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**A FIRST SPECIES OF TETRAMORIUM (HYMENOPTERA, FORMICIDAE,
MYRMICINAE) WITH A POLYMORPHIC WORKER CASTE**

By SEIKI YAMANE and WEEYAWAT JAITRONG

Abstract

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A first *Tetramorium* ant with a polymorphic worker caste is described from Laos as *T. polymorphum* sp. nov. It may be most closely related to *T. kheperra* (Bolton), but is distinguished from the latter by the medially concave anterior margin of the clypeus and the lack of regular puncto-reticulation on the frontal area just behind the clypeus. The workers of *T. polymorphum* are roughly sorted into three size classes. In the minor and media workers most standing hairs on the dorsum of body are branched, while in the major worker and queen almost all the standing hairs are simple. Another new species related to *T. kheperra*, *T. hasinae* sp. nov., is described from Thailand. Additional collection records are given to *T. kheperra*.

Authors' address. Yamane, Sk.: Graduate School of Science and Engineering, Kagoshima University, Kagoshima, 890-0065 Japan (e-mail: sky@sci.kagoshima-u.ac.jp). Jaitrong, W.: Thailand Natural History Museum, National Science Museum, Technopolis, Khlong 5, Khlong Luang, Pathum Thani, 12120 Thailand (e-mail: polyrhachis@yahoo.com).

INTRODUCTION

Tetramorium Mayr, 1855, is one of the large ant genera with more than 400 species around the world (Bolton, 1995). The Old World species were revised by Bolton (1976, 1977, 1980), but many species are still waiting to be described. Although all the Tetramoriini genera have a monomorphic worker caste, this has rarely been stated explicitly (e.g., Emery, 1922; Bolton, 1976; but see Bolton, 2003, p. 285).

Recently we collected a species of *Tetramorium* interesting in this regard from Laos, Indo-china. This species belongs to the so-called *Triglyphothrix* Forel, 1890, in which the females (queen and worker) have branched hairs on the body mixed with simple hairs (Emery, 1922; Bolton, 1976). This taxon was originally erected as an independent genus (Forel, 1890), but later synonymized with *Tetramorium* (Bolton, 1985). Our species most closely resembles the famous tramp species *T. kheperra* (Bolton, 1976) in worker characters, but has a different sculpture on the dorsum of the head, medially concave anterior margin of clypeus, and worker caste with different size classes that can be grouped into three subcastes.

During our careful examination of all the material of this group, we have found another undescribed species closely related to *T. kheperra*. All these three species fall to *T. kheperra* in Bolton's (1976) key to the Oriental, Indo-Malayan and Polynesian species of '*Triglyphothrix*'. In this paper we describe the two new species, and discuss the morphological specialization in the polymorphic species.

MATERIALS AND METHODS

We used the material deposited in the Collection of Seiki Yamane (SKY Collection) at Kagoshima University. The type material of *T. kheperra* Bolton was not examined, but specimens from the type locality (Bogor, Java) were examined (the two new species have not been found in Java).

The material of the new polymorphic species, *T. polymorphum*, was collected on 12th June 2010 from a colony nesting under a relatively large stone in a dry evergreen forest located at ca. 300 m alt., in Phang Dang Village, Pak-Gnam District, Vientiane Province, Laos (Fig. 1). Most of the ants were found in chambers and galleries dug just below the stone but the nest was spread in shallow soil. The type series of *T. hasinae* was collected in Papra Station, Khao Nan N.P., Nakhon Si Thammarat Prov., S. Thailand.

Morphological observations were made with a Nikon SMZ1000 stereomicroscope. Multi-focused montages were produced using Helicon Focus 4.75 Pro from a series of source images taken by a Nikon EOS Kissx4 digital camera attached to a Nikon ECLIPSE E600 microscope. Workers and a dealated queen were measured using a micrometer; all measurements are expressed in millimeters to the second decimal place.

Abbreviations used for the measurements and indices are as follows: HL, head length, full-face view, measured along midline from mid-point of vertex to mid-point of anterior clypeal margin; HW, maximum width of head capsule excluding eyes in full-face view, measured at its widest point; CI (Cephalic index), $HW/HL \times 100$; SL, scape length excluding the basal of constriction and condylar bulb; SI (scape index), $SL/HW \times 100$; ML, mandible length, straight-line length of mandible, measured from base at insertion into head capsule to mandibular apex; ED, eye diameter, maximum length of compound eye; PW, maximum width of pronotum in dorsal view; MSL, mesosomal length, diagonal

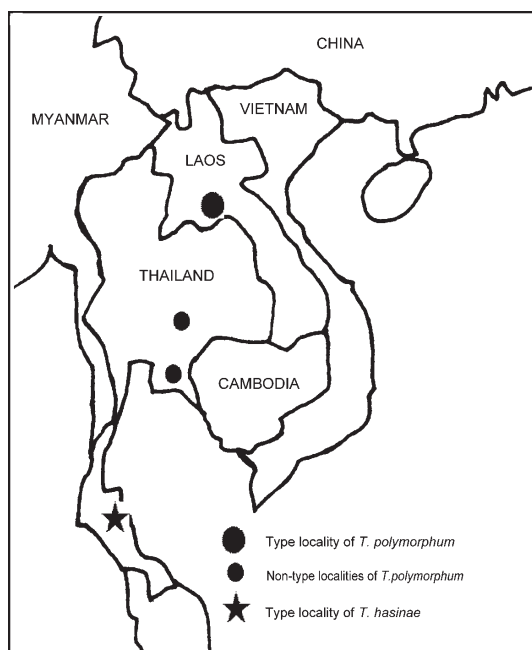


Fig. 1. Locations of the type localities of *Tetramorium hasinae*, sp. nov. and *T. polymorphum* sp. nov.

length of alitrunk in lateral view, from frontalmost point of declivous area of pronotum to posteriormost point of apex of metapleural lobe; PL, petiole length; PH, maximum height of petiole; DPW, dorsal petiolar width.

