

A new species of the paper wasp genus *Ropalidia* Guérin-Méneville, *plebeja* group (Hymenoptera, Vespidae, Polistinae), from Vietnam

Hoa Thi Quynh Bui^{1,2}, Thai Van Mai³, Lien Thi Phuong Nguyen^{1,4}

1 Graduate University of Science and Technology, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Road, Nghia Do, Cau Giay, Hanoi, Vietnam **2** Department of Natural Science and Technology, Tay Nguyen University, Buon Ma Thuot 6300, Dak Lak, Vietnam **3** Vietnam National Museum of Nature, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Road, Nghia Do, Cau Giay, Hanoi, Vietnam **4** Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Road, Nghia Do, Cau Giay, Hanoi, Vietnam

Corresponding author: Lien Thi Phuong Nguyen (phuonglientit@gmail.com)

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Abstract

A new species, *Ropalidia daklak* Bui, Mai & Nguyen, **sp. nov.**, belonging to the *plebeja*-group of the genus *Ropalidia* Guérin-Méneville, 1831 is described and figured based on females and males from Vietnam. The nest structure of the new species is described, and an updated key is provided to all known species of the group.

Keywords

Nest, new species, Polistinae, *R. plebeja* group, Vespidae, Vietnam

Introduction

The social wasp genus *Ropalidia* Guérin-Méneville, 1831, is one of the largest genera among the social wasps, consisting of about 180 extant species (Kojima and Carpenter 1997). Given the considerable diversity, several publications have organized the species within the genus, either as formal subgenera or informal species-groups (Richards 1978; Kojima 1997, 2001). Currently, several species-groups have been proposed (Kojima 2001), with

the *R. plebeja* group being a notable one. The *R. plebeja* group has hitherto contained six species: *Ropalidia andamanensis* Das & Gupta, 1989, *R. celebensis* van der Vecht, 1941, *R. cristata* Kojima, 1989, *R. plebeja* (de Saussure, 1862), *R. rufoplagiata* (Cameron, 1905), and *R. turneri* Richards, 1978 (Kojima et al. 2002). The defining character for this species group is the morphology of first metasomal tergum: barely petiolate basally and abruptly swollen dorsally at the posterior end of the basal slit (Kojima 2001; Kojima et al. 2002). The most recent publication on the *R. plebeja* group by Kojima et al. (2002), described the males, larvae, and nests of some species in this group, such as *R. plebeja*, *R. celebensis*, and *R. rufoplagiata*, along with a key to all of the species. In Vietnam, only one species in this species group, *R. rufoplagiata*, has been recorded previously (Nguyen et al. 2006).

In present work, based on specimens deposited in the Institute of Ecology and Biological Resources, Hanoi, Vietnam (IEBR), one species of the *R. plebeja* species group is described as new to science. In addition, an updated key is provided to all known species in the group.

Material and methods

The material examined in the present study is deposited in the collections of the Institute of Ecology and Biological Resources (IEBR), Hanoi, Vietnam. Adult morphological and color characters were observed on pinned specimens with the aid of a stereomicroscope. The male terminal sterna and genitalia were dissected out, cleared in KOH, and mounted on hand-washing gel for observation and taking photos with the stereomicroscope. Terminology for male genitalia follows that of Kojima (1999). Measurements of body parts were made with an ocular micrometer attached to the stereomicroscope, with accuracy to 0.1 mm. Nest characters were examined after the nest had been air-dried (see Figs 18, 19), and the terminology of Wenzel (1998) was used for nest characters. Photographs of the nest were taken in the field (Fig. 10) and after further development of the offspring in the lab (Figs 18, 19; note the difference in the number of cells with cocoon caps). Photographic images of the wasps were obtained using a Nikon SMZ 800N Digital StereoMicroscope with ILCE-5000L/WAP2 digital camera attached, using Helicon Focus 7 software for stacking; the plates were edited with Photoshop CS6. The abbreviations F, S, and T (I, II, III, ...) refer to numbered flagellomeres, metasomal sterna, and metasomal terga, respectively.

Systematics

Ropalidia daklak Bui, Mai & Nguyen, sp. nov.

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Figs 1–19

Material examined. Holotype (deposited in IEBR): VIETNAM: • ♀; Dak Lak province, Krong Ana, Dray Sap; 12°32'53.5"N, 107°58'27.9"E; 19 Jun. 2020; Bui TQH leg.;

Nest#VN-TN-2020-R-01; QHoa-A11-12. **Paratype** (deposited in IEBR): VIETNAM:
• 3 ♂♂, 8 ♀♀, same data as holotype.

