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# ZOOTAXA

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## The ant genus *Pheidole* Westwood, 1839 (Hymenoptera: Formicidae) in Madagascar—taxonomic revision of the *bessonii* species-group

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## Abstract

The present study represents a taxonomic revision of the *P. bessonii* species-group from Madagascar. Eighteen members of this group are recognized and described, and an illustrated identification key to this group is also presented. One name is raised to species level: *P. decollata* Forel, 1892 **stat. nov.** We also redescribe worker castes and designate lectotypes for *P. bessonii* Forel, 1891, *P. decollata* Forel, 1892, *P. grallatrix* Emery, 1899, *P. madecassa* Forel, 1892, and *P. oswaldi* 1891. The following 13 new species are described: *Pheidole antsahabe* **sp. nov.**, *Pheidole atsirakambiaty* **sp. nov.**, *Pheidole clara* **sp. nov.**, *Pheidole flammea* **sp. nov.**, *Pheidole flavodepressa* **sp. nov.**, *Pheidole mantadioflava* **sp. nov.**, *Pheidole maro* **sp. nov.**, *Pheidole ovalinoda* **sp. nov.**, *Pheidole similis* **sp. nov.**, *Pheidole tenebrovulgaris* **sp. nov.**, *Pheidole uranus* **sp. nov.**, *Pheidole voreios* **sp. nov.**, *Pheidole zirafy* **sp. nov.**

**Key words:** endemic species, Malagasy region, Myrmicinae, taxonomy

## Introduction

The hyper-diverse ant genus *Pheidole* Westwood, 1839 is recognized as one of the five dominant ant genera of Madagascar. Together, *Camponotus*, *Hypoponera*, *Strumigenys*, *Tetramorium*, and *Pheidole* account for more than 50% of the estimated ant species on the island (Fisher & Peeters 2019). Despite the unquestionable abundance and diversity of those genera on Madagascar, their taxonomy had long been in a deficient state. Thanks to series of recent taxonomic studies on the diversity of *Strumigenys* (Fisher 2000), *Camponotus* (Rakotonirina *et al.* 2016, 2017; Rakotonirina & Fisher 2018; Rasoamanana *et al.* 2017) and *Tetramorium* (Hita Garcia & Fisher 2011, 2012a, 2012b, 2014, 2015), our understanding of these lineages on the island is much better. The first species-group division for the Malagasy members of *Pheidole* was proposed by Salata & Fisher (2020a). In the same publication they also reviewed 11 species-groups, redescribed 6 species, and described 46 taxa new to science. In the following publication, a taxonomic revision of the *sikorae* group, Salata & Fisher (2020b) redescribed 3 species and described an additional 41 new to science. Based on the most recent data (Salata & Fisher 2020a, 2020b), there are 106 valid

species and subspecies of *Pheidole* on Madagascar. However, the number is still incomplete and is expected to increase with forthcoming revisions of the *fervens*, *megacephala*, and *lucida* species groups.

Below we present a taxonomic revision of the *bessonii* species-group. Most members of the group can be recognized by these characters: the minor workers have a distinct occipital collar and an elongated head and body (e.g., Figs 12A, C, 14A, C, 26A, C); the major workers have a sub-rectangular head, a distinct tubercle-like mesonotal process, and shagreened gaster (e.g., 21B, D, 23B, D, 26B, D). An elongated head with a more or less developed neck is also known for *Camponotus jodina* Rasoamanana, Csösz & Fisher, *C. karaha* Rasoamanana, Csösz & Fisher, *Aphaenogaster gonacantha* (Emery), and *Aphaenogaster swammerdami* Forel, all of which share their distribution range with *P. grallatrix* Emery and *P. zirafy* **sp. nov.** The long neck may represent an adaptation to environmental conditions or mimicry between these genera. Major and minor workers of the *bessonii* group are morphologically reminiscent of the *comata-singaporensis* complex (= *longipes* in Salata & Fisher 2020a), which could suggest an Indo-Australian origin. However, the elongated occiput of minor workers is known among some Neotropical species as well, e.g. *P. ajaxigibba* Longino, *P. fiorii* Emery or *P. leonina* Wilson.

The *bessonii* group is moderately large and consists of 18 species, of which 13 are new to science. Six members of the group are very common across most of the island while the remaining 12 have a more restricted distribution mostly concentrated on the northern and north-eastern parts of the island. We also agree with comments proposed by Fischer & Fisher (2013) in recognizing *P. ragnax* Fischer & Fisher, described and known only from Reserve Forestière Sohoa on Mayotte, as a member of the *bessonii* species-group. This categorization affords the group a Malagasy distribution.

## Materials and methods

The majority of the material was collected by Brian L. Fisher and members of the Madagascar Biodiversity Centre from across Madagascar between 1991 and 2018. The study was additionally supported with material deposited in the Museum d'Historie Naturelle, Geneva, Switzerland.

**Repositories.** Collections are referred to by the following acronyms:

**CASC**—California Academy of Sciences, San Francisco, California, USA;

**MSNG**—Natural History Museum, Genoa, Italy;

**MHNG**—Museum d'Historie Naturelle, Geneva, Switzerland;

**PBZT**—Parc Botanique et Zoologique de Tsimbazaza, Antananarivo, Madagascar.

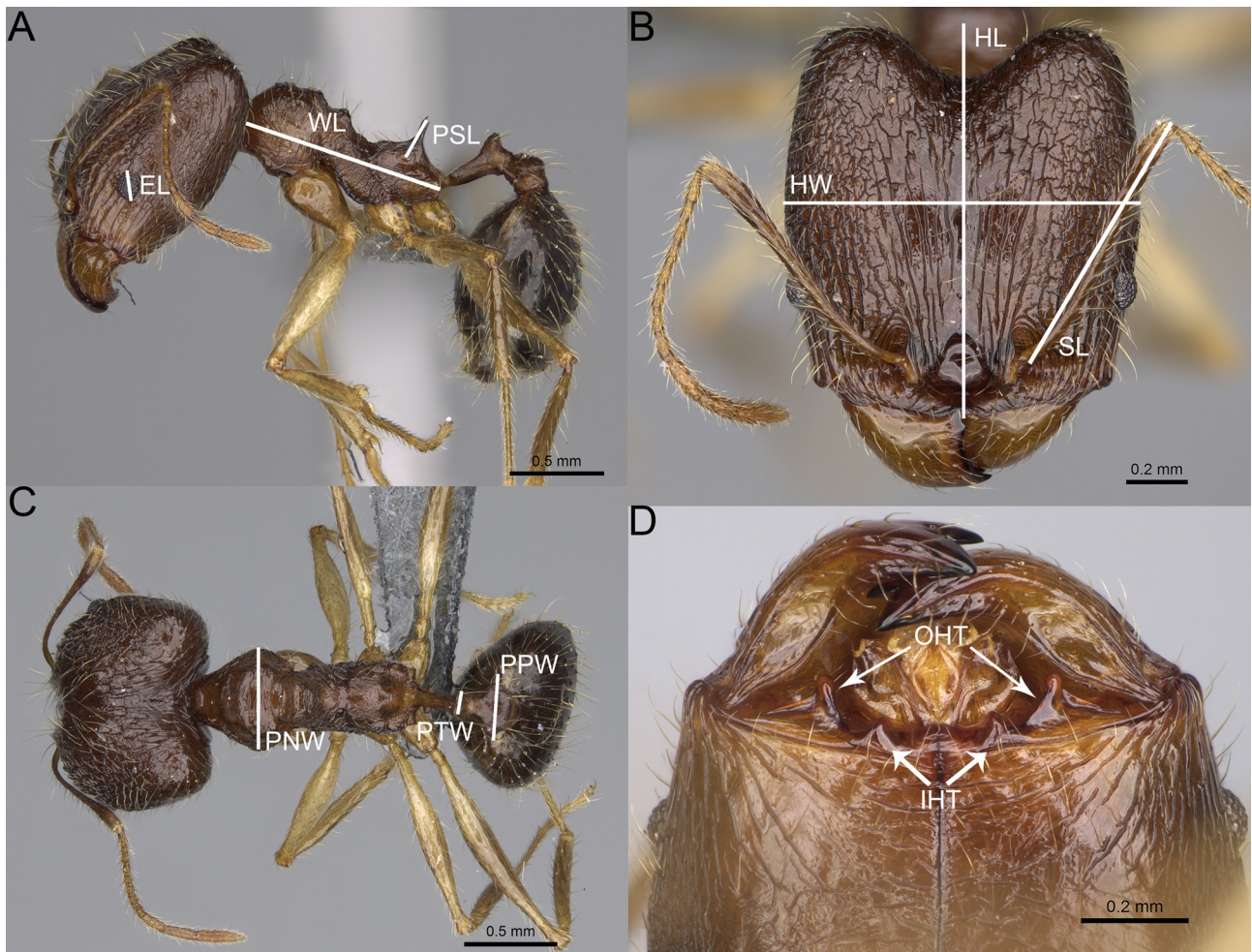
All observations and measurements were taken using a pin-holding stage, permitting rotations around the X, Y, and Z axes at magnifications from 32× to 100× with a Leica MZ12.5 microscope and an orthogonal crosshair micrometer, at an accuracy of 0.01 mm to approximately 0.005 mm. All measurements are presented in mm as minimum and maximum values with the arithmetic mean in parentheses. Photographs were taken using a JVC KY-75 or Leica DFC450 digital camera with a Leica Z16 APO microscope and Leica Application Suite software (v3.8). Unless stated otherwise, photographs were taken by Michele Esposito. Images of specimens and full data of all pinned specimens examined in the present contribution are available online at AntWeb ([www.AntWeb.org](http://www.AntWeb.org)). Type specimens are accessible using the unique CASENT identifying specimen code. Measurements and indices are in line with Salata and Fisher 2020 and are mostly the same as in Longino (2009, 2019) and several other revisions (Eguchi 2008; Fischer *et al.* 2012; Fischer and Fisher 2013; Wang *et al.* 2018). The general morphological terminology follows Wilson (2003) and Longino (2009, 2019).

As older taxa are often insufficiently characterized by their original describers, diagnoses are provided in the re-descriptions for *P. bessonii*, *P. decollata*, *P. grallatrix*, *P. madecassa*, and *P. oswaldi* to make identifications easier.

Pilosity inclination degree follows that used in Wilson (1955). Appressed (0–5°) hairs run parallel or nearly parallel to the body surface. Decumbent hairs stand 10–40°, subdecumbent hairs stand ~45° from the surface, suberect hairs bend about 10°–20° from vertical, and erect hairs stand vertical or nearly vertical.

Maps were generated using the tmap v2.2 package on R v3.5. R Core Team (Tennekes 2018).





**FIGURE 1.** *Pheidole flammea* sp. nov., illustrations of measurements (A–C). A. Profile. B. Full-face view. C. Dorsal view. D. Inner hypostomal tooth (IHT) and outer hypostomal tooth (OHT).

## Measurements and Indices

### Measurements

**EL**—eye length; measured along the maximum vertical diameter of the eye;

**HL**—maximum distance from the midpoint of the anterior clypeal margin to the midpoint of the posterior margin of the head, measured in full-face view; in majors from midpoint of tangent between anteriormost position of clypeus to midpoint of tangent between posteriormost projection of the vertex;

**HW**—head width; measured in full-face view, at widest point of the head, posterior to the eyes;

**MTL**—metatibia length; measured from the junction with the femur to the junction with the first tarsal segment;

**PNW**—pronotum width; maximum width of promesonotum measured in dorsal view;

**PPW**—postpetiole width; maximum width of postpetiole in dorsal view;

**PSL**—propodeal spine length; measured from the center of the propodeal spiracle to the tip of the propodeal spine in lateral view;

**PTW**—petiole width; maximum width of petiole in dorsal view;

**SL**—scape length; maximum straight-line length of scape excluding the basal condylar bulb;

**WL**—mesosoma length (Weber’s length); diagonal length of mesosoma in lateral view from the anterior point of the pronotal slope but excluding the neck, to the posteroventral metapleural corner.

### Indices

**CI**—cephalic index:  $HW / HL * 100$ ;

**MTI**—tibia index:  $MTL / HW * 100$ ;

**SI**—scape index:  $SL / HW * 100$ ;  
**PNI**—pronotum index:  $PNW / HW * 100$ ;  
**PPI**—postpetiole width index:  $PPW / PTW * 100$ ;  
**PSLI**—propodeal spine index:  $PSL / HW * 100$ .

### Abbreviations

**m.**—male; **q.**—gyne; **s.**—major worker; **w.**—minor worker.

### Synopsis of species of the *Pheidole bessonii* group

*Pheidole antsahabe* **sp. nov.**  
*Pheidole atsirakambiaty* **sp. nov.**  
*Pheidole bessonii* Forel, 1891  
*Pheidole clara* **sp. nov.**  
*Pheidole decollata* Forel, 1892 **stat. nov.**  
*Pheidole flammea* **sp. nov.**  
*Pheidole flavodepressa* **sp. nov.**  
*Pheidole grillatrix* Emery, 1899  
*Pheidole madecassa* Forel, 1892  
*Pheidole mantadioflava* **sp. nov.**  
*Pheidole maro* **sp. nov.**  
*Pheidole oswaldi* Forel, 1891  
*Pheidole ovalinoda* **sp. nov.**  
*Pheidole similis* **sp. nov.**  
*Pheidole tenebrovulgaris* **sp. nov.**  
*Pheidole uranus* **sp. nov.**  
*Pheidole voreios* **sp. nov.**  
*Pheidole zirafy* **sp. nov.**

### Taxonomy

The following repetitive characters occurring in the majority of species have been omitted from the individual species accounts. Unless stated otherwise, the following descriptions apply to all species treated here:

**Major workers.** Dorsal face of head in lateral view not depressed posteriorly; antennal socket shallow; frontal lobe absent; head in full-face view with distinct posteromedian concavity; antenna 12-segmented with 3-segmented club; masticatory margin of mandible with large, stout apical tooth and preapical tooth, followed by long diastema and then short and crenulate tooth just before rounded basal angle; outer surface of mandible mostly smooth and shining, sometimes with weak and sparse puncta; antennal scrobe absent; promesonotum strongly convex, well above level of propodeum; postpetiole shiny and microreticulate, short with slightly convex dorsum, in dorsal view oval with lateromedian dentate projection, pilosity erect; petiole shiny and microrugulate, peduncle with small horizontal lobes on its basal part, node triangular with rounded top, in rear view node dorsoventrally concave, pilosity erect.

**Minor workers.** Antennal socket shallow, surrounded with few indistinct wrinkles that curve posterolaterally, most often with sculptured interspaces; frontal lobe absent; head in full-face view oval, posterior and anterior of compound eye convex; antenna 12-segmented with 3-segmented club; humeral tubercle not developed into projection; clypeus smooth and shiny; anterior margin regularly convex; promesonotum well above level of propodeum; petiole smooth with ventral face slightly convex, node triangular with few erect setae; postpetiole smooth, convex with few erect setae; gaster smooth and shiny.

## Revision of the *Pheidole bessonii* group

**Diagnosis. Major worker.** Postpetiole in profile without conspicuous ventral convexity; antennal socket shallow; frontal lobe absent or indistinct; propodeal spine moderate to large, wide to narrow; head in full-face view sub-rectangular, with lateral margins varying from relatively straight to slightly convex, not or slightly widening posteriorly; head in lateral view sub-oval with distinctly convex dorsal and ventral cephalic margins; occipital lobe never with transverse costulae and usually entirely sculptured (except *P. madecassa*, *P. maro* and *P. uranus*); frons entirely sculptured, medially costulate to rugocostulate, lateral sides with usually weaker sculpture; antennal scrobe absent or very indistinct; costulae and rugulae on the rest of head thick to very thin; promesonotum short, angular, and moderately low to very low; mesonotal process usually distinct; postpetiole in dorsal view with lateromedian dentate projection; gaster usually at least partially shagreened. **Minor worker.** Postpetiole in profile without conspicuous ventral convexity; antennal socket shallow; frontal lobe absent or indistinct; propodeal spine minute to moderately large, wide to narrow; promesonotum in lateral view never box-like and posterior mesonotum never steep; promesonotal groove present and distinct (except *P. tenebrovulgaris*); posterior region of head usually elongated, forming short to long neck; nuchal collar present and weakly developed to distinct (except *P. madecassa* and *P. maro*); promesonotum moderately low to very low and moderately long to very long, and arched.

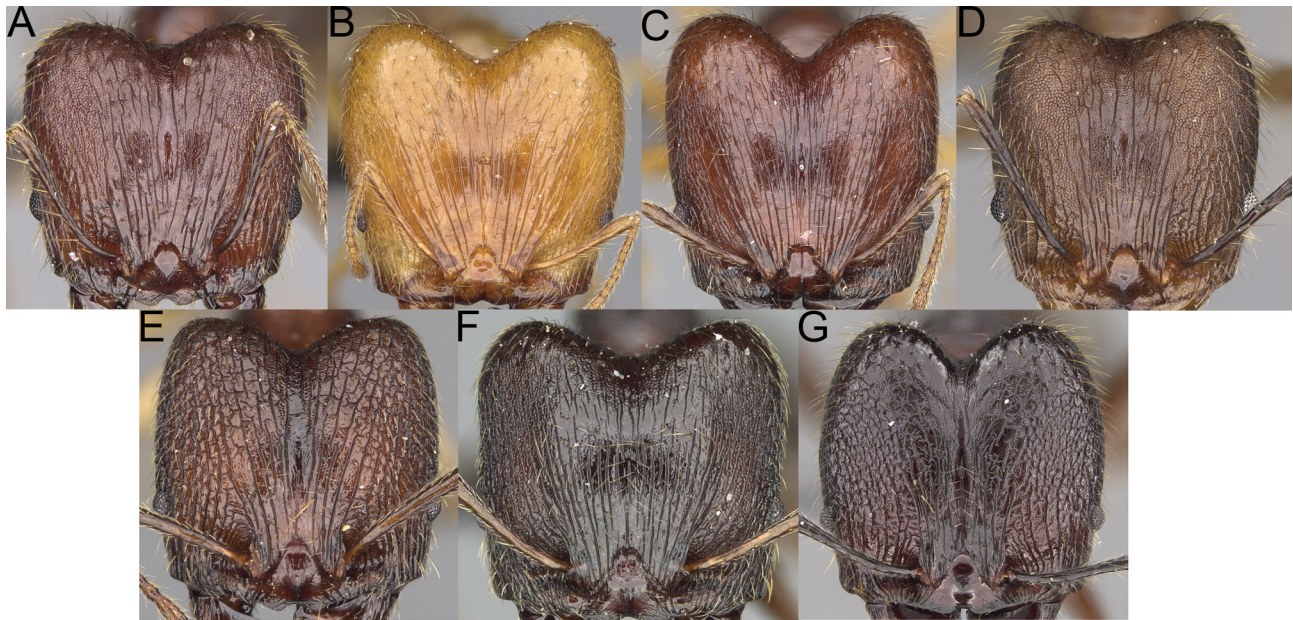
**Comments.** The *P. bessonii* group consist of species widely distributed on the island. Six species—*P. bessonii*, *P. decollata*, *P. grallatrix*, *P. maro*, *P. oswaldi* and *P. tenebrovulgaris* can be considered common. The remaining 12 species have more restricted distributions primarily limited to the northern and northeastern parts of the island. The majority of the major and minor workers of the *bessonii* group can be easily separated from other taxa based on the combination of the above-mentioned characters. However, majors of *P. madecassa* and *P. maro* can be confused with major workers of the *longispinosa* group. They can be separated based on distinctly shorter propodeal spines, denser frons sculpture, and brighter body coloration. Additionally, minors of *P. tenebrovulgaris* can be confused with two members of the *sikorae* group: *P. trichotos* Salata & Fisher and *P. veteratrix* Forel. *Pheidole tenebrovulgaris* can be separated based on larger body size, longer propodeal spines, higher promesonotum, and dark brown body coloration. There is also one member of the *bessonii* group known from Mayotte: *P. ragnax*. Because its original description is comprehensive and the species is not recorded from Madagascar, we decided not to include it in our revision. However, we included it in comparative diagnoses within the descriptions of most similar species.

## Key to the *Pheidole bessonii* group

- 1 Major worker. Head, in full face view, slightly widening posteriorly and occipital lobe mostly smooth *or* head not widening posteriorly and occipital lobes with rugae that never arch posterolaterally, body never yellow or orange, head never with short and dense setae (Fig. 2). Minor worker. Posterior part of head not to slightly elongated but never forming a neck, and nuchal collar absent to weakly developed (Fig. 3). . . . . 2
- Major worker. Head not or slightly widening posteriorly, occipital lobe and sometimes frons with rugae or costulae that arch posterolaterally distinctly to indistinctly. If occipital lobes with rugae then body yellow to orange *or* brown with lateral sides of head with short, dense setae (Fig. 6). Minor worker. Posterior part of head elongated and often forming a neck, nuchal collar distinct (Fig. 7). . . . . 8
- Note. Major worker of *P. ovalinoda* and *P. flammea* have occipital lobes with distinct rugae and dark body coloration. The best character to distinguish between these taxa is the difference in pilosity on the side of head. *Pheidole ovalinoda* has sides of head with short, decumbent to suberect setae while *P. flammea* has sides of head with long, suberect to erect setae. If characters match *P. ovalinoda* then go to couplet #2; if characters match *P. flammea* then go to couplet #8.
- 2 Major worker. Occipital lobes with thick and moderately dense rugae with mostly smooth interspaces, outer hypostomal tooth absent to weakly developed (Figs 2E, 4G). Minor worker. Petiolar peduncle moderately short and thick and node high, postpetiole short and moderately high (Fig. 5E). . . . . *Pheidole ovalinoda*
- Major worker. Occipital lobes mostly smooth or with thin and moderately sparse rugae with interspaces most often sculptured, outer hypostomal tooth present and distinct (Figs 2A–D, F, G, 4E, F). Minor worker. Petiolar peduncle moderately long and thin and node low, postpetiole longer and flat (Fig. 5A–D, F, G). . . . . 3
- 3 Major worker. Occipital lobes with thin rugae and indistinctly punctate to smooth interspaces, side of head with moderately dense, short, appressed to subdecumbent pilosity, body dark brown (Fig. 2F). Minor worker. Promesonotal groove absent to indistinct, mesosoma entirely punctate, body dark brown. (Fig. 5F) . . . . . *Pheidole tenebrovulgaris*
- Major worker. Occipital lobes mostly smooth or occipital lobes punctate with sparse and indistinct rugae, sides of head with dense, long, suberect to erect pilosity and body yellowish orange to brown (Fig. 2A–D, G). Minor worker. Promesonotal groove present and distinct, mesosoma sparsely punctate to smooth, body yellow to yellowish brown (Fig. 5A–D, G). . . . . 4
- 4 Major workers. Occipital lobes never with reduced sculpture or smooth notches (Fig. 2A, D). Minor workers. Posterior part of



- head slightly elongated, mesosoma mostly punctate (Figs 3A, D, H, K, 5A, D). . . . . 5
- Major worker. Occipital lobes entirely or mostly smooth (Fig. 2B, C, G). Minor worker. Posterior part of head never elongated and mesosoma mostly or entirely smooth (Figs 3B, C, G, I, J, N, 5B, C, G). . . . . 6
- 5 Major worker. Promesonotum in lateral view moderately long, angular, and very low (Fig. 4D), inner hypostomal tooth small (Fig. 27L). Minor worker. Occiput slightly elongated, promesonotum moderately long, angular, and very low (Figs 3D, K, 5D). . . . . *Pheidole oswaldi*
- Major worker. Promesonotum in lateral view short, angular, and moderately low (Fig. 4A), inner hypostomal tooth moderately large (Fig. 27E). Minor worker. Occiput not elongated, promesonotum moderately long, angular, and moderately low (Figs 3A, H, 5A). . . . . *Pheidole decollata*



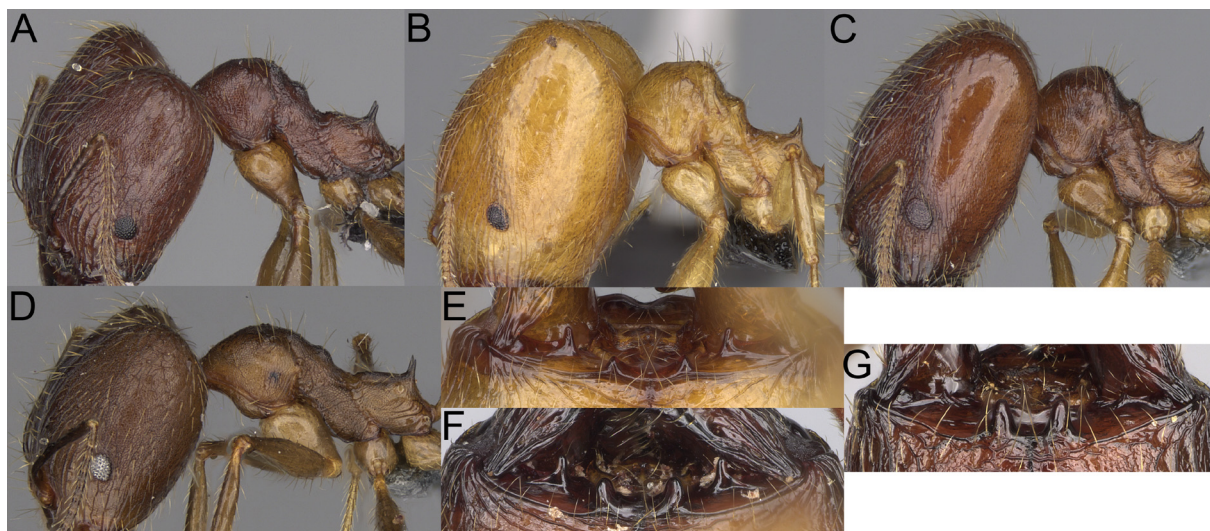
**FIGURE 2.** Major worker, head. *Pheidole decollata* (A). *Pheidole madecassa* (B). *Pheidole maro* (C). *Pheidole oswaldi* (D). *Pheidole ovalinoda* (E). *Pheidole tenebrovulgaris* (F). *Pheidole uranus* (G).