Names of the collectors and institutions (collections) are abbreviated as follows: KE (K. Eguchi), SKY (Sk. Yamane). BMNH (Natural History Museum, London), SEHU (Systematic Entomology Collection, Hokkaido University, Japan), SKYC (Seiki Yamane Collection at Kagoshima University, Japan), THNHM (Thailand Natural History Museum, National Science Museum).

SYSTEMATICS

Tetramorium kheperra (Bolton) (Fig. 2A–C)

Triglyphothrix kheperra Bolton, 1976: 349.

Tetramorium kheperra: Bolton, 1985: 247; Bolton, 1995: 410.

Worker diagnosis (see also Bolton, 1976)

Head with regular puncto-reticulation over dorsal surface. Antennal scrobe strongly developed. Clypeus with a median and a few lateral obliquely running carinae; anterior margin entire. Propodeal declivity extensively smooth and shiny, with two transverse carinae above. Propodeal spine acute, distinctly longer than propodeal lobes. Petiolar node in dorsal view slightly broader than long; with petiole in profile tergal portion of

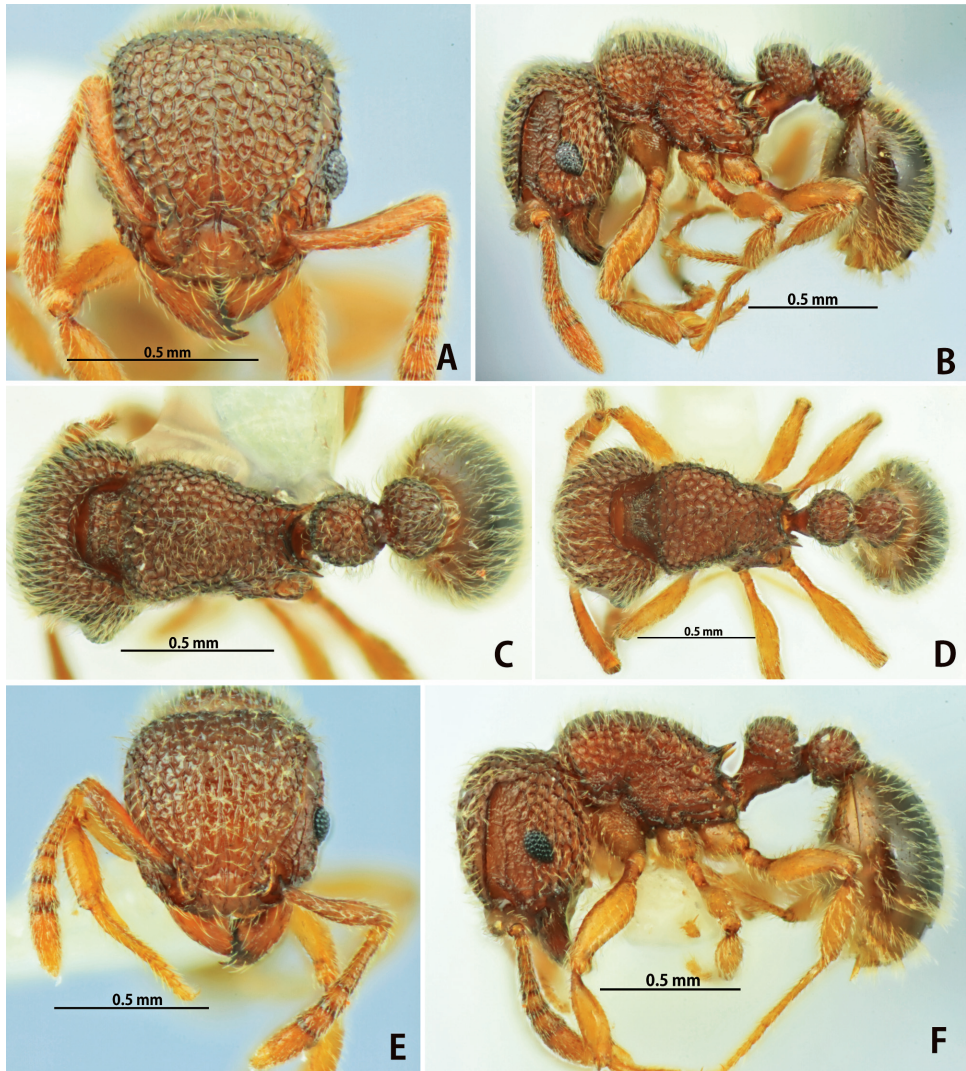


Fig. 2. A–C, *Tetramorium kheperra* (Bolton), worker; D–F, *T. polymorphum* sp. nov., minor worker (paratype).

the node higher than long. Gastral tergite 1 entirely smooth and shining. Dorsum of body densely covered with branched hairs; hairs on gastral tergite 1 universally trifid, forming a dense pelt over surface.