Diagnosis. This species can be distinguished from other species in the *R. plebeja* group by the following combination of characters: pronotal carina raised into thin lamella but somewhat weaker at dorsal part; vertex weakly sloping down to occipital carina behind posterior ocelli; epicnemial carina absent, border between punctured posterodorsal and unpunctured anteroventral areas of mesepisternum well-defined; disc of mesoscutellum flat, in lateral view mesoscutellum smoothly passing into mesoscutum; median concavity of propodeum deep and wide, with distinct lateral edges; TI with posterior lamella depressed, wide and flat; TII dorsally with lateral margins abruptly diverging in basal third, then almost parallel to near apical margin. In female, head in frontal view 1.2 times as wide as high; distance between posterior ocelli about 2.2 times as long as their diameter. In male, antennal scape about 2.45 times as long as wide; digitus gradually widened from base to near apex, then abruptly curved to a sharp point at apex; penis valves short, slightly more than half as long as basal apodeme.

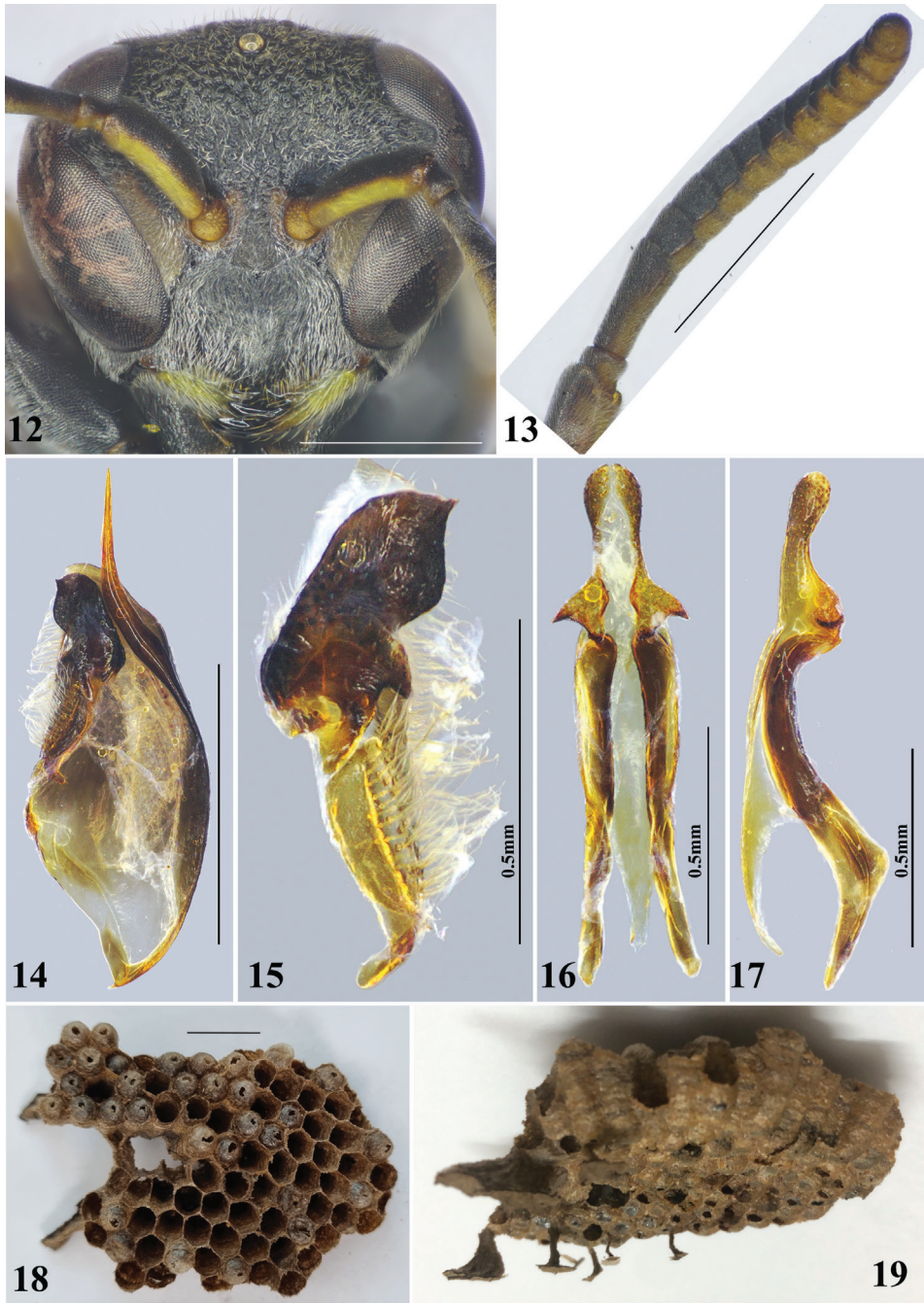
Description. Female (Fig. 10). Body length (head + mesosoma + first two metasomal segments) 8.14–10.62 mm (holotype: 9.22 mm); forewing length 6.8–8.5 mm (holotype: 8.08 mm).

