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The ant subgenus *Campomyrma* of the genus *Polyrhachis* Smith, 1857 (Hymenoptera, Formicidae, Formicinae) in Thailand and Laos, with descriptions of two new species

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Abstract

The subgenus *Campomyrma* Wheeler, 1911 of the genus *Polyrhachis* Smith, 1758 in Thailand and Laos is reviewed. Four species are recognized, of which two are described and illustrated as new to science based on the worker and dealate queen under the names *Polyrhachis quadrispinosa* Jaitrong & Noon-anant, **sp. nov.** (found in a dead twig on a rubber tree) and *P. lao* Jaitrong & Yamane, **sp. nov.** (collected in dead wood). *Polyrhachis sukarmani* Kohout, 2007 is recorded for the first time from Thailand. A key to the Thai and Lao species of the subgenus based on the worker caste is given.

Key words: spiny ant, new species, taxonomy, distribution, Thailand, Laos

Introduction

The spiny ant genus *Polyrhachis* Smith, 1857 is one of the largest ant genera in the world in number of species. It is mainly distributed in tropical and subtropical areas of the Old-World, New Guinea, and Australia. Currently, 706 extant species, 82 subspecies, and one fossil species are known (Mezger & Moreau 2015; Bolton 2023). *Campomyrma* Wheeler, 1911 is a subgenus of *Polyrhachis*, with 55 described species and three subspecies that can be divided into eight species groups: *P. creusa*, *P. equina*, *P. gravis*, *P. inconspicua*, *P. micans*, *P. schwiedlandi*, *P. xiphias*, and group A species groups (Andersen 2000, Kohout 2007, 2013a, 2013b). The subgenus is distributed in India, Sri Lanka, China, various countries in Southeast Asia, and Australia to New Guinea (Dorow 1995; Bolton 2023). Most species of the subgenus *Campomyrma* are known to nest in rotting wood (Jaitrong *et al.* 2020). Recently, 65 *Polyrhachis* species were recorded from Thailand and Laos (Jaitrong *et al.* 2016; Khachonpisitsak *et al.* 2020; Jaitrong *et al.* 2023). Among them, two species, *Polyrhachis halidayi* Emery, 1889 and *P. shixingensis* Wu & Wang, 1995, belong to the subgenus *Campomyrma*, though the latter, recorded by Khachonpisitsak *et al.* (2020), proved to be based on a misidentification.

Four species of *Campomyrma* are currently recognized from Thailand and Laos. However, surveys of ants in Trang and Satun Provinces, southern Thailand, led to the discovery of unidentified *Polyrhachis* specimens belonging to the subgenus *Campomyrma*. After carefully comparing them with the images of the type specimens of closely related species, we concluded that this species is new to science. We also carefully examined the specimens recorded as '*P. shixingensis*' by Khachonpisitsak *et al.* (2020) and found that this is also a new species of *Campomyrma*. In this paper, we review the subgenus in Thailand and Laos, describing the new species as *Polyrhachis quadrispinosa* Jaitrong & Noon-anant, **sp. nov.** and *P. lao* Jaitrong & Yamane, **sp. nov.** based on the worker and dealate queen.

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Material and methods

The type series of *Polyrhachis quadrispinosa* was collected from southern Thailand, Trang Province, Palian District, Ban Li Phang, near Khao Ting Cave, in a rubber tree plantation (7º9′35″N, 99º48′01″E). The holotype and paratypes were point-mounted and examined along with other specimens of *Polyrhachis* subgenus *Campomyrma* deposited in the ant collection at the Natural History Museum of the National Science Museum, Thailand (THNHM); Seiki Yamane Collection, Kitakyushu Museum of Natural History and Human History, Japan (SKYC); and the Ant Collection at the Faculty of Science, Prince of Songkla University, Thailand (PSUSC). The holotype and paratype workers were compared with images of type specimens of closely related species (*Polyrhachis cedarensis* Forel, 1915; *Polyrhachis hexacantha* (Erichson, 1842); *Polyrhachis ops* Forel, 1907; *Polyrhachis phryne* Forel, 1907; *Polyrhachis sidnica* Mayr, 1866; and *Polyrhachis sukarmani* Kohout, 2007) available on Antweb (2023). The specimens collected from Thailand and Laos identified as *Polyrhachis shixingensis* Wu & Wang, 1995 in Khachonpisitsak *et al.* (2020) were reassessed and considered a new species. Specimens of *P. shixingensis* collected from Vietnam and Cambodia were also examined. Male genitalia of *Polyrhachis halidayi* Emery, 1889 were stored in 10% KOH solution for one day, then put in 80% alcohol after cleaning in water for detailed observation.

Most morphological observations were made with a ZEISS Discovery V12 stereoscope. Multi-focused montage images were produced using NIS-Elements-D from a series of source images taken by a Nikon Digital Sight-Ri1 camera attached to a Nikon AZ100M stereoscope.

The abbreviations used for type depositories are as follows:

BMNH	The Natural History Museum, London, UK.
CFRB	Chinese Academy of Forestry, Forest Research Institute, Beijing, China
MCSN	Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italy
PSUSC	Ant Collection at the Faculty of Science, Prince of Songkla University, Thailand
SKYC	Seiki Yamane Collection, Kitakyushu Museum of Natural History and Human History, Japan
THNHM	The Natural History Museum of the National Science Museum, Thailand

Specimens were measured using a micrometer on a ZEISS Discovery V12 stereoscope. All measurements are given in millimeters and recorded to the second decimal place. The abbreviations used for the measurements and indices are as follows (edited from Kohout 2013b):

TL	Total length (the necessarily composite measurement of the entire ant).
HL	Head length (the maximum measurable length of the head in perfect full-face view, measured from the anterior-most point of the clypeal border or teeth to the posterior-most point of the occipital margin).
HW_1	Head width (width of the head in perfect full-face view, measured immediately in front of the eyes).
HW_2	Head width (width of the head in perfect full-face view, measured at the level mid-length of the eyes).
SL	Scape length (length of the antennal scape, excluding the condyle).
ML	Mesosoma length. Diagonal length of the mesosoma in profile, from the point at which the pronotum meets the cervical shield to the posterior margin of the metapleuron.
PW	Pronotal width (width of the pronotal dorsum measured across the humeri).
MTL	Metathoracic tibial length (maximum measurable length of the tibia of the hind leg).
CI	Cephalic index (HW_1/HL x 100).
SI	Scape index (SL/HW_1 x 100).

Results and Discussion

Taxonomy

Genus *Polyrhachis* Smith, 1857

Polyrhachis Smith, 1857: 58. Type-species: *Formica bihamata*, by original designation.

Subgenus *Campomyrma* Wheeler, 1911

Campomyrma Wheeler, 1911: 860 (as subgenus of *Polyrhachis*). Type-species: *Polyrhachis clypeata* (junior synonym of *Formica exercita*), by original designation.

Diagnosis of worker. Members of the subgenus can be characterized by the mesosoma being box-like, laterally marginate throughout its length; presence of propodeal spine (short or long); scale-like petiole, in most cases with two acute spines projecting posterolaterally and sometimes two denticles or distinct spines in between in dorsal view. Body black to dark brown; pilosity sparse or absent.

Key to Thai and Lao species based on worker caste

1. Petiole without distinct dorsolateral spines (Fig. 1D) . . . . . *P. sukarmani* Kohout, 2007
- Petiole with distinct dorsolateral spines (Fig. 1A–C). 2
2 Dorsum of petiole with four long spines (Fig. 1A); vertex and gastral tergites II–IV without erect hairs; propodeal spine relatively long, longer than wide at base; antennal scape shorter than or about as long as head width . . . . . *P. quadrispinosa* Jaitrong & Noon-anant, **sp. nov.**
- Dorsum of petiole with two acute spines projecting posterolaterally and two denticles in between (Fig. 1B–C); vertex with two erect hairs but pilosity on gastral tergites variable; propodeal spine relatively short, shorter than wide or almost as long as wide at base; antennal scape longer than head width. 3
3 Mesonotum longer than broad; propodeal spine posteriorly directed with apex slightly up curved; pair of median denticles on dorsum of petiole rudimentary with round apices; first gastral tergite without erect hairs; in dorsal view, propodeal dorsum deeply concave. . . . . *P. lao* Jaitrong & Yamane, **sp. nov.**
- Mesonotum broader than long; propodeal spine upward-directed; pair of median denticles on dorsum of petiole distinct with acute apices; first gastral tergite with sparse erect hairs; in dorsal view, propodeal dorsum only shallowly concave. . . . . *P. halidayi* Emery, 1889