Material examined. Philippines: Pupok, Napsan, Palawan (H. Fukuda). Brunei: Tasek Merinbun, Borneo, Eg99-BOR-023, -080 (KE). Indonesia: Laiya (house garden), Labbang, S. Sulawesi (SKY); Desa Lipukasi, Kab. Barru, S. Sulawesi (SKY); Ubud, Bali (SKY); Bogor, W. Java (SKY & F. Ito); Samarinda, East Kalimantan, Borneo (SKY); Maninjau, W. Sumatra (SKY); Ulu Gadut, Padang, W. Sumatra (SKY); Pulau Sipora, Mentawai Is., W. Sumatra (SKY & So. Yamane); Bukit Lawang (HQ), G. Leuser N.P., N. Sumatra (SKY). Malaysia: Tawau Hills N.P.,

Sabah, Borneo (KE); Semangoh, Sarawak, Borneo (SKY); Kubah N.P., Sarawak, Borneo (SKY); Ulu Gombak, Malay Pen. (SKY); Lata Tembakar (HQ), Terengganu, Malay Pen. (SKY). Myanmar: Campus of Yangon University (SKY). Thailand: Kao Chong, Trang Prov. (SKY); Sai Khao, Pattani Prov. (SKY); Natawee, Songkhla Prov. (SKY); Khao Nam Khang N.P., Songkhla Prov. (SKY); Sakaerat (HQ), Nakornratchasima Prov. (Sk. Yamane); Khao Soi Dao N.P., Chantaburi Prov., Eg01-TH-045 (KE); same loc. (SKY); Nam Tok Phlio N.P. (300–500 m alt.), Chantaburi Prov.; Khao Ang Reu Nai W.S., Chacheongsao Prov. (SKY); Pha Tad Watershed, Kanchanaburi Prov. (SKY). Vietnam: Ban Xan (700 m alt.), Que Phong Distr., Nghe An Prov. (T.V. Bui); Cuc Phuong N.P. (370 m alt.), Ninh Binh Prov.. (SKY); Ba Vi N.P. (400–600 m alt.), Ha Tai Prov., Eg99-VN-112 (KE); same loc. (400–550 m alt.) (SKY); Ninh So Village, Thuong Tin Distr., Ha Tai Prov. (T.V. Bui). (Several specimens will be deposited in SEHU.)

Remarks. This is a widespread tramp species also recorded from Sumba and Prinsen [Panaitan] islands in Indonesia, Hong Kong and Assam (Bolton, 1976). Among our material the queen is not available. Most of the specimens examined were collected in disturbed habitats. Specimens collected from colonies by Dr. K. Eguchi do not bear information about nesting site. Workers were found in Kew Gardens (London) in 1974 among the roots of a plant imported from Assam (Bolton, 1967). This indicates that the species may be an underground nester.

Tetramorium hasinae Yamane et Jaitrong, sp. nov.
(Fig. 3A–F)

Holotype: worker, Papra Station, Khao Nan N.P., Nakhon Si Thammarat Prov., S. Thailand, TH07-SKY-44 (Sk. Yamane), deposited in THNHM. Paratypes: four workers and one dealated queen from the same colony to which the holotype belongs, deposited in TNHM and SKYC.

Worker diagnosis

Head with regular and rather fine puncto-reticulation over dorsal surface. Antennal scrobe strongly developed. Clypeus reticulate, with entire anterior margin. Upper half of propodeal declivity with several fine transverse carinae and mat; propodeal spine acute, distinctly longer than propodeal lobes. Petiolar node in dorsal view slightly broader than long or almost as broad as long; with petiole in profile tergal portion of the node almost as high as long. Gastral tergite 1 entirely smooth and shining. Dorsum of body densely covered with branched hairs; hairs on gastral tergite 1 universally trifid, forming a dense pelt over surface.

Worker description

The worker caste may be monomorphic.

Measurements (holotype). HL 0.53, HW 0.51, CI 96, SL 0.34, SI 67, ML 0.28, ED 0.13, PW 0.39, MSL 0.57, PL 0.27, PH 0.20, DPW 0.18.

Head slightly longer than broad, in full-face view with very feebly convex sides, rounded posterolateral corners and almost straight or feebly concave posterior margin. Disc of clypeus consisting of almost flat basal half and steep apical half, and in full-face view without an anteromedian indentation; anterior margin of clypeus with a narrow transverse plate-like fringe that is situated below the level of the disk and has weakly convex anterior margin. Frontal lobe weakly developed, slightly elevated laterally; frontal carinae strongly divergent, extending well beyond the level of posterior margin of eye;

