species seems to be closely related to *Pheidole parvicorpus* EGUCHI, 2001, but is distinguished well from the latter in having the head of the major covered with two types of hairs, the antennal segment X of the major and the minor longer than its width, and other morphological characteristics of the antennal scapes, eyes, and gaster. The species is considered a subterranean ant because (1) the specimens were found in soil samples but not in the litter samples; (2) eyes are extremely reduced and body color is yellowish. Thus, this species and *P. parvicorpus*, which is also presumably subterranean, are ecologically unique among Bornean *Pheidole* species.

Key words: Ants, *Pheidole schoedli*, new species, Borneo, subterranean, *Pheidole parvicorpus*.

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Introduction

Pheidole, the most species-rich genus in the family Formicidae, includes nearly 900 named species. Particularly in warmer climates, it is one of the dominant ant genera in numbers of colonies and workers, as well as in biomass (WILSON 2003). Taxonomy of *Pheidole* species in the Oriental tropics and subtropics has been improved in recent years. EGUCHI (2001) revised the Bornean species and recognized 52 species, and briefly discussed biogeography of Indo-Malayan and Indo-Chinese species. Furthermore, taxonomic studies on Indo-Chinese species are on-going (EGUCHI & BUI 2005, EGUCHI 2006). However, subterranean species which nest and forage underground are poorly encountered in those studies.

In the course of our recent examination on *Pheidole* specimens collected from North Borneo by A. Malsch and Y. Hashimoto, we found a unique species which is new to science and presumably subterranean. We here describe the species and name it *Pheidole schoedli* sp.n. in honor to the late Dr. Stefan Schödl.

Methods

The ranges and arithmetic means (in parentheses) of the following measurements and indices are given in the description. The measurements were taken using a Nikon SMZ1000 binocular microscope (40 - 80 × magnifications).

HL Head length: maximum length of head capsule in full-face view. In the major where anterior margin of clypeus and posterior margin of head are concave the measurement is taken from the mid-point of a transverse line spanning the anteriormost and posteriormost projecting points. In the minor it is

measured in a straight line from the mid-point of anterior margin of clypeus to the mid-point of posterior margin of head.

- HW Head width: maximum width of head capsule in full-face view, excluding eyes.
SL Scape length: maximum straight-line scape length, excluding the articular condyle.
FL Length of hind femur: maximum length of hind femur, measured from the junction with the trochanter to the junction with the tibia.
CI Cephalic index: $HW / HL * 100$.
SI Scape index: $SL / HW * 100$.
FI Hind femur index: $FL / HW * 100$.

All images were produced using an image producing system (microscope: Nikon Eclipse E600; camera: Nikon Coolpix 8400; software: Auto-Montage). Those images were then cleaned up using Adobe Photoshop CS2.

Abbreviations of the specimen depositories are:

- ACEG Ant Collection of Katsuyuki Eguchi.
BMNH The Natural History Museum, London, UK
ITBC Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Kota Kinabalu, Malaysia
MCZC Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MHNG Muséum d'Histoire Naturelle, Geneva, Switzerland
MNHA Museum of Nature and Human Activities, Hyogo, Japan
NHMW Naturhistorisches Museum Wien, Austria

Taxonomy

Pheidole schoedli sp.n. (Figs. 1 - 7)

Type material. Holotype: major from Sample No. 4186; type locality: Poring Hot Spring, East ridge, 820 - 860 m a.s.l., Sabah, Malaysia (leg. Annette K.F. Malsch, 16.V. 1998); depository: ITBC. Paratypes: 10 majors, 24 minors and 1 male from the same colony to which the holotype belongs, depository: NHMW, ITBC, BMNH, MHNG, MCZ, MNHA, ACEG.

Non-type material examined. Malaysia: Sabah: Maliau Basin [Y. Hashimoto's soil core: 1-1, 2-12]; Deramakot Forest Reserve (secondary Forest) [leg. C. Brühl].

Diagnosis. Cranium (excluding median part of clypeus) entirely covered with decumbent / appressed hairs among which standing hairs are scattered [major]; eye much reduced, consisting of at most 10 ommatidia [major] and at most 4 ommatidia [minor]; frontal carina and antennal scrobe absent [major]; antennal segment X longer than broad [major and minor]; hypostoma with a pair of long submedian processes, but without median process [major]; promesonotal dome without conspicuous prominence on its posterior declivity [major and minor]; postpetiole not massive [major and minor].