Head black; clypeus yellow to orange, dorsal margins black, with two black spots medially; spot at inner orbit close to clypeus and spot between antennal toruli (usually separated into paired smaller spots) brown; ill-defined spot above yellow spot at inner orbit, central spot behind posterior ocelli (usually absent), and most of gena (sometimes reduced to posterior band narrowing ventrally) reddish-brown; mandible brown in apical half, ivory white basally. Antenna brown to dark brown, but yellowish beneath. Mesosoma black; pronotum reddish-brown, except black pronotal collar and yellow band along carina. Tegula brown; mesoscutum black with two triangular orange spots at anterior margin; disc of mesoscutellum dull orange with black anterior margin and yellow to light brown posterior margin, metanotum yellow, propodeum black, propodeal teeth and propodeal valvula brown. First metasomal segment reddish-brown, with wide, pre-apical yellow band on tergum (sometimes interrupted medially on tergum); second metasomal segment black, thin lamella brown; third to sixth metasomal segments black. Legs reddish-brown; coxae black with a yellow spot; trochanters black basally; femora black basally. Wings hyaline, with subapical blackish cloud; pterostigma yellowish-orange; veins brown.

Body covered with appressed tomentum and dense, suberect, silvery setae; setae longer on apical part of clypeus and apical margin of propodeum than on other body parts. Clypeus with sparse, shallow punctures; frons with dense, deep punctures, interspaces between punctures much narrower than their diameters; vertex less densely punctured, interspaces between punctures narrower than their diameters; punctures on gena large, sparse, shallow, interspaces between punctures wider than their diameters. Pronotum, mesoscutum, metapleuron, and lateral surfaces of propodeum with dense punctures as on frons; punctures on mesoscutellum and metanotum slightly larger, with interspaces slightly wider than those on mesoscutum; posterior margin of metanotum impunctate and polished; median concavity of propodeum with fine, transverse



Figures 1–11. *Ropalidia daklak* sp. nov. **1–10** female **1** head, frontal view **2** head, dorsal view **3** antenna **4** gena **5** mesosoma, dorsal view **6** mesosoma, lateral view **7** propodeum **8** metasoma, dorsal view **9** metasoma, lateral view **10** habitus **11** nest (photo was taken on 19 June 2020). Scale bars: 1 mm.



Figures 12–19. *Ropalidia daklak* sp. nov. **12–17** male **18, 19** nest (photos were taken on 12 March 2023) **12** head, frontal view **13** antenna **14** inner aspect of paramere with digitus and volsella **15** digitus **16, 17** aedeagus (**16** ventral view **17** lateral view) **18** nest, view from cell opening **19** nest, beneath. Scale bars: 1 mm (**12–14, 18**); 0.5 mm (**15–17**).

striae; dorsolateral surface of propodeum with distinct and oblique striae. First metasomal tergum impunctate on anterior surface, with ill-defined punctures preapically; punctures on second metasomal tergum relatively large, their interspaces smaller than their diameters; punctures on second sternum similar to those on second tergum.