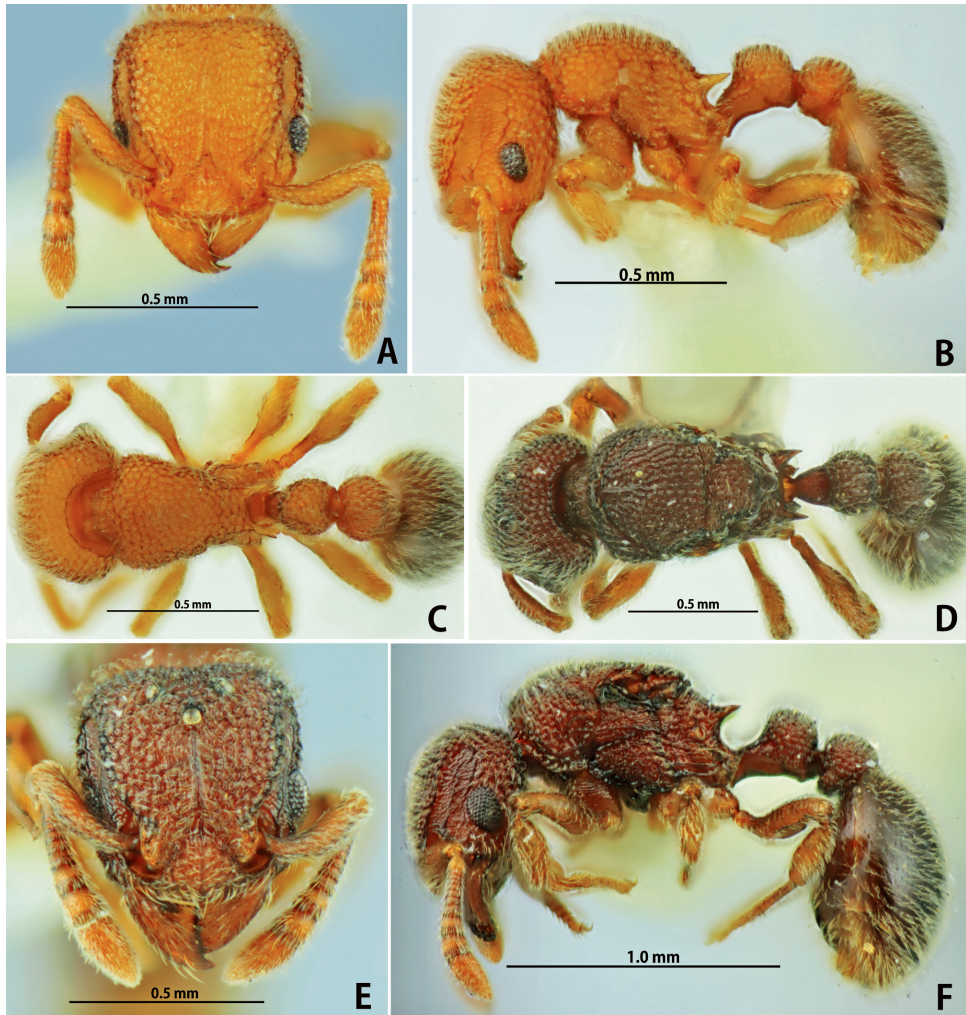


Fig. 3. *Tetramorium hasinae* sp. nov. A–C, worker (paratype); D–F, queen (paratype).

antennal scrobe distinct, strongly margined dorsally by the frontal carina but ill defined ventrally. Eye moderate in size, composed of ca. 30 ommatidia, narrowed anteriorly, located anterior to the mid-length of head; distance between mandibular base and anterior margin of eye slightly shorter than maximum eye length. Mandible subtriangular, with a protruding apical tooth and a smaller preapical tooth; third tooth slightly smaller than the preapical; remaining portion of masticatory margin with a few denticles. Antenna 12-segmented; scape relatively short, not reaching posterolateral corner of head, slightly broadened in distal two-thirds; second segment as long as broad; third to eighth segments each very short, much broader than long, and shorter than the second; antennal club 3-segmented, longer than the remaining portion of funiculus; apical segment distinctly longer than tenth and eleventh combined. Mesosoma short, robust and slightly longer

than head, seen from above distinctly broader anteriorly than posteriorly, with broadly rounded anterolateral corners, without any suture separating pronotum, mesonotum and propodeum from one another; in profile mesosoma with evenly convex dorsal outline. Propodeal spines longer than tenth antennal segment; posterior declivity of propodeum short, concave, separated from dorsum by a weak transverse carina and laterally walled by rather developed propodeal lobes, which are roundly convex posteriad. Petiole with a short peduncle; its node seen from above slightly broader than long or almost as broad as long, seen in profile as high as long and with anterior and posterior slopes steep and almost parallel; postpetiole without peduncle; its node similar to petiolar node in size and shape, but distinctly broader than long seen from above, seen in profile slightly lower, with indistinct anterior and posterior slopes. First gastral tergite slightly longer than broad, strongly convex laterally, occupying 4/5 of the whole dorsum of gaster.

Head dorsally densely puncto-reticulate; sides of head similarly but more coarsely punctate. Antennal scrobe superficially and finely sculptured, often with a distinct median carina and irregular shorter carinae. Mandible striate over the surface. Clypeus reticulate. Pro-mesonotum regularly densely puncto-reticulate; mesopleuron and lateral face of propodeum irregularly sculptured; upper half of propodeal declivity finely striate and mat; lower half smooth and shiny. Nodes of petiole and postpetiole almost entirely puncto-reticulate; dorsum of petiolar peduncle densely micropunctate and mat; lateral face of the peduncle more irregularly sculptured and mat. Gastral tergites smooth and shining. Fore coxa in profile finely striate rather than punctate; femora and tibiae smooth and shiny.

Standing hairs on dorsum of head short, of uniform length, and branched; on the venter of head most of hairs decumbent. Hairs on dorsum of mesosoma longer than those on head, rather uniform in length, and branched (mostly trifid); lateral face of mesosoma with sparse indistinct hairs. Dorsa of petiole and postpetiole, and gastral tergites and sternites with dense trifid standing hairs; peduncle and venter of petiole without standing hairs; venter of postpetiole with a few standing hairs. All legs covered with numerous standing or suberect hairs. Body yellowish brown to brown; antennal scape colored as in head; funiculus slightly darker; club often partly yellow; gaster dark brown. Legs lighter; tibiae often yellow.

Queen description

Measurements (paratype). HL 0.60, HW 0.60, CI 100, SL 0.38, SI 63, ML 0.34, ED 0.16, PW 0.54, MSL 0.80, PL 0.34, PH 0.26, DPW 0.25.