**FIGURE 3.** Minor worker, head. *Pheidole decollata*, full-face (A), lateral (H). *Pheidole madecassa*, full-face (B), lateral (I). *Pheidole maro*, full-face (C), lateral (J). *Pheidole oswaldi*, full-face (D), lateral (K). *Pheidole ovalinoda*, full-face (E), lateral (L). *Pheidole tenebrovulgaris*, full-face (F), lateral (M). *Pheidole uranus*, full-face (G), lateral (N).



- 6 Major worker. Lateral frons densely rugose-reticulate, occipital lobes mostly smooth, posteriorly with sparse and weakly developed rugae (Fig. 2G). Minor worker. Occiput slightly elongated; nuchal collar weakly developed (Fig. 3G, N). . . . . *Pheidole uranus*
- Major worker. Frons laterally smooth with sparse rugulae, occipital lobes smooth, sometimes with weakly developed rugopuncta (Fig. 2B, C). Minor worker. Occiput not elongated, nuchal collar absent (Fig. 3B, C, I, J). . . . . 7
- 7 Major worker. Antennal scrobe with sparse and very thin rugulae with indistinctly punctate interspaces, mesosoma weakly microreticulate, inner hypostomal tooth large, body reddish brown (Figs 2C, 4C, F). Minor worker. Frons and mesosoma with very sparse, weakly developed puncta (Figs 3C, 5C). . . . . *Pheidole maro*
- Major worker. Antennal scrobe with sparse, very thin rugulae with smooth interspaces, mesosoma smooth with very indistinct and thin rugulae, inner hypostomal tooth small, body yellow to orange (Figs 2B, 4B, E). Minor worker. Frons and mesosoma smooth, only anterolateral frons with weakly developed puncta (Figs 3B, 5B). . . . . *Pheidole madecassa*



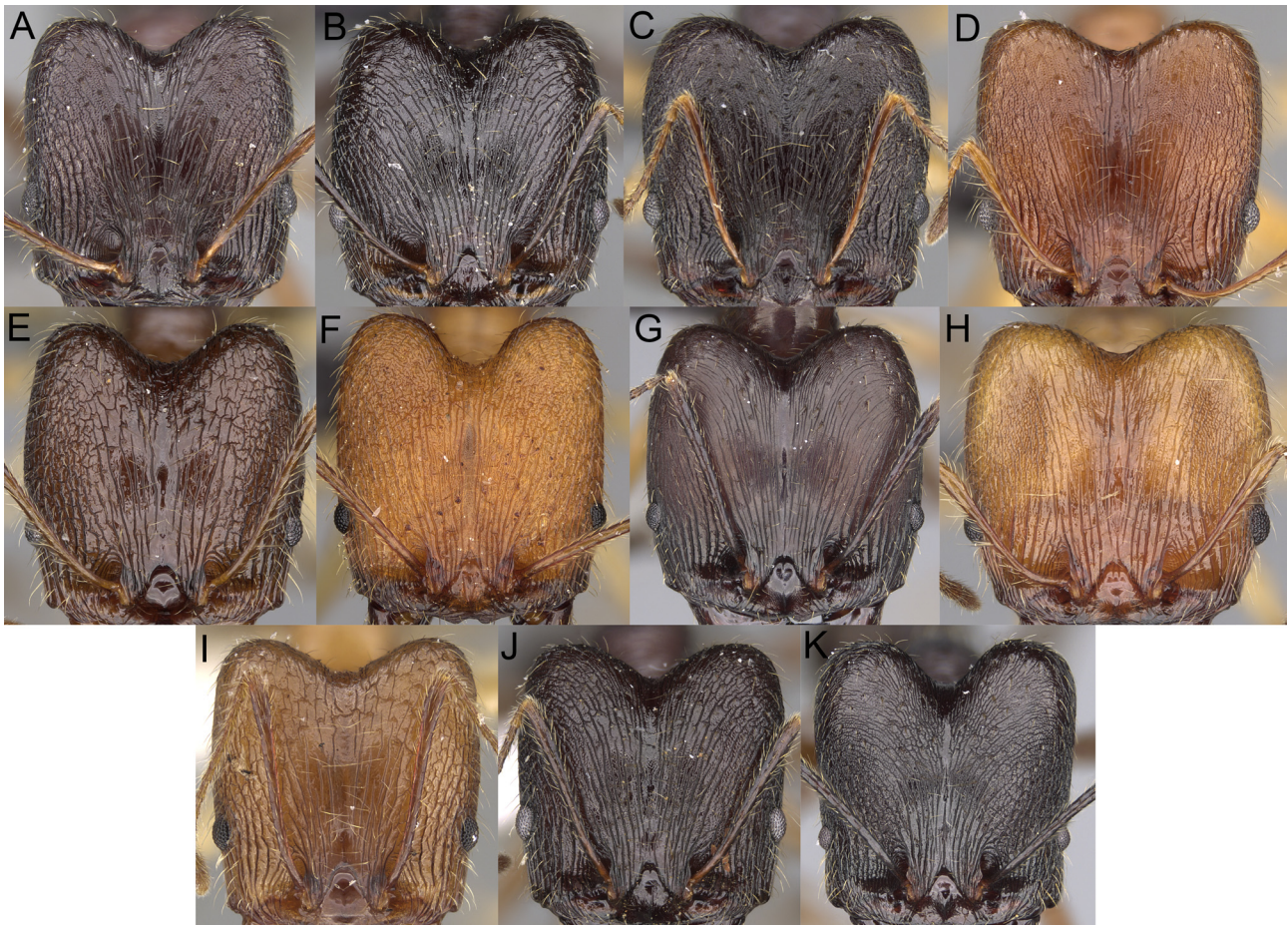
**FIGURE 4.** Major worker. *Pheidole decollata*, profile (A). *Pheidole madecassa*, profile (B), hypostomal tooth (E). *Pheidole maro*, profile (C), hypostomal tooth (F). *Pheidole oswaldi*, profile (D). *Pheidole ovalinoda*, hypostomal tooth (G).



**FIGURE 5.** Minor worker, profile. *Pheidole decollata* (A). *Pheidole madecassa* (B). *Pheidole maro* (C). *Pheidole oswaldi* (D). *Pheidole ovalinoda* (E). *Pheidole tenebrovularis* (F). *Pheidole uranus* (G).



8	At least minor worker yellow to orange. ....	9
-	Minor and major worker bright brown to brownish black. ....	13
9	Major worker. Head elongated, posteromedian concavity very deep, CI > 112.0, HL > 1.8 mm (Fig. 6F). Minor worker. Head with moderately long and narrow neck (Fig. 7F, Q). ....	<i>Pheidole flavodepressa</i>
-	Major worker. Head not elongated, posteromedian concavity deep, CI < 112.0, HL < 1.8 mm (Fig. 6A, D, H, I). Minor worker. Head with short and moderately thick neck (Fig. 7A, D, H, I, L, O, S, T). ....	10
10	Major worker. Body brown, costulae on posterior frons arching posterolaterally (Fig. 6A). Minor worker. Promesonotum with weakly developed network of sparse microreticulae (Fig. 8A). ....	<i>Pheidole antsahabe</i>
-	Major worker. Body yellow to orange, costulae on posterior frons never arching posterolaterally (Fig. 6D, H, I). Minor worker. Promesonotum smooth or distinctly punctate (Fig. 8D, H, I). ....	11
11	Major worker. Head with lateral sides relatively straight, frons laterally with thick rugocostulae and rugulate interspaces (Fig. 6I). Minor worker. Promesonotum smooth, frons mostly smooth (Figs 7I, 8I). ....	<i>Pheidole similis</i>
-	Major worker. Head with lateral sides slightly convex, frons laterally sparsely rugopunctate (Fig. 6D, H). Minor worker. Promesonotum punctate, frons weakly punctate (Figs 7D, H, 8D, H). ....	12



**FIGURE 6.** Major worker, head. *Pheidole antsahabe* (A). *Pheidole atsirakambiaty* (B). *Pheidole bessonii* (C). *Pheidole clara* (D). *Pheidole flammea* (E). *Pheidole flavodepressa* (F). *Pheidole grallatrix* (G). *Pheidole mantadioflava* (H). *Pheidole similis* (I). *Pheidole voreios* (J). *Pheidole zirafy* (K).

12	Major worker. Antennal scrobes very indistinct, mostly punctate with additional network of thin and sparse rugae, anterior mesonotum placed slightly higher than pronotum (Figs 6H, 8N). Minor worker. Frons with sparse puncta, propodeal spines small with wide base (Figs 7H, 8H). ....	<i>Pheidole mantadioflava</i>
-	Major worker. Antennal scrobes absent, frons laterally with thick and dense rugae with distinctly punctate interspaces, anterior mesonotum placed lower than pronotum (Figs 6D, 8L). Minor worker. Only anterolateral frons with sparse puncta, propodeal spines small and thin (Figs 7D, 8D). ....	<i>Pheidole clara</i>
13	Major worker. Occipital lobes with thick, sparse rugae with smooth interspaces, frons laterally with thick, dense rugae with smooth to indistinctly rugulate interspaces (Fig. 6E). Minor worker. Head with short and moderately narrow neck (Fig. 7E, P). ....	<i>Pheidole flammea</i>
-	Major worker. Occipital lobes with very thin, dense rugae, most often with sculptured interspaces, frons laterally with thin, dense rugae with distinctly sculptured interspaces (Fig. 6B, C, G, J, K). Minor worker. Head without a neck or with a long and narrow neck (Fig. 7B, C, G, J, K, M, N, R, U, V). ....	14
14	Major worker. Head elongated, posteromedian concavity very deep, HL > 2.4 mm, CI > 110.0 or head not elongated and pos-	



- teromedian concavity deep and mesosoma mostly smooth (Figs 6G, K, 8M, O). Minor worker. Head with long and narrow neck (Fig. 7G, K, R, V). . . . . 15
- Major worker. Head not elongated, posteromedian concavity deep, and mesosoma entirely sculptured, HL < 2.4 mm, CI < 110.0 (Figs 6B, C, J, 10D). Minor worker. Head without neck. (Fig. 7B, C, J, M, N, U). . . . . 16
- 15 Major worker. Head elongated, posteromedian concavity very deep, and mesosoma entirely sculptured (Figs 6K, 8O). Minor worker. Neck very long, promesonotal and propodeal dorsum mostly smooth with sparse, transverse rugae, propodeal side and mesopleuron densely rugoreticulate (Figs 7K, V, 8K). . . . . *Pheidole zirafy*
- Major worker. Head not elongated and posteromedian concavity deep, mesosoma mostly smooth (Figs 6G, 8M). Minor worker. Neck long, mesosoma smooth (Figs 7G, R, 8G). . . . . *Pheidole grallatrix*



**FIGURE 7.** Minor worker, head. *Pheidole antahabe*, full-face (A), profile (L). *Pheidole atsirakambiaty*, full-face (B), profile (M). *Pheidole bessonii*, full-face (C), profile (N). *Pheidole clara*, full-face (D), profile (O). *Pheidole flammea*, full-face (E), profile (P). *Pheidole flavodepressa*, full-face (F), profile (Q). *Pheidole grallatrix*, full-face (G), profile (R). *Pheidole mantadioflava*, full-face (H), profile (S). *Pheidole similis*, full-face (I), profile (T). *Pheidole voreios*, full-face (J), profile (U). *Pheidole zirafy*, full-face (K), profile (V).

- 16 Major worker. Body black, frons and occipital lobes with moderately thick, moderately dense costulae that arch posterolaterally, interspaces between costulae smooth to indistinctly rugopunctate (Fig. 6B). Minor worker. Body black, frons punctate with few rugae, mesosoma distinctly punctate (Figs 7B, 8B). . . . . *Pheidole atsirakambiaty*
- Major worker. Body brown, at least frons laterally more rugulate, frons and occipital lobes with distinctly punctate to rugopunctate interspaces (Fig. 6C, J). Minor worker. Body yellowish brown to blackish brown, frons usually with strongly reduced sculpture and with smooth notches, mesosoma with smooth notches (Figs 7C, J, 8C, J). . . . . 17
- 17 Major worker. Occipital lobes with moderately thin and sparse rugulae that arch posterolaterally, interspaces between rugulae punctate, frons laterally with sparse costulae with distinctly punctate interspaces (Fig. 6J). Minor worker. Occiput elongated,



mesosoma microreticulate, promesonotum with sparse microreticulae, promesonotal dorsum mostly to entirely smooth, propodeal spines small and narrow (Figs 7J, 8J). . . . . *Pheidole voreios*

- Major worker. Occipital lobes punctate, sometimes with thin and very sparse rugulae that arch posterolaterally, frons laterally with sparser, thinner rugocostulae with distinctly punctate interspaces (Fig. 6C). Minor worker. Occiput not elongated or elongated very slightly, promesonotum mostly smooth, lateral mesosoma sparsely microreticulate, propodeal spines very small with relatively wide base (Figs 7C, 8C). . . . . *Pheidole bessonii*



**FIGURE 8.** Profile. *Pheidole antsahabe*, minor worker (A). *Pheidole atsirakambiaty*, minor worker (B). *Pheidole bessonii*, minor worker (C). *Pheidole clara*, minor worker (D), major worker (L). *Pheidole flammea*, minor worker (E). *Pheidole flavodepressa*, minor worker (F). *Pheidole gallatrix*, minor worker (G), major worker (M). *Pheidole mantadioflava*, minor worker (H), major worker (N). *Pheidole similis*, minor worker (I). *Pheidole voreios*, minor worker. (J). *Pheidole zirafy*, minor worker (K), major worker (O).

## Species accounts

### *Pheidole antsahabe* sp. nov.

Figs 9A–F, 27A, 28A

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Forêt d' Antsahabe, 11.4 km 275° W Daraina, -13.21167 49.55667, 550 m, 16-Nov-2004, tropical dry forest, ex rotten log, B. L. Fisher *et al.* leg. BLF10469, CASENT0107506 (CASC).

**PARATYPES:** 1w., the same data as holotype, CASENT0923247 (CASC).

**Other material.** Madagascar. Antsiranana: 4w., Ampasindava, Forêt d' Ambalanivy, 3.9 km 181° S Ambaliha, -13.79861, 48.16167, 600 m, B. L. Fisher *et al.* leg. (CASC); 1s., Binara Forest, -13.26206, 49.60672, 559 m, B. L. Fisher *et al.* leg. (CASC); 10w., 7s., Forêt d' Andavakoera, 21.4 km 75° ENE Ambilobe; 4.6 km 356° N Betsiaka,

-13.11833, 49.23, 425 m, B. L. Fisher *et al.* leg. (CASC); 4w., Forêt d' Antsahabe, 11.4 km 275° W Daraina, -13.21167, 49.55667, 550 m, B. L. Fisher *et al.* leg. (CASC); 2w., Forêt de Binara, 7.5 km 230° SW Daraina, -13.255, 49.61667, 375 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Galoko chain, Mont Galoko, -13.58745, 48.71419, 380 m, B. L. Fisher *et al.* leg. (CASC); 1w., Masoala National Park, -15.3014, 50.22776, 280 m, B. L. Fisher *et al.* leg. (CASC); 2w., Montagne des Français, 7.2 km 142° SE Antsiranana (=Diego Suarez), -12.32278, 49.33817, 180 m, B. L. Fisher *et al.* leg. (CASC). Toamasina: 1w., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80219, 48.40585, 995 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, northern part of Antsiranana.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, lateral margins relatively straight; side of head with moderately dense, moderately long, subdecumbent to suberect pilosity; medial frons with dense and thick costulae; frons laterally rugose-punctate; occipital lobe obliquely rugulose; interspaces between rugulae indistinctly punctate to smooth; scape, when laid back, exceeding midlength of head by two-fifths of its length; inner hypostomal tooth indistinct, small, and bulge-like with tip directed posteriorly; outer hypostomal tooth lobe-like, high, and wide with tip directed posteriorly; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma with sparse microreticulae; promesonotum with transverse rugulae; katapisternum and side of propodeum rugose; gaster shagreened; body brown. **Minor workers.** Occiput forming short and moderately narrow neck; nuchal collar distinct; head mostly smooth; frons with sparse puncta; scape, when laid back, exceeding posterior head margin by three-fifths of its length; promesonotum in lateral view low and moderately long, arched; promesonotal groove present; metanotal groove distinct; propodeal spines with narrow base; promesonotum weakly microreticulate; katapisternum and propodeum punctate; body orange.

**Description. Major workers.** Measurements (n=8): HL: 1.59–1.78 (1.7); HW: 1.49–1.61 (1.55); SL: 1.19–1.25 (1.21); EL: 0.21–0.28 (0.24); WL: 1.65–1.71 (1.68); PSL: 0.27–0.33 (0.3); MTL: 1.32–1.43 (1.38); PNW: 0.61–0.66 (0.64); PTW: 0.18–0.22 (0.21); PPW: 0.56–0.62 (0.59); CI: 106.9–110.8 (109.4); SI: 75.1–80.8 (78.2); PSLI: 15.9–19.3 (17.5); PPI: 30.0–37.5 (34.8); PNI: 38.7–42.4 (41.0); MTI: 85.9–91.5 (88.7).

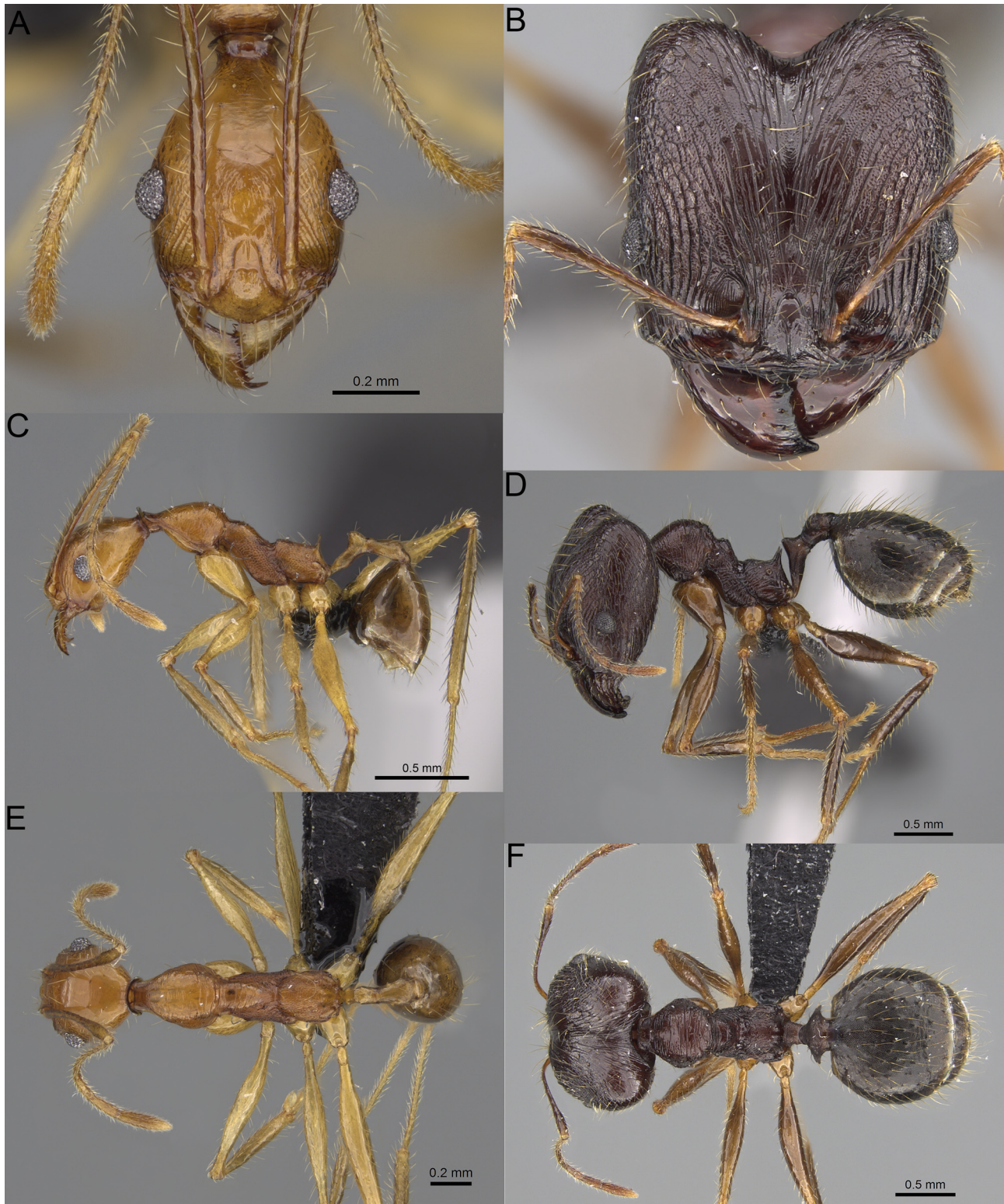
**Head.** In full-face view sub-rectangular, not widening posteriorly, side relatively straight (Fig. 9B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of head with moderately dense, moderately long, subdecumbent to suberect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Medial frons with dense and thick costulae; interspaces between costulae smooth or indistinctly punctate. Frons laterally rugulate; interspaces between rugae punctate; rugae and costulae on posterior frons arch posterolaterally. Occipital lobes with thin rugulae that arch posterolaterally; interspaces between rugulae indistinctly punctate to smooth. Gena with dense and thick costulae; interspaces between costulae indistinctly punctate. Sides posterolateral from eyes with network of dense but very thin rugoreticulae. Center of clypeus shiny and with weakly developed puncta, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 9B, D). Inner hypostomal tooth indistinct, small and bulge-like, with top directed posteriorly; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent (Fig. 27A). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove present; propodeal spines moderately long with moderately wide base and acute top; humeral tubercle weakly produced (Fig. 9D). Surface shiny and with sparse microreticulae; promesonotum with additional transverse and thin rugae; katapisternum and lateral sides of propodeum with additional rugae. Pilosity moderately dense, moderately long, and erect (Fig. 9D, F). **Gaster.** Shiny and shagreened; pilosity moderately sparse, long, and erect (Fig. 9D, F). **Color.** Brown, legs and antennae yellowish-brown (Fig. 9D, F).

**Description. Minor workers.** Measurements (n=10): HL: 0.72–0.89 (0.82); HW: 0.46–0.59 (0.52); SL: 0.99–1.27 (1.15); EL: 0.14–0.18 (0.16); WL: 0.95–1.21 (1.1); PSL: 0.11–0.16 (0.13); MTL: 0.82–1.13 (1.03); PNW: 0.33–0.41 (0.38); PTW: 0.08–0.12 (0.09); PPW: 0.13–0.18 (0.15); CI: 150.8–161.4 (155.8); SI: 206.7–227.3 (220.2); PSLI: 14.8–17.4 (16.2); PPI: 51.2–71.2 (62.9); PNI: 67.1–79.3 (73.6); MTI: 180.3–206.2 (196.6).

**Head.** In full-face view oval, posterior region elongated forming short and moderately narrow neck; nuchal collar distinct (Fig. 9A). Pilosity relatively sparse, long, subdecumbent to erect. Sculpture shiny and mostly smooth; frons with sparse puncta. Clypeus without median longitudinal carina; two lateral longitudinal carinae absent.



Scape, when laid back, exceeding posterior head margin by three-fifths its length; pilosity dense, subdecumbent to erect (Fig. 9A, C). **Mesosoma.** In lateral view, promesonotum low, moderately long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderate, triangular and with narrow base (Fig. 9C). Promesonotum with weak microreticulæ; katapisternum and propodeum punctate. Pilosity very sparse, long, and erect (Fig. 9C, E). **Gaster.** With sparse and erect pilosity (Fig. 9C, E). **Color.** Orange, legs and sometimes head brighter (Fig. 9C, E).



**FIGURE 9.** *Pheidole antsahabe*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0923247) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0107506).

**Biology.** The species was collected between 180–600 m in elevation, in rainforest and tropical dry forest. Nests were located in rotten logs, in soil, and in rotten sticks on the ground. Workers were collected from sifted litter.

**Comments.** *Pheidole antsahabe* is most similar to the sympatric *P. voreios*. Major workers of *P. antsahabe* differ in the smooth to indistinctly punctate interspaces between costulae on the medial frons, and the presence of sparse microreticulae on the promesonotal dorsum. In contrast, *P. voreios* majors have distinctly punctate interspaces between costulae on the medial frons and mostly to entirely smooth promesonotum. Minors can be separated from *P. voreios* by the orange body coloration, longer and thinner neck, and sparser sculpture on the promesonotum. Minors of *P. voreios* have brown body, shorter and thicker neck, and distinctly stronger sculpture on the promesonotum. Additionally, minor workers of *P. antsahabe* can be confused with *P. mantadioflava* and *P. clara* but differ from them in having a longer, narrower neck and a promesonotum that is never entirely smooth nor entirely punctate.