Head: In frontal view (Fig. 1) about 1.13 times as wide as high; in dorsal view (Fig. 2) about 2.5 times as wide as long, with gena slightly convex and distinctly narrowing posteriorly. Distance between posterior ocelli 2.25 times as long as their diameter, about 0.59 times as long as distance between posterior ocellus and inner compound eye margin; area between ocelli slightly raised. Vertex (Fig. 2) weakly sloping down to occipital carina. Inner compound eye margins converging ventrally; distance between them at vertex nearly 1.25 times as wide as at clypeus. Clypeus weakly convex, pointed below, transverse, nearly 1.53 times as wide (excluding lateral lobes) as high (measured from bottom of dorsal emargination to apex). Mandible normal, not twisted. Gena (Fig. 4) in profile weakly widening ventrally to level of compound eye mid-height, then slightly narrowing further ventrally, about 1.26 times as wide as compound eye; occipital carina complete, fine, smoothly and weakly curved. Malar space short, about 0.70 times as wide as diameter of antennal torulus. Antenna as in Fig. 3; scape slightly curved, slightly more than 3.60 times as long as wide; flagellum weakly thickened apically to FIX; FI about 2.71 times as long as its own apical width, about 1.41 times as long as FII and FIII combined; each of FII to FIX wider than long; FIX slightly more than 1.46 times as wide as FI; FX nearly bullet-shaped, about 1.1 times as wide as long.

Mesosoma: Rather thick, about as long as thorax, and as wide as mesoscutum between tegulae. Pronotum (Fig. 5) in dorsal view with anterior margin weakly rounded; lateral sides slightly concave and weakly diverging posteriorly; pronotal carina complete, raised into low lamella, barely sinuate at humeral angles. Mesoscutum strongly convex, about as long as wide (Fig. 5). Disc of mesoscutellum trapezoidal, nearly flat, with lateral margins truncate. Disc of metanotum weakly produced posteromedially, nearly on same level of mesoscutellum (Fig. 6), with fine lateral marginal carinae. Concavity on posterior surface of propodeum (Fig. 7) deep and wide, its margins marked laterally by ridges; posterior surface broadly angled at two-thirds anteriorly of propodeum; propodeal orifice rounded above, about 1.65 times as long as wide; propodeal valvula small (most of propodeal tooth visible in lateral view), with broadly rounded triangular outline and marginal carina at base.

Metasoma: First metasomal segment short, TI in dorsal view (Fig. 8) strongly widened after short, basal, parallel-sided part, then almost not constricted near apical margin; maximum width of posterior widened part nearly 3.27 times as wide as width of basal, parallel-sided part; in profile (Fig. 9) abruptly swollen dorsally at posterior end of basal slit, then dorsal margin weakly and broadly convex and broadly curved down to posterior lamella near apical margin, posterior lamella depressed, wide and flat, in dorsal view barely narrowing posteriorly near posterior margin; sternum emarginate posteriorly. Second metasomal segment about 1.06 times as long as wide, about 2.06 times as wide as maximum width of first tergum; suture between TII and SII barely visible; posterior lamella narrow, weakly depressed.

Male. Similar to female except as follows: Body length (head+mesosoma+first two metasomal segments) 8.32–9.22 mm; forewing length 6.84–8.04 mm.

Coloration generally as in female, but markings partly reduced or absent: head black, clypeus entirely black, spot at inner orbit and spot between antennal sockets light-brown, mandible dark brown with a large yellow mark in the middle, mesosoma entirely black, propodeum black with short narrow yellow band, tegulae pale yellow, first metasomal segment (Fig. 13) orange with wide, yellow band on pre-apical tergum (sometimes interrupted medially on tergum).

Head: In frontal view relatively wider than in female (Fig. 12), about 1.26 times as wide as high; compound eye slightly more swollen laterally; inner compound eye margins more strongly converging ventrally than in female, their distance at vertex about 1.43 times as long as that at clypeus; clypeus less produced below, about 1.54 times as wide as high; gena in profile proportionally slightly wider than in female, about 1.27 times as wide as compound eye; posterior ocelli more widely separated from each other, distance between them about 0.58 times as long as distance from posterior ocellus to inner compound eye margin, area around ocellus strongly elevated. Mandible with deep and wide emargination between dorsal first and second teeth. Antennal (Fig. 13) scape short, thick, swollen medially, about 2.45 times as long as wide; flagellum much less strongly swollen apically, widest at FVII, then weakly narrowed apically; FXI rounded apically, nearly 0.67 times as long as its own basal width; apical third of FI, FII to FX, and basal half of FXI with longitudinal ridge-like tyloids.