Similar to the worker in structure, sculpture and pilosity, with the following conditions that should be noted: eye large, slightly shorter than or as broad as the apical segment of antenna; distance between eye and mandibular base much shorter than eye length; median ocellus larger than lateral ocelli; pro-mesonotal suture distinct; mesothoracic parapteron clearly separated from mesoscutellum by a furrow, but ill defined from mesoscutum; mesoscutum much narrower than parapteron; anepisternum clearly divided from katepisternum by a furrow; metanotum very short and indistinct; dorsal face of propodeum longer than in the worker and gently sloping. Median carina of clypeus more distinct than in the worker; median carinae on the dorsum of head starting near the base of clypeus, fused into a single carina before median ocellus and reaching the posterior margin of head; mesonotum extensively rugoso-punctate (not puncto-reticulate); metanotum coarsely puncto-reticulate; propodeal dorsum with still coarser

puncto-reticulation. Dorsum of head, mesosoma, waist and gaster covered with dense trifid hairs as in the worker. Body reddish brown with gaster darker; legs and antenna paler, partly yellowish.

Etymology. The specific name is dedicated to Ms. Sasitorn Hasin of Kasetsart University, who much helped us in collecting the material.

Remarks. This species has a much more regular and dense puncto-reticulation on the dorsa of head, mesosoma and waist than in *T. kheperra* and *T. polymorphum*, and is distinguished from the latter two by the characteristics given in the key. It is known only from the type locality. The colony was found from rotting wood in a tropical rainforest.

Tetramorium polymorphum Yamane et Jaitrong, sp. nov.
(Figs. 2D–F, 4A–F)

Holotype: Worker, Phang Dang Village, Pak-Gnam District, Vientiane Province, Laos, Sk. Yamane leg., deposited in SKYC. Paratypes: one dealated queen and 60 workers (40 minors, 7 medias and 13 majors) collected by Sk. Yamane and W. Jaitrong from the same colony to which the holotype belongs (LA10-SKY-100 & WJT10-LAO-114), deposited in BMNH, SEHU, SKYC, THNHM, Museum Zoologicum Bogoriense (Cibinong, Indonesia), and Borneensis at Malaysia Sabah University.

Worker diagnosis

Puncto-reticulation on dorsum of head restricted to posterior 3/4 of its surface; anterior portion of frons with longitudinal rugulae only. Antennal scrobe strongly developed. Clypeus with a median and a few lateral longitudinal carinae; anterior margin medially emarginate. Propodeal declivity smooth and shiny; propodeal spine acute, longer than propodeal lobe. Petiolar node in dorsal view broader than long (much broader in larger specimens); with petiole in profile tergal portion of the node higher than long. Gastral tergite 1 entirely smooth and shining. Dorsum of body densely covered with branched hairs; hairs on gastral tergite 1 universally trifid, forming a dense pelt over surface in the minor worker, but standing hairs on dorsum of body partly or entirely simple in the media and major workers.

Worker description

The workers from the colony (type series) are roughly grouped into 3 size classes, which are distinguished in head width as follows: minor workers, 0.58–0.75 mm; media workers, 0.80–0.90 mm; major workers, 1.03–1.10 mm. The minor and media workers are somewhat continuous in all the measurements, while the major workers are clearly separable from the others (Fig. 5). Here, the worker description is based on the minor worker. Morphological differences among the three subcastes are given in “Variation”.

Measurements (holotype). HL 0.67, HW 0.66, CI 99, SL 0.44, SI 67, ML 0.36, ED 0.14, PW 0.48, MSL 0.66, PL 0.26, PH 0.25, DPW 0.24.

Head almost as long as broad, in full-face view with weakly convex sides, broadly rounded posterolateral corners and almost straight posterior margin. Disc of clypeus in profile weakly convex with a steep slope anteriorly; with head in full-face view clypeus with an anteromedian indentation; anterior margin of clypeus with a narrow transverse plate-like fringe that is situated below the level of the disk and weakly concave medially. Frontal lobe weakly developed; frontal carinae strongly divergent, extending well