Major (Figs. 1 - 5). Measurements and indices [n = 5]: HL 1.85 - 2.04 (1.97) mm; HW 1.54 - 1.71 (1.63) mm; SL 0.81 - 0.92 (0.87) mm; FL 1.05 - 1.27 (1.19) mm; CI 82 - 84 (83); SI 53 - 55 (54); FI 68 - 76 (73). Body yellowish brown. Head in full-face view elongate, relatively shallowly concave posteriorly; vertex in profile not impressed (in the type series), or often very weakly impressed (in non-type specimens from Maliau Basin); cranium except median part of clypeus covered with short decumbent/appressed hairs; long standing hairs scattered among the decumbent/appressed hairs; frons smooth, but sparsely sculptured with short interrupted longitudinal rugulae (type series), or weakly rugose longitudinally with interspaces weakly punctured (specimens from Maliau Basin); vertex almost smooth (type series, see Fig. 3), or weakly rugose-reticulate longitudinally with interspaces weakly punctured (specimens from Maliau Basin, see Fig. 4); dorsal and dorsolateral faces of vertexal lobe almost smooth (type series, see Fig. 3), or weakly rugose-reticulate (specimens from Maliau Basin, see Fig. 4); anterolateral face of dorsum of head reticulate; gena longitudinally rugose; median part of clypeus smooth, without median longitudinal carina; frontal carina and antennal scrobe absent; hypostoma with pair of well-developed lateral processes (just mesal to each mandibular base) and pair of long submedian processes (arrows in Fig. 5), but without median process; outer surface of mandible entirely smooth and shining except its base, scattering decumbent/appressed hairs; antenna 12-segmented; scape a little exceeding mid-length of head when it laid backward; antennal club 3-segmented; basal segment of club (antennal segment X) longer than broad; eye much reduced, consisting of at most 10 ommatidia. Promesonotal dome weakly punctured anterodorsally, smooth or dimly rugose-punctate dorsally, smooth on central part of lateral face; dome in profile without conspicuous prominence on posterior declivity; humerus very weakly produced (dome at humeri almost as broad as at bottom); mesopleuron, metapleuron, and propodeum weakly punctured (in the type series central part of mesopleuron

and anterolateral part of propodeum smooth); propodeal spine elongate triangular. Petiole much longer than postpetiole (excluding helcium); petiolar node low, in rear view at most very weakly concave mediodorsally; postpetiole not massive. First gastral tergite sparsely pilose with short decumbent/appressed hairs and long standing hairs, weakly to dimly rugose-punctate at least around its articulation with postpetiole.

Minor (Figs. 6, 7). Measurements and indices [n = 6]: HL 0.83 - 0.89 (0.86) mm; HW 0.78 - 0.82 (0.80) mm; SL 0.68 - 0.74 (0.71) mm; FL 0.72 - 0.82 (0.77) mm; CI 91 - 94 (92); SI 86 - 91 (89); FI 92 - 100 (97). Body pale yellow. Head in full-face view weakly concave posteromedially; frons and vertex smooth and shining (posterior-most part of vertex dimly rugose in specimens from Maliau Basin); dorsolateral part of head and gena very weakly rugose-punctate; dorsal part of preoccipital carina obsolete; median part of clypeus smooth and shining, without median longitudinal carina; antenna 12-segmented; scape almost reaching or a little exceeding posterior margin of head; antennal club 3-segmented; basal segment of club longer than broad; eye much reduced, consisting of at most 4 ommatidia. Promesonotal dome in profile relatively low, without conspicuous prominence on posterior declivity; dorsum of dome smooth and shining, but with anteriormost part (type series, specimen from Deramakot) or anterior slope (specimens from Maliau Basin) weakly punctured; lateral face of dome largely smooth (partly very weakly punctured); humerus in dorsolateral view not or hardly produced; mesopleuron weakly punctured, often with smooth central part; metapleuron weakly punctured or almost smooth; propodeum (except smooth anterolateral part) weakly punctured; propodeal spine small, elongate-triangular. Petiole longer than postpetiole (excluding helcium); petiolar node low, in rear view hardly concave or not concave mediodorsally; postpetiole not massive, weakly punctured posterodorsally and laterally.

Remarks. Body sculpture is generally weaker in the type series and a specimen from Deramakot than in specimens from the Maliau Basin. It is also possible that future examination of colony samples from various localities would reveal that the two forms are different biological species.

This species is well distinguished from other Oriental species of the genus in having a combination of the characteristics given in the diagnosis. However, when referring to EGUCHI (2001), the present species may be identified to *Pheidole parvicorpus* EGUCHI, 2001 of which worker is also characterized in having extremely reduced eyes. The two species are undoubtedly closely related to each other, but they are well distinguished as follows: 1) The scape almost reaches or a little exceeds the posterior margin of the head in the minor of *Pheidole schoedli* sp.n., but does not reach the posterior margin of the head in the minor of *P. parvicorpus*. 2) The hairs on the head and the first gastral tergite are clearly categorized into two types in the major of *P. schoedli* sp.n. (short decumbent/appressed hairs and long standing hairs), but not in the major of *P. parvicorpus* (hairs are subdecumbent to suberect and similar in length). 3) The basal segment of the club is longer than broad in the worker of *P. schoedli* sp.n., but as long as or shorter than broad in the worker of *P. parvicorpus*;



Figs. 1 - 7: *Pheidole schoedli* sp.n.: 1 - 3, 5: major of the type series; 4: nontype major from soil core 2-12 from Maliau Basin, Sabah; 6, 7: minor of the type series. (1, 6) Body in lateral view. (2, 7) Head in full-face view. (3, 4) Vertex and vertexal lobe (left) in full-face view. (5) Hypostoma, arrows indicating submedian processes.