Genitalia: As in Figs 14–17. Parameral spine lacking setae. Volsella flattened, strongly spatulate, and wide in inner aspect (Fig. 14). Digitus gradually widened from base to near apex, then abruptly curved to a sharp point at apex (Fig. 15). Penis valves short, slightly more than half as long as basal apodeme (about 0.51 times as long as basal apodeme); in ventral view proximal part strongly produced laterally into fin-like shape (Fig. 16); apical part curved ventrally in profile (Fig. 17); proximal margin without teeth.

Nest (Figs 11, 18, 19; note that the photos of the nest were taken on different dates). One nest (Nest#VN-TN-2020-R-01, QHoa-A11-12) together with nine females and three males was collected in Dray Sap, Krong Ana, Dak Lak Province, at 12°32'53.5"N, 107°58'27.9"E on 19 June 2020. The nest was found in a pepper (*Piper nigrum* L.) and coffee (*Coffea robusta* Chev.) tree garden, with 5 to 6 year old pepper and 15 year old coffee plants. The nest was constructed on the leaf of a pepper tree about 1 m from the ground, which was under the shade of a large coffee tree. It was horizontally attached to the dorsal surface of the dried pepper leaf. It had one main terminal and seven smaller pedicels (Figs 18, 19). The length of the main pedicel was 5.2 mm, the width was 12.16 mm. The lengths of seven smaller pedicels ranged from 4.0 mm to 6.88 mm and the widths from 2.06 mm to 7.36 mm. The color of the nest was light brown with dark brown and white bands interleaved, indicating that the nest was made from different material sources. The nest carton was brittle, made from small chips of plant fiber mixed with a small amount of oral secretion. The nest was under construction with 86 completed cells and eight unfinished cells. Among 86 cells, 20 cells had larvae, there were no egg cells, and 32 cells had cocoon caps. The outer cells

were elliptical or rounded, with an average depth and diameter of 8.1 mm ($n = 12$, range 6.12–11.48 mm) and 4.1 mm ($n = 12$, range 3.38–4.82 mm), respectively. The cells inside were hexagonal in section, average depth and diameter of cell with cocoon caps were 10.43 mm ($n = 19$, range 9.02–12.78 mm) and 4.55 mm ($n = 12$, range 4.2–4.88), respectively; non-cocoon cap cells were usually shorter than cells with cocoon caps, with depths ranging from 8.54 to 11.18 mm, and side to side diameters from 3.92 to 4.78 mm. The cocoon cap was light brown, and became dark brown with time, and was strongly convex.

Distribution. Vietnam (Tay Nguyen highland).

Etymology. The specific epithet refers to the name of the province where the holotype was collected.

Remarks. The new species is compared with *R. rufoplagiata* based on the description of Kojima et al. (2002) and the one specimen of this species from Vietnam. The new species comes close to *R. rufoplagiata* in the following characters: medial concavity of propodeum deep and wide, with distinct lateral edges; metanotum slightly produced medioposteriorly; penis valves short, slightly more than half as long as basal apodeme; first metasomal tergum in profile relatively weakly swollen dorsally in posterior half with posterior lamella depressed and flattened. It is differentiated by: mesoscutellum in lateral view smoothly passing to mesoscutum (strongly convex at the anterior margin in *R. rufoplagiata*); gena of female in profile wider than compound eye, about 1.26 times as wide as the compound eye (about 0.9 times as wide as the compound eye in *R. rufoplagiata*), distance between posterior ocelli 2.2 times as long as their diameter (slightly more than twice in *R. rufoplagiata*); clypeus of male about 1.54 times as wide as high (1.4 times as wide as high in *R. rufoplagiata*), distance between posterior ocelli about 0.58 times as long as distance from posterior ocellus to inner compound eye margin (0.85 times in *R. rufoplagiata*), antennal scape about 2.45 times as long as wide (slightly less than 3 times as long as wide in *R. rufoplagiata*), digitus gradually widened from base to near apex, then abruptly curved to a sharp apex (digitus gradually narrowed from midlength to apex, with a bluntly pointed apex in *R. rufoplagiata*) [the characters of the male of *R. rufoplagiata* were taken from Kojima et al. (2002)].