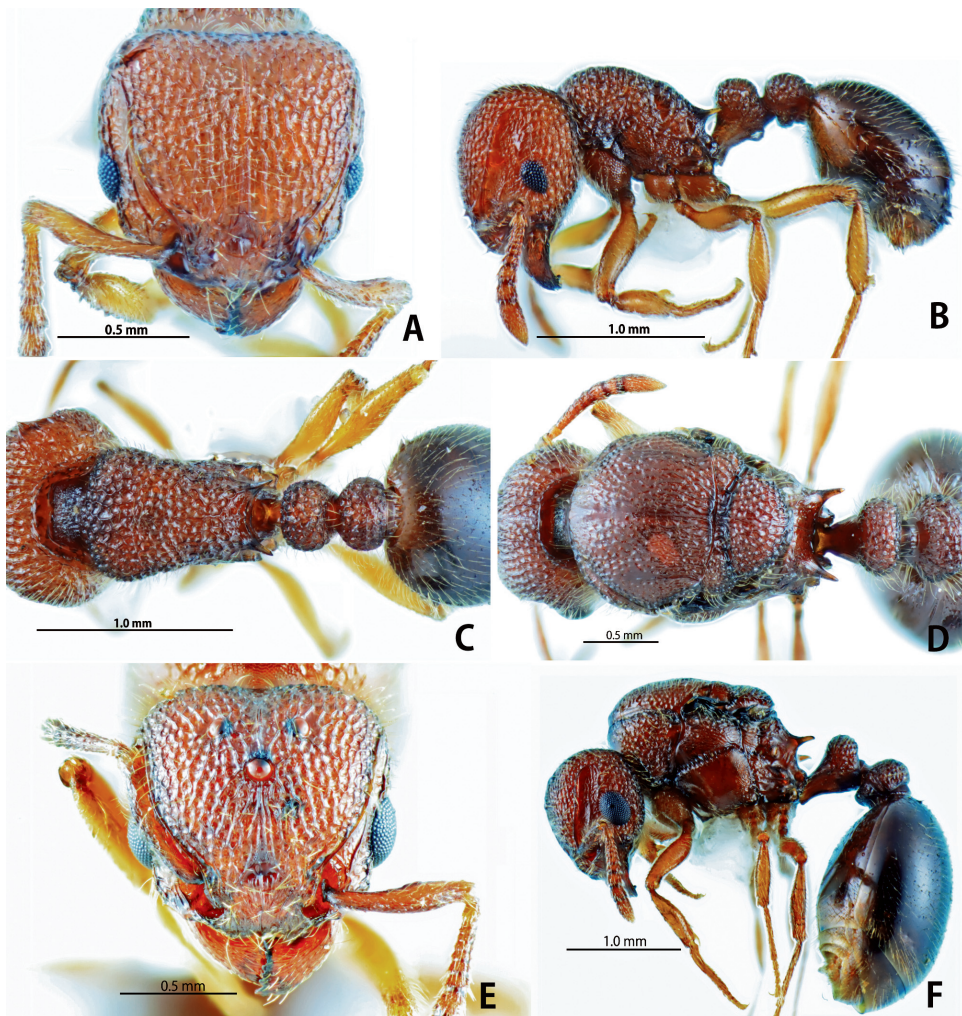


Fig. 4. *Tetramorium polymorphum* sp. nov. A–C, major worker (paratype); D–F, queen (paratype).

beyond the level of posterior margin of eye; antennal scrobe distinct, strongly margined dorsally by the frontal carina but ill defined ventrally. Eye moderate in size, composed of ca. 30 ommatidia, distinctly narrowed anteriorly, located anterior to the mid-length of head; distance between mandibular base and anterior margin of eye slightly longer than maximum eye length. Mandible subtriangular, with a protruding apical tooth and a smaller preapical tooth; remaining portion of masticatory margin with a few indistinct denticles or almost edentate. Antenna 12-segmented; scape relatively short, not reaching posterolateral corner of head, slightly broadened in distal two-thirds; second segment slightly longer than broad; third to eighth segments each much broader than long and shorter than the second; antennal club 3-segmented, longer than the remaining portion of funiculus; apical segment slightly longer than tenth and eleventh combined. Mesosoma short and robust, seen from above distinctly broader anteriorly than posteriorly, with

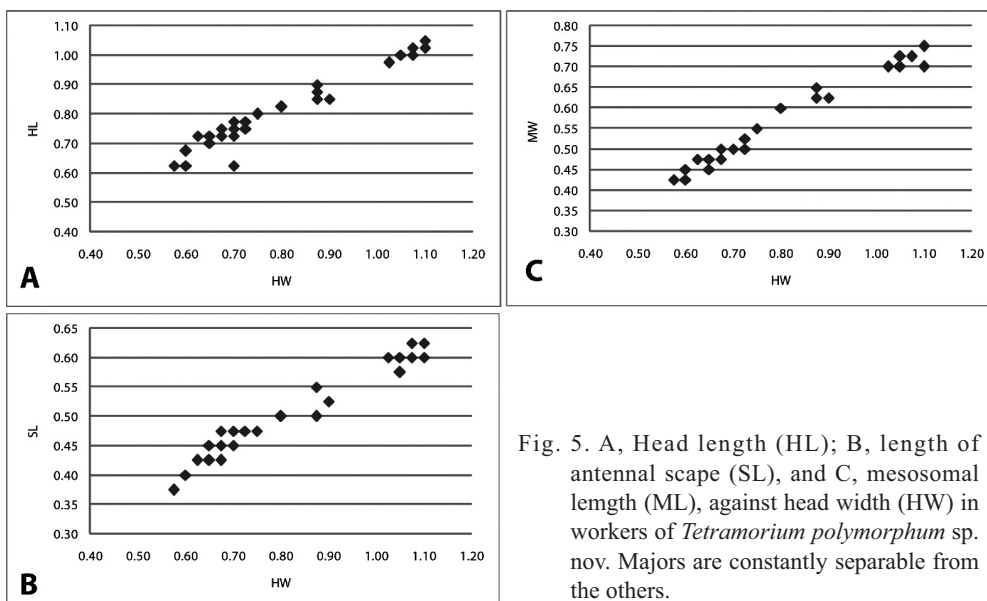


Fig. 5. A, Head length (HL); B, length of antennal scape (SL), and C, mesosomal length (ML), against head width (HW) in workers of *Tetramorium polymorphum* sp. nov. Majors are constantly separable from the others.

broadly rounded anterolateral corners, without any suture separating pronotum, mesonotum and propodeum from one another; in profile Mesosoma with evenly convex dorsal outline. Propodeal spines as long as tenth antennal segment; propodeal declivity short, concave, separated from dorsum by a distinct transverse carina and laterally walled by rather developed propodeal lobes, which is roundly convex posteriad. Petiole with a short peduncle; its node seen from above distinctly broader than long, seen in profile higher than long and with anterior and posterior slopes steep and almost parallel; postpetiole without peduncle; its node similar to petiolar node in size and shape, but slightly shorter and lower, with indistinct anterior and posterior slopes. First gastral tergite slightly longer than wide, occupying 4/5 of the whole dorsum of gaster, with anterolateral corner rounded.