**Etymology.** From the type locality.

### *Pheidole atsirakambiaty* sp. nov.

Figs 10A–F, 27B, 28B

**HOLOTYPE:** 1s., Madagascar, Fianarantsoa, Forêt d’Atsirakambiaty, 7.6 km 285° WNW Itremo, -20.59333 46.56333, 1550 m, 22-Jan-2003, montane rainforest, ex rotten log/termite mound, Fisher *et al.* leg. BLF07274, CASENT0491660 (CASC). **PARATYPES:** 6w., 2s., 1m., 1q., the same data as holotype, CASENT0491661, CASENT0491664, CASENT0491665, CASENT0491666, CASENT0872258, CASENT0491662 (CASC, MHNG, PBZT).

**Other material.** Madagascar. Fianarantsoa: 11w., 3s., Forêt d’Atsirakambiaty, 7.6 km 285° WNW Itremo, -20.59333 46.56333, 1550 m, Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, Fianarantsoa, Forêt d’Atsirakambiaty.

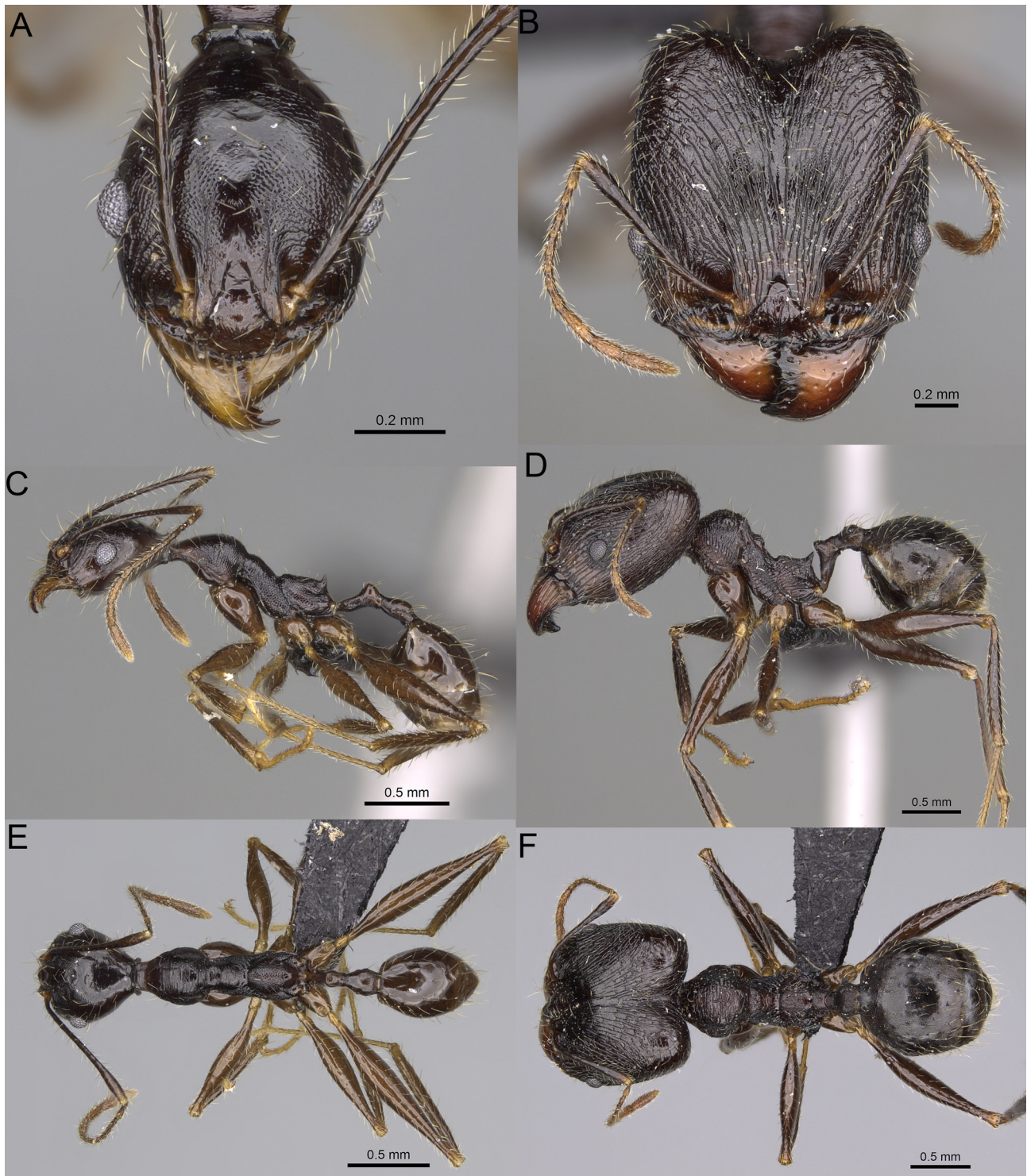
**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, lateral margin relatively straight; sides of head with moderately dense, moderately long, suberect pilosity; frons with moderately thick and moderately dense costulae that arch posterolaterally; interspaces between costulae smooth to indistinctly rugopunctate; occipital lobes with thin and sparse rugulae that arch posterolaterally; interspaces between rugulae sparsely rugopunctate; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth absent; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth present; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process tubercle-like; promesonotum with thick, dense and transverse rugae; interspaces between rugae distinctly punctate; katapisternum and propodeum with sparse rugae; interspaces between rugae rugopunctate; gaster shagreened; body black. **Minor workers.** Occiput slightly elongated; nuchal collar distinct; head mostly smooth; frons rugopunctate; scape, when laid back, exceeding posterior head margin by half its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderately small with wide base; mesosoma punctate; promesonotal dorsum with sparser puncta and transverse, thin rugae; body black.

**Description. Major workers.** Measurements (n=7): HL: 1.88–2.1 (1.99); HW: 1.75–1.97 (1.86); SL: 1.21–1.25 (1.24); EL: 0.23–0.29 (0.26); WL: 1.62–1.74 (1.69); PSL: 0.23–0.32 (0.28); MTL: 1.36–1.49 (1.42); PNW: 0.59–0.74 (0.64); PTW: 0.19–0.31 (0.23); PPW: 0.52–0.73 (0.6); CI: 103.4–110.8 (107.0); SI: 61.5–71.5 (66.7); PSLI: 11.2–15.9 (14.0); PPI: 32.2–42.7 (39.3); PNI: 32.6–37.6 (34.5); MTI: 72.1–79.2 (76.1).

**Head.** In full-face view sub-rectangular, not widening posteriorly, lateral margin relatively straight (Fig. 10B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of the head with moderately dense, moderately long, suberect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Frons with moderately thick and moderately dense costulae that arch posterolaterally; interspaces between costulae smooth to indistinctly rugopunctate. Occipital lobe with thin and sparse rugulae that arch posterolaterally; interspaces between rugulae sparsely rugopunctate. Gena with dense and thick costulae; interspaces between costulae indistinctly rugopunctate. Sides posterolateral from eyes with dense but thin rugocostulae; interspaces between rugocostulae rugopunctate. Center of clypeus shiny and indistinctly punctate, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median and lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 10B, D). Inner hypostomal tooth absent; outer hypostomal tooth lobe-like, high and



wide, with top arching posterolaterally; median tooth present (Fig. 27B). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove present; propodeal spines moderate with wide base and acute top; humeral tubercle weakly produced (Fig. 10D). Surface shiny; promesonotum with thick, dense, and transverse rugae; interspaces between rugae distinctly punctate; katapisternum and propodeum with sparse rugae; interspaces between rugae rugopunctate. Pilosity moderately dense, long, and erect (Fig. 10D, F). **Petiole.** In rear view node dorsoventrally convex (Fig. 10D, F). **Gaster.** Dull and shagreened; pilosity moderately sparse, long, and erect (Fig. 10D, F). **Color.** Black, antennae and legs brown, mandibles ochraceous (Fig. 10D, F).



**FIGURE 10.** *Pheidole atsirakambiaty*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0491661) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0491660).

**Description. Minor workers.** Measurements (n=10): HL: 0.85–0.95 (0.91); HW: 0.59–0.71 (0.65); SL: 1.13–1.29 (1.23); EL: 0.16–0.2 (0.18); WL: 1.16–1.29 (1.23); PSL: 0.12–0.15 (0.13); MTL: 1.07–1.21 (1.13); PNW: 0.41–0.47 (0.44); PTW: 0.1–0.14 (0.12); PPW: 0.17–0.22 (0.2); CI: 133.4–143.6 (139.1); SI: 180.3–196.8 (189.1); PSLI: 13.0–16.5 (14.8); PPI: 47.7–68.3 (59.2); PNI: 64.1–72.1 (67.9); MTI: 163.4–183.0 (173.8).

**Head.** In full-face view oval, occiput slightly elongated; nuchal collar distinct (Fig. 10A). Pilosity relatively dense, moderately long, subdecumbent to erect. Sculpture shining and smooth; frons rugopunctate. Clypeus with median longitudinal carina present; two lateral longitudinal carinae absent. Scape, when laid back, exceeding posterior head margin by half its length; pilosity dense, subdecumbent to erect (Fig. 10A, C). **Mesosoma.** In lateral view, promesonotum low, long and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderately small, triangular and with wide base (Fig. 10C). Surface punctate; promesonotal dorsum with sparser puncta and thin, transverse rugae. Pilosity very sparse, long, and erect (Fig. 10C, E). **Gaster.** With sparse and erect pilosity (Fig. 10C, E). **Color.** Black, with legs, mandibles, and antennae brown (Fig. 10C, E).

**Biology.** The specimens were collected at 1550 m elevation, in montane rainforest and grassland. Nests were located in rotten logs on termite mounds and under stones.

**Comments.** Considering the ants known from northern Madagascar, *Pheidole atsirakambiaty* is most similar to *P. voreios* and parapatric *P. bessonii*. Its majors can be separated based on the black body and the presence of moderately thick, moderately dense costulae that arch posterolaterally, and rugulate frons and occipital lobes with smooth to indistinctly rugopunctate interspaces between rugulae. Majors of *P. voreios* and *P. bessonii* have a body that is brown to blackish brown, their head sculpture is never arches uniformly posterolaterally, and interspaces between rugocostulae are smooth to punctate. Minors can be distinguished based on their black body and distinctly punctate mesosoma. In contrast, minors of *P. voreios* and *P. bessonii* have a body that is bright brown to brown and their mesosoma is never distinctly punctate.

**Etymology.** From the type locality.

### *Pheidole bessonii* Forel, 1891

Figs 11A–F, 27C, 28C

*Pheidole oswaldi* r. *bessonii* Forel, 1891: 176, pl. 5, fig. 3 (w.).

Forel, 1905: 162 (s.).

Status as species: Dalla Torre, 1893: 88.

LECTOTYPE [designated here]: 1w., top specimen of the pin, Madagascar, Fianarantsoa, coll. Besson, ANTC3392, CASENT0101838 (MHNG). PARALECTOTYPES: 1w., bottom specimen, the same pin as lectotype; 3w., the same data as lectotype (CASENT0923201).

**Other material.** Madagascar. Antananarivo: 11w., Ambohitantely 1410, -18.2253 47.28683, 1410 m, Fisher *et al.* leg. (CASC). Fianarantsoa: 1w., 9.0 km NE Ivohibe, -22.42667 46.93833, 900 m, Fisher *et al.* leg. (CASC); 12w., Belle Vue trail, Ranomafana National Park, Fianarantsoa Prov., -21.2665 47.42017, 1020 m, R. Harin'Hala leg. (CASC); 4w., dry wash, 1 km E of Isalo National Park Interpretive Center, Fianarantsoa Prov., -22.62667 45.35817, 885 m, Irwin *et al.* leg. (CASC); 5w., Fitovavy Fitovinany Region, District of Ifanadiana Belle vue area 1200 m S of Ranomafana National Park entrance, -21.2665 47.42017, 1018 m, M. Rin'ha leg. (CASC); 9w., 2s., Forêt d'Analalava, 29.6 km 280° W Ranohira, -22.59167 45.12833, 700 m, Fisher *et al.* leg. (CASC); 4w., JIRAMA water works near river, Ranomafana National Park, Fianarantsoa Prov., -21.2485 47.45217, 690 m, R. Harin'Hala leg. (CASC); 1w., Mampiarika IV Non Protected Area, 27.98 km SW Ambositra, -20.73528 47.08382, 1486 m, A. Ravelomanana leg. (CASC); 8w., 4s., Parc National d'Isalo, 9.1 km 354° N Ranohira, -22.48167 45.46167, 725 m, Fisher *et al.* leg. (CASC); 1w., Parc National d'Isalo, Ambovo Springs, 29.3 km 4° N Ranohira, -22.29833 45.35167, 990 m, Fisher *et al.* leg. (CASC); 3w., 1s., Parc National d'Isalo, Sahanafa River, 29.2 km 351° N Ranohira, -22.31333 45.29167, 500 m, Fisher *et al.* leg. (CASC); 1w., Parc National de Ranomafana, Vatoharanana River, 4.1 km 231° SW Ranomafana, -21.29 47.43333, 1100 m, Fisher *et al.* leg. (CASC); 4w., R.S. Ivohibe 8.0 km E Ivohibe, -22.48333 46.96833, 1200 m, Fisher *et al.* leg. (CASC); 2w., R.S. Ivohibe, 7.5 km ENE Ivohibe, -22.47 46.96, 900 m, Fisher *et al.* leg. (CASC); 19w., radio tower, Ranomafana National Park, Fianarantsoa Prov., -21.25833 47.40717, 1130 m, Irwin *et al.* leg. (CASC); 1s., Ranomafana National Park, Talatakely; Sahambavy; Fianarantsoa Rural, -21.451179 47.3023894, 1139 m, Lee & Ribardo leg. (CASC); 2w., stream area, 900 m E of Isalo National Park Interpretive



Center, Fianarantsoa Prov., -22.62667 45.35817, 750 m, R. Harin'Hala leg. (CASC); 12w., Vohiparara broken bridge, Fianarantsoa Prov., -21.22617 47.36983, 1110 m, R. Harin'Hala leg. (CASC); 1w., Ampangabe I Non Protected Area, 21.4 km W Itremo, -20.61111 46.60688, 1414 m, A. Ravelomanana leg. (CASC); 1w., Ampangabe II Non Protected Area, 21.29 km W Itremo, -20.61139 46.60809, 1402 m, A. Ravelomanana leg. (CASC); 2w., Antapia III Non Protected Area, 26.43 km SW Ambositra, -20.72 47.08785, 1494 m, A. Ravelomanana leg. (CASC); 1w., Antohatsahomby II Non Protected Area, 23.38 km NW Itremo, -20.55444 46.58438, 1640 m, A. Ravelomanana leg. (CASC); 3w., Forêt d'Analalava, 29.6 km 280° W Ranohira, -22.59167 45.12833, 700 m, Fisher *et al.* leg. (CASC); 1w., Mampiarika II Non Protected Area, 28.08 km SW Ambositra, -20.73556 47.08384, 1464 m, A. Ravelomanana leg. (CASC); 3w., Mampiarika III Non Protected Area, 28.93 km SW Ambositra, -20.73583 47.08399, 1487 m, A. Ravelomanana leg. (CASC); 1w., 2s., Mampiarika IV Non Protected Area, 27.98 km SW Ambositra, -20.73528 47.08382, 1486 m, A. Ravelomanana leg. (CASC); 1w., Manandriana II Non Protected Area, 27.12 km SW Ambositra, -20.7325 47.09461, 1589 m, A. Ravelomanana leg. (CASC); 1s., Parc National d'Isalo, 9.1 km 354° N Ranohira, -22.48167 45.46167, 725 m, Fisher *et al.* leg. (CASC); 1w., Parc National d'Isalo, Sahanafa River, 29.2 km 351° N Ranohira, -22.31333 45.29167, 500 m, Fisher *et al.* leg. (CASC); 1w., Soanierenana II Non Protected Area, 25.61 km SW Ambositra, -20.72194 47.10896, 1732 m, A. Ravelomanana leg. (CASC). Mahajanga: 9w., 5s., Forêt Ambohimanga, 26.1 km 314° Mampikony, -15.96267 47.43817, 250 m, Fisher *et al.* leg. (CASC); 1w., Mahavavy River, 6.2 km 145° SE Mitsinjo, -16.05167 45.90833, 20 m, Fisher *et al.* leg. (CASC); 4w., 8s., 1q., Parc National d'Ankarafantsika, Ampijoroa Station Forestière, 5.4 km 331° NW Andranofasika, -16.29889 46.813, 70 m, Fisher *et al.* leg. (CASC); 2w., Parc National d'Ankarafantsika, Ampijoroa Station Forestière, 40 km 306° NW Andranofasika, -16.32083 46.81067, 130 m, Fisher *et al.* leg. (CASC); 8w., Parc National d'Ankarafantsika, Forêt de Tsimaloto, 18.3 km 46° NE de Tsaramandroso, -16.22806, 47.14361, 135 m, Fisher *et al.* leg. (CASC); 7w., 5s., Parc National de Baie de Baly, 12.4 km 337° NNW Soalala, -16.01 45.265, 10 m, Fisher *et al.* leg. (CASC); 12w., 3s., Parc National de Namoroka, 16.9 km 317° NW Vilanandro, -16.40667 45.31, 100 m, Fisher *et al.* leg. (CASC); 2w., 1s., Parc National de Namoroka, 9.8 km 300° WNW Vilanandro, -16.46667 45.35, 140 m, Fisher *et al.* leg. (CASC); 1w., Parc National Tsingy de Bemaraha, 10.6 km ESE 123° Antsalova, -18.70944 44.71817, 150 m, Fisher *et al.* leg. (CASC); 4w., 1s., Parc National Tsingy de Bemaraha, 2.5 km 62° ENE Bekopaka, Ankidrodroa River, -19.13222 44.81467, 100 m, Fisher *et al.* leg. (CASC); 6w., 1s., Parc National Tsingy de Bemaraha, 3.4 km 93° E Bekopaka, Tombeau Vazimba, -19.14194 44.828, 50 m, Fisher *et al.* leg. (CASC); 1w., 1s., Réserve d'Ankoririka, 10.6 km 13° NE de Tsaramandroso, -16.26722 47.04861, 210 m, Fisher *et al.* leg. (CASC); 2w., 1s., Réserve Spéciale de Bemarivo, 23.8 km 223° SW Besalampy, -16.925 44.36833, 30 m, Fisher *et al.* leg. (CASC); 1w., Réserve forestière Beanka, 50.2 km E Maintirano, -18.02649 44.05051, 250 m, Fisher *et al.* leg. (CASC). Toamasina: 1w., 1s., 6.3 km S Ambanizana, Andranobe, -15.6813 49.958, 25 m, Fisher *et al.* leg. (CASC). Toliara: 1w., 50 km N Morondava, -20.06667, 44.58333, A. Pauly leg. (CASC); 1w., 1s., Anosy Region, Parc National d'Andohahela, Forêt de Manatalinjo, -24.82505 46.57811, 90 m, Fisher *et al.* leg. (CASC); 1w., Antafoky, -23.48778 44.0775, 60 m, Fisher *et al.* leg. (CASC); 1w., 1s., Beza-Mahafaly, 27 km E Betioky, -23.65 44.63333, 135 m, Fisher *et al.* leg. (CASC); 1s., Fiherenana, -23.17694 43.96083, 100 m, Fisher *et al.* leg. (CASC); 1w., Fiherenana, -23.23528 43.87083, 50 m, Fisher *et al.* leg. (CASC); 1w., Forêt Classée d'Analavelona, 29.2 km 343° NNW Mahaboboka, -22.675 44.19, 1100 m, Fisher *et al.* leg. (CASC); 3w., 3s., Forêt de Beroboka, 5.9 km 131° SE Ankidranoka, -22.23306 43.36633, 80 m, Fisher *et al.* leg. (CASC); 4w., Forêt de Kirindy, 15.5 km 64° ENE Marofandilia, -20.045 44.66222, 100 m, Fisher *et al.* leg. (CASC); 7w., Forêt de Kirindy, 15.5 km 64° ENE Marofandilia, -20.06855 44.6595667, 30 m, Fisher *et al.* leg. (CASC); 4w., Forêt de Mahavelo, Isantoria River, -24.75833 46.15717, 110 m, Fisher *et al.* leg. (CASC); 1w., Forêt de Mahavelo, Isantoria River, 5.5 km 37° NE Ifotaka, -24.75361 46.1515, 115 m, Fisher *et al.* leg. (CASC); 3w., 3s., Forêt de Mite, 20.7 km 29° WNW Tongobory, -23.52417 44.12133, 75 m, Fisher *et al.* leg. (CASC); 1w., Forêt Ivohibe 55.0 km N Tolagnaro, -24.569 47.204, 200 m, Fisher *et al.* leg. (CASC); 1w., Forêt Vohidava 88.9 km N Amboasary, -24.24067 46.28783, 500 m, Fisher *et al.* leg. (CASC); 1w., 1s., Forêt Vohidava 89.2 km N Amboasary, -24.239 46.28233, 850 m, Fisher *et al.* leg. (CASC); 2w., Ivahona, -23.45591 46.17376, 820 m, Fisher *et al.* leg. (CASC); 1w., Makay Mts., -21.21836 45.3106, 510 m, Fisher *et al.* leg. (CASC); 2w., Makay Mts., -21.30997, 45.12946, 590 m, Fisher *et al.* leg. (CASC); 3w., Manderano, -23.52722 44.0875, 70 m, Fisher *et al.* leg. (CASC); 1w., Manombo, -22.81092 43.7344, 177 m, Fisher *et al.* leg. (CASC); 1w., Manombo, -22.8123 43.73932, 165 m, Fisher *et al.* leg. (CASC); 1w., Parc National d'Andohahela, Col du Sedro, 3.8 km 113° ESE Mahamavo, 37.6 km 341° NNW Tolagnaro, -24.76389 46.75167, 900 m, Fisher *et al.* leg. (CASC); 6w., Parc National d'Andohahela, Forêt d'Ambohibory, 1.7 km 61° ENE Tsimelahy, 36.1 km 308° NW Tolagnaro, -24.93



46.6455, 300 m, Fisher *et al.* leg. (CASC); 3w., Parc National d'Andohahela, Forêt de Manatalinjo, 33.6 km 63° ENE Amboasary, 7.6 km 99° E Hazofotsy, -24.81694 46.61, 150 m, Fisher *et al.* leg. (CASC); 1w., Parc National de Kirindy Mite, 16.3 km 127° SE Belo sur Mer, -20.79528 44.147, 80 m, Fisher *et al.* leg. (CASC); 4w., Parc National de Zombitse, 19.8 km 84° E Sakaraha, -22.84333 44.71, 770 m, Fisher *et al.* leg. (CASC); 11w., 5s., 3m., Réserve Privé Berenty, Forêt de Bealoka, Mandraré River, 14.6 km 329° NNW Amboasary, -24.95694 46.2715, 35 m, Fisher *et al.* leg. (CASC); 5w., Réserve Spéciale d'Ambohijanahary, Forêt d'Ankazotsihitafototra, 34.6 km 314° NW Ambaravarana, -18.2645.41833, 1100 m, Fisher *et al.* leg. (CASC); 2w., Réserve Spéciale d'Ambohijanahary, Forêt d'Ankazotsihitafototra, 35.2 km 312° NW Ambaravarana, -18.26667 45.40667, 1050 m, Fisher *et al.* leg. (CASC); 1w., Sakaraha, -22.91233 44.53283, 470 m, Fisher *et al.* leg. (CASC); 1w., Sept Lacs, -23.52833, 44.15556, 80 m, Fisher *et al.* leg. (CASC); 1w., southern Isoky-Vohimena Forest, 59 km NE Sakaraha, -22.46667 44.85, 730 m, Fisher *et al.* leg. (CASC); 14w., 9s., Forêt Classée d'Analavelona, 29.2 km 343° NNW Mahaboboka, -22.675 44.19, 1100 m, Fisher *et al.* leg. (CASC); 1w., Forêt Classée d'Analavelona, 29.4 km 343° NNW Mahaboboka, -22.675 44.18667, 1050 m, Fisher *et al.* leg. (CASC); 1s., Forêt Vohidava 89.2 km N Amboasary, -24.239 46.28233, 850 m, Fisher *et al.* leg. (CASC); 2w., Makay Mts., -21.21761, 45.33917, 500 m, Fisher *et al.* leg. (CASC); 2w., Makay Mts., -21.22336 45.32628, 480 m, Fisher *et al.* leg. (CASC); 4w., Makay Mts., -21.30997 45.12946, 590 m, Fisher *et al.* leg. (CASC); 2w., 2m., Makay Mts., -21.31664 45.1296, 620 m, Fisher *et al.* leg. (CASC); 3w., 2s., Parc National de Zombitse, 19.8 km 84° E Sakaraha, -22.84333 44.71, 770 m, Fisher *et al.* leg. (CASC); 1w., Réserve Privé Berenty, Forêt de Malaza, Mandraré River, 8.6 km 314° NW Amboasary, -25.00778 46.306, 40 m, Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, widely distributed on the island except Antsiranana.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not or slightly widening posteriorly, lateral margin slightly convex with sparse, long, decumbent to subdecumbent pilosity; medial frons with moderately thick to thin and dense costulae that are on the posterior part; interspaces between costulae smooth to indistinctly punctate; frons laterally with sparser and thinner rugocostulae; interspaces between rugocostulae distinctly punctate; occipital lobes punctate, sometimes with additional network of sparse and thin rugae, sculpture weakening posteriorly; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth absent or indistinct, bulge-like; outer hypostomal tooth lobe-like, high and wide, directed posteriorly; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma microreticulate; promesonotum with additional thin, sparse, and transverse rugae; gaster shagreened; body brown to blackish brown. **Minor workers.** Occiput elongated; nuchal collar distinct; head sculpture smooth; anterior frons with sparse puncta; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines very small with relatively wide base; promesonotum mostly smooth with sparse microreticulae laterally; mesopleuron and propodeum with sparse microreticulae; body bright brown to brown.