Ropalidia rufoplagiata (Cameron, 1905)

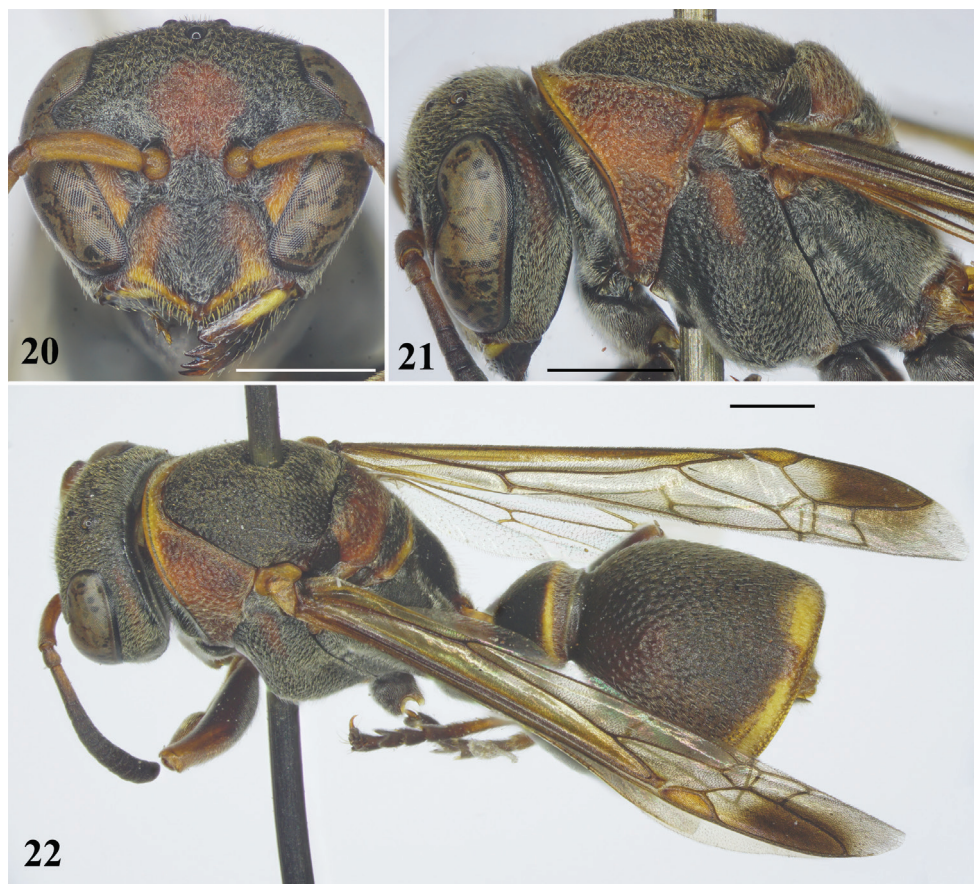
Figs 20–22

Icaria rufoplagiata Cameron, 1905: 71, ♂, ♀, “Tjandi near Semarang”; van der Vecht 1941: 167 [designation of lectotype].

Ropalidia rufoplagiata (Cameron): van der Vecht 1941: 111, 165.

Material examined. VIETNAM: • ♀; Hai Phong, Cat Ba national park; 18.Jul.2003, Nguyen TPL leg.

Distribution. India; China; Myanmar; Thailand; Malaysia; Vietnam; Taiwan.



Figures 20–22. *Ropalidia rufoplagiata*, female. 20. Head, frontal view. 21. Mesosoma, lateral view. 22. Habitus. Scale bars: 1 mm.

Key to species of the *Ropalidia plebeja* group

This key is based on the one by Kojima et al. (2002) (unless the sexes are specified, the characters given in the key can be applied to both sexes). From couplet 1 to couplet 4, follow the key by Kojima et al. (2002), and then use the following modified couplets:

- 5 Median concavity of propodeum deep and wide, with distinct lateral edges; metanotum slightly produced medioposteriorly **6**
- Median concavity of propodeum shallow and narrow, without distinct lateral edges; metanotum not produced medioposteriorly ***R. andamanensis***
- 6 Gena of female in profile about 0.9 times as wide as compound eye; distance between posterior ocelli slightly more than twice as long as their diameter; clypeus of male about 1.4 times as wide as high; antennal scape slightly less

- than 3 times as long as wide; digitus gradually narrowed from midlength to apex, with a bluntly pointed apex.....*R. rufoplagiata*
- Gena of female wider than compound eye; distance between posterior ocelli about 2.2 times as long as their diameter; clypeus of male greater than 1.5 times as wide as high; antennal scape about 2.45 times as long as wide; digitus gradually widened from base to near apex, then abruptly curved to a sharp-pointed apex *R. daklak* **sp. nov.**

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