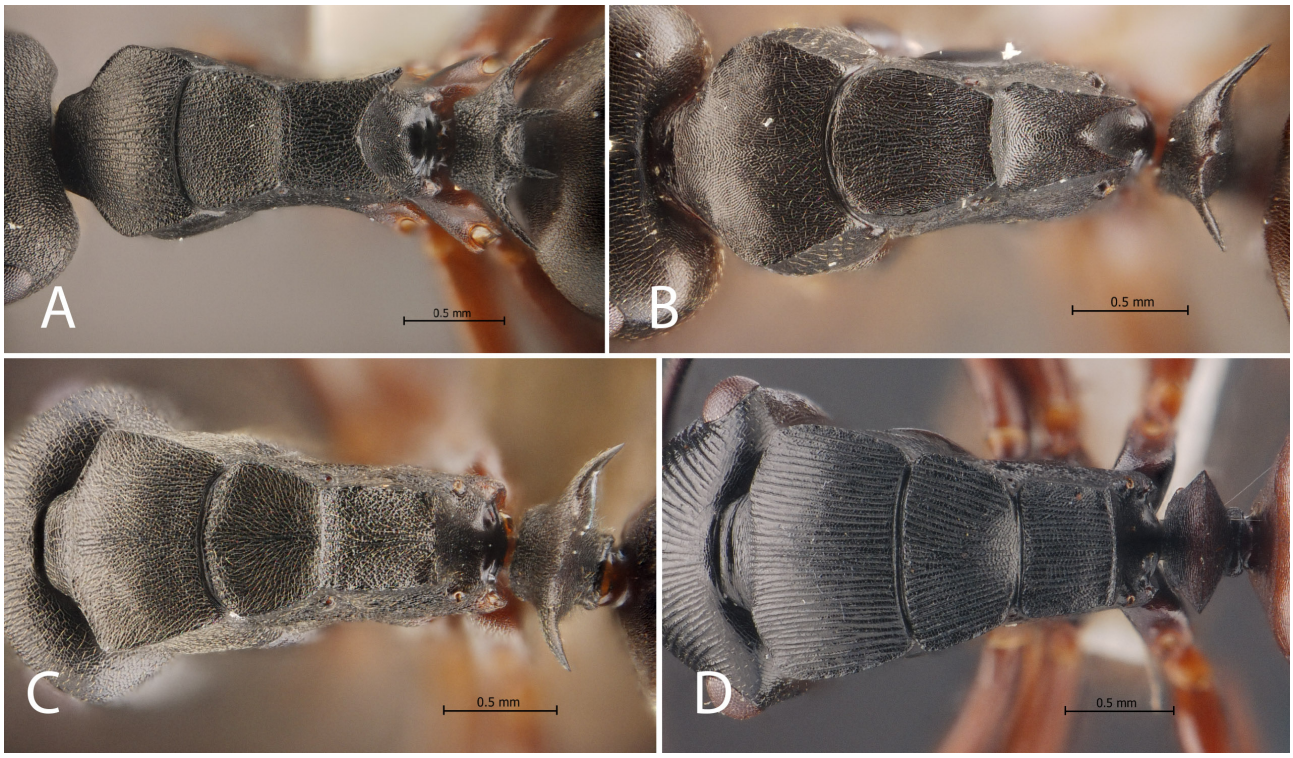

FIGURE 1. Dorsa of mesosoma and petiole. **A.** *Polyrhachis quadrispinosa*, new species (paratype worker, THNHM-I-00027177); **B.** *Polyrhachis lao*, new species (holotype, THNHM-I-00027051); **C.** *Polyrhachis halidayi* (non-type worker, THNHM-I-00027200); **D.** *Polyrhachis sukarmani* (non-type worker, THNHM-I-00027252).

***Polyrhachis halidayi* Emery, 1889**
(Figs. 1C, 2–5)

Polyrhachis halidayi Emery, 1889: 517 (w.). Type locality: Myanmar. Bingham, 1903: 413 (q.). Combination in *Polyrhachis* (*Campomyrma*): Emery, 1925: 180; Wong & Guénard, 2020: 29, full queen description, including wing venation.

Types. Syntype worker from Myanmar, Tenasserim, Kawkareet (MCSN, images available on Antweb were examined).

Non-type material examined. THAILAND. Two workers (THTHM-I-00027190) and 1 queen (THNHM-I-00027191), N Thailand, Chiang Rai Province, Mae Fa Luang District, Doi Tung, 19.VI.2002, W. Jaitrong leg., WJT02-TH-0081 (THNHM); 14 workers, N Thailand, Chiang Mai Province, Doi Saket District, Pa Miang Subdistrict, 19º5′12″N, 99º21′11″E, 15.VII.2022, C. Wimolsuthikul leg., CW150722-02 (THNHM); 5 workers (THNHM-I-00027192) and 2 queens (THNHM-I-00027193), N Thailand, Chiang Mai Province, Fang District, Doi Pha Hom Pok, 27.V.2008, W. Jaitrong leg., WJT06-N4 (THNHM); 1 worker (THNHM-I-00027240), N Thailand, Chiang Mai Province, Fang District, Doi Ang Khang, 22.IX.2013, W. Jaitrong leg., WJT220913-11 (THNHM); 8 workers (THNHM-I-00027194), N Thailand, Chiang Mai Province, Mueang Chiang Mai, Doi Suthep, 1400–1500 m a.s.l., 16–20.VIII.2004, S. Sonthichai leg. (THNHM); 9 workers (THNHM-I-00027195), same locality and collector, 27.IX–1.X.2004 (THNHM); 5 workers (THNHM-I-00027196), same locality and collector, 8–12.X.2004 (THNHM); 3 workers (THNHM-I-00027197), same locality and collector, 6–10.2004 (THNHM); 7 workers (THNHM-I-00027198), same locality and collector, 27.VII.2004 (THNHM); 8 workers (THNHM-I-00027199), N Thailand, Chiang Mai Province, Mae Tang District, Huai Nam Dang, 6.XI.2007, T. Jeenthong leg., TJ07-TH-12 (THNHM); 8 workers (THNHM-I-00027241), 1 dealate queen (THNHM-I-00027242), same locality, 7.III.2008, W. Jaitrong leg., WJT070308-12 (THNHM); 6 workers (THNHM-I-00027243), same locality, date and collector, WJT070308-8 (THNHM); 5 workers (THNHM-I-00027244), same locality, date and collector, WJT070308-3 (THNHM); 5 workers, N Thailand, Chiang Mai Province, Mae Tang District, Mae Sala Lung Watershed Management Research Station, 7.III.2008, W. Jaitrong leg., WJT070308-4 (THNHM); 5 workers, N Thailand, Chiang Mai Province, Doi Inthanon, Chom Thong District, 4.III.2008, W. Jaitrong leg., WJT040308-12 (THNHM); 3 workers, same locality, date and collector, WJT040308-3 (THNHM); 3 workers, date and collector, WJT040308-03 (THNHM); 8 workers, same locality and collector, 1.III.2008, WJT010308-2 (THNHM); 2 workers, N. Thailand, Chiang Mai Province, Hod District, Bo Luang Subdistrict, 1109 m alt., 27.X.2018, Sk. Yamane leg., TH18-Sky-331 (dead bamboo, SKYC); 11 workers (THNHM-I-00027245), N Thailand, Chiang Mai Province, Mae Cham District, Mae Klang Watershed Research Station, 15.VII.2019, W. Jaitrong leg., WJT19-WJT005 (THNHM); 7 workers (THNHM-I-00027200), N Thailand, Chiang Mai Province, Omkoi District, Omkoi National Forest, 17º51′5″6N, 98º22′34″E, 1006 m a.s.l., 26.X.2018, W. Jaitrong leg., WJT261019-A (THNHM); 8 workers (THNHM-I-00027201), same locality, 17.VII.2016, W. Jaitrong leg., TH16-WJT-865 (THNHM); 11 workers (THNHM-I-00027246), N Thailand, Chiang Mai province, Omkoi District, Mu Sur Paktang Village, 1312m a.s.l., 17º48′35″6N, 98º25′17″E, 25.X.2018, W. Jaitrong leg., WJT251018-38 (THNHM); 7 workers (THNHM-I-00027202), N Thailand, Nan Province, Doi Phuka, hill evergreen forest, 29.V.2004, W. Jaitrong leg., WJT04-N023; 1 worker, W Thailand, Tak Province, Umphang W.S., Maekhlong Ki Station, 25.V.2015, Sk. Yamane leg., TH15-SKY-157 (dead twig on tree, SKYC); 5 workers (THNHM-I-00027203), W Thailand, Tak Province, Umphang District, Umphang W.S., Ban Mae Khlong Yai, 950–1000m a.s.l., 11.IX.2004, W. Jaitrong leg., WJT04-W010 (THNHM); 12 workers (THNHM-I-00027204), Same wildlife sanctuary, Mae Klong Ki Station, hill evergreen forest, 25.I.2015, W. Jaitrong leg., TH15-WJT-025 (THNHM); 8 workers (THNHM-I-00027205), 1 dealate queen (THNHM-I-00027206), and 2 alate queens (THNHM-I-00027207), same wildlife sanctuary, Mae Klong Yai Station, 26.V.2015, W. Jaitrong leg., TH15-WJT-638 (THNHM); 8 workers (THNHM-I-00027208), same wildlife sanctuary, Mae Klong Ki, 25.V.2015, W. Jaitrong leg., TH15-WJT-613 (THNHM); 5 workers (THNHM-I-00027209), same wildlife sanctuary, Mae Klong Ki, hill evergreen forest, 25.V.2015, W. Jaitrong leg., WJT250515-3 (THNHM); 6 workers (THNHM-I-00027210), same wildlife sanctuary, Mae Klong Ki, hill evergreen forest, W. Jaitrong leg., WJT250515-4 (THNHM); 19 workers (THNHM-I-00027211), same wildlife sanctuary, Doi Cha Rod Fa, 28.V.2015, W. Jaitrong leg., TH15-WJT-671 (THNHM); 1 male, same locality, 1250 m alt., 26.V.2015, Sk. Yamane leg., TH15-SKY-168 (rotting wood, SKYC); 3 workers (THNHM-I-00027212), W Thailand, Tak Province, Umphang District, Thung Yai W.S., dry evergreen forest, 25.V.2000, W. Jaitrong. (THNHM); 9 workers, W Thailand, Kanchanaburi Province, Thong Pha Phum District, Ban Sahakorn Nikhom, 7.XI.2021, W. Jaitrong leg., TH21-WJT-788 (THNHM); 10 workers, W Thailand, Ratchaburi Province, Suan Phueng District, Mt. Khao Lan22.V.2020, W. Jaitrong leg., TH20-WJT-063 (THNHM); 7