**Description. Major workers.** Measurements (n=10): HL: 1.78–2.13 (1.97); HW: 1.74–2.01 (1.89); SL: 1.13–1.2 (1.17); EL: 0.22–0.27 (0.25); WL: 1.61–1.78 (1.68); PSL: 0.26–0.34 (0.3); MTL: 1.24–1.38 (1.3); PNW: 0.66–0.75 (0.7); PTW: 0.22–0.31 (0.28); PPW: 0.62–0.81 (0.7); CI: 99.7–106.5 (104.3); SI: 57.8–65.4 (61.7); PSLI: 13.9–16.6 (15.3); PPI: 32.1–47.0 (40.4); PNI: 34.2–39.1 (37.0); MTI: 64.8–74.8 (69.1).

**Head.** In full-face view sub-rectangular, slightly widening posteriorly with sides slightly convex (Fig. 11B); in lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Sides of head with sparse, long, decumbent to subdecumbent pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Medial frons with moderately thick to thin and dense costulae on the posterior part; interspaces between costulae smooth to indistinctly punctate. Frons laterally with sparser and thinner rugocostulae; interspaces between rugocostulae distinctly punctate. Occipital lobes punctate, sometimes with additional network of sparse and thin rugae; sculpture weakening posteriorly. Gena with dense, moderately thick to thin costulae; interspaces between costulae distinctly punctate. Sides posterolateral from eyes densely punctate to microreticulate, sometimes with additional network of thin and sparse rugulae. Center of clypeus shiny and with a few rugulae, lateral sides with distinct rugulae; median notch present, moderately wide, and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 11B, D). Inner hypostomal tooth absent or indistinct, bulge-like; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent (Fig. 27C). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately

steep; mesonotal process distinct and tubercle-like; promesonotal groove weakly developed; metanotal groove present; propodeal spines moderately long with wide base and acute top; humeral tubercle weakly produced (Fig. 11D). Surface shiny and microreticulate; promesonotum with additional thin, sparse, and transverse rugae. Pilosity moderately dense, long, and erect (Fig. 11D, F). **Gaster.** Dull and shagreened; pilosity moderately sparse, long, and erect (Fig. 11D, F). **Color.** Brown to blackish brown, antennae and legs yellowish brown, mandibles ochraceous (Fig. 11D, F).



**FIGURE 11.** *Pheidole bessonii*, full-face view (A), profile (C), and dorsal view (E) of minor worker (CASENT0496974) and full-face view (B), profile (D), and dorsal view (F) of major worker (CASENT0496976).



**Description. Minor workers.** Measurements (n=10): HL: 0.69–0.82 (0.77); HW: 0.52–0.61 (0.57); SL: 0.9–1.09 (1.0); EL: 0.13–0.19 (0.16); WL: 0.96–1.12 (1.04); PSL: 0.07–0.12 (0.1); MTL: 0.78–0.95 (0.88); PNW: 0.33–0.41 (0.37); PTW: 0.09–0.12 (0.1); PPW: 0.17–0.21 (0.18); CI: 131.4–137.6 (133.5); SI: 169.3–183.2 (175.0); PSLI: 10.2–15.3 (13.3); PPI: 48.7–60.0 (55.3); PNI: 61.0–68.7 (65.2); MTI: 144.7–158.1 (152.8).

**Head.** In full-face view oval, posterior region elongated; nuchal collar distinct (Fig. 11A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture shiny and smooth; anterolateral frons with sparse puncta. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 11A, C).

**Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines very small, triangular, and with relatively wide base (Fig. 11C). Promesonotum mostly smooth with sparse microreticulae on lateral sides; katepisternum, anepisternum, and propodeum with sparse microreticulae. Pilosity very sparse, moderately long, and erect (Fig. 11C, E). **Gaster.** With sparse and erect pilosity (Fig. 11C, E). **Color.** Bright brown to brown, legs, mandibles, and antennae yellowish (Fig. 11C, E).

**Biology.** The species was collected between 30–1732 m elevation, in *Uapaca* woodland, montane rainforest, tropical dry forest, savanna and woodland, gallery forest and rainforest. Nests were located in rotten logs, in the soil, and under stones. Workers were collected from sifted litter.

**Comments.** *Pheidole bessonii* is probably one of the most widespread *Pheidole* species known from Madagascar. Morphologically it is most similar to *P. voreios* and *P. atsirakambiaty*, and its major workers can be separated from both species by punctate occipital lobes (which sometimes have additional thin and very sparse rugulae that arch posterolaterally), and sparsely rugocostulate lateral frons with distinctly punctate interspaces between rugocostulae. In contrast, majors of *P. voreios* and *P. atsirakambiaty* always have distinctly rugulate to costulate occipital lobes and frons. Minors of *P. bessonii* can be separated from *P. voreios* and *P. atsirakambiaty* by the less elongated posterior part of the neck, a mostly smooth promesonotum with sparse microreticulae on its sides, and very small propodeal spines. *Pheidole voreios* and *P. atsirakambiaty* have a more elongated posterior part of the neck, mostly or entirely sculptured promesonotum, and larger propodeal spines. In addition, majors and minors of *P. bessonii* can be distinguished from *P. voreios* by the brown body.

### *Pheidole clara* sp. nov.

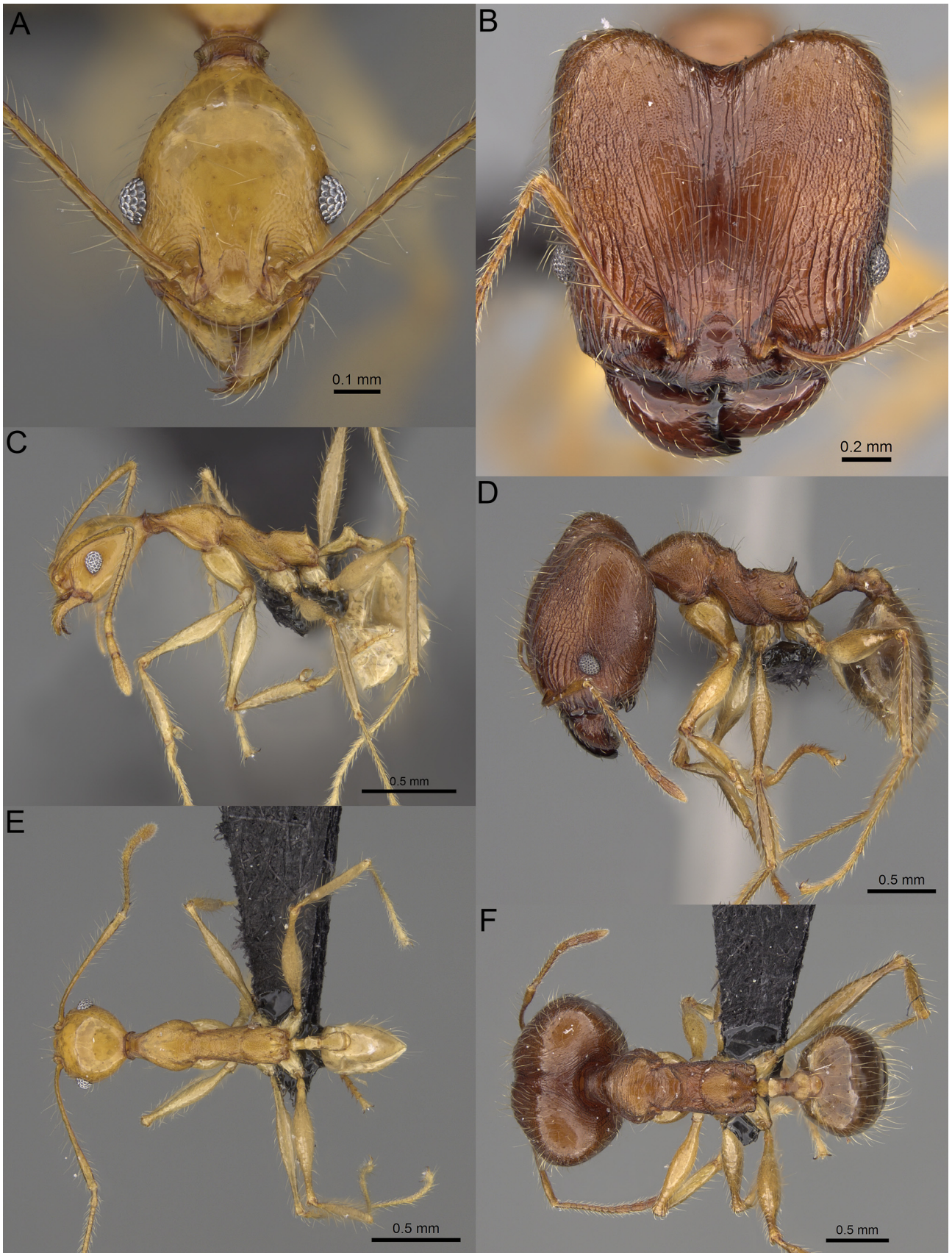
Figs 12A–F, 27D, 28D

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Parc National de Marojejy, Manantenina River, 27.6 km 35° NE Andapa, 9.6 km 327° NNW Manantenina, -14.435 49.76, 775 m, 17-Nov-2003, rainforest, ex dead twig above ground, B. L. Fisher *et al.* leg. BLF09023, CASENT0494851 (CASC). **PARATYPES:** 2w., 1s., 1q the same data as holotype, CASENT0494852, CASENT0494850, CASENT0494849 (CASC, MHNG, PBZT).

**Other material.** Madagascar. Toamasina: 3w., 2s., 1q., 5.3 km SSE Ambanizana, Andranobe, -15.67133 49.97395, 425 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, from Parc National de Marojejy, Antsiranana south to Andranobe, Toamasina.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, slightly widening posteriorly, with lateral margins slightly convex; side of head with moderately dense, long, suberect to erect pilosity; medial frons with dense costulae; interspaces between costulae smooth to indistinctly punctate; frons laterally with thick and dense rugae; interspaces between rugae distinctly punctate; occipital lobes with weakly developed and sparse rugae; interspaces between rugae punctate; sculpture weakening posteriorly; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth distinct, large, triangular, and directed posteriorly; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process indistinct and tubercle-like; mesosoma punctate; promesonotal dorsum with sculpture reduced and additional transverse rugae; gaster smooth; body orange. **Minor workers.** Occiput elongated forming short and moderately narrow neck; nuchal collar distinct; head sculpture smooth; anterolateral frons with sparse puncta; scape, when laid back, exceeding the posterior head margin by three-fifths of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small and thin; mesosoma punctate; katepisternum with a smooth notch; body yellow.



**FIGURE 12.** *Pheidole clara*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0494849) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0494851).



**Description. Major workers.** Measurements (n=3): HL: 1.77–1.9 (1.81); HW: 1.67–1.79 (1.73); SL: 1.01–1.14 (1.05); EL: 0.22–0.23 (0.23); WL: 1.55–1.59 (1.57); PSL: 0.24–0.27 (0.26); MTL: 1.16–1.24 (1.19); PNW: 0.62–0.66 (0.64); PTW: 0.18–0.2 (0.18); PPW: 0.4–0.44 (0.42); CI: 103.0–105.7 (104.3); SI: 58.1–63.6 (60.7); PSLI: 13.1–15.2 (14.4); PPI: 42.5–46.0 (44.5); PNI: 36.4–37.1 (36.8); MTI: 68.3–69.2 (68.9).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides slightly convex (Fig. 12B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with moderately dense, long, suberect to erect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Medial frons with dense costulae; interspaces between costulae smooth to indistinctly punctate. Frons laterally with thick and dense rugae; interspaces between rugae distinctly punctate. Occipital lobes with weakly developed and sparse rugae; interspaces between rugae punctate; sculpture weakening posteriorly. Gena with dense and moderately thick costulae; interspaces between costulae smooth. Sides posterolateral from eyes with dense but very thin network of rugoreticulae; sculpture weakening posteriorly. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 12B, D). Inner hypostomal tooth distinct, large, triangular, and directed posteriorly; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth absent (Fig. 27D). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process indistinct and tubercle-like; promesonotal groove absent; metanotal groove indistinct; propodeal spines moderately long with narrow base and acute top; humeral tubercle weakly produced (Fig. 12D). Surface punctate; promesonotal dorsum with reduced puncta and additional transverse rugae. Pilosity dense, long, and erect (Fig. 12D, F). **Gaster.** Shiny and smooth; pilosity moderately sparse, long, and erect (Fig. 12D, F). **Color.** Orange, antennae and legs yellow (Fig. 12D, F).

**Description. Minor workers.** Measurements (n=5): HL: 0.75–0.82 (0.78); HW: 0.52–0.59 (0.55); SL: 1.04–1.1 (1.06); EL: 0.14–0.17 (0.16); WL: 1.03–1.12 (1.07); PSL: 0.1–0.13 (0.11); MTL: 0.92–1.03 (0.96); PNW: 0.36–0.4 (0.38); PTW: 0.08–0.11 (0.09); PPW: 0.14–0.17 (0.14); CI: 140.3–145.9 (143.2); SI: 188.4–206.6 (195.5); PSLI: 12.9–15.8 (14.7); PPI: 52.1–77.5 (62.3); PNI: 65.5–72.1 (69.1); MTI: 171.1–177.3 (175.2).

**Head.** In full-face view oval, posterior region elongated forming short and moderately narrow neck; nuchal collar distinct (Fig. 12A). Pilosity relatively sparse, long, subdecumbent to erect. Sculpture shiny and smooth; anterolateral frons with sparse puncta; antennal sockets with few indistinct rugulae that are curved posterolaterally; interspaces between rugulae smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by three-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 12A, C). **Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small, thin, and triangular (Fig. 12C). Sculpture punctate, katapisternum with a smooth notch. Pilosity very dense, long, and erect (Fig. 12C, E). **Gaster.** With sparse and erect pilosity (Fig. 12C, E). **Color.** Yellow (Fig. 12C, E).

**Biology.** The species was collected between 425–775 m elevation, in rainforest. Nests were located in rotten logs and dead twigs above the ground.

**Comments.** *Pheidole clara*, a species recorded from southeastern Antsiranana and the northernmost part of Toamasina, is most similar to *P. mantadioflava*, known from the northeastern part of Toamasina. Majors of *P. clara* differ in the absence of antennal scrobes and the anterior mesonotum being at the same level or lower than the pronotum. In contrast, *P. mantadioflava* has weakly developed antennal scrobes and its anterior mesonotum is placed slightly higher than the pronotum. Minors of *P. clara* can be separated by sparse puncta restricted only to anterolateral frons and by their small and thin propodeal spines. Minors of *P. mantadioflava* have entire frons sparsely punctate and their propodeal spines are small with a wide base.

**Etymology.** Latin for clear or bright, in reference to the bright body coloration of minor workers.

### *Pheidole decollata* Forel, 1892 stat. nov.

Figs 13A–F, 27E, 28E

*Pheidole oswaldi* r. *decollata* Forel, 1892: 527 (s.w.).

LECTOTYPE: [designated here]: 1s., top specimen on the pin, Madagascar, Antananarivo, Andrangoloaka Forest, coll. Sikora, CASENT0101716, ANTC3357 (MHNG). PARALECTOTYPES: 1s., bottom specimen, the same

pin as lectotype, CASENT0876547, ANTC3357 (MHNG); 2w., the same data as lectotype, CASENT0101720, ANTC3358 (MHNG).

**Other material.** Madagascar. Antananarivo: 29w., 9s., 3 km 41° NE Andranomay, 11.5 km 147° SSE Anjozobe, -18.47333 47.96, 1300 m, Fisher *et al.* leg. (CASC); 1w., Analamanga Region, District of Ankazobe, Ambohitantely, 46 km NE of Ankazobe, -18.198 47.2815, 701 m, M. Rinha leg. (CASC); 3w., Forêt de galerie, Andranorovitra, 24.0 km NNE Ankazobe, -18.11243 47.19757, 1491 m, Fisher *et al.* leg. (CASC); 5w., 4s., Forêt de galerie, Telomirahavavy, 23.4 km NNE Ankazobe, -18.12167 47.20627, 1520 m, Fisher *et al.* leg. (CASC); 5w., 2s., 1m., Mandraka, -18.91813 47.91717, 1312 m, Fisher *et al.* leg. (CASC); 3w., 3s., Réserve Naturelle Sohisika, Sohisika 24.6 km NNE Ankazobe, -18.10322 47.18692, 1464 m, Fisher *et al.* leg. (CASC); 4w., 3s., Réserve Spéciale d'Ambohitantely, Forêt d'Ambohitantely, 20.9 km 72° NE d'Ankazobe, -18.22528 47.28683, 1410 m, Fisher *et al.* leg. (CASC); Antsiranana: 2w., 1s., 2.0 km S Andrakata, -14.65 49.71667, 520 m, Fisher *et al.* leg. (CASC); 5w., 5s., 1q., 6.5 km SSW Befingotra, Rés. Anjanaharibe-Sud, -14.75 49.5, 875 m, Fisher *et al.* leg. (CASC); 1w., 7 km N Joffreville [camp 2 of Fisher], -12.33333 49.25, 360 m, R. Harin'Hala leg. (CASC); 1w., 9.2 km WSW Befingotra, Rés. Anjanaharibe-Sud, -14.75 49.46667, 1280 m, Fisher *et al.* leg. (CASC); 3w., 9.2 km WSW Befingotra, Rés. Anjanaharibe-Sud, -14.75 49.46667, 1200 m, Fisher *et al.* leg. (CASC); 2w., 1s., Ambondrobe, 41.1 km 175° Voehemar, -13.71533 50.10167, 10 m, Fisher *et al.* leg. (CASC); 1s., Ampasindava, Forêt d'Ambilanivy, 3.9 km 181° S Ambaliha, -13.79861 48.16167, 600 m, Fisher *et al.* leg. (CASC); 17w., 13s., 3m., Betaolana Forest, along Bekona River, -14.52996 49.44039, 880 m, Fisher *et al.* leg. (CASC); 4w., 4s., Binara Forest, -13.26392 49.59919, 1065 m, Fisher *et al.* leg. (CASC); 2w., 2s., Binara Forest, -13.26388 49.60141, 900 m, Fisher *et al.* leg. (CASC); 2w., 2s., Binara Forest, -13.26206 49.60672, 559 m, Fisher *et al.* leg. (CASC); 8w., 4s., 1m., 1q., Forêt Ambanitaza, 26.1 km 347° Antalaha, -14.67933 50.18367, 240 m, Fisher *et al.* leg. (CASC); 2w., Forêt de Binara, 9.1 km 233° SW Daraina, -13.26333 49.60333, 650-800 m, Fisher *et al.* leg. (CASC); 3w., 7s., Forêt de Binara, 9.4 km 235° SW Daraina, -13.26333 49.6, 1100 m, Fisher *et al.* leg. (CASC); 3w., Makirovana forest, -14.17066 49.95409, 415 m, Fisher *et al.* leg. (CASC); 2w., Makirovana forest, -14.16666 49.95, 715 m, Fisher *et al.* leg. (CASC); 4w., Makirovana forest, -14.16044 49.95216, 550 m, Fisher *et al.* leg. (CASC); 1w., Marojejy, tributary Manantenina R., -14.43333 49.75, 750 m, Quinter & Nguyen leg. (CASC); 1w., Masoala National Park, -15.3014 50.22776, 280 m, Fisher *et al.* leg. (CASC); 2w., 1s., Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, -13.41933 48.33117, 30 m, Fisher *et al.* leg. (CASC); 13w., 2s., Parc National de Marojejy, Antranohofa, 26.6 km 31° NNE Andapa, 10.7 km 318° NW Manantenina, -14.44333 49.74333, 1325 m, Fisher *et al.* leg. (CASC); 3w., 1s., Parc National de Marojejy, Manantenina River, 27.6 km 35° NE Andapa, 9.6 km 327° NNW Manantenina, -14.435 49.76, 775 m, Fisher *et al.* leg. (CASC); 27w., 10s., Parc National de Marojejy, Manantenina River, 28.0 km 38° NE Andapa, 8.2 km 333° NNW Manantenina, -14.43667 49.775, 450 m, Fisher *et al.* leg. (CASC); 6w., Parc National Montagne d'Ambre [1st campsite], 960 m, Irwin *et al.* leg. (CASC); 1w., Parc National Montagne d'Ambre [lemur trail], 975 m, R. Harin'Hala leg. (CASC); 4w., Parc National Montagne d'Ambre [Petit Lac road], -12.5333333, 49.166667, 1125 m, R. Harin'Hala leg. (CASC); 1s., Parc National Montagne d'Ambre, 12.2 km 211° SSW Joffreville, -12.59639 49.1595, 1300 m, Fisher *et al.* leg. (CASC); 12w., 9s., 1q. Parc National Montagne d'Ambre, 3.6 km 235° SW Joffreville, -12.53444 49.1795, 925 m, J. Boutin leg. (CASC); 2w., 1s., Parc National Montagne d'Ambre, Antomboka, -12.51269 49.17807, 970 m, Fisher *et al.* leg. (CASC); 2w., 1s., Parc National Montagne d'Ambre, Lac maudit, -12.58502 49.15147, 1250 m, Fisher *et al.* leg. (CASC); 2w., 1s., 1q., Parc National Montagne d'Ambre, Mahasarika, -12.53176 49.17662, 1135 m, Fisher *et al.* leg. (CASC); 1w., 1s., Parc National Montagne d'Ambre, Roussettes, -12.52574 49.17238, 1025 m, Fisher *et al.* leg. (CASC); 3w., 3s., Prov. Antsiranana R.S. Manongarivo 17.3 km 218° SW Antanambao, -14.02167 48.41833, 1580 m, Fisher *et al.* leg. (CASC); 1s., R.S. Manongarivo, 12.8 km 228° SW Antanambao, -13.97667 48.42333, 780 m, Fisher *et al.* leg. (CASC); 3w., 3s., R.S. Manongarivo, 14.5 km 220° SW Antanambao, -14 48.43167, 1220 m, Fisher *et al.* leg. (CASC); 1w., 1s., R.S. Manongarivo, 14.5 km 220° SW Antanambao, -13.99833 48.42833, 1175 m, Fisher *et al.* leg. (CASC); 3w., 3s., R.S. Manongarivo, 14.5 km 220° SW Antanambao, -13.99833 48.42833, 1175 m, Fisher *et al.* leg. (CASC); 4w., 1s., Réserve Spéciale d'Ambre, 3.5 km 235° SW Sakaramy, -12.46889 49.24217, 325 m, Fisher *et al.* leg. (CASC); 1w., RNI Marojejy, 10 km NW Manantenina, -14.43333, 49.76667, 750 m, E.L. Quinter leg. (CASC); 1w., RNI Marojejy, 8 km NW Manantenina, -14.43333 49.78333, 450 m, E.L. Quinter leg. (CASC); 2w., Sakalava Beach [vegetated beach dunes], -12.26972 49.39167, 10 m, R. Harin'Hala leg. (CASC); 4w., 1s., SAVA Region, District of Sambava, Marojejy National Park, 5 km W of Manantenina village, 1st Camp site (Mantella), -14.43817 49.774, 487 m, M. Rin'Ha leg. (CASC); 2w., 1s., 1q., Sava Region: Parc National de Marojejy, Manantenina River, 21.3 km 27.0° NE Andapa, -