Head dorsally longitudinally rugulose but not very regularly; dorsum of head in anterior portion, particularly its central portion, without cross meshes, but posterior 3/4 with cross-meshes in addition to rugulae to show irregular reticulation; lateral face of head more regularly puncto-reticulate. Crypeus with a median longitudinal carina as well as a few lateral ones. Antennal scrobe superficially sculptured, often with a distinct median carina and irregular shorter carinae. Mandible densely striate over the surface. Dorsum of mesosoma, lateral face of pronotum and upper mesopleuron densely and coarsely punctate; lower mesopleuron much more minutely punctate, in addition to them sometimes with weak irregular carinae; metapleuron and lateral face of propodeum coarsely reticulate; propodeal declivity extensively smooth and shiny. Nodes of petiole and postpetiole almost entirely punctate; dorsum of petiolar peduncle smooth to superficially sculptured; side of the peduncle anteriorly densely sculptured and somewhat mat. Gastral tergites smooth and shining. Fore coxa with dense punctation rather than striation. Standing hairs on dorsum of head simple or branched; frequency of branched hairs higher near posterior margin; on the venter of head most of hairs decumbent. Hairs

on dorsum of mesosoma longer than those on head, rather uniform in length, and mostly branched (trifid); lateral face of mesosoma with much shorter and indistinct hairs. Dorsal of petiole and postpetiole, and gastral tergites and sternites with dense trifid standing hairs; peduncle and venter of petiole without standing hairs; venter of postpetiole with a few standing hairs. All legs covered with numerous standing or suberect hairs. Body brown to reddish brown; antenna slightly darker; gaster dark reddish brown. Apical segment of antenna often and legs light brown to yellowish.

Variation. In the media and major workers head broader than long; antennal scape relatively shorter than in the minor worker (Fig. 5); petiolar node seen from above much broader than long. In the major, clypeus often with obliquely running carinae, and eye composed of more than 50 ommatidia. In the media many of the standing hairs on the dorsum of body simple (shorter hairs tending to be branched), and in the major almost all the standing hairs on the dorsum of body simple (a few short hairs on head and mesosoma may be branched).

Queen description

Measurements (paratype). HL 1.05, HW 1.10, CI 105, SL 0.68, SI 62, ML 0.55, ED 0.32, PW 1.25, AL 1.77, PL 0.66, PH 0.50, DPW 0.53.

Very distinctive in its large body. In structure, sculpture and pilosity similar to the major worker, with the following differences: Eye large, distinctly longer than and broader than apical antennal segment; distance between eye and mandibular base only slightly longer than half the length of eye; pro-mesonotal suture distinct; mesothoracic paraptera broadly convex anteriorly and posteriorly, separated from scutellum by a shallow but wide suture and from mesoscutum by a narrower suture; anepisternum separated from katepisternum by a wide furrow provided with a series of carinae on bottom; metanotum very short, separated from mesoscutellum and propodeum by deep sutures; propodeal dorsum sloping, not separable from declivity; petiole and postpetiole much broader than long; their nodes seen in profile distinctly higher than long. Median furrow on the dorsum of head indistinct, incomplete, not reaching the posterior margin of head; anterior portion of frons medially with rugae only, but reticulate laterally; mesonotum in posterior 2/3 rugulose rather than puncto-reticulate; anepisternum irregularly sculptured; katepisternum extensively smooth to superficially sculptured, shining; propodeal dorsum weakly and longitudinally rugulose; declivity with several transverse carinae and weakly shining. All the standing hairs on the body simple. Body uniformly dark reddish brown; coxae and femora slightly paler.

Non-type material examined. Minor and media workers (from dry dipterocarp forest), Sakaerat, Nakornratchasima Prov., Thailand (SKY); Minor and media workers (mostly from a secondary forest), Khao Ang Reu Nai W.S., Chacheongsao Prov., Thailand, TH03-SKY-94, 108 (SKY).

Remarks. This species is known only from the type locality in Laos, and Chacheongsao Prov. and Nakornratchasima Prov., Thailand. It is distinguished from the other two species by the characteristics given in the key. The queen is very large, has a similar set of characteristics to that of the worker. However, all the body hairs are simple, and the petiole and postpetiole are relatively shorter and higher compared with the worker. The information from the single colony found in Lao (Fig. 6) suggests that this species inhabits the evergreen forest, preferring more natural conditions than *T. kheperra*.



Fig. 6. Colony of *Tetramorium polymorphum* sp. nov. located under a large stone, which was removed to take photos. Major workers are clearly recognized.

KEY TO THREE SPECIES TREATED ABOVE (WORKERS)

1. Anterior clypeal margin weakly concave. Clypeus with one median and a few lateral carinae running longitudinally. Anterior portion of frons just behind clypeus not reticulate, with longitudinal rugulae only *T. polymorphum* sp. nov.
- . Anterior clypeal margin straight or feebly convex. Clypeus with one longitudinal median carina and a few shorter and obliquely running carinae, or entirely reticulate. Dorsum of head almost entirely puncto-reticulate 2
2. Clypeus with carinae, not reticulate. Propodeal declivity extensively smooth and shining, with a strong transverse carina between propodeal spine, and a weaker carina below it ... *T. kheperra*
- . Clypeus reticulate. Upper half of propodeal declivity with several fine transverse carinae and mat *T. hasinae* sp. nov.