workers (THNHM-I-00027213), W Thailand, Prachuap Khiri Khan Province, Kaeng Krachan, Pala-U, 25.III.2007, W. Jaitrong leg., WJT07-TH-A (THNHM); 3 workers, W Thailand, Phetchaburi Province, Kaeng Krachan N.P., 370 m alt., 25.VI.2014, Sk. Yamane, N. Noon-anant and M. Maruyama leg., KK14-pol-04 (dead bamboo, SKYC); 2 workers and a alate queen, same locality, 900 m alt., 26.VI.2014, same collector, KK14-Pol-07 (dead bamboo stem, SKYC); 2 workers, same locality, 27.VI.2014, same collectors, KK14-Pol-11 (dead sasa-bamboo stem, SKYC); 7 workers (THNHM-I-00027214); 3 workers, same locality, 20.VIII.2015, N. Noon-anant leg. (PSUSC), NE Thailand, Loei Province, Phu Luang W.S., Head Quarter, 15.V.2007, S. Hasin leg., SH07-TH-93 (THNHM); 5 workers (THNHM-I-00027215), same locality and collector, 10.V.2007, SH07-TH-60 (THNHM); 3 workers and 1 male, same locality, 10.IV.2008, Sk. Yamane leg., TH08-SKY-22 (dead hollow twig, SKYC); 5 workers (THNHM-I-00027247), NE Thailand, Nakhon Ratchasima Province, Pak Chong District, Khao Yai, 20.X.2021, W. Jaitrong leg., TH21-WJT-657 (THNHM); 1 worker, same locality, hill evergreen forest, 21.II.1998, W. Jaitrong leg. (THNHM); 1 worker, same locality, 900–1000 m alt., 30.V.2000, Sk. Yamane leg., TH00-SKY-23 (rotting wood, SKYC); 13 workers, central Thailand, Uthai Thani Province, Ban Rai District, 25.X.2014, W. Jaitrong leg., WJT251014-6 (THNHM); 9 workers (THNHM-I-00027216), E Thailand, Chanthaburi Province, Soi Dao District, Khao Soi Dao W.S., Soi Dao Nuar, 19.I.2008, W. Jaitrong leg., WJT08-TH-73 (THNHM); 6 workers (THNHM-I-00027217), same locality, date, and collector, WJT08-TH-77 (THNHM); 1 worker (THNHM-I-00027218), E Thailand, Rayong Province, Khao Ang Rue Nai W.S., Siraman Station, dry evergreen forest, 4.IV.2004, W. Jaitrong leg. (THNHM); 1 alate queen (THNHM-I-00027219), E Thailand, Sa Kaeo Province, Khao Ang Rue Nai W.S., Khao Takrub, 28.VI.2003, W. Jaitrong leg., WJT03-TH-213 (THNHM); 7 workers, 2 alate queens, and 5 males, S Thailand, Trang Province, Na Yong District, Khao Chong Botanical Garden, evergreen forest, 8.VII.2018, W. Jaitrong leg., WJT080718-04 (THNHM); 1 alate queen, S Thailand, Palian District, Kuan Mai Dam, Khao Banthad W.S., Ton Tae Waterfall, 198.II.2022, W. Jaitrong leg., Light trap (THNHM).

Measurements and indices. Workers (n = 10): TL 6.80–8.80, HL 1.88–1.96, HW_1 1.52–1.80, HW_2 1.60–1.80, SL 1.84–1.92, ML 2.16–2.28, PW 1.16–1.32, MTL 1.52–1.64, CI 81–92, SI 107–121. **Queens** (n = 3): TL 8.68–8.80, HL 2.04–2.12, HW_1 1.72, HW_2 1.88–1.92, SL 1.96–2.00, ML 2.80–2.96, PW 1.56–1.60, MTL 1.52–1.68, CI 81–84, SI 114–116. **Males** (n = 5): TL 6.30–6.37, HL 1.16–1.19, HW_1 0.83, HW_2 1.16–1.19, SL 1.35–1.39, ML 2.41–2.44, PW 1.42–1.49, MTL 1.98–2.01, CI 69–71, SI 164–168.

Description of worker (Figs. 1C, 2). Head in full-face view slightly longer than broad (CI 81–92), broader posteriorly. Lateral margins of head in front of eye slightly convex, converging towards bases of mandibles, behind eye rounding into curved occipital margin. Frontal lobe in full-face view narrow, not covering antennal socket. Frontal carina in full-face view sinuate, moderately raised in profile. Clypeus in dorsal view shield-shaped, with distinct median carina; anterior margin roundly convex, not coarsely rugged, medially shallowly incised; posterior margin weakly concave medially. Mandible subtriangular, its masticatory margin with five distinct teeth (including smallest basal and largest apical teeth). Antennal scape slender and slightly longer than head width (SI 107–121); antennal segments II to XII longer than broad, gradually decreasing in length toward tip of antenna, but apical segment longest, with segments II and XII slightly longer. Eye located at posterior part of head, facing anterolaterally; moderately convex, slightly exceeding lateral cephalic outline in full-face view.

Mesosoma box-like, its dorsum distinctly marginate along the entire length. Pronotum in profile with very weakly convex dorsal outline; in dorsal view subtrapezoidal, slightly broader anteriorly, with anterior margin arcuate and anterolateral corner bluntly angular. Promesonotal suture distinct; mesonotum in profile view with flat dorsal outline; in dorsal view narrower than pronotum but broader than propodeum; its anterior margin arcuate. Metanotal groove laterally impressed, medially indistinct; propodeal dorsum posteriorly armed with short, upturned teeth. Petiole scale-like with two acute spines projecting posterolaterally, and two denticles in between in dorsal view.

Mandibles micropunctate but slightly shiny. Frontal face of head costate. Mesosoma with costate dorsum and macropunctate lateral face. Legs micropunctate. Gaster finely shagreened.

Vertex with 2 erect hairs; eye with very sparse minute erect hairs; mesosomal dorsum and petiole without erect hairs; gastral tergite with sparse short erect and dense pale yellow decumbent hairs.

Body black; scapes, coxae, tarsi and gaster reddish-brown to black; eye brown, dark reddish brown or grey; condylar bulbs, apical flagellar segments, and gastral tip yellowish to dark reddish brown; palps and claws yellow to brown; most of legs, except coxae and tarsi, brown or light to dark reddish-brown.

Description of queen (Fig. 3). In general habitus including coloration and pilosity the queen is similar to the worker except for caste-specific structures. Body larger with head width including eyes 1.88–1.92 mm (1.60–1.80

mm in worker). Eye larger and more prominent, essentially without erect hairs; ocelli arranged in low triangle. Anterior clypeal margin with distinct median notch and blunter median carina. Anterolateral corner of pronotum in dorsal view reduced to protrusions. Mesoscutum in profile view with convex dorsal outline, with anterior one-third sloping and the rest almost flat; in dorsal view median line very short, only reaching 1/5 length of mesoscutum; parapsides flat. Mesoscutellar disc flat. Metanotum medially very short but longer laterally, much lower than mesoscutellum and propodeum. Propodeal and petiolar spines smaller than those of workers. Mesosomal dorsum with dozens of brown erect hairs.