14.43686 49.74291, 1350 m, Fisher *et al.* leg. (CASC); 3w., 1s., 1m., Sava Region: Parc National de Marojejy, Manantenina River, 28.0 km 24.8° NE Andapa, -14.43461 49.76074, 780 m, Fisher *et al.* leg. (CASC); 4w., 2s., 1m., Sava Region: Parc National de Marojejy, Manantenina River, 28.0 km 24.8° NE Andapa, -14.43461 49.76074, 780 m, Fisher *et al.* leg. (CASC); 2w., 1s., 1m., Sava Region: Parc National de Marojejy, Manantenina River, 28.1 km 25.7° NE Andapa, -14.43553 49.76463, 680 m, Fisher *et al.* leg. (CASC); 5w., 3s., 2q., Sava Region: Parc National de Marojejy, near Manantenina River, -14.43677 49.77541, 475 m, Fisher *et al.* leg. (CASC). Fianarantsoa: 6w., 2s., 2 km W Andrambovato, along river Tatamaly, -21.51167 47.41, 1075 m, Fisher *et al.* leg. (CASC); 2w., 40 km S Ambalavao, Rés. Andringitra, -22.21667 46.96667, 1275 m, Fisher *et al.* leg. (CASC); 1w., 1q., 43 km S Ambalavao, Rés. Andringitra, -22.23333 47, 825 m, Fisher *et al.* leg. (CASC); 2w., 1s., 45 km S Ambalavao, -22.21667 47.01667, 720 m, Fisher *et al.* leg. (CASC); 7w., 4s., 1q., 45 km S. Ambalavao, -22.21667 47.01667, 785 m, Fisher *et al.* leg. (CASC); 5w., 3s., 7.6 km 122° Kianjavato, Forêt Classée Vatovavy, -21.4 47.94, 175 m, Fisher *et al.* leg. (CASC); 2w., 1s., 8.0 km NE Ivohibe, -22.42167 46.89833, 1200 m, Fisher *et al.* leg. (CASC); 2w., 9.0 km NE Ivohibe, -22.42667 46.93833, 900 m, Fisher *et al.* leg. (CASC); 1s., dry wash, 1 km E of Isalo National Park Interpretive Center, Fianarantsoa Prov., -22.62667 45.35817, 885 m, R. Harin'Hala leg. (CASC); 1s., Forêt d'Ambalagoavy Nord, Ikongo, Ambatombe, -21.857068 47.37849, 625 m, R. Harin'Hala leg. (CASC); 1w., Forêt d'Atsirakambiaty, 7.6 km 285° WNW Itremo, -20.59333 46.56333, 1550 m, Fisher *et al.* leg. (CASC); 3w., Forêt d'Atsirakambiaty, 7.6 km 285° WNW Itremo, -20.59333 46.56333, 1550 m, Fisher *et al.* leg. (CASC); 4w., 2s., Forêt de Vevembe, 66.6 km 293° Farafangana, -22.791 47.18183, 600 m, 23-Apr-2006, rainforest, transition to montane forest, Fisher *et al.* leg. (CASC); 3w., 4s., Parc National Befotaka-Midongy, Papango 27.7 km S Midongy-Sud, Mount Papango, -23.83517 46.96367, 940 m, Fisher *et al.* leg. (CASC); 2w., 2s., Parc National Befotaka-Midongy, Papango 28.5 km S Midongy-Sud, Mount Papango, -23.84083 46.9575, 1250 m, Fisher *et al.* leg. (CASC); 1w., Parc National d'Isalo, 9.1 km 354° N Ranohira, -22.48167 45.46167, 725 m, Fisher *et al.* leg. (CASC); 10w., 2s., Parc National de Ranomafana, Vatoharanana River, 4.1 km 231° SW Ranomafana, -21.29 47.43333, 1100 m, Fisher *et al.* leg. (CASC); 2w., 1s., Parc Nationale Ranomafana: Talatakely, -21.24833 47.42667, Griswold *et al.* leg. (CASC); 8w., 1s., R.S. Ivohibe 8.0 km E Ivohibe, -22.48333 46.96833, 1200 m, Fisher *et al.* leg. (CASC); 2w., 1s., R.S. Ivohibe, 7.5 km ENE Ivohibe, -22.47 46.96, 900 m, Fisher *et al.* leg. (CASC); 1w., radio tower, Ranomafana National Park, Fianarantsoa Prov., -21.25833 47.40717, 1130 m, Irwin *et al.* leg. (CASC); 1s., Ranomafana, -21.25 47.36667, A. Pauly leg. (CASC); 1w., Ranomafana National Park, Talatakely area, 0.4 km WSW of Park Entrance, -21.41667 47.68333, 900 m, D.H. & K.M. Kavanaugh leg. (CASC); 1w., Vohiparara broken bridge, Fianarantsoa Prov., -21.22617 47.36983, 1110 m, R. Harin'Hala leg. (CASC); 1s., Vohiparara Kidonavo 1, -21.22632 47.37007, 1100 m, V. C. Clark leg. (CASC). Mahajanga: 28w., 3m., 3q., Region Sofia, Ampotsidia, -14.42935 48.69863, 1193 m, Fisher *et al.* leg. (CASC); 11w., Region Sofia, Ampotsidia, -14.40775 48.70201, 1625 m, Fisher *et al.* leg. (CASC); 6w., 2m., Region Sofia, Ampotsidia, -14.41592 48.71118, 1364 m, Fisher *et al.* leg. (CASC); 4w., 1m., 1q., Region Sofia, Ampotsidia, -14.42188 48.72083, 1400 m, Fisher *et al.* leg. (CASC); 2w., 3s., Réserve Spéciale Marotandrano, Marotandrano 48.3 km S Mandritsara, -16.28322 48.81443, 865 m, Fisher *et al.* leg. (CASC); 1w., 1s., 1q., Toamasina, 5.3 km SSE Ambanizana, Andranobe, -15.67133 49.97395, 425 m, Fisher *et al.* leg. (CASC); 1w., 2s., 6.8 km S Ambanizana, -15.68333, 49.8, 25 m, Fisher *et al.* leg. (CASC); 1w., 2s., 6.9 km NE Ambanizana, Ambohitsitondroina, -15.58506 50.00952, 825 m, Fisher *et al.* leg. (CASC); 1w., 2s., 6.9 km NE Ambanizana, Ambohitsitondroina, -15.56667 50, 1000 m, Fisher *et al.* leg. (CASC); 1w., Ambanizana, Parc National Masoala, -15.57167 50.00611, 800-897 m, Andriamalala *et al.* leg. (CASC); 1w., 1s., Ambanizana, Parc National Masoala, -15.57222 50.00694, 930-1110 m, Andriamalala *et al.* leg. (CASC); 1s., Ambatovy, 12.4 km NE Moramanga, -18.83937 48.30842, 1080 m, Fisher *et al.* leg. (CASC); 1w., 1s., Ambatovy, 12.4 km NE Moramanga, -18.84773 48.29568, 1000 m, Fisher *et al.* leg. (CASC); 1w., Ambatovy, 12.4 km NE Moramanga, -18.85813 48.28488, 1040 m, Fisher *et al.* leg. (CASC); 1w., Analamay, -18.80623 48.33707, 1068 m, Fisher *et al.* leg. (CASC); 3w., Andasibe National Park, botanic garden near entrance, West of ANGAP office, -18.925172 48.418651, 1025 m, Irwin *et al.* leg. (CASC); 1w., F.C. Didy, -18.19833 48.57833, 960 m, H. J. Ratsirarson leg. (CASC); 2w., F.C. Sandranantitra, -18.04833 49.09167, 450 m, H. J. Ratsirarson leg. (CASC); 4w., 1s., Forêt Ambatovy, 14.3 km 57° Moramanga, -18.85083 48.32, 1075 m, Fisher *et al.* leg. (CASC); 1w., Manakambahiny, near Vavatenina Forest, -17.46667 49.35, A. Pauly leg. (CASC); 1w., Montagne d'Akirindro 7.6 km 341° NNW Ambinanitelo, -15.28833 49.54833, 600 m, Fisher *et al.* leg. (CASC); 5w., 1s., Montagne d'Anjanaharibe, 18.0 km 21° NNE Ambinanitelo, -15.18833 49.615, 470 m, Fisher *et al.* leg. (CASC); 3w., 2s., Montagne d'Anjanaharibe, 19.5 km 27° NNE Ambinanitelo, -15.17833 49.635, 1100 m, Fisher *et al.* leg. (CASC); 1w., P.N. Mantadia, -18.79167 48.42667, 895 m, H. J. Ratsirarson leg. (CASC); 2w., 2s., Parc National de Zahamena, Besaky River, -17.75244 48.85321, 760 m, Fisher *et al.* leg. (CASC); 2w., Parc National Ma-



nanara-Nord, 7.1 km 261° Antanambe, -16.455 49.7875, 225 m, Fisher *et al.* leg. (CASC); 1w., Reserve Betampona, Camp Vohitsivalana, 37.1 km 338° Toamasina, -17.88667, 49.2025 520 m, Fisher *et al.* leg. (CASC); 3w., 1s., Réserve Nationale Intégrale Betampona, Betampona 35.1 km NW Toamasina, -17.91801 49.20074, 500 m, Fisher *et al.* leg. (CASC); 1w., 1s., Sahafina forest 11.4 km W Brickaville, -18.81445 48.96205, 140 m, Fisher *et al.* leg. (CASC); 2w., Toliara, 10 km NW Enakara, Rés. Andohahela, -24.56667 46.81667, 430 m, Fisher *et al.* leg. (CASC); 4w., 1s., 11 km NW Enakara, Rés. Andohahela, -24.56667 46.83333, 800 m, Fisher *et al.* leg. (CASC); 1w., 2s., 11 km NW Enakara, Rés. Andohahela, -24.56667 46.81667, 950 m, Fisher *et al.* leg. (CASC); 1w., 13 km NW Enakara, Rés. Andohahela, -24.55. 46.8, 1250 m, Fisher *et al.* leg. (CASC); 2w., 1s., 13 km NW Enakara, Rés. Andohahela, -24.56667 46.81667, 1000 m, Fisher *et al.* leg. (CASC); 6w., 4s., 1m., Anosy Region, Anosyenne Mts, 29.33 km NW Manantenina, -24.13993 47.07418, 540 m, Fisher *et al.* leg. (CASC); 3w., 3s., Forêt Ivohibe 55.0 km N Tolagnaro, -24.569 47.204, 200 m, Fisher *et al.* leg. (CASC); 4w., 2s., 1q., Forêt Ivohibe 55.6 km N Tolagnaro, -24.56167 47.20017, 650 m, Fisher *et al.* leg. (CASC); 2w., 3s., Grand Lavasoa, 25.9 km W Tolagnaro, -25.08767 46.749, 450 m, Fisher *et al.* leg. (CASC); 4w., 3s., Parc National Andohahela, Col de Tanatana, 33.3 km NW Tolagnaro, -24.7585 46.85367, 275 m, Fisher *et al.* leg. (CASC); 1w., 1s., Parc National Andohahela, Manangotry, 33.8 km NW Tolagnaro, -24.75117 46.85783, 575 m, Fisher *et al.* leg. (CASC); 13w., 7s., Parc National d'Andohahela, Col du Sedro, 3.8 km 113° ESE Mahamavo, 37.6 km 341° NNW Tolagnaro, -24.76389 46.75167, 900 m, Fisher *et al.* leg. (CASC); 7w., 3s., Parc National d'Andohahela, Manampanihy River, 5.4 km 113° ESE Mahamavo, 36.7 km 343° NNW Tolagnaro, -24.76389 46.76683, 650 m, Fisher *et al.* leg. (CASC); 1w., 1s., Réserve Spéciale d'Ambohijanahary, Forêt d'Ankazotsihitafototra, 34.6 km 314° NW Ambaravarana, -18.26 45.41833, 1100 m, Fisher *et al.* leg. (CASC); 19w., 11s., Réserve Spéciale d'Ambohijanahary, Forêt d'Ankazotsihitafototra, 35.2 km 312° NW Ambaravarana, -18.26667 45.40667, 1050 m, Fisher *et al.* leg. (CASC).

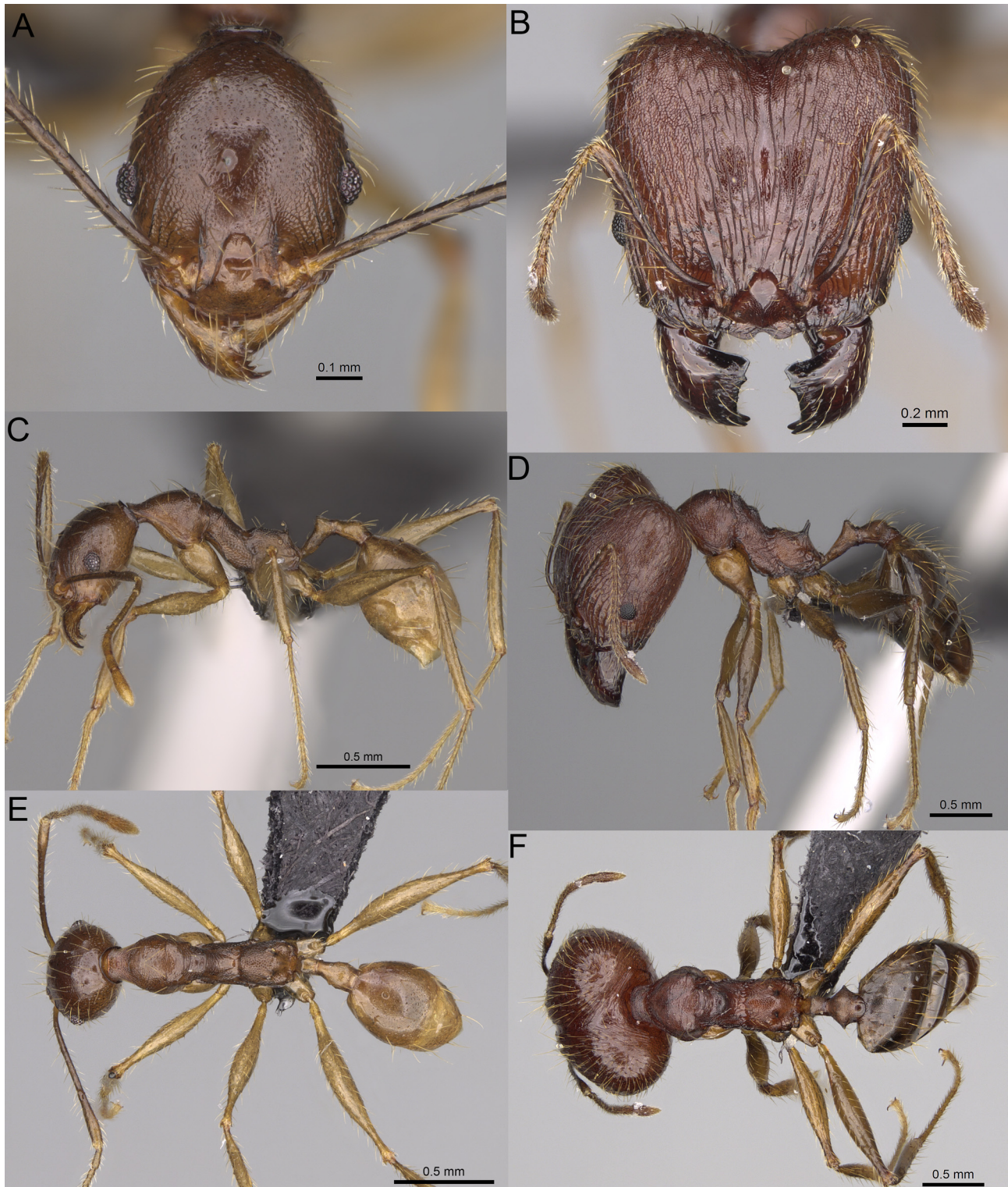
**Geographic range.** Madagascar, widely distributed mostly across the central and eastern parts of the island.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, slightly widening posteriorly, with lateral margins relatively straight; side of head with dense, long, suberect to erect pilosity; medial frons with sparse and thick costulae; interspaces between costulae indistinctly punctate; frons laterally with thick and sparse rugae; interspaces between rugae distinctly punctate; occipital lobes punctate with sparse and weakly developed rugae; scape, when laid back, exceeding the midlength of head by one-fifth of its length; inner hypostomal tooth distinct, bulge-like; outer hypostomal tooth lobe-like, moderately high and wide, with top arching posterolaterally; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum smoothly declining towards propodeum; mesonotal process indistinct and tubercle-like; mesosoma microreticulate; lateral sides of pronotum, propodeum, and katapisternum with additional, thin and transverse rugae; gaster smooth; body yellowish orange to brown. **Minor workers.** Occiput not elongated; nuchal collar indistinct; head sculpture distinctly to indistinctly punctate and fading posteriorly to the vertex, gena mostly or entirely smooth; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum moderately low, moderately long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines thin and very small to small; mesosoma punctate; body yellow to brown.

**Description. Major workers.** Measurements (n=10): HL: 1.54–1.7 (1.6); HW: 1.49–1.61 (1.53); SL: 1.04–1.09 (1.06); EL: 0.15–0.18 (0.17); WL: 1.49–1.6 (1.54); PSL: 0.22–0.27 (0.24); MTL: 1.12–1.21 (1.17); PNW: 0.59–0.64 (0.62); PTW: 0.17–0.21 (0.18); PPW: 0.35–0.43 (0.39); CI: 101.9–107.8 (104.3); SI: 64.8–71.4 (68.9); PSLI: 12.8–16.6 (15.1); PPI: 39.2–42.0 (40.2); PNI: 38.5–42.0 (40.2); MTI: 69.4–80.5 (76.5).

**Head.** In full-face view sub-rectangular, slightly widening posteriorly, with lateral sides slightly convex (Fig. 13B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of head with dense, long, suberect to erect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Medial frons with sparse and thick costulae; interspaces between costulae indistinctly punctate. Frons laterally with thick and sparse rugae; interspaces between rugae distinctly punctate. Occipital lobes punctate with sparse and indistinct rugae. Gena with dense and moderately thick costulae; interspaces between costulae mostly punctate. Sides posterolateral from eyes microreticulate with additional network of thin and sparse rugulae. Center of clypeus shiny with weakly developed rugulae, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by one-fifth of its length; pilosity subdecumbent to erect (Fig. 13B, D). Inner hypostomal tooth distinct, bulge-like; outer hypostomal tooth lobe-like, moderately high and wide, with top arching posterolaterally; median tooth absent (Fig. 27E). **Mesosoma.** In lateral view, promesonotum short, angular,

and moderately low; posterior mesonotum smoothly declining towards propodeum; mesonotal process indistinct and tubercle-like; promesonotal groove absent; metanotal groove indistinct; propodeal spines moderately long with moderately wide base and acute top; humeral tubercle weakly produced (Fig. 13D). Surface microreticulate; lateral sides of pronotum, propodeum, and katepisternum with additional thin and transverse rugae. Pilosity dense, long, and erect (Fig. 13D, F). **Gaster.** Shiny and smooth; pilosity moderately sparse, long, and erect (Fig. 13D, F). **Color.** Yellowish orange to brown, antennae and legs yellow (Fig. 13D, F).



**FIGURE 13.** *Pheidole decollata*, full-face view (A), profile (C), and dorsal view (E) of minor worker (CASENT0122880) and full-face view (B), profile (D), and dorsal view (F) of major worker (CASENT0923265).



**Description. Minor workers.** Measurements (n=9): HL: 0.72–0.91 (0.85); HW: 0.54–0.66 (0.62); SL: 0.99–1.13 (1.09); EL: 0.11–0.15 (0.13); WL: 0.99–1.19 (1.12); PSL: 0.08–0.14 (0.12); MTL: 0.93–1.04 (0.99); PNW: 0.34–0.47 (0.42); PTW: 0.09–0.13 (0.11); PPW: 0.16–0.23 (0.19); CI: 131.0–142.5 (138.0); SI: 171.1–183.7 (176.6); PSLI: 10.3–15.6 (13.8); PPI: 51.1–60.9 (56.7); PNI: 63.1–72.7 (68.8); MTI: 152.0–173.5 (160.4).

**Head.** In full-face view oval, posterior region not elongated; nuchal collar weakly developed (Fig. 13A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture distinctly to indistinctly punctate, fading posteriorly; vertex and gena mostly or entirely smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 13A, C). **Mesosoma.** In lateral view, promesonotum moderately low and moderately long and arched; promesonotal groove present; metanotal groove distinct; propodeal spines very small to small, thin, and triangular (Fig. 13C). Sculpture punctate. Pilosity sparse, long, and erect (Fig. 13C, E). **Gaster.** With sparse and erect pilosity (Fig. 13C, E). **Color.** Yellow to brown, legs and antennae usually brighter than the rest of the body (Fig. 13C, E).

**Biology.** The species was collected between 10–1625 m elevation, in montane rainforest, rainforest, montane ravine forest, montane shrubland, disturbed gallery montane forest, tropical forest, and montane forest. Nest were located in rotten logs, branches, and sticks on the ground, and dead twigs above the ground. Workers were collected from sifted litter.

**Comments.** *Pheidole decollata* is most similar to sympatric *P. oswaldi*. Its major workers can be separated based on the short, angular, and moderately low promesonotum and moderately large inner hypostomal tooth. In contrast, majors of *P. oswaldi* have a moderately long, angular, and very low promesonotum and small inner hypostomal tooth. Minors of *P. decollata* have the posterior region of the head not elongated and the promesonotum is moderately long, moderately low, and angular. Minor workers of *P. oswaldi* have slightly elongated posterior region of head, and moderately long, angular, and very low promesonotum.

### *Pheidole flammea* sp. nov.

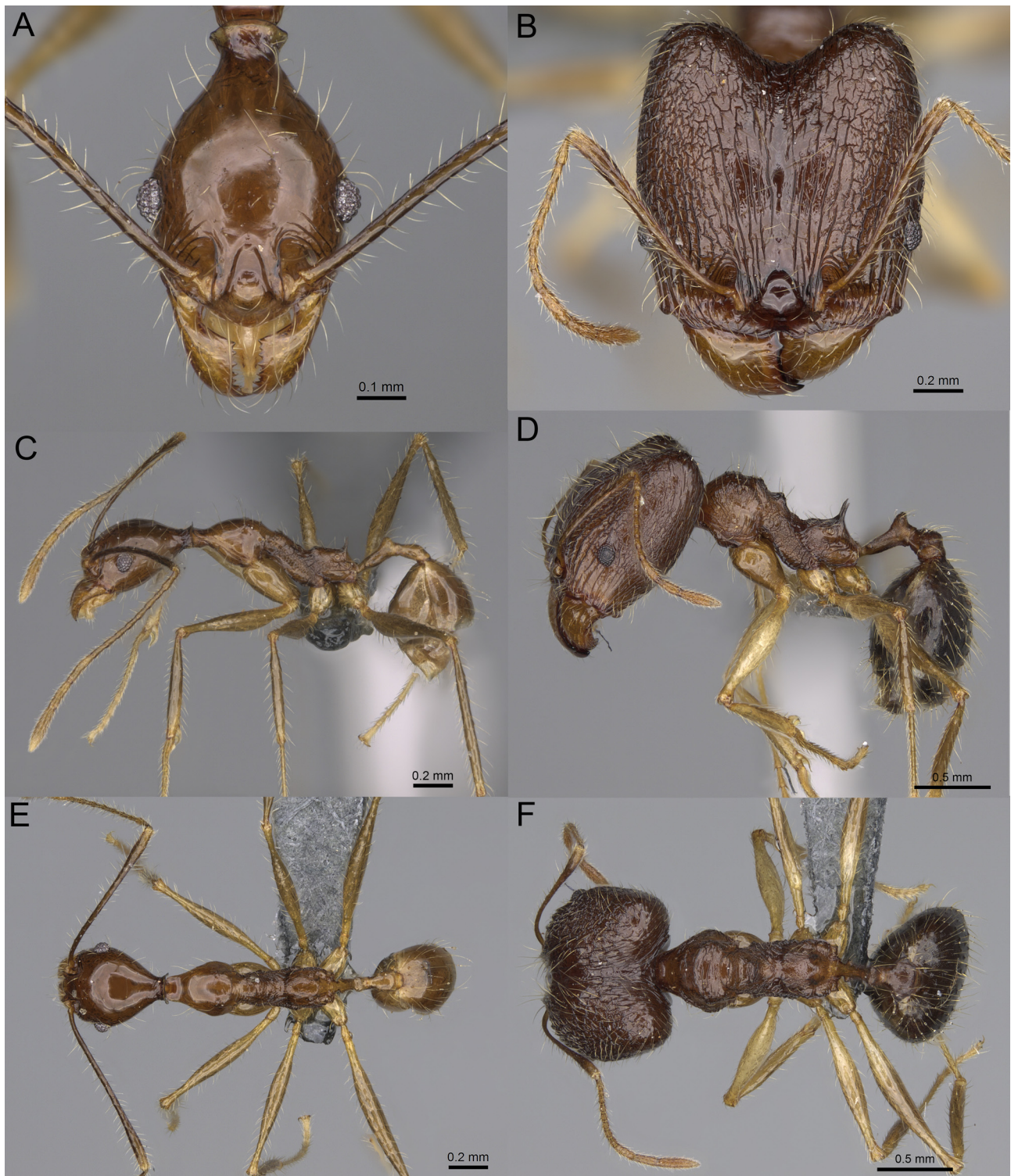
Figs 14A–F, 27F, 28F

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Galoko chain, Mont Galoko, -13.58487 48.71818, 520 m, 17-Feb-2013, rainforest, ex rotten log, B. L. Fisher *et al.* leg. BLF30615, CASENT0923251 (CASC). **PARATYPES:** 1w., 1q., the same data as holotype, CASENT0298332, CASENT0298333 (CASC, MHNG).

**Geographic range.** Madagascar, Antsiranana, Mont Galoko.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins slightly convex; side of head with moderately dense, long, suberect to erect pilosity; medial frons with sparse costulae; interspaces between costulae smooth; frons laterally with thick and dense rugae; interspaces between rugae smooth to indistinctly rugulate; occipital lobes with thinner rugae; interspaces between rugae smooth; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth small, bulge-like, and arching posteroventrally; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma microreticulate; promesonotal dorsum with reduced microreticulae and additional transverse rugae; lateral pronotum with smooth notch; katepisternum and lateral sides of propodeum with additional rugae; gaster indistinctly shagreened; body brown. **Minor workers.** Occiput elongated forming short and moderately narrow neck; nuchal collar distinct; head sculpture smooth; scape, when laid back, exceeding the posterior head margin by three-fifths of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderately large and thin; pronotum, mesonotum, and dorsal propodeum smooth; anepisternum, katepisternum, and lateral sides of propodeum with sparse puncta and rugae; body brown.

**Description. Major workers.** Measurements (n=1): HL: 1.65; HW: 1.5; SL: 1.19; EL: 0.18; WL: 1.45; PSL: 0.3; MTL: 1.21; PNW: 0.56; PTW: 0.18; PPW: 0.46; CI: 110.7; SI: 79.7; PSLI: 17.9; PPI: 38.8; PNI: 37.6; MTI: 81.1.



**FIGURE 14.** *Pheidole flammea*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0298333) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0923251).