4) The eye consists of at most 4 ommatidia in the minor of *P. schoedli* sp.n., but 5 or 6 ommatidia in the minor of *P. parvicorpus*.

Distribution. North Borneo.

Biology

Annette Malsch collected the type series of *Pheidole schoedli* sp.n. from the top soil (820 - 860 m a.s.l.) during nest sampling on the ground. She finds neither workers nor

colonies of the species from her Winkler samples, while Y. Hashimoto extracted the workers and dealate queens from his soil-core samples. BRÜHL & al. (1998), using Winkler litter sifters, extensively extracted litter-dwelling ants between 550 and 1140 m a.s.l. in Poring Hot Spring (the type locality) but did not obtain any specimens of *P. schoedli* (K. Eguchi examined his samples: see <http://www.antbase.de/literature-pdf/ants-of-poring-2005.pdf>).

These field observations as well as morphological features including much-reduced eyes and yellowish body in the worker caste suggest that this species is a subterranean nester and forager. The worker of *Pheidole parvicorpus* also has much-reduced eyes and yellowish body. Nests of *P. parvicorpus* have been found in soil-core samples as well as in rotting wood on the ground (see EGUCHI 2001), but we have never examined *P. parvicorpus* collected by baiting and pit-fall trapping on the ground. Thus, *P. parvicorpus* may be also a subterranean forager and occasionally or usually a subterranean nester. We frequently encounter *Pheidole* species foraging actively on the ground surface (EGUCHI & al. 2004), while WILSON (2005) obtained evidence that at least three small-sized Neotropical species of *Pheidole* most frequently prey on oribatid mites which are one of the most abundant small invertebrates of the soil and litter. Thus, it is important to study food preference and foraging ecology of *Pheidole parvicorpus* and *P. schoedli* in order to understand functions of *Pheidole* species, dominant ants in tropical and warm temperate ecosystems.

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Zusammenfassung

Pheidole schoedli sp.n. wird von Nordborneo beschrieben. Die Art scheint mit *Pheidole parvicorpus* EGUCHI,

2001 nahe verwandt zu sein, unterscheidet sich von letzterer aber deutlich dadurch, dass der Kopf der Major-Arbeiterin von zwei verschiedenen Haartypen bedeckt ist, dass das Antennensegment X von Major- und Minor-Arbeiterinnen länger als breit ist, sowie durch weitere morphologische Merkmale von Fühlerscapus, Augen und Gaster. Die Ameise lebt offenbar subterran, denn erstens wurden Individuen in Erdproben, nicht aber in Laubproben gefunden und zweitens sind die Augen extrem reduziert und der Körper ist gelblich gefärbt. Somit sind die neue Art und *P. parvicorpus*, von der ebenfalls eine subterrane Lebensweise vermutet wird, ökologisch einzigartig unter den *Pheidole*-Arten Borneos.

References

- BRÜHL, C., GUNIK G. & LINSENMAYER, K.E. 1998: Stratification of ants (Hymenoptera, Formicidae) in a primary rain forest in Sabah, Borneo. – *Journal of Tropical Ecology* 14: 285-297.
- EGUCHI, K. 2001: A revision of the Bornean species of the ant genus *Pheidole* (Insecta: Hymenoptera: Formicidae: Myrmicinae). – *Tropics Monograph Series* 2: 1-154.
- EGUCHI, K. 2006: Six new species of *Pheidole* WESTWOOD from North Vietnam (Insecta, Hymenoptera, Formicidae). – *Revue suisse de Zoologie* 113: 115-131.
- EGUCHI, K. & BUI, T.V. 2005: A New South Vietnamese species of the genus *Pheidole* with a truncated head in the major and queen (Insecta, Hymenoptera, Formicidae). – *Sociobiology* 45: 721-730.
- EGUCHI, K., BUI, T.V. & YAMANE, Sk. 2004: A preliminary study on foraging distance and nesting sites of ants in Indo-Chinese lowland vegetation (Insecta, Hymenoptera, Formicidae). – *Sociobiology* 43: 445-457.
- WILSON, E.O. 2003: *Pheidole* in the New World – a dominant, hyperdiverse ant genus. – Harvard University Press, Cambridge, MA, London, England, 794 pp.
- WILSON, E.O. 2005: Oribatid mite predation by small ants of the genus *Pheidole*. – *Insectes Sociaux* 52: 263-265.