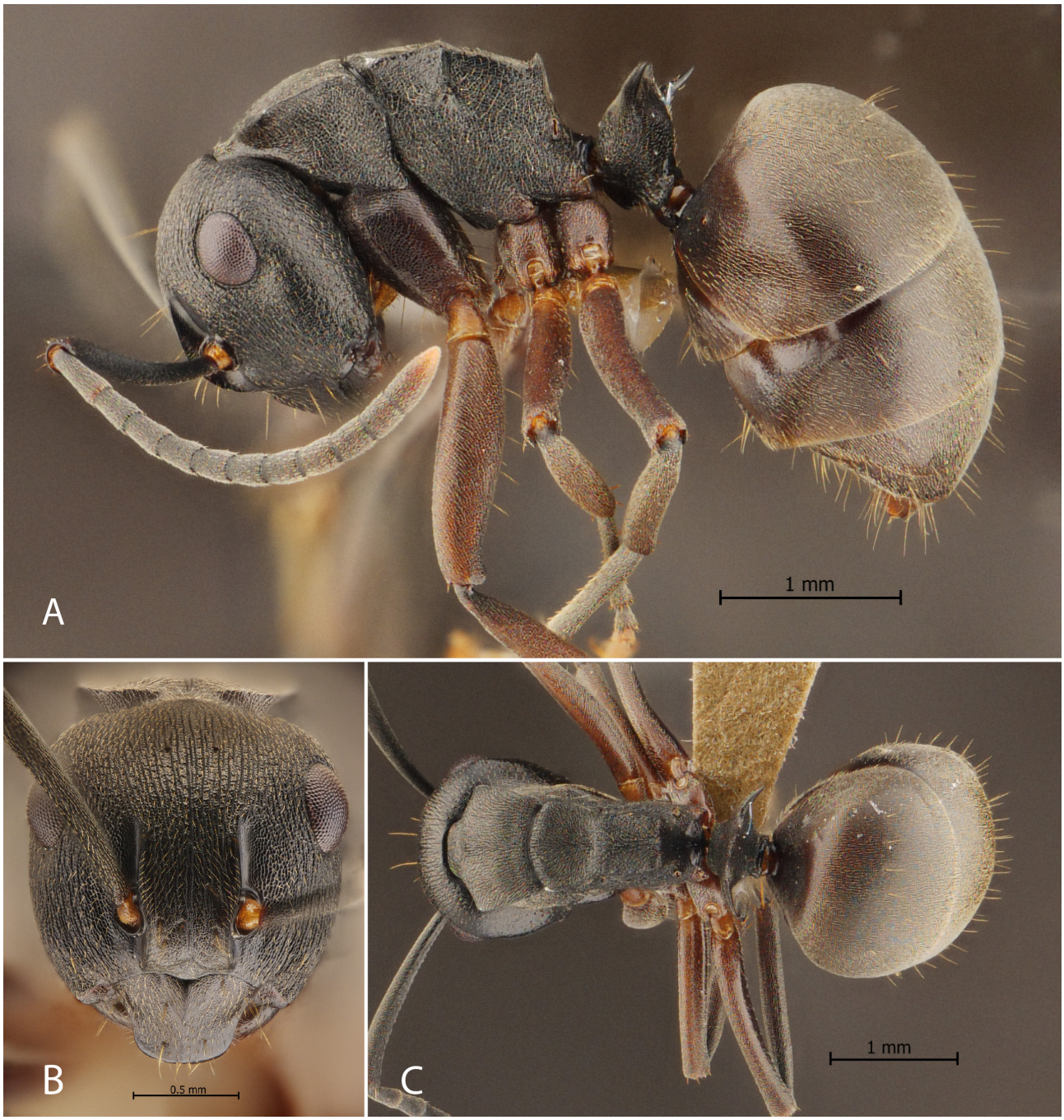

FIGURE 2. *Polyrhachis halidayi* (non-type worker, THNHM-I-00027200). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

Description of male (Figs. 4–5). With general characteristics of *Polyrhachis* males (Wong and Guénard, 2020). Head in full-face view longer than broad, but if including eyes, then almost as long as broad. Clypeus broad, posteriorly clearly demarcated from frons, with posteromedian margin shallowly emarginate medially, anteriorly broadly convex, with anterior margin entire but weakly serrate. Mandible weakly widened apicad, with outer and

basal margins almost parallel, twice as long as broad; masticatory margin short and edentate (masticatory margin with small denticles in some specimens) with apex bluntly pointed. Eye large, positioned at mid-length of lateral face of head; distance between mandibular base and anterior margin of eye (malar space) 0.76 times as long as maximum diameter of eye; ocelli relatively small, arranged in very low triangle; distance between anterior and posterior ocelli slightly longer than diameter of anterior ocellus. Antennal scape moderately long, distinctly longer than head width including eyes.

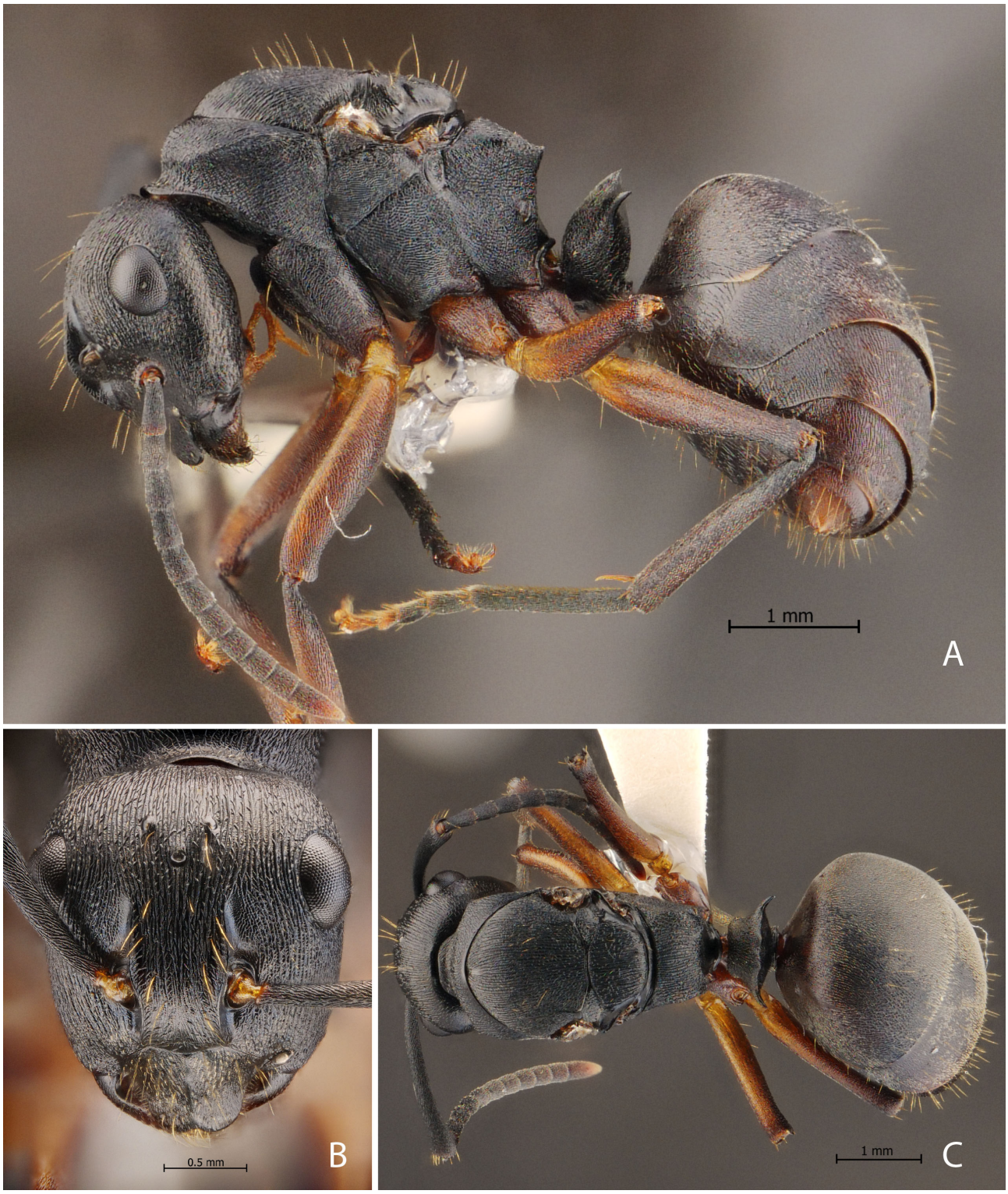

FIGURE 3. *Polyrhachis halidayi* (non-type queen, THNHM-I-00027206). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

FIGURE 4. *Polyrhachis halidayi* (non-type male, THNHM-I-00027205). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

Mesosoma in dorsal view much broader than head including eyes. Pronotum short ('narrow'), almost entirely concealed by inflated mesoscutum. Mesoscutum with short longitudinal median line, without notaulus; parapsidal line distinct and long, running along border of lateral and dorsal faces; scuto-scutellar sulcus prominent; mesoscutellum subtriangular, much narrower than mesoscutum, distinctly narrowed posteriad. Metanotum short ('narrow'), deeply indented, clearly defined from propodeum with deep furrow. With mesosoma in profile view, pronotum much lower than mesoscutum, with steep anterior slope, without dorsal face. Mesoscutum convex with gently sloping anterior slope and rather flat posterior portion; mesopleuron in profile large, divided into anepisternum and katepisternum,

the latter being larger than the former; mesoscutellum slightly higher than mesoscutum, with rounded posterodorsal corner. Propodeum in profile without distinct separation of dorsum from declivity; spines absent; spiracle elongate, located on lateral face anterior to posterior margin. Petiole in dorsal view slightly broader than long; in profile globular, slightly longer than high. Gaster relatively long but slightly smaller than mesosoma; gastral tergite II almost as long as each of gastral tergites III–V but shorter and smaller than gastral tergite I.