**Head.** In full-face view sub-rectangular, not widening posteriorly with lateral sides slightly convex (Fig. 14B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with moderately dense, long, suberect to erect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Medial frons with sparse costulae; interspaces between costulae smooth. Frons laterally with thick and dense rugae; interspaces between rugae smooth to indistinctly rugulate. Occipital lobes with thinner rugae; interspaces between rugae smooth. Gena with sparse and moderately thick costulae; interspaces between



costulae smooth. Sides posterolateral from eyes with dense but very thin network of rugoreticulae; sculpture weakening posteriorly. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 14B, D). Inner hypostomal tooth small, bulge-like, and arching posteroventrally; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth absent (Fig. 27F). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove absent; propodeal spines long with narrow base and acute top; humeral tubercle weakly produced (Fig. 14D). Surface shiny and microreticulate; promesonotal dorsum with reduced microreticulae and additional transverse rugae; lateral pronotum with smooth notch; katapisternum and lateral sides of propodeum with additional rugae. Pilosity dense, long, and erect (Fig. 14D, F). **Gaster.** Shiny and indistinctly shagreened; pilosity moderately sparse, long, and erect (Fig. D, F). **Color.** Brown, antenna, mandibles and legs yellowish (Fig. 14D, F).

**Description. Minor workers.** Measurements (n=1): HL: 0.79; HW: 0.49; SL: 1.17; EL: 0.13; WL: 1.03; PSL: 0.14; MTL: 1.03; PNW: 0.36; PTW: 0.08; PPW: 0.13; CI: 161.7; SI: 238.3; PSLI: 17.1; PPI: 60.3; PNI: 73.7; MTI: 208.8.

**Head.** In full-face view oval, posterior region elongated forming short and moderately narrow neck; nuchal collar distinct (Fig. 14A). Pilosity relatively sparse, long, and subdecumbent to erect. Sculpture shiny and smooth; antennal sockets with few indistinct rugulae that are curved posterolaterally; interspaces between rugulae smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by three-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 14A, C). **Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderately large, thin, and triangular (Fig. 14C). Pronotum, mesonotum, and dorsal propodeum smooth; anepisternum, katapisternum, and lateral sides of propodeum with sparse puncta and rugae. Pilosity moderately sparse, long, and erect (Fig. 14C, E). **Gaster.** With sparse and erect pilosity (Fig. 14C, E). **Color.** Brown, legs, antennae and mandibles yellowish (Fig. 14C, E).

**Biology.** The species was collected at 520 m elevation, in rainforest. A nest was located in a rotten log.

**Comments.** *Pheidole flammea* is known only from Galoko Mountain. Its majors are most similar to *P. ovalinoda* and differ in moderately dense, long and suberect to erect pilosity on the side of the head, large outer hypostomal tooth, and mostly smooth interspaces between rugae on head. Majors of *P. ovalinoda* have dense, short and decumbent to suberect setae on sides of head, strongly reduced outer hypostomal tooth, and more distinctly sculptured interspaces between rugae on head. Minors of *P. flammea* are most similar to parapatric *P. antsahabe* and differ in brown body coloration, smooth promesonotum, and larger propodeal spines. In contrast, minors of *P. antsahabe* have black body coloration, sculptured promesonotum, and shorter propodeal spines.

**Etymology.** Latin for flames, in reference to the shape and density of setae on head of minor workers.

### *Pheidole flavodepressa* sp. nov.

Figs 15A–F, 27G, 28G

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Makirovana forest, -14.104 50.03574, 225 m, 4-May-2011, rainforest, sifted litter (leaf mold, rotten wood), B. L. Fisher *et al.* leg. BLF27044, CASENT0243625 (CASC). **PARATYPES:** 1w., the same data as holotype, CASENT0230800 (CASC).

**Other material.** Madagascar. Antsiranana: 4w., 2s., Makirovana forest, -14.104 50.03574, 225 m, B. L. Fisher *et al.* leg. (CASC); 1w., R.S. Manongarivo, 14.5 km 220° SW Antanambao, -13.99833 48.42833, 1175 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, Antsiranana, Makirovana forest and R.S. Manongarivo.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, elongated, not widening posteriorly, lateral margins relatively straight with very deep posteromedian concavity; side of head with moderately dense, long, subdecumbent to suberect pilosity; medial frons with dense and thick costulae; interspaces between costulae distinctly rugulate; frons laterally with thick and dense rugae; interspaces between rugae distinctly rugulate; occipital lobes

with thick and dense rugae; interspaces between rugae distinctly rugulate; sculpture not weakening posteriorly; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth indistinct and bulge-like; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum smoothly declining towards propodeum; mesonotal process indistinct and tubercle-like; mesosoma punctate; promesonotum with additional thin, dense, and transverse rugae; katapisternum and lateral sides of propodeum with additional thick and dense rugulae; gaster shagreened; body orange. **Minor workers.** Occiput elongated forming moderately long and narrow neck; nuchal collar distinct; head sculpture smooth; scape, when laid back, exceeding the posterior head margin by three-fifths of its length; promesonotum low, very long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines long and thin; mesosoma smooth; body yellow.

**Description. Major workers.** Measurements (n=3): HL: 1.86–1.89 (1.88); HW: 1.56–1.66 (1.6); SL: 1.33–1.41 (1.37); EL: 0.2–0.23 (0.22); WL: 1.68–1.76 (1.71); PSL: 0.4–0.42 (0.41); MTL: 1.53–1.54 (1.54); PNW: 0.64–0.66 (0.65); PTW: 0.18–0.2 (0.19); PPW: 0.53–0.58 (0.56); CI: 113.7–119.3 (117.3); SI: 83.6–90.2 (85.8); PSLI: 21.0–22.3 (21.9); PPI: 31.2–35.8 (33.8); PNI: 39.6–42.3 (40.7); MTI: 92.8–98.9 (95.9).

**Head.** In full-face view sub-rectangular, elongated, not widening posteriorly, lateral sides relatively straight with very deep posteromedian concavity (Fig. 15B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of head with moderately dense, long, subdecumbent to suberect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Medial frons with dense and thick costulae; interspaces between costulae distinctly rugulate. Frons laterally with thick and dense rugae; interspaces between rugae distinctly rugulate. Occipital lobes with thick and dense rugae; interspaces between rugae distinctly rugulate; sculpture not weakening posteriorly. Gena with dense and moderately thick costulae; interspaces between costulae mostly smooth. Sides posterolateral from eyes with dense but very thin network of rugoreticulae; sculpture not weakening posteriorly. Center of clypeus shiny with few rugae, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 15B, D). Inner hypostomal tooth indistinct, bulge-like; outer hypostomal tooth lobe-like, high, and wide, with top arching posterolaterally; median tooth absent (Fig. 27G). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum smoothly declining towards propodeum; mesonotal process indistinct and tubercle-like; promesonotal groove absent; metanotal groove indistinct; propodeal spines long, with narrow base and acute top; humeral tubercle weakly produced (Fig. 15D). Surface punctate; promesonotum with additional thin, dense, and transverse rugae; katapisternum and lateral sides of propodeum with additional thick and dense rugulae. Pilosity dense, long, and erect (Fig. 15D, F). **Petiole.** In rear view node dorsoventrally slightly convex (Fig. 15D, F). **Gaster.** Dull and shagreened; pilosity moderately sparse, long, and erect (Fig. 15D, F). **Color.** Orange, antennae and legs yellow, gaster and mandibles brownish-orange (Fig. 15D, F).

**Description. Minor workers.** Measurements (n=5): HL: 0.84–0.91 (0.87); HW: 0.48–0.51 (0.49); SL: 1.26–1.36 (1.31); EL: 0.14–0.16 (0.15); WL: 1.12–1.18 (1.14); PSL: 0.2–0.24 (0.22); MTL: 1.14–1.25 (1.19); PNW: 0.37–0.38 (0.38); PTW: 0.07–0.09 (0.08); PPW: 0.13–0.16 (0.15); CI: 173.5–185.3 (177.1); SI: 257.9–279.6 (266.9); PSLI: 22.8–27.6 (25.7); PPI: 49.0–62.0 (56.0); PNI: 74.4–79.6 (76.9); MTI: 236.1–256.3 (242.2).

**Head.** In full-face view oval, posterior region elongated forming moderately long and narrow neck; nuchal collar distinct (Fig. 15A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture shiny and smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by three-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 15A, C). **Mesosoma.** In lateral view, promesonotum low, very long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines long, thin, and triangular (Fig. 15C). Sculpture smooth. Pilosity very sparse, long, and erect (Fig. 15C, E). **Gaster.** With sparse and erect pilosity (Fig. 15C, E). **Color.** Yellow (Fig. 15C, E).

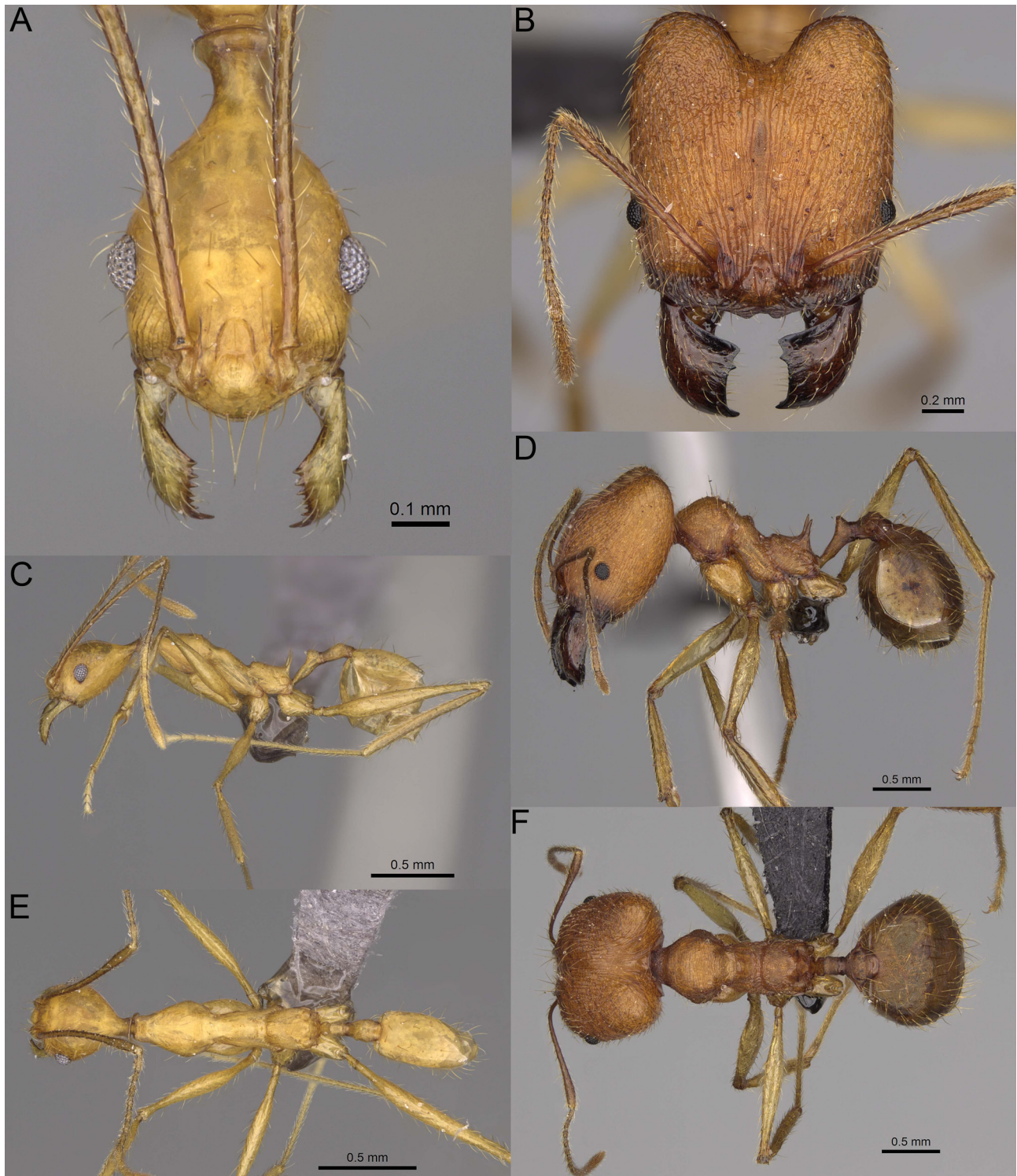
**Biology.** The species was collected between 225–1175 m elevation, in rainforest and montane rainforest. Nesting preferences are unknown. Workers were collected from sifted litter.

**Comments.** *Pheidole flavodepressa* is known from two localities in Antsiranana and is most similar to parapatric *P. zirafy*. Majors of *P. flavodepressa* can be separated based on orange body coloration, side of head with moderately dense, long and subdecumbent to suberect pilosity, and occipital lobes with thick and dense rugae with distinctly rugulate interspaces between rugae. Majors of *P. zirafy* have blackish brown body, moderately sparse,



short and appressed to decumbent pilosity on side of head, and occipital lobes with rugae that are thin, weakening posteriorly, and archposterolaterally, with mostly smooth interspaces between rugae. Minors of *P. flavodepressa* have yellow body coloration, shorter and thicker neck, and smooth mesosoma. In contrast, *P. zirafy* has dark brown minors with longer and thinner neck and mostly sculptured mesosoma. Minor workers of *P. flavodepressa* may also be confused with those of *P. antsahabe*, *P. similis*, *P. mantadioflava*, and *P. clara*, but differ from them in distinctly longer and thinner neck.

**Etymology.** Latin for yellow and deep, in reference to the yellow body coloration and deep posteromedian concavity in major workers.



**FIGURE 15.** *Pheidole flavodepressa*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0230800) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0243625).



***Pheidole grallatrix* Emery, 1899**

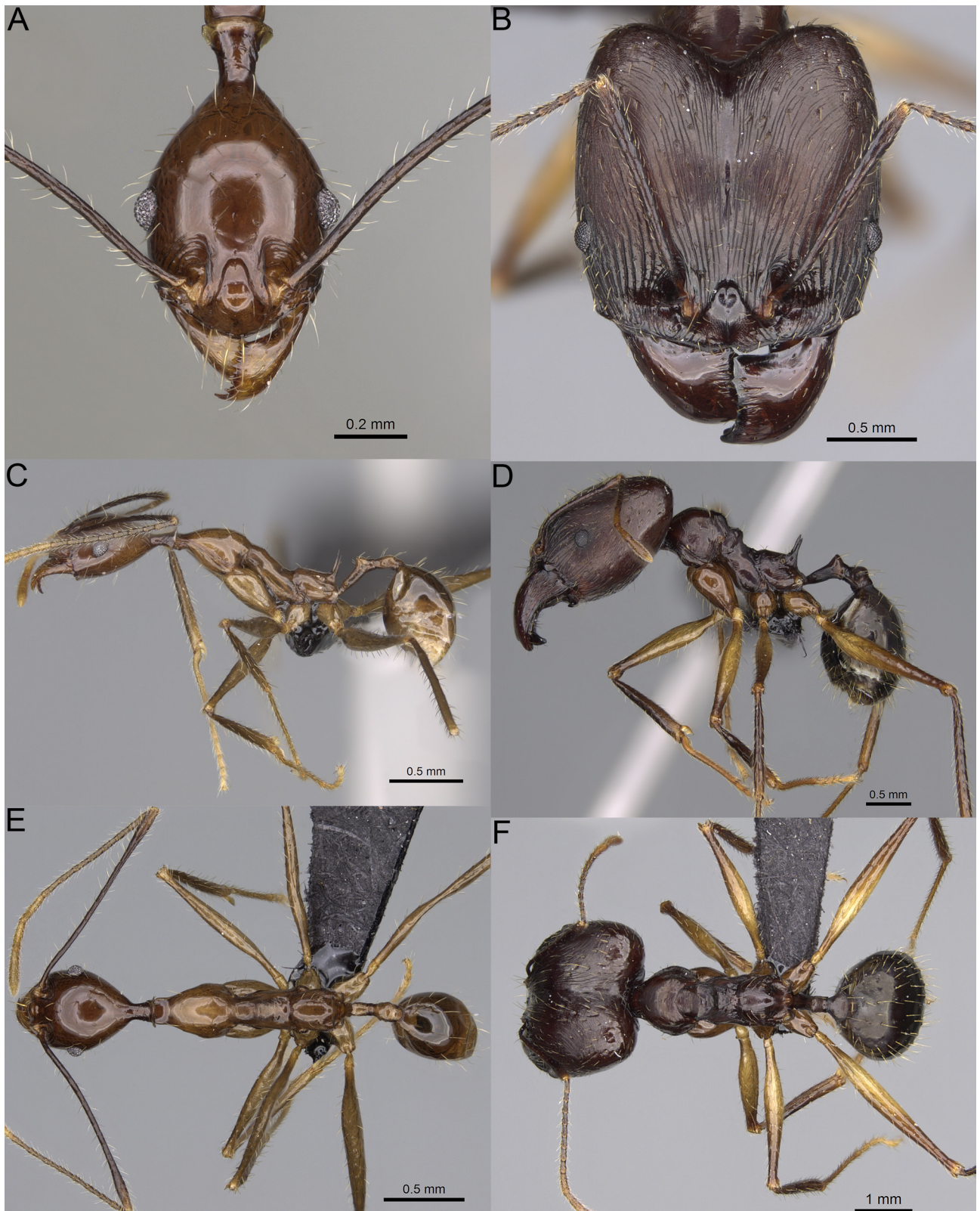
Figs 16A–F, 27H, 28H

*Pheidole grallatrix* Emery, 1899: 278 (s.w.)

LECTOTYPE [designated here]: 1s., Madagascar, Toamasina, Baie d'Antongil, coll. Mocquerys, CASENT0904224, ANTC24064 (MSNG). PARALECTOTYPES: 2w., the same data as lectotype, CASENT0904225, ANTC24065 (MSNG), CASENT0101943, ANTC3397 (MHNG).

**Other material.** Madagascar. Antsiranana: 3w., 6.5 km SSW Befingotra, Rés. Anjanaharibe-Sud, -14.75 49.5, 875 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt de Binara, 7.5 km 230° SW Daraina, -13.255 49.61667, 375 m, B. L. Fisher *et al.* leg. (CASC); 1w., Makirovana forest, -14.17066 49.95409, 415 m, B. L. Fisher *et al.* leg. (CASC); 4w., 1s., Masoala National Park, -15.32331 50.30751, 60 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Parc National de Marojejy, Manantenina River, 27.6 km 35° NE Andapa, 9.6 km 327° NNW Manantenina, -14.435 49.76, 775 m, B. L. Fisher *et al.* leg. (CASC); 1w., 3s., Parc National de Marojejy, Manantenina River, 28.0 km 38° NE Andapa, 8.2 km 333° NNW Manantenina, -14.43667 49.775, 450 m, B. L. Fisher *et al.* leg. (CASC); 1w., RNI Marojejy, 8 km NW Manantenina, -14.43333 49.78333, 450 m, E.L. Quinter leg. (CASC); 4w., SAVA Region, District of Sambava, Marojejy National Park, 5 km W of Manantenina village, 1st Camp site (Mantella), -14.43817 49.774, 487 m, M. Rin'Ha leg. (CASC); 4w., 1s., Sava Region: Parc National de Marojejy, near Manantenina River, -14.43677 49.77541, 475 m, B. L. Fisher *et al.* leg. (CASC). Fianarantsoa: 5w., 1s., 7.6 km 122° Kianjavato, Forêt Classée Vavovavy, -21.4 47.94, 175 m, B. L. Fisher *et al.* leg. (CASC); 2s., Forêt d'Ambalagoavy Nord, Ikongo, Ambatombe, -21.857068 47.37849, 625 m, Harin'Hala & Irwin leg. (CASC); 2w., JIRAMA water works near river, Ranomafana National Park, Fianarantsoa Prov., -21.2485 47.45217, 690 m, Irwin *et al.* leg. (CASC); 1w., radio tower, Ranomafana National Park, Fianarantsoa Prov., -21.25833 47.40717, 1130 m, Irwin *et al.* leg. (CASC); 1s., Ranomafana, -21.25 47.36667, A. Pauly leg. (CASC); 1w., Réserve Speciale Manombo 24.5 km 228° Farafangana, -23.01583 47.719, 30 m, B. L. Fisher *et al.* leg. (CASC). Toamasina: 1w., 5.3 km SSE Ambanizana, Andranobe, -15.67133 49.97395, 425 m, B. L. Fisher *et al.* leg. (CASC); 2w., 6.3 km S Ambanizana, Andranobe, -15.6813 49.958, 25 m, B. L. Fisher *et al.* leg. (CASC); 1w., Bevolota 17.1 km N Andasibe, -18.77071 48.43164, 995 m, B. L. Fisher *et al.* leg. (CASC); 2w., F.C. Sandranantitra, -18.04833 49.09167, 450 m, H. J. Ratsirarson leg. (CASC); 5w., 4s., Forêt d'Analava Mandrisy, 5.9 km 195° Antanambe, -16.48567 49.847, 10 m, B. L. Fisher *et al.* leg. (CASC); 7w., 5s., Ile Sainte Marie, Forêt Kalalao, 9.9 km 34° Ambodifotatra, -16.9225 49.88733, 100 m, B. L. Fisher *et al.* leg. (CASC); 2s., Manakambahiny, near Vavatenina Forest, -17.46667 49.35, A. Pauly leg. (CASC); 3w., Montagne d'Akirindro 7.6 km 341° NNW Ambinanitelo, -15.28833 49.54833, 600 m, B. L. Fisher *et al.* leg. (CASC); 7w., 4s., 1q., Montagne d'Anjanaharibe, 18.0 km 21° NNE Ambinanitelo, -15.18833 49.615, 470 m, B. L. Fisher *et al.* leg. (CASC); 1w., Montagne d'Anjanaharibe, 19.5 km 27° NNE Ambinanitelo, -15.17833 49.635, 1100 m, B. L. Fisher *et al.* leg. (CASC); 1s., Nosy Mangabe, 7.43 km S Maroantsetra, -15.4973 49.76223, 3 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Parc National de Zahamena, Besaky River, -17.75244 48.85321, 760 m, B. L. Fisher *et al.* leg. (CASC); 6w., 3s., Parc National Mananara-Nord, 7.1 km 261° Antanambe, -16.455 49.7875, 225 m, B. L. Fisher *et al.* leg. (CASC); 5w., Parcelle E3 Tampolo, -17.28104 49.43012, 10 m, B. L. Fisher *et al.* leg. (CASC); 2w., Parcelle K7 Tampolo, -17.28333 49.41667, 10 m, B. L. Fisher *et al.* leg. (CASC); 6w., 3s., Parcelle K9 Tampolo, -17.175 49.268, 10 m, B. L. Fisher *et al.* leg. (CASC); 4w., 1s., Res. Ambodiriana, 4.8 km 306° Manompana, along Manompana river, -16.67233 49.70117, 125 m, B. L. Fisher *et al.* leg. (CASC); 1w., Reserve Betampona, Camp Rendrirendry 34.1 km 332° Toamasina, -17.924 49.19967, 390 m, B. L. Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale Ambatovaky, Sandrangato river, -16.7633 49.26692, 520 m, B. L. Fisher *et al.* leg. (CASC); 4w., Réserve Spéciale Ambatovaky, Sandrangato river, -16.81739 49.29402, 360 m, B. L. Fisher *et al.* leg. (CASC); 3w., 6s., 2m., S.F. Tampolo, 10 km NNE Fenoarivo Atn., -17.2825 49.43, 10 m, B. L. Fisher *et al.* leg. (CASC); 5w., 5s., Sahafina forest 11.4 km W Brickaville, -18.81445 48.96205, 140 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Tampolo, -17.28333 49.41667, 10 m, B. L. Fisher *et al.* leg. (CASC); 1w., Torotorofotsy, -18.77048 48.43043, 1005 m, B. L. Fisher *et al.* leg. (CASC). Toliara: 6w., Anosy Region, Anosyenne Mts, 29.33 km NW Manantenina, -24.13993 47.07418, 540 m, B. L. Fisher *et al.* leg. (CASC); 1w., Parc National Andohahela, Col de Tanatana, 33.3 km NW Tolagnaro, -24.7585 46.85367, 275 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, widely distributed across rainforest on the eastern part of the island.



**FIGURE 16.** *Pheidole gallatrix*, full-face view (A), profile (C), and dorsal view (E) of minor worker (CASENT0923248) and full-face view (B), profile (D), and dorsal view (F) of major worker (CASENT0067235).

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins slightly convex; side of head with moderately sparse, short, appressed to subdecumbent pilosity; frons with thin and sparse costulae that sometimes arch posterolaterally on the posterior part; interspaces between costulae smooth



to indistinctly punctate; occipital lobes sometimes partially smooth, with thin rugopuncta that weaken posteriorly and arch posterolaterally; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth indistinct, low and bulge-like; outer hypostomal tooth lobe-like, higher than inner tooth, top directed posteriorly; inner and outer hypostomal tooth closely spaced and not connected by concavity; promesonotum short, angular and low; posterior mesonotum smoothly declining towards propodeum; mesonotal process distinct and tubercle-like; mesosoma smooth, only posterolateral sides of pronotum, katapisternum, and propodeum sometimes with sparse and thick rugulae; gaster smooth; body reddish brown to brown. **Minor workers.** Occiput elongated into a long, narrow neck terminating in a distinct nuchal collar; head sculpture smooth; scape, when laid back, exceeding the posterior head margin by half of its length; promesonotum very low, long, and slightly arched; promesonotal groove present; metanotal groove distinct; propodeal spines long and thin; mesosoma smooth; body brown to dark brown.

**Description. Major workers.** Measurements (n=10): HL: 2.04–2.36 (2.26); HW: 1.87–2.21 (2.09); SL: 1.55–1.68 (1.63); EL: 0.25–0.28 (0.26); WL: 1.84–2.19 (2.08); PSL: 0.39–0.48 (0.44); MTL: 1.8–2.03 (1.92); PNW: 0.69–0.83 (0.76); PTW: 0.21–0.24 (0.23); PPW: 0.49–0.58 (0.53); CI: 104.1–110.5 (107.8); SI: 73.8–83.6 (77.8); PSLI: 17.8–20.9 (19.6); PPI: 39.4–46.2 (42.8); PNI: 34.9–38.4 (36.1); MTI: 87.9–96.3 (91.5).