DISCUSSION

The workers of *Tetramorium polymorphum* sp. nov. from the single colony are roughly sorted into three size classes. Although these classes are not very distinctive in structural characters, the standing hairs on the body are mostly simple in the major worker. The cephalic index and the relative length of the antennal scape also change with body size (Fig. 5). This is a first case of worker polymorphism in any sense among the *Tetramorium* species, although geographical variation in worker size has been reported in a European species, *T. moravicum* Kratochvil (Schlick-Steiner et al., 2005). Also in the

queen all the standing hairs are simple. We could not examine the queen of *T. kheperra* in spite of its wide distribution range and common occurrence. The queen of *T. hasinae* has abundant branched hairs over body surface as in the worker. The body size of the *T. polymorphum* queen is also exceptionally large among the Asian *Tetramorium* species.

The simple standing hairs of the major worker and queen may lead ant taxonomists to exclude this species from ‘*Triglyphothrix*’ if only these castes are examined. Bolton (1976, 1977) retained the generic status of *Triglyphothrix*, though the difficulty in this treating was noticed when he revised the Ethiopian fauna of Tetramoriini (1980). Later (1985) he synonymized *Triglyphothrix* with *Tetramorium* since there are species with branched hairs within groups most members of which possess only simple hairs. This observation led him to conclude that branched hairs may have arisen in different species groups independently (Bolton, 1985). The discovery of the polymorphic species closely related to the typical ‘*Triglyphothrix*’ species *T. kheperra* but with the major worker and queen lacking branched hairs further supports the inclusion of *Triglyphothrix* in *Tetramorium*. Nothing is known of the function of the major workers in *Tetramorium polymorphum*. Judging from the aggressive behaviour of this species as shown during the collecting, the majors possibly play a defensive role.

Finally it should be emphasized that any widespread, common ant species occurring in disturbed areas may have sibling species in the more natural habitats like forests. Recently the forest inhabitant *Tetramorium scabrum* Mayr, once a junior synonym of *T. pacificum* Mayr inhabiting disturbed areas, was separated from the latter based on both morphological and molecular characters (Schlick-Steiner et al., 2006). *Odontoponera transversa* (F. Smith) proved to be a forest counterpart of *O. denticulata* (F. Smith) that prefers disturbed areas (Yamane, 2009). Yashiro et al. (2010) found that two species are included in the so-called *Pachycondyla* (*Brachyponera*) *chinensis* (Emery) in Japan; in this case the newly found *P. nakasujii* Yashiro et al. prefers forests and *P. chinensis* is a widespread species inhabiting sparse forests and forest edges and having become a pest in the United States. The two new species of *Tetramorium* described in the present paper may represent a similar case; they may be forest inhabitants with restricted distribution ranges, while *T. kheperra* is a widespread tramp species. In all the cases the species inhabiting disturbed areas tend to have a wider range in distribution, and more common in geographical areas of potentially seasonal forests.

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REFERENCES

- Bolton, B. 1976. The ant tribe Tetramoriini (Hymenoptera: Formicidae). Constituent genera, review of smaller genera and revision of *Tryglyphothrix* Forel. Bulletin of

- the British Museum (Natural History) Entomology, 34: 283–379.
- Bolton, B. 1977. The ant tribe Tetramoriini (Hymenoptera: Formicidae). The genus *Tetramorium* Mayr in the Oriental and Indo-Australian regions, and in Australia. Bulletin of the British Museum (Natural History) Entomology, 36: 67–151.
- Bolton, B. 1980. The ant tribe Tetramoriini (Hymenoptera: Formicidae). The genus *Tetramorium* Mayr in the Ethiopian zoogeographical region. Bulletin of the British Museum (Natural History) Entomology, 40: 193–384.
- Bolton, B. 1985. The ant genus *Triglyphothrix* Forel a synonym of *Tetramorium* Mayr. Journal of Natural History, 19: 243–248.
- Bolton, B. 1995. A New General Catalogue of Ants of the World. 504 pp. Harvard University Press, Cambridge, Massachusetts.
- Bolton, B. 2003. Synopsis and classification of Formicidae. Memoirs of the American Entomological Institute, 71: 1–369.
- Emery, C. 1922. In Wytsman, P. Genera Insectorum. Hymenoptera, Fam. Formicidae, subfam. Myrmicinae. Fasc. 174C: 207–397. Bruxelles.
- Forel, A. 1890. Aenictus-Typhlatta découverte de M. Wroughton. Nouveaux genres de formicides. Annales de la Société Entomologique de Belgique. Comptes-rendus, 34: cii–cxiv.
- Schlick-Steiner, B. C., Steiner, F. M. and Zettel, H. 2006. *Tetramorium pacificum* Mayr, 1870, *T. scabrum* Mayr, 1879 sp. rev., *T. manobo* (Calilung, 2000) (Hymenoptera: Formicidae) – three good species. Myrmecologische Nachrichten, 8: 181–191.
- Schlick-Steiner, B. C., Steiner, F. M., Sanetra, M., Heller, G., Christian, E. and Seifert, B. 2006. Queen size dimorphism in the ant *Tetramorium moravicum* (Hymenoptera, Formicidae): Morphometric, molecular genetic and experimental evidence. Insectes Sociaux, 52: 186–193.
- Yamane, Sk. 2009. *Odontoponera denticulata* (F. Smith) (Formicidae: Ponerinae), a distinct species inhabiting disturbed areas. Journal of the Myrmecological Society of Japan [Ari], (32): 1–8.
- Yashiro, T., Matsuura, K., Guénard, B., Terayama, M. and Dunn, R. R. 2010. On the evolution of the species complex *Pachycondyla chinensis* (Hymenoptera: Formicidae: Ponerinae), including the origin of its invasive form and description of a new species. Zootaxa, 2685: 39–50.