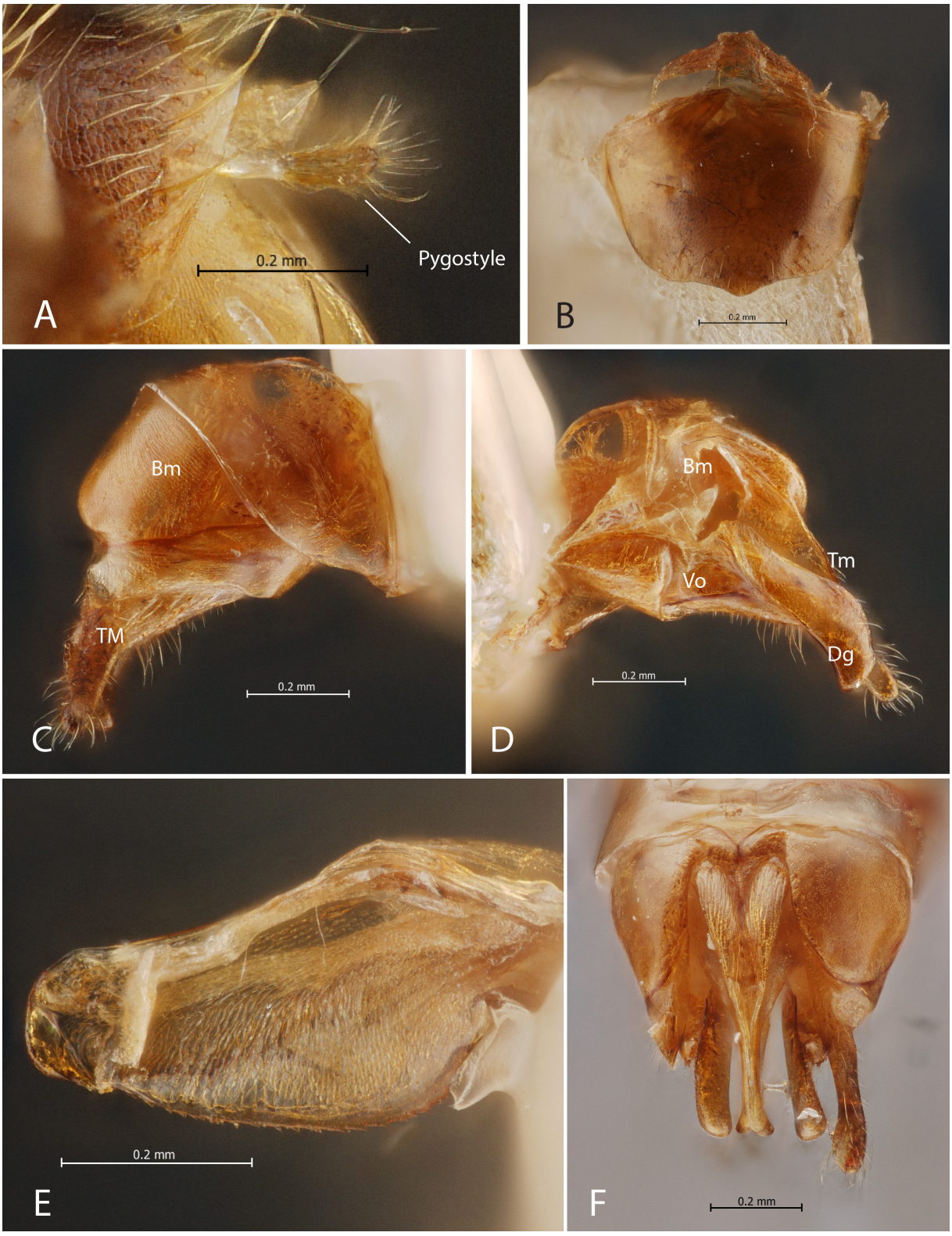

FIGURE 5. Male genitalia of *Polyrhachis halidayi*. **A.** Pygostyle in profile; **B.** abdominal sternite IX; **C.** paramere, right side, in outer view; **D.** paramere and volsella, right side, inner view; **E.** penisvalva, right side, in outer view; **F.** genital capsule in dorsal view. Abbreviations: Bm basimere; Dg digitus; Tm telomere; Vo volsella.

Almost the entire head and thorax minutely and densely sculptured in various patterns and matt; lateral face of mesoscutellum essentially smooth and shiny. Propodeum and gaster sculpture weaker and more superficial than on head and thorax, and faintly shiny.

Dorsum of head with sparse appressed pubescence and sparse erect/suberect hairs. Clypeus with several pairs of long suberect/decumbent hairs. Mandible with shorter decumbent hairs in apical portion. Dorsum of mesosoma with appressed pubescence that is denser and longer than those on head; erect/suberect hairs generally absent on mesoscutum, but present on mesoscutellum; propodeum lacking such hairs. Petiole densely covered with erect hairs over surface. Gastral tergites covered with dense appressed pubescence; erect/suberect hairs few, many being confined to posterior portion of gaster; sternite without short pubescence but sparsely with longer appressed hairs. Antenna and legs covered with short appressed pubescence; longer hairs mostly confined to apices of scape, femora, tibiae, and tarsal segments. Body brown to dark reddish brown; legs and genitalia yellowish or light brown; maxillary and labial palpi yellowish.

Genitalia(Fig. 5A–F). Pygostyle clavate, long (about 0.2 mm), its apical one-third brown with dense erect hairs, while basal two-third narrow, whitish, without hairs. Abdominal sternite IX (subgenital plate) subtrapezoid, almost as long as broad; posterior margin of abdominal sternite IX weakly convex with median portion produced; ventral face of the segment, along posterior margin with several erect hairs; anterior margin of abdominal sternite IX roundly convex. Genital capsule slightly broader than long. Paramere in profile relatively large; telomerer narrow, long, truncate at apex, with clear articulation to basimere; telomere with dense erect hairs, hairs on its apex longer than elsewhere; basimere in profile large, almost as long as high, its outer face divided into two parts (upper and lower) by transverse suture. Volsella linear, dorsal, and ventral outlines sinuate; digitus short, its apex broadly convex, dorsal margin convex, while ventral margin feebly concave; ventral margin of volsella with ca. 20 long hairs. Valviceps in profile broad, broadened posteriorly, clearly longer than high; anteroventral corner weakly produced; ventral margin convex, serrated with over 20 denticles.

Habitat. *Polyrhachis halidayi* inhabits both primary (dry evergreen, mixed deciduous, hill evergreen) and disturbed forests from lowland to highland (250–1500m a.s.l.). Although Wong and Guénard (2020) reported these ants nesting sites as arboreal in-between leaves, our data show that the species use rotting wood on forest floor, dead bamboo stems, and twigs on trees as nesting sites.

Distribution. China (Wang & Wu 1991; Guénard & Dunn 2012; Liu *et al.* 2015; Wong & Guénard 2020), India (Bharti *et al.* 2016), Laos (Jaitrong *et al.* 2016), Myanmar (type locality; Emery 1889), Thailand (Jaitrong & Nabhitabhata 2005; Khachonpisitsak *et al.* 2020), and Vietnam (Yamane *et al.* 2002) (Fig. 10).

Remarks. *Polyrhachis halidayi* is similar to *P. quadrispinosa* **sp. nov.** and *P. lao* **sp. nov**. They share the scale-like petiole, with two acute spines projecting dorsolaterally, and two denticles in between. However, *P. halidayi* can be easily separated from the latter two by the propodeal spine, short and pointed upward (propodeal spine longer, subtriangular, pointed backward in the latter two); first gastral tergite with sparse standing hairs (without hairs in the latter two). *Polyrhachis halidayi* belongs to *Polyrhachis creusa* species group. It is similar to *P. creura* Emery, 1897. However, *P. halidayi* can be separated from *P. creura* by: 1) erect hairs on gastral tergites I and II (without hairs in *P. creura*); 2) weak or without striation on pronotum (distinct striation on pronotum in *P. creura*); anterior clypeal margin convex medially without denticles (feebly concave and serrate in *P. creura*).

Polyrhachis lao **Jaitrong & Yamane, sp. nov.**

(Figs. 1B, 6)

Polyrhachis shixingensis Wu & Wang, 1995: Khachonpisitsak *et al.* 2020: 74 (misidentification).