**Head.** In full-face view sub-rectangular, not widening posteriorly with lateral sides slightly convex (Fig. 16B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with moderately sparse, short, appressed to subdecumbent pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Frons with thin and sparse costulae that sometimes arch posterolaterally on the posterior part; interspaces between costulae smooth to indistinctly punctate. Occipital lobes sometimes partially smooth; with thin rugopuncta that weaken posteriorly arch posterolaterally. Gena with dense and thick costulae; interspaces between costulae distinctly punctate. Sides posterolateral from eyes with dense and thin microreticulae that weaken posteriorly. Center of clypeus shiny and indistinctly punctate, lateral sides with weakly developed rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 16B, D). Inner hypostomal tooth indistinct, low and bulge-like; outer hypostomal tooth lobe-like, higher than inner tooth, top directed posteriorly; inner and outer hypostomal tooth closely spaced and not connected by concavity (Fig. 27H). **Mesosoma.** In lateral view, promesonotum short, angular and low; posterior mesonotum smoothly declining towards propodeum; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove absent; propodeal spines long, narrow and with acute top; humeral tubercle weakly produced (Fig. 16D). Surface shiny and smooth; posterolateral sides of pronotum, katapisternum, and propodeum sometimes with sparse and thick rugulae. Pilosity moderately dense, short, and erect (Fig. 16D, F). **Petiole.** Smooth; in rear view node dorsoventrally convex medially (Fig. 16D, F). **Postpetiole.** Shagreened; dorsum with slightly sparser sculpture (Fig. 16D, F). **Gaster.** Shiny and smooth; pilosity moderately sparse, moderately long, and erect (Fig. 16D, F). **Color.** Reddish brown to brown, antennae and legs yellowish brown (Fig. 16D, F).

**Description. Minor workers.** Measurements (n=10): HL: 0.99–1.22 (1.04); HW: 0.58–0.77 (0.62); SL: 1.51–1.9 (1.6); EL: 0.16–0.19 (0.17); WL: 1.27–1.58 (1.38); PSL: 0.22–0.29 (0.25); MTL: 1.4–1.77 (1.51); PNW: 0.42–0.55 (0.46); PTW: 0.08–0.11 (0.1); PPW: 0.14–0.2 (0.16); CI: 159.4–175.0 (167.8); SI: 246.5–269.5 (258.3); PSLI: 21.8–25.0 (23.8); PPI: 51.6–79.4 (63.5); PNI: 71.0–77.1 (74.4); MTI: 230.6–258.9 (243.3).

**Head.** In full-face view oval, posterior region elongated into long, narrow neck terminated by distinct nuchal collar (Fig. 16A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture shiny and smooth; antennal sockets with few indistinct and curved posterolaterally rugulate; interspaces between rugulae smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin, neck not included, by half of its length; pilosity dense, subdecumbent to erect (Fig. 16A, C). **Mesosoma.** In lateral view, promesonotum very low, long, and slightly arched; promesonotal groove present; metanotal groove distinct; propodeal spines long, thin, and triangular (Fig. 16C). Sculpture smooth. Pilosity very sparse, short, and erect (Fig. 16C, E). **Petiole.** Peduncle with ventral face straight (Fig. 16C, E). **Gaster.** With sparse and erect pilosity (Fig. 16C, E). **Color.** Brown to dark brown, legs and antennae brighter (Fig. 16C, E).

**Biology.** The species was collected between 3–1130 m elevation, in rainforest, littoral forest, montane rainforest, low elevation rainforest, an open area near a stream, tropical dry forest, mixed tropical forest, and on a sandy beach. Nests were located in rotten logs, soil, root mats, and under stones. Workers were collected from sifted litter and tree trunks.

**Comments.** Majors of *P. grallatrix* are most similar to *P. bessonii*, *P. atsirakambiaty*, and *P. voreios* and can be easily separated based on smooth mesosoma in which the posterolateral sides of pronotum, katapisternum, and propodeum may be sparsely rugulate. In contrast, *P. bessonii*, *P. atsirakambiaty*, and *P. voreios* have entirely sculptured mesosoma. Minors of *P. grallatrix* are most similar to *P. zirafy* and can be separated based on smooth mesosoma. In contrast, *P. zirafy* has dense and thin rugoreticulae on lateral sides of propodeum, anepisternum, and katapisternum. Distribution of *P. grallatrix* overlaps only with *P. zirafy* and *P. voreios*.

### ***Pheidole madecassa* Forel, 1892**

Figs 17A–F, 27I, 28I

*Pheidole madecassa* Forel, 1892: 525 (s.w.)

LECTOTYPE: [designated here]: 1s., bottom specimen on the pin, Madagascar, Toamasina, Mangoro river, coll. Sikora, CASENT0101707, ANTC3400 (MHNG). PARALECTOTYPES: 1s., top specimen, the same pin as lectotype, CASENT0876545, ANTC3400 (MHNG); 2w., the same data as lectotype, CASENT0101897, ANTC3401 (MHNG).

**Other material.** Madagascar. Antsiranana: 2w., 1s., 9.2 km WSW Befingotra, Rés. Anjanaharibe-Sud, -14.75 49.46667, 1180 m, B. L. Fisher *et al.* leg. (CASC); 1w., 9.2 km WSW Befingotra, Rés. Anjanaharibe-Sud, -14.75, 49.46667 1200 m, B. L. Fisher *et al.* leg. (CASC). Toamasina: 3w., 1s., 6.9 km NE Ambanizana, Ambohitsitondroina, -15.58506 50.00952, 825 m, B. L. Fisher *et al.* leg. (CASC); 6w., F.C. Didy, -18.19833 48.57833, 960 m, H. J. Ratsirarson leg. (CASC); 1s., Forêt Ambatovy, 14.3 km 57° Moramanga, -18.85083 48.32, 1075 m, B. L. Fisher *et al.* leg. (CASC); 2w., 1s., Reserve Betampona, Camp Vohitsivalana, 37.1 km 338° Toamasina, -17.88667 49.2025, 520 m, B. L. Fisher *et al.* leg. (CASC); 1w., 2s., Réserve Spéciale Ambatovaky, Sandrangato river, -16.76912 49.26704, 475 m, B. L. Fisher *et al.* leg. (CASC); 3w., Réserve Spéciale Ambatovaky, Sandrangato river, -16.80561 49.29507, 480 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, from Andapa in Antsiranana south to Moramanga in Toamasina.

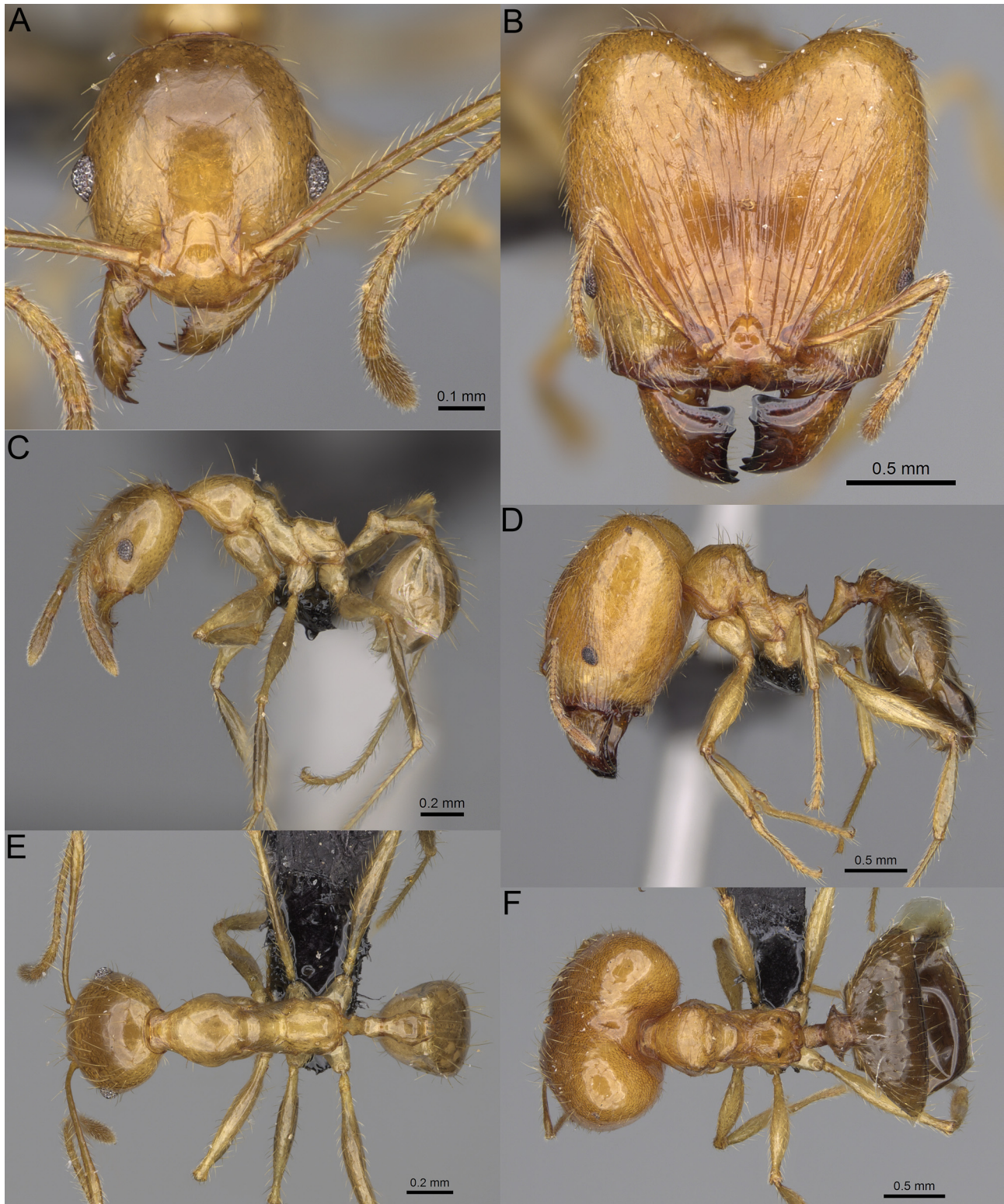
**Diagnosis. Major workers.** Head in full-face view sub-rectangular, slightly widening posteriorly, with lateral margins slightly convex; side of head with dense, long, subdecumbent to suberect pilosity; antennal scrobes very indistinct with sparse and very thin rugocostulae; interspaces between rugocostulae smooth; frons with sparse and thin costulae; interspaces between costulae smooth; occipital lobes smooth; scape, when laid back, not reaching the midlength of head; inner hypostomal tooth indistinct, tooth-like, closely spaced, and directed posteriorly; outer hypostomal tooth lobe-like, high, and moderately wide; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma smooth with very indistinct, and thin rugulae; gaster indistinctly shagreened; body yellow to orange. **Minor workers.** Occiput not elongated; nuchal collar absent; head sculpture smooth; scape, when laid back, exceeding the posterior head margin by one-fifth of its length; promesonotum moderately low, moderately short, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines indistinct; mesosoma smooth; body yellow.

**Description. Major workers.** Measurements (n=6): HL: 1.87–2.38 (2.15); HW: 1.88–2.35 (2.07); SL: 0.94–0.99 (0.96); EL: 0.22–0.26 (0.23); WL: 1.45–1.67 (1.55); PSL: 0.2–0.3 (0.24); MTL: 1.07–1.21 (1.14); PNW: 0.69–0.8 (0.74); PTW: 0.18–0.28 (0.23); PPW: 0.55–0.73 (0.63); CI: 99.7–107.9 (104.0); SI: 39.9–52.4 (46.8); PSLI: 9.7–13.0 (11.2); PPI: 32.9–41.1 (37.4); PNI: 34.2–36.6 (35.7); MTI: 51.4–61.6 (55.3).

**Head.** In full-face view sub-rectangular, slightly widening posteriorly, with lateral sides slightly convex (Fig. 17B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with dense, long, subdecumbent to suberect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Antennal scrobes very indistinct; with sparse and very thin rugocostulae; interspaces between rugocostulae smooth. Frons with sparse and thin costulae; interspaces between costulae smooth. Occipital lobes smooth. Gena with moderately dense and thin costulae; interspaces between costulae smooth. Sides posterolateral from eyes smooth; anterior parts indistinctly shagreened. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide, and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, not reaching the midlength of head; pilosity subdecumbent to erect (Fig. 17B, D). Inner hypostomal tooth indistinct, tooth-like, closely spaced, and directed posteriorly; outer hypostomal tooth lobe-like, high, and moderately wide; median tooth absent (Fig. 27I). **Mesosoma.** In lateral



view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove absent; propodeal spines moderately long, with wide base and acute top; humeral tubercle weakly produced (Fig. 17D). Surface mostly smooth, with very indistinct, and thin rugulae. Pilosity moderately dense, long, and erect (Fig. 17D, F). **Gaster.** Shiny and indistinctly shagreened; pilosity moderately dense, long, and erect (Fig. 17D, F). **Color.** Yellow to orange, gaster and mandibles darker (Fig. 17D, F).



**FIGURE 17.** *Pheidole madecassa*, full-face view (A), profile (C), and dorsal view (E) of minor worker (CASENT0162735) and full-face view (B), profile (D), and dorsal view (F) of major worker (CASENT0923255).

**Description. Minor workers.** Measurements (n=7): HL: 0.68–0.77 (0.73); HW: 0.6–0.66 (0.63); SL: 0.85–0.96 (0.9); EL: 0.12–0.14 (0.13); WL: 0.86–1.04 (0.96); PSL: 0.09–0.11 (0.1); MTL: 0.68–0.89 (0.78); PNW: 0.37–0.42 (0.4); PTW: 0.1–0.11 (0.1); PPW: 0.17–0.2 (0.18); CI: 113.3–126.3 (117.0); SI: 132.1–153.6 (143.4); PSLI: 12.9–15.3 (13.9); PPI: 53.3–63.3 (58.1); PNI: 61.3–65.1 (63.3); MTI: 110.5–144.6 (124.6).

**Head.** In full-face view oval, posterior region not elongated; nuchal collar absent (Fig. 17A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture smooth; anterolateral frons with weakly developed puncta. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by one-fifth of its length; pilosity dense, subdecumbent to erect (Fig. 17A, C). **Mesosoma.** In lateral view, promesonotum moderately low, moderately short, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines weakly developed and triangular (Fig. 17C). Sculpture smooth. Pilosity very sparse, long, and erect (Fig. 17C, E). **Gaster.** With sparse and erect pilosity (Fig. 17C, E). **Color.** Yellow (Fig. 17C, E).

**Biology.** The species was collected between 475–1200 m elevation, in rainforest and montane rainforest. Nests were located in rotten logs, dead branches above the ground, and root mats. Workers were collected from sifted litter and on low vegetation.

**Comments.** *Pheidole madecassa* is most similar to sympatric *P. maro*. Major workers of *P. madecassa* can be separated by smooth interspaces between rugocostulae on antennal scrobes, mostly smooth mesosoma with very indistinct and thin rugulae, small inner hypostomal tooth, and yellow to orange body. Majors of *P. maro* have indistinctly punctate interspaces between rugocostulae on antennal scrobes, sculptured mesosoma, large inner hypostomal tooth, and reddish-brown body. Minor workers of *P. madecassa* can be distinguished by smooth mesosoma and mostly smooth frons with weakly punctuated anterolateral areas. In contrast, minors of *P. maro* have indistinctly sculptured frons and mesosoma.

### *Pheidole mantadioflava* sp. nov.

Figs 18A–F, 27J, 28J

**HOLOTYPE:** 1s., Madagascar, Toamasina, Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80424 48.40081, 968 m, 12-Dec-2012, rainforest, ex dead bamboo above ground, B. L. Fisher *et al.* leg. BLF30377, CASENT0923250 (CASC). **PARATYPES:** 1w., the same data as holotype, CASENT0301826 (CASC).

**Other material.** Madagascar. Toamasina: 1w., Ambatovy, 12.4 km NE Moramanga, -18.84963 48.2947, 1010 m, B. L. Fisher *et al.* leg. (CASC); 2w., Ankerana, -18.4017 48.80605, 1035 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Bevolota 17.1 km N Andasibe, -18.77071 48.43164, 995 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80388 48.40506, 1013 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80424 48.40081, 968 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.79956 48.4028, 1058 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80438 48.40735, 960 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Ambohibolakely, -18.77898 48.36375, 918 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.76124 48.42134, 939 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.75737 48.42302, 1018 m, B. L. Fisher *et al.* leg. (CASC); 1w., 2s., F.C. Didy, -18.19833 48.57833, 960 m, H. J. Ratsirarson leg. (CASC); 1w., 1q., Réserve Spéciale Ambatovaky, Sandrangato river, -16.76912 49.26704, 475 m, B. L. Fisher *et al.* leg. (CASC); 2w., Réserve Spéciale Ambatovaky, Sandrangato river, -16.7633 49.26692, 520 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, distributed in mountains and highlands between Moramanga and Antenina in Toamasina.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins slightly convex; side of head with moderately dense, long, suberect to erect pilosity; antennal scrobes present, very indistinct, and mostly punctate, with additional network of thin and sparse rugae; frons with moderately dense and thick costulae; interspaces between costulae smooth to indistinctly punctate; occipital lobes with very indistinct and short rugae; sculpture weakening posteriorly and posterior part mostly smooth; scape, when laid back, exceeding the midlength of head by one-fifth of its length; inner hypostomal tooth distinct and bulge-like; outer



hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent; promesonotum short, angular, and moderately low, anterior mesonotum placed slightly higher than pronotum; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma microreticulate; promesonotal dorsum with sculpture reduced and additional transverse rugae; gaster indistinctly shagreened; body orange. **Minor workers.** Occiput elongated forming short and moderately narrow neck; nuchal collar distinct; head sculpture mostly smooth; frons with sparse puncta; scape, when laid back, exceeding the posterior head margin by three-fifths of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small with wide base; mesosoma punctate; body yellow.

**Description. Major workers.** Measurements (n=10): HL: 1.57–1.82 (1.69); HW: 1.47–1.8 (1.65); SL: 0.95–1.06 (1.0); EL: 0.21–0.25 (0.23); WL: 1.35–1.53 (1.47); PSL: 0.23–0.28 (0.25); MTL: 0.78–1.17 (1.06); PNW: 0.54–0.64 (0.6); PTW: 0.18–0.21 (0.2); PPW: 0.39–0.51 (0.44); CI: 98.5–107.0 (102.6); SI: 57.5–64.8 (60.7); PSLI: 13.5–16.9 (14.8); PPI: 40.1–51.3 (45.5); PNI: 32.5–37.7 (36.0); MTI: 52.9–71.3 (64.2).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides slightly convex (Fig. 18B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with moderately dense, long, suberect to erect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Antennal scrobes present and very indistinct; mostly punctate with additional network of thin and sparse rugae. Frons with moderately dense and thick costulae; interspaces between costulae smooth to indistinctly punctate. Occipital lobes with very indistinct and short rugae; sculpture weakening posteriorly and posterior part mostly smooth. Gena with sparse and moderately thick costulae; interspaces between costulae smooth. Sides posterolateral from eyes with dense but very thin network of rugoreticulae; sometimes with smooth notches; sculpture weakening posteriorly. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide, and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by one-fifth of its length; pilosity subdecumbent to erect (Fig. 18B, D). Inner hypostomal tooth distinct and bulge-like; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent (Fig. 27J). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low, anterior mesonotum placed slightly higher than pronotum; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove absent; propodeal spines moderately long, with narrow base and acute top; humeral tubercle weakly produced (Fig. 18D). Surface shiny and microreticulate; promesonotal dorsum with microreticulae reduced and additional transverse rugae. Pilosity moderately dense, long, and erect (Fig. 18D, F). **Gaster.** Shiny and indistinctly shagreened; pilosity moderately sparse, long, and erect (Fig. 18D, F). **Color.** Orange, legs and occipital lobes brighter, yellow (Fig. 18D, F).

**Description. Minor workers.** Measurements (n=10): HL: 0.78–0.84 (0.81); HW: 0.53–0.58 (0.55); SL: 0.97–1.1 (1.04); EL: 0.14–0.17 (0.15); WL: 0.99–1.11 (1.06); PSL: 0.07–0.11 (0.1); MTL: 0.83–0.96 (0.9); PNW: 0.36–0.41 (0.38); PTW: 0.08–0.11 (0.1); PPW: 0.14–0.19 (0.17); CI: 145.6–154.1 (147.6); SI: 180.7–194.6 (188.9); PSLI: 9.5–14.1 (12.2); PPI: 51.3–70.1 (62.3); PNI: 66.9–71.3 (69.4); MTI: 154.7–169.7 (164.1).

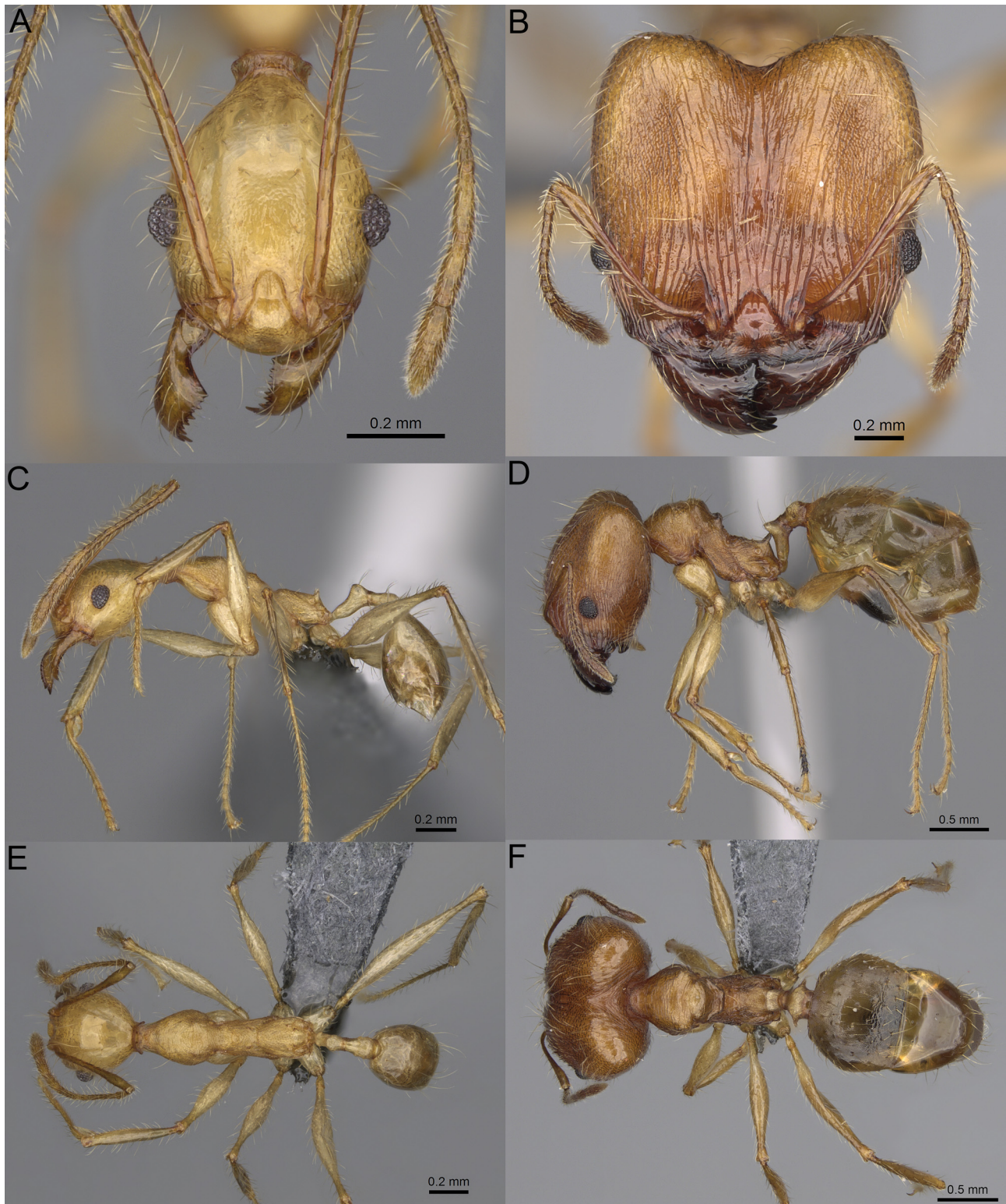
**Head.** In full-face view oval, posterior region elongated forming short and moderately narrow neck; nuchal collar distinct (Fig. 18A). Pilosity relatively sparse, long, subdecumbent to erect. Sculpture shiny and mostly smooth; frons with sparse puncta. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by three-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 18A, C). **Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small and triangular, with wide base (Fig. 18C). Sculpture punctate. Pilosity very sparse, moderately long, and erect (Fig. 18C, E). **Gaster.** With sparse and erect pilosity (Fig. 18C, E). **Color.** Yellow, mandibles and gaster usually darker (Fig. 18C, E).

**Biology.** The species was collected between 475–1035 m elevation, in rainforest, montane rainforest, and montane forest. Nests were located in rotten logs and sticks on the ground and dead bamboo above ground. Workers were collected from sifted litter.