Types. Holotype worker (THNHM-I-00027051, THNHM), central Laos, Vientiane Province, Naxythong District, Sivilay Village, 18º15′′N, 102º27′E, 9.VI.2010, Sk. Yamane leg., LA10-SKY-021. Paratypes: 5 workers (THNHM-I-00027052 to THNHM-I-00027054, THNHM; SKY090610-1 to SKY090610-2, SKYC), same data as holotype; 8 workers (THNHM-I-00027055 to THNHM-I-00027062, THNHM), central Laos, Vientiane Province, Naxythong District, Sivilay Village, from dead wood, 9.VI.2010, W. Jaitrong leg., WJT10-LAO-42.

Non-type material examined. THAILAND. Three workers (THNHM-I-00027220), NE Thailand, Mukdahan Province, Khang Chang Neam District, mixed deciduous forest, honey baiting, P. Kosonpanyapiwat leg., P.34.

FIGURE 6. *Polyrhachis lao*, **sp. nov.** (holotype, THNHM-I-00027051). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

Measurements and indices (Holotype and paratypes, n = 10): TL 5.40–5.56, HL 1.40–1.80, HW_1 1.32–1.64, HW_2 1.64–1.80, SL 1.64–1.80, ML 1.84–2.20, PW 0.96–1.08, MTL 1.28–1.36, CI 90–94, SI 107–124.

Description of worker. Head in full-face view slightly longer than broad (CI 90–94) with posterior margin broadly convex, lateral margin weakly convex. Frontal lobe in full-face view narrow, not covering antennal socket. Frontal carina in profile view elevated, in full-face view weakly sinuate, and reaching level of mid-length of eyes; median line ill developed, attaining level of anterior margins of eye. Clypeus in full-face view broad and weakly convex, anteriorly broadly truncate with rugged anterior margin, posteriorly broadly convex with posteromedian

portion rather straight and medially weakly concave; in profile clypeus weakly convex, with well-marked median ridge. Mandible elongate-subtriangular, i.e., outer and inner margins only slightly diverging apicad; its masticatory margin with 5 distinct teeth (including smallest basal and largest apical teeth). Antennal scape clavate, relatively long, about 1.10–1.24 times as long as head width (SI 107–124) including eyes. Eye in full-face view weakly convex, located just anterior to posterolateral corner of head; its outer margin reaching lateral margin of head.

Mesosoma box-like, its dorsum distinctly marginate along entire length. Dorsum of pronotum flat, broader than long, distinctly narrowed posteriad, with anterolateral corner roundly convex and marginate, without any projection or spine; anterior margin gradually sloping to pronotal lobe; posterior margin shallowly emarginate; lateral face of pronotum in profile subtriangular. In dorsal view, mesonotum clearly longer than broad, lateral margin weakly convex; in lateral view mesopleuron flat, demarcated from metapleuron by distinct groove; lower portion of mesopleuron anteriorly with carinate free margin; metapleuron not clearly demarcated from lateral face of propodeum. Propodeal dorsum excluding spines almost as long as broad or slightly longer than broad, and distinctly concave; propodeum with long spines, in profile view almost as long as width at base and pointed backward. Petiole dorsally with two long lateral spines and two rudimentary median denticles.

Dorsum of head, clypeus, and antenna finely micropunctate; basal half of mandible micropunctate, apical half somewhat smooth and shiny; mesosoma and legs entirely micropunctate except for mesonotum (in some specimens) with imbricate-reticulate; lateral face of mesosoma slightly shiny compared with dorsum; gaster finely micropunctate.

Dozens of brown erect hairs present along anterior clypeal margin; 3–4 erect hairs present along each frontal carina; vertex with two erect hairs; mesosoma, petiole, and first gastral tergite without erect hairs; second to fourth gastral tergites with sparse short erect hairs; gastral sternites with sparse long hairs; tip of gaster with some hairs. Body black to dark brown; antennae and legs reddish brown.

Etymology. The specific epithet, *lao*, refers to its type locality in Laos.

Habitat. Lao specimens (colony WJT10-LAO-42) were collected from a plantation. The nest was in a dead wood hanging on a shrub.

Distribution. Laos and Thailand (Khachonpisitsak *et al.* 2020; referred to as *P. shixingensis*) (Fig. 10).

Remarks. *Polyrhachis lao* Jaitrong & Yamane, **sp. nov.** is most similar to *Polyrhachis halidayi*, from which the former is easily separated by the characteristics mentioned in the key. It is similar to the species of the *P. xiphias*-group in sharing the condition of median clypeal carina, but in the *P. xiphias*-group the dorsal ridge of the petiole between the lateral spines is entire, without median spines or denticles. Khachonpisitsak *et al.* (2020) treated this species as *Polyrhachis shixingensis* of the *P. xiphias*-group, a larger species recorded from China and Vietnam, but the treatment was based on misidentification. *Polyrhachis lao* is also similar to *P. quadrispinosa* Jaitrong & Noon-anant**, sp. nov.**; differences between the two species are given in the key.

Polyrhachis quadrispinosa Jaitrong & Noon-anant, sp. nov.

(Figs. 1A, 7, 8)

Types. Holotype worker (THNHM-I-00027172, THNHM), S Thailand, Trang Province, Palian District, Ban Li Phang, near Khai Ting Cave, rubber tree plantation, 7º9′35″N, 99º48′01″E, 19.V.2022, W. Jaitrong leg., TH22-WJT-155. Paratypes: 14 workers (THNHM-I-00027173 to THNHM-I-00027183 and THNHM-I-00027185 to THNHM-I-00027187, THNHM), 1 worker (SKY190522-1, SKYC) and 1 queen (THNHM-I-00027188, THNHM), same data as holotype.

Non-type material examined. THAILAND. One worker, W Thailand, Phetchaburi Province, Kaeng Krachan N.P., 20.VIII.2015, N. Noon-anant leg.(PSUSC), (1 worker (THNHM-I-00027248), S Thailand, Surat Thani Province, Ban Takhun District, Ratchaprapa Dam, canopy fogging, in 1994, L. Lebel leg. (THNHM); 1 worker (THNHM-I-0027249), same locality and collecting method, in 2010, N. Noon-anant leg. (THNHM); 1 worker, S Thailand, Phatthalung Province, Tamot District, Lan Mom Jui, 3.XII.2004, N. Noon-anant leg. (THNHM); 1 worker (THNHM-I-00027189, THNHM), S Thailand, Satun Province, Mueang District, Tarutao N.P., Talo Wow Station, evergreen forest, 6º39′39″N, 99º40′07″E, 90 m a.s.l., 7.III.2007, W. Jaitrong leg., WJT07-TH344 (THNHM); 1 worker (THNHM-I-00027250), S Thailand, Songkhla Province, Hat Yai District, canopy fogging, 19.XI.2001, N. S. Tongjerm leg., NN191101-01 (THNHM); 1 worker, S Thailand, Songkhla Province, Chang W.S., Ton Nga [= Ton Nga Chiang W.S.], 22.X.2011, Sk. Yamane leg. (SKYC). **MALAYSIA.** One worker, W Malaysia, Selangor, Ulu Gombak, 5.X. 2002, F. Ito leg. (SKYC).

FIGURE 7. *Polyrhachis quadrispinosa*, **sp. nov.** (holotype worker, THNHM-I-00027172). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

Measurements and indices (holotype and paratype workers, n = 10): TL 4.00–4.55, HL 1.45–1.70, HW_1 1.30–1.55, HW_2 1.40–1.65, SL 1.35–1.40, ML 1.60–1.85, PW 0.95–1.05, MTL 1.40–1.50, CI 89–97, SI 90–103. **Paratype queen**: TL 5.95, HL 1.95, HW_1 1.65, HW_2 1.80, SL 1.50, ML 2.55, PW 1.40, MTL 1.75, CI 85, SI 91.

Description of worker (Figs. 1A, 7). Head in full-face view almost as long as broad (CI 89–97) with posterior margin broadly convex. Frontal lobe in full-face view narrow, not covering antennal socket. Frontal carina in profile view elevated, in full-face view weakly sinuate, and reaching level of mid-length of eye. Clypeus in dorsal view broad and weakly convex, its anterior margin almost straight medially and posterior margin broadly convex but

very weakly concave medially. Mandible subtriangular, its masticatory margin with five distinct teeth (including smallest basal and largest apical teeth). Antennal scape clavate, relatively short, about 0.85–0.96 times as long as head width (SI 90–103) including eyes. Eye located just posterior to mid-length of head laterally, weakly convex, slightly protruding from the lateral margin of head.

Mesosoma box-like, its dorsum distinctly marginate laterally along entire length. Pronotum in dorsal view weakly convex, distinctly shorter than broad, anterior margin convex, posterior margin feebly concave, and anterolateral corner roundly convex, not produced as process or spine; lateral face of pronotum in profile subtriangular. In dorsal view mesonotum sub-trapezoidal, slightly shorter than broad and almost as long as pronotum; with mesosoma in profile view mesopleuron flat, divided into small upper portion and large lower portion by shallow impression; mesopleuron, metapleuron and lateral face of propodeum continuous, without any distinct suture between them. Propodeal dorsum excluding spines almost as long as broad, and shorter than mesonotum; propodeum with long spines, almost as long as petiolar spines, and pointed backward and slightly up curved. Petiole with 4 long spines dorsally (2 median spines slightly shorter than lateral spines); petiolar node (excluding spines) shorter than high; subpetiolar process indistinct.

Mandible, antenna, and clypeus finely micropunctate; head, mesosoma, and petiole entirely macropunctate, except for irregularly striate pronotum; propodeal spine entirely punctate; gaster finely micropunctate; legs micropunctate.

Entire body without erect hairs, except for a few hairs on mandibles, anterior clypeal margin and tip of gaster. Eye essentially without erect hairs. Body black; legs reddish brown.

Description of queen (Fig. 8). In general habitus including coloration and pilosity similar to worker except for caste-specific structures. Body slightly larger with head width including eyes 1.80 mm (1.50 mm in worker). Eye larger and more prominent; ocelli arranged in low triangle. Anterolateral corner of pronotal dorsum round, without any projection. Mesoscutum in dorsal view slightly shorter than broad, with parapsidal line in posterior half of its length; mesopleuron divided into upper and lower sections by groove; lower section about 2 times as large as upper section. Metanotum in dorsal view short ('narrow'), indented, sharply demarcated from propodeum by deep furrow; metapleuron barely differentiated from mesopleuron, completely fused with lateral face of propodeum; propodeal spines short, blunt; propodeal declivity concave. Spines on petiole distinctly shorter than in worker.

Etymology. The specific epithet, *quadrispinosa*, refers to the two pairs of (i.e., four) conspicuous spines on the petiole dorsum.

Habitat. The type series was collected from a dead twig hanging on a tree in a rubber tree plantation near a limestone cave.

Distribution. Thailand (Phetchaburi, Trang, Satun, and Songkhla Provinces); Malaysia (Ulu Gombak) (Fig. 10).

Remarks. *Polyrhachis quadrispinosa* Jaitrong & Yamane, **sp. nov.** is similar to *Polyrhachis cedarensis* Forel, 1915; *P. hexacantha* (Erichson, 1842); *P. ops* Forel, 1907; *P. phryne* Forel, 1907; and *P. sidnica* Mayr, 1866 (all from Australia) in having long propodeal spine and four long petiolar spines dorsally and lacking standing hairs on body. *Polyrhachis quadrispinosa* is easily distinguished from *P. cedarensis* by the following characteristics: 1) median spines on petiole shorter than lateral spines (slightly longer than lateral spines in *P. cedarensis*); 2) head macropunctate without striation (with longitudinal striation in *P. cedarensis*); 3) head round, posterolateral corner of head broadly convex (head subrectangular, posterolateral corner of head distinctly convex as in *P. cedarensis*). *Polyrhachis quadrispinosa* differs from *P. hexacantha* by 1) pronotum in dorsal view, with anterolateral corner roundly convex without process or spine (with distinct blunt spine in *P. hexacantha*); 2) pronotum punctate, with irregular striation (without striation in *P. hexacantha*); 3) propodeal spine entirely punctate (base of propodeal spine somewhat smooth and shiny in *P. hexacantha*). *Polyrhachis quadrispinosa* can be distinguished from *P. ops* by: 1) propodeal spine long, longer than broad at base (shorter than broad at base in *P. ops*); 2) head round (head subrectangular in *P. ops*); 3) with pronotum in dorsal view, anterolateral corner roundly convex without produced conner or spine (right-angled in *P. ops*). *Polyrhachis quadrispinosa* can be separated from *P. phryne* by the following characteristics: 1) pronotum in dorsal view, anterolateral corner roundly convex without produced corner or spine (with blunt angle in *P. phryne*); 2) head and mesosoma macropunctate (puncto-reticulate in *P. phryne*); 3) propodeal spine long, longer than its base (shorter than or about the same length of its base in *P. phryne*). *Polyrhachis quadrispinosa* is separated from *P. sidnica* by: 1) in dorsal view metanotal groove distinct (invisible in *P. sidnica*); 2) in profile propodeal spine straight (slightly curved upward in in *P. sidnica*); 3) head in full-face view, eye weakly convex, its outer margin slightly extending beyond lateral margin of head (distinctly convex, distinctly

extending beyond lateral margin of head in *P. sidnica*); 4) anterolateral corner in dorsal view roundly convex, not produced as process or spine (produced as a short tooth or denticle in *P. sidnica*).

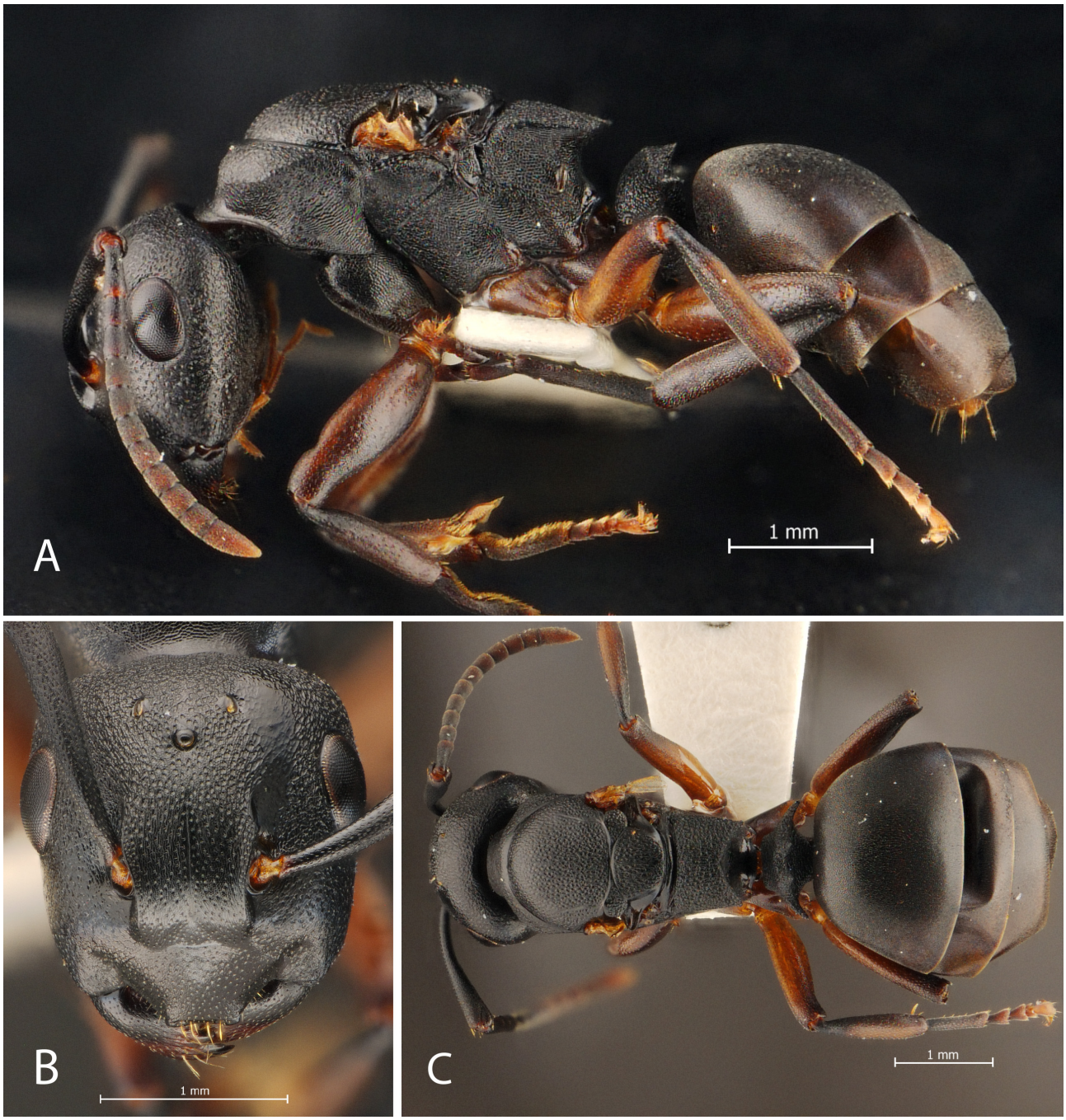

FIGURE 8. *Polyrhachis quadrispinosa*, **sp. nov.** (paratype queen, THNHM-I-00027188). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

Polyrhachis sukarmani **Kohout, 2007**
(Figs. 1D, 9)

Polyrhachis sukarmani Kohout, 2007: 14, figs. 2, 11, 12 (w.q.). Type locality: East Malaysia, Sabah, Meliau Range (ITBC-USM 2004 Exp.).

Types. Holotype, 12 paratype workers, and 1 queen from East Malaysia, Sabah, Meliau Range, 05º49′N, 117º07′E, 95m, VIII. 2004, Sukarman & Sarina (BMNH, images available on Antweb were examined).