**Comments.** *Pheidole mantadioflava*, known from the northeastern part of Toamasina, is most similar to *P. clara*, recorded from southeastern Antsiranana and the northernmost part of Toamasina. Majors of *P. mantadioflava* differ in the presence of antennal scrobes and anterior mesonotum placed slightly higher than pronotum. In contrast, majors of *P. clara* lack antennal scrobes and their anterior mesonotum is not placed higher than the pronotum. Minors of *P. mantadioflava* can be separated based on presence of sparse puncta on the entire surface of frons and small

propodeal spines with a wide base. Minor workers of *P. clara* have sparse puncta restricted only to anterolateral frons, and their propodeal spines are small and thin.

**Etymology.** Combination of the name of the type locality and a Latin word for yellow, in reference to the body colouration.



**FIGURE 18.** *Pheidole mantadioflava*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0301826) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0923250).



***Pheidole maro* sp. nov.**

Figs 19A–F, 27K, 28K

HOLOTYPE: 1s., Madagascar, Toamasina, Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.76465 48.41938, 1039 m, 4-Dec-2012, rainforest, ex rotten log, B. L. Fisher *et al.* leg. BLF30097, CASENT0923256 (CASC). PARATYPES: 1w., the same data as holotype, CASENT0299307 (CASC).

**Other material.** Antananarivo: 1w., Forêt de galerie, Telomirahavavy, 23.4 km NNE Ankazobe, -18.12167 47.20627, 1520 m, B. L. Fisher *et al.* leg. (CASC). Antsiranana: 1w., Ampasindava, Forêt d'Ambilanivy, 3.9 km 181° S Ambaliha, -13.79861 48.16167, 600 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt Ambanitaza, 26.1 km 347° Antalaha, -14.67933 50.18367, 240 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt d'Andavakoera, 21.4 km 75° ENE Ambilobe; 4.6 km 356° N Betsiaka, -13.11833 49.23, 425 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt de Binara, 9.1 km 233° SW Daraina, -13.26333 49.60333, 800 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt de Binara, 9.1 km 233° SW Daraina, -13.26333 49.60333, 650-800 m, B. L. Fisher *et al.* leg. (CASC); 1w., Makirovana forest, -14.16506 49.9477, 900 m, B. L. Fisher *et al.* leg. (CASC); 1w., Montagne des Français, 7.2 km 142° SE Antsiranana (=Diego Suarez), -12.32278 49.33817, 180 m, B. L. Fisher *et al.* leg. (CASC); 1w., Parc National de Marojejy, Manantenina River, 27.6 km 35° NE Andapa, 9.6 km 327° NNW Manantenina, -14.435 49.76, 775 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., R.S. Manongarivo, 14.5 km 220° SW Antanambao, -13.99833 48.42833, 1175 m, B. L. Fisher *et al.* leg. (CASC); 2w., Réserve Spéciale d'Ambre, 3.5 km 235° SW Sakaramy, -12.46889 49.24217, 325 m, B. L. Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale de l'Ankarana, 13.6 km 192° SSW Anivorano Nord, -12.86361 49.22583, 210 m, B. L. Fisher *et al.* leg. (CASC); 2w., Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, B. L. Fisher *et al.* leg. (CASC); 3w., Sakalava Beach [vegetated beach dunes], -12.26972 49.39167, 10 m, R. Harin'Hala leg. (CASC); 2w., SAVA Region, District of Sambava, Marojejy National Park, 5 km W of Manantenina village, 1st Camp site (Mantella), -14.43817 49.774, 487 m, M. Rin'Ha leg. (CASC). Fianarantsoa: 2w., 43 km S Ambalavao, Rés. Andringitra, -22.23333 47, 825 m, B. L. Fisher *et al.* leg. (CASC); 4w., 45 km S. Ambalavao, -22.21667 47.01667, 785 m, B. L. Fisher *et al.* leg. (CASC); 2w., 9.0 km NE Ivohibe, -22.42667 46.93833, 900 m, B. L. Fisher *et al.* leg. (CASC); 21w., Belle Vue trail, Ranomafana National Park, Fianarantsoa Prov., -21.2665 47.42017, 1020 m, M.E. Irwin *et al.* leg. (CASC); 2w., Fitovavy Fitovinany Region, District of Ifanadiana, 12 km W of Ranomafana, -21.25083 47.40717, 1127 m, M. Rin'Ha leg. (CASC); 2w., 2s., Parc National de Ranomafana, Vatoharanana River, 4.1 km 231° SW Ranomafana, -21.29 47.43333, 1100 m, B. L. Fisher *et al.* leg. (CASC); 1w., R.S. Ivohibe 8.0 km E Ivohibe, -22.48333 46.96833, 1200 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., R.S. Ivohibe, 7.5 km ENE Ivohibe, -22.47 46.96, 900 m, B. L. Fisher *et al.* leg. (CASC); 18w., radio tower, Ranomafana National Park, Fianarantsoa Prov., -21.25833 47.40717, 1130 m, M.E. Irwin *et al.* leg. (CASC); 10w., Vohiparara broken bridge, Fianarantsoa Prov., -21.22617 47.36983, 1110 m, R. Harin'Hala leg. MA-02-09A-06 (CASC). Mahajanga: 1w., Réserve Spéciale Marotandrano, Marotandrano 48.3 km S Mandritsara, -16.28322 48.81443, 865 m, B. L. Fisher *et al.* leg. (CASC). Toamasina: 2w., 7 km SE Andasibe National Park Headquarters, -18.969856 48.465894, 1050 m, M.E. Irwin *et al.* leg. (CASC); 1s., Ambanizana, Parc National Masoala, -15.57167 50.00611, 800-897 m, D. Andriamalala *et al.* leg. (CASC); 1w., 1s., Ambanizana, Parc National Masoala, -15.57167 50.00611, 900-950 m, D. Andriamalala *et al.* leg. (CASC); 2w., 2s., Ambatovy, 12.4 km NE Moramanga, -18.84963 48.2947, 1010 m, B. L. Fisher *et al.* leg. (CASC); 2w., 2s., Ambatovy, 12.4 km NE Moramanga, -18.83937 48.30842, 1080 m, B. L. Fisher *et al.* leg. (CASC); 3w., Ambatovy, 12.4 km NE Moramanga, -18.84773 48.29568, 1000 m, B. L. Fisher *et al.* leg. (CASC); 1w., Ambatovy, 12.4 km NE Moramanga, -18.85813 48.28488, 1040 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Analamay, -18.80623 48.33707, 1068 m, B. L. Fisher *et al.* leg. (CASC); 2w., Andasibe National Park, botanic garden near entrance, West of ANGAP office, -18.925172 48.418651, 1025 m, M.E. Irwin *et al.* leg. (CASC); 2w., Ankerana, -18.40636 48.80254, 1108 m, B. L. Fisher *et al.* leg. (CASC); 1w., Ankerana, -18.4017 48.80605, 1035 m, B. L. Fisher *et al.* leg. (CASC); 1s., Bevolota 17.1 km N Andasibe, -18.77071 48.43164, 995 m, B. L. Fisher *et al.* leg. (CASC); 1s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80398 48.40358, 1064 m, B. L. Fisher *et al.* leg. (CASC); 2w., 1s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.79956 48.4028, 1058 m, B. L. Fisher *et al.* leg. (CASC); 2w., 2s., Corridor Forestier Analamay-Mantadia, Ambatoharanana, -18.80438 48.40735, 960 m, B. L. Fisher *et al.* leg. (CASC); 2w., Corridor Forestier Analamay-Mantadia, Ambohibolakely, -18.77898 48.36375, 918 m, B. L. Fisher *et al.* leg. (CASC); 2w., Corridor Forestier Analamay-Mantadia, Ambohibolakely, -18.76087 48.37128, 1044 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.76124 48.42134, 939 m, B. L. Fisher *et al.* leg. (CASC); 4w., 4s., Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.76465

48.41938, 1039 m, B. L. Fisher *et al.* leg. (CASC); 1w., Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.75641 48.42195, 1036 m, B. L. Fisher *et al.* leg. (CASC); 1w., Corridor Forestier Analamay-Mantadia, Tsaravoniana, -18.75737 48.42302, 1018 m, B. L. Fisher *et al.* leg. (CASC); 3w., F.C. Andriantantely, -18.695 48.81333, 530 m, H. J. Ratsirarson leg. (CASC); 2w., 1s., F.C. Didy, -18.19833 48.57833, 960 m, H. J. Ratsirarson leg. (CASC); 1w., F.C. Sandranantitra, -18.04833 49.09167, 450 m, H. J. Ratsirarson leg. (CASC); 2w., Forêt Ambatovy, 14.3 km 57° Moramanga, -18.85083 48.32, 1075 m, B. L. Fisher *et al.* leg. (CASC); 2w., Montagne d'Akirindro 7.6 km 341° NNW Ambinanitelo, -15.28833 49.54833, 600 m, B. L. Fisher *et al.* leg. (CASC); 2w., 2s., Montagne d'Anjanaharibe, 18.0 km 21° NNE Ambinanitelo, -15.18833 49.615, 470 m, B. L. Fisher *et al.* leg. (CASC); 5w., 2s., Montagne d'Anjanaharibe, 19.5 km 27° NNE Ambinanitelo, -15.17833 49.635, 1100 m, B. L. Fisher *et al.* leg. (CASC); 3w., P.N. Mantadia, -18.79167 48.42667, 895 m, H. J. Ratsirarson leg. (CASC); 1w., Parc National de Zahamena, -17.73359 48.72625, 950 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Parc National de Zahamena, Onibe River, -17.75908 48.85468, 780 m, B. L. Fisher *et al.* leg. (CASC); 1s., Parc National Mananara-Nord, 7.1 km 261° Antanambe, -16.455 49.7875, 225 m, B. L. Fisher *et al.* leg. (CASC); 1w., Parcelle K9 Tampolo, -17.175 49.268, 10 m, B. L. Fisher *et al.* leg. (CASC); 4w., Réserve Spéciale Ambatovaky, Sandrangato river, -16.77274 49.26551, 450 m, B. L. Fisher *et al.* leg. (CASC); 3w., Réserve Spéciale Ambatovaky, Sandrangato river, -16.81739 49.29402, 360 m, B. L. Fisher *et al.* leg. (CASC); 2w., 1s., Sahafina forest 11.4 km W Brickaville, -18.81445 48.96205, 140 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Station forestière Analamazaotra, Analamazaotra 1.3 km S Andasibe, -18.38466 48.41271, 980 m, B. L. Fisher *et al.* leg. (CASC); 4w., 1s., Torotorofotsy, -18.87082 48.34737, 1070 m, B. L. Fisher *et al.* leg. (CASC); 1w., Torotorofotsy, -18.77048 48.43043, 1005 m, B. L. Fisher *et al.* leg. (CASC); 1w., Toliara, 13 km NW Enakara, Rés. Andohahela, -24.55 46.8, 1250 m, B. L. Fisher *et al.* leg. (CASC); 1w., Parc National Andohahela, Col de Tanatana, 33.3 km NW Tolagnaro, -24.7585 46.85367, 275 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, widely distributed across the eastern part of the island.

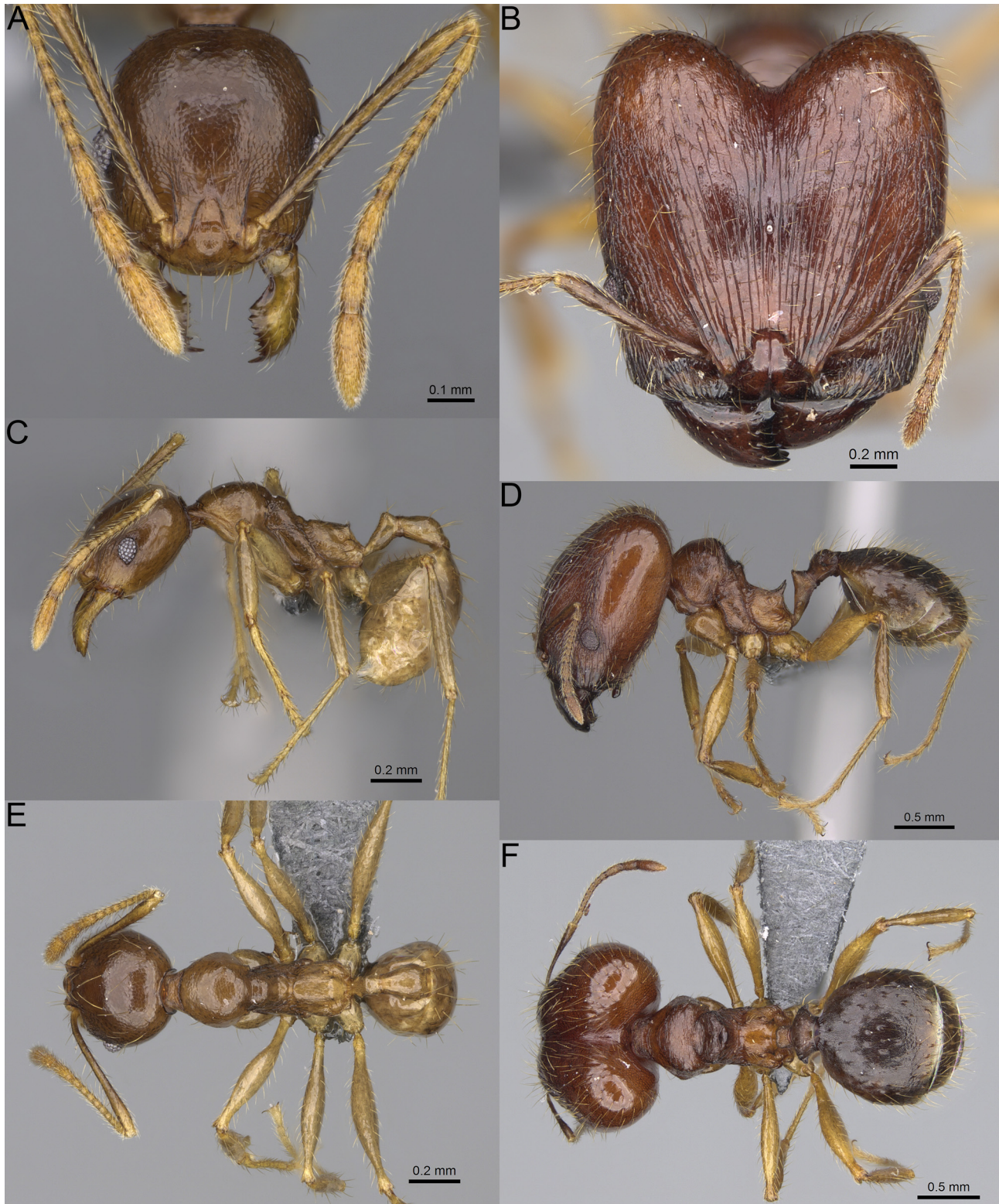
**Diagnosis. Major workers.** Head in full-face view sub-rectangular, slightly widening posteriorly, with lateral margins slightly convex; side of head with moderately dense, long, suberect to erect pilosity; antennal scrobes very indistinct, with sparse and very thin rugocostulae; interspaces between rugocostulae indistinctly punctate; frons with sparse and thin costulae; interspaces between costulae mostly smooth and sometimes indistinctly punctate; occipital lobes mostly smooth, sometimes with weakly developed rugopuncta; scape, when laid back, not reaching the midlength of head; inner hypostomal tooth distinct, bulge-like, closely spaced, and arching posteroventrally; outer hypostomal tooth lobe-like, high, and moderately wide; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma indistinctly microreticulate; gaster shagreened; body reddish brown. **Minor workers.** Occiput not elongated; nuchal collar absent; head sculpture mostly smooth; frons and sometimes vertex with very sparse puncta; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum moderately low, moderately short, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small and thin; mesosoma with very sparse and weakly developed puncta; body yellowish brown.

**Description. Major workers.** Measurements (n=10): HL: 2.01–2.31 (2.17); HW: 1.8–2.13 (2.04); SL: 0.86–1.00 (0.94); EL: 0.23–0.27 (0.25); WL: 1.35–1.61 (1.49); PSL: 0.24–0.31 (0.27); MTL: 1.05–1.17 (1.11); PNW: 0.69–0.88 (0.76); PTW: 0.23–0.31 (0.25); PPW: 0.59–0.88 (0.72); CI: 99.9–111.4 (106.7); SI: 42.7–49.3 (46.5); PSLI: 10.8–13.6 (12.4); PPI: 32.9–41.7 (35.6); PNI: 35.0–41.9 (37.3); MTI: 50.2–58.4 (54.4).

**Head.** In full-face view sub-rectangular, slightly widening posteriorly, with lateral sides slightly convex (Fig. 19B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with moderately dense, long, suberect to erect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Antennal scrobes very indistinct; with sparse and very thin rugocostulae; interspaces between rugocostulae indistinctly punctate. Frons with sparse and thin costulae; interspaces between costulae mostly smooth and sometimes indistinctly punctate. Occipital lobes mostly smooth, sometimes with weakly developed rugopuncta. Gena with moderately dense and thin costulae; interspaces between costulae mostly punctate. Sides posterolateral from eyes smooth; sometimes anterior parts with dense and very thin network of rugoreticulae. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, not reaching the midlength of head; pilosity subdecumbent to erect (Fig. 19B, D). Inner hypostomal tooth distinct, bulge-like, closely spaced, and arching posteroventrally; outer hypostomal tooth lobe-like, high, and moderately wide; median tooth absent (Fig. 27K). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior



mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove absent; propodeal spines moderately long with wide base and acute top; humeral tubercle weakly produced (Fig. 19D). Surface indistinctly microreticulate. Pilosity moderately dense, long, and erect (Fig. 19D, F). **Postpetiole.** In dorsal view trapezoidal and distinctly wider than long (Fig. 19D, F). **Gaster.** Shiny and shagreened; pilosity moderately sparse, long, and erect (Fig. 19D, F). **Color.** Reddish brown, antenna, legs and propodeum yellowish, gaster usually darker than mesosoma (Fig. 19D, F).



**FIGURE 19.** *Pheidole maro*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0299307) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0923256).

**Description. Minor workers.** Measurements (n=9): HL: 0.67–0.75 (0.71); HW: 0.58–0.68 (0.62); SL: 0.8–0.91 (0.82); EL: 0.13–0.15 (0.14); WL: 0.83–0.98 (0.92); PSL: 0.07–0.11 (0.1); MTL: 0.68–0.82 (0.72); PNW: 0.38–0.43 (0.4); PTW: 0.09–0.12 (0.1); PPW: 0.17–0.22 (0.2); CI: 107.7–123.5 (115.0); SI: 123.9–150.7 (134.2); PSLI: 10.0–15.5 (13.6); PPI: 44.0–60.0 (51.4); PNI: 62.8–68.8 (64.9); MTI: 106.8–135.8 (116.3).

**Head.** In full-face view oval, posterior region not elongated; nuchal collar absent (Fig. 19A). Pilosity relatively sparse, moderately short, subdecumbent to erect. Sculpture mostly smooth; frons and sometimes vertex with very sparse puncta. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 19A, C). **Mesosoma.** In lateral view, promesonotum moderately low, moderately short, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small, thin, and triangular (Fig. 19C). Sculpture with very sparse and weakly developed puncta. Pilosity sparse, moderately long, and erect (Fig. 19C, E). **Gaster.** With sparse and erect pilosity (Fig. 19C, E). **Color.** Yellowish brown, mandibles, antenna, and gaster usually brighter than the rest of the body (Fig. 19C, E).

**Biology.** The species was collected between 10–1520 m elevation, in rainforest, montane rainforest, mixed tropical forest, tropical dry forest, and montane forest. Nests were located in rotten logs and under moss. Workers were collected from sifted litter and on low vegetation.

**Comments.** *Pheidole maro* is most similar to sympatric *P. madecassa*. Its major workers can be separated based on indistinctly punctate interspaces between rugocostulae on antennal scrobes, sculptured mesosoma, large inner hypostomal tooth, and reddish-brown body. Majors of *P. madecassa* have smooth interspaces between rugocostulae on antennal scrobes, mostly smooth mesosoma with very indistinct and thin rugulae, small inner hypostomal tooth, and yellow to orange body. Minor workers can be distinguished based on presence of indistinct sculpture on frons and mesosoma. In contrast, minors of *P. madecassa* have smooth mesosoma, and mostly smooth frons with weakly developed puncta on anterolateral areas.

**Etymology.** Malagasy for many or plentiful, in reference to the wide distribution of the species.

### *Pheidole oswaldi* Forel, 1891

Figs 20A–F, 27L, 28L

*Pheidole oswaldi* Forel, 1891: 173 (s.w.q.m.).

LECTOTYPE [designated here]: 1s., Madagascar, Toamasina, 30 miles SW Toamasina, 28.IX.1889, coll. Oswald, CASENT0101640, ANTC3354 (MHNG). PARALECTOTYPES: 3w., the same data as lectotype, CASENT0101724, ANTC3355 (MHNG); 1q., Imerina, coll. Sikora, CASENT0101808, ANTC3353 (MHNG); 1m., Imerina, coll. Sikora, CASENT0101706, ANTC3356 (MHNG).

**Other material.** Madagascar. Fianarantsoa: 3w., 1s., Parc National de Ranomafana, Vatoharanana River, 4.1 km 231° SW Ranomafana, -21.29 47.43333, 1100 m, Fisher *et al.* leg. (CASC). Toamasina: 2w., 1s., 5.3 km SSE Ambanizana, Andranobe, -15.67133 49.97395, 425 m, Fisher *et al.* leg. (CASC); 8w., 3q., Ankerana, -18.4061 48.82029, 725 m, Fisher *et al.* leg. (CASC); 1w., 1s., Ankerana, -18.40062 48.81311, 865 m, Fisher *et al.* leg. (CASC); 8w., Ankerana, -18.40636 48.80254, 1108 m, Fisher *et al.* leg. (CASC); 6w., 2s., 1m., Ankerana, -18.4061 48.82029, 725 m, Fisher *et al.* leg. (CASC); 1w., 1s., Ankerana, -18.40672 48.82281, 681 m, Fisher *et al.* leg. (CASC); 2w., 1s., 1m., Ankerana, -18.40636 48.80254, 1108 m, Fisher *et al.* leg. (CASC); 1w., F.C. Andriantantely, -18.695 48.81333, 530 m, H. J. Ratsirarson leg. (CASC); 6w., F.C. Sandranantitra, -18.04833 49.09167, 450 m, H. J. Ratsirarson leg. (CASC); 2w., Montagne d'Akirindro 7.6 km 341° NNW Ambinanitelo, -15.28833 49.54833, 600 m, Fisher *et al.* leg. (CASC); 26w., 12s., Montagne d'Anjanaharibe, 18.0 km 21° NNE Ambinanitelo, -15.18833 49.615, 470 m, Fisher *et al.* leg. (CASC); 5s., Montagne d'Anjanaharibe, 19.5 km 27° NNE Ambinanitelo, -15.17833 49.635, 1100 m, Fisher *et al.* leg. (CASC); 1s., Nosy Mangabe, 7.43 km S Maroantsetra, -15.4973 49.76223, 3 m, Fisher *et al.* leg. (CASC); 1w., 1s., Parc National de Zahamena, -17.73359 48.72625, 950 m, Fisher *et al.* leg. (CASC); 2w., 1s., Parc National de Zahamena, Tetezambatana forest, near junction of Nosivola and Manakambahiny Rivers, -17.74298 48.72936, 860 m, Fisher *et al.* leg. (CASC); 1w., 1s., Parc National Mananara-Nord, 7.1 km 261° Antanambe, -16.455 49.7875, 225 m, Fisher *et al.* leg. (CASC); 2w., 2s., Res. Ambodiriana, 4.8 km 306° Manompana, along Manompana river, -16.67233 49.70117, 125 m, Fisher *et al.* leg. (CASC); 2w., 2s., Reserve Betampona, Camp Rendrirendry 34.1 km 332° Toamasina, -17.924 49.19967, 390 m, Fisher *et al.* leg. (CASC); 2w.,



2s., Reserve Betampona, Camp Vohitsivalana, 37.1 km 338° Toamasina, -17.88667 49.2025, 520 m, Fisher *et al.* leg. (CASC); 2w., 1s., 1m., Réserve Spéciale Ambatovaky, Sandrangato river, -16.81753 49.29498, 360 m, Fisher *et al.* leg. (CASC); 2w., 1m., Réserve Spéciale Ambatovaky, Sandrangato river, -16.76912 49.26704, 475 m, Fisher *et al.* leg. (CASC); 1w., 1s., Réserve Spéciale Ambatovaky, Sandrangato river, -16.77468 49.26551, 355 m, Fisher *et al.* leg. (CASC); 1w., 1s., 1q., Réserve Spéciale Ambatovaky, Sandrangato river, -16.7633 49.26692, 520 m, Fisher *et al.* leg. (CASC); 1w., 1s., Réserve Spéciale Ambatovaky, Sandrangato river, -16.7702 49.26638, 470 m, Fisher *et al.* leg. (CASC); 1w., 1s., Réserve Spéciale Ambatovaky, Sandrangato river, -16.7755 49.26427, 430 m, Fisher *et al.* leg. (CASC); 2w., 2s., Réserve Spéciale Ambatovaky, Sandrangato river, -16.81739 49.29402, 360 m, Fisher *et al.* leg. (CASC); 4w., 3s., 1q., Réserve Spéciale Ambatovaky, Sandrangato river, -16.81745 49.2925, 400 m, Fisher *et al.* leg. (CASC); 3w., 1m., Réserve Spéciale Ambatovaky, Sandrangato river, -16.80561 49.29507, 480 m, Fisher *et al.* leg. (CASC).