Non-type material examined. THAILAND. One worker, S Thailand, Chumphon Province, Pathio District, unknown date, N. Noon-anant leg.; 1 worker (THNHM-I-00027251, THNHM), S Thailand, Phatthalung Province, Tamot District, 3.XII.2004, N. Noon-anant leg.; 1 worker (THNHM-I-00027252, THNHM), S Thailand, Nakhon Si Thammarat Province, Tha Sala District, Khao Nan N.P., 8º46′1″N, 99º48′16″E, 10.VII.2006, S. Jantarit leg.

FIGURE 9. *Polyrhachis sukarmani* (non-type worker, THNHM-I-00027252). **A.** Body in profile view; **B.** head in full-face view; **C.** body in dorsal view.

Measurements and indices. Workers (n = 2): TL 5.44–5.60, HL 1.48–1.52, HW_1 1.32–1.36, HW_2 1.44–1.48, SL 1.48, ML 1.84–1.88, PW 1.16–1.20, MTL 1.44–1.48, CI 89, SI 109–112.

Description of worker. Head in full-face view slightly longer than broad (CI 89) with posterior margin broadly convex; lateral margin of head in front of eye weakly convex, behind eye rounding abruptly into weakly convex posterior margin. Clypeus in full-face view broad with median portion weakly convex; anterior clypeal margin broadly truncated medially, truncate portion with obtusely angulate lateral corner; posterior margin clearly demarcated from frons by suture that is medially concave; lateral margin indicated by clearly defined line breaking sculpturation; with clypeus in profile dorsal outline almost straight with blunt median carina. Frontal lobe in full-face view narrow, not covering antennal socket. Frontal carinae in profile sinuate, medially with margins weakly raised, posteriorly somewhat converging; area between frontal carinae broad, very weakly convex medially with median line short and obsolete. Eyes located just anterior to posterolateral corner of head, distinctly convex, in full face view clearly breaking lateral cephalic margin. Antennal scape clavate, relatively long, about 1.00–1.03 times as long as head width (SI 109–112) including eye. Mandible subrectangular, with almost parallel inner and outer margins; its masticatory margin with 5 distinct teeth (including smallest basal and largest apical teeth).

Mesosomal dorsum with deeply impressed promesonotal suture and metanotal groove. Pronotal dorsum much broader than long; anterior margin weakly convex, equipped with carina that is interrupted medially where dorsum gradually sloping to pronotal lobe (pronotal collar); anterolateral corner of pronotum distinctly angled; lateral margins also carinate, weakly convex; posterolateral corner rounded; mesonotum broader than long, distinctly narrowed posteriad, with lateral margin carinate. Propodeal dorsum transverse, lateral margins posteriorly terminating in small, upturned processes that are connected by continuous transverse carina separating propodeal dorsum from relatively high, virtually vertical declivity. Petiole scale-like, rather slim in profile and narrow in dorsal view, dorsal margin in posterior view arcuate, obtusely angular laterally, without spines. Anterior face of first gastral segment concave, rounding onto dorsum of the tergite, which has broadly rounded anterolateral corner.

Clypeus and area between frontal carinae anteriorly reticulate-punctate; dorsum of head and vertex distinctly, more-or-less regularly, longitudinally striate; temple and gena irregularly sculptured. Mandible finely, mostly longitudinally striate with numerous piliferous pits. Pronotal and propodeal dorsa rather regularly, longitudinally striate with striae on mesonotum distinctly converging posteriorly; lateral faces of mesosoma and petiole finely reticulate. Gaster very finely shagreened. Clypeus along anterior margin with dozens of brown standing hairs; along each frontal carina 3–4 hairs present; vertex with 2 standing hairs; mesosoma, petiole, and first and second gastral tergites without standing hairs; third to fifth gastral tergites with few standing hairs; gastral sternites with sparse long hairs. Head, mesosoma and petiole black; antenna, legs and gaster rather dark to reddish brown.

Habitat. *Polyrhachis sukarmani* inhabits lowland evergreen forests. Most specimens were collected using canopy fogging method from high trees (ca. 30 m above ground level), while some were collected from the lower vegetation (1.5–2.0 m above ground level).

Distribution. Thailand (**new record**), Malaysia (Sabah, Kohout 2007), and Indonesia (Kalimantan, Kohout 2007) (Fig. 10).

Remarks. *Polyrhachis sukarmani* is somewhat similar to *Polyrhachis reidi* Kohout, 2007 from E Malaysia (Borneo, Sabah), both having the dorsum of the head and mesosoma rather regularly, longitudinally striate. However, *P. sukarmani* can be separated from *P. reidi* by the following characteristics: body smaller (HL < 1.75 in *P. sukarmani* versus HL > 2.34 in *P. reidi*); pronotum in dorsal view distinctly transverse, broader than long (almost as long as broad in *P. reidi*); propodeal junction right angled (obtuse in *P. reidi*). Kohout (2013a) did not place *P. sukarmani* and *P. reidi* in any species groups.

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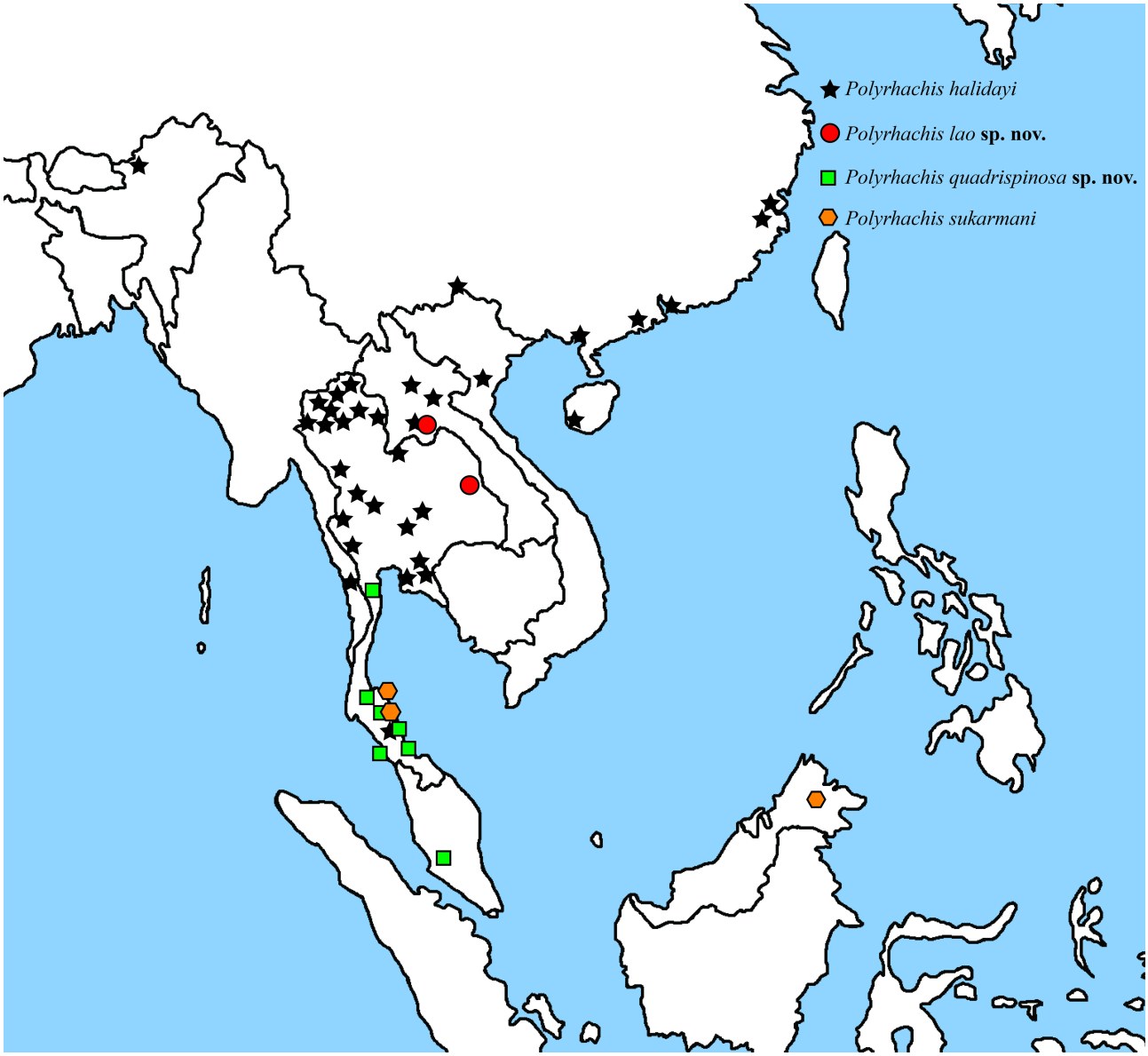

FIGURE 10. Distribution of *Polyrhachis* subgenus *Campomyrma* in Thailand and Laos (Based on material examined), and surrounding countries (Based on literature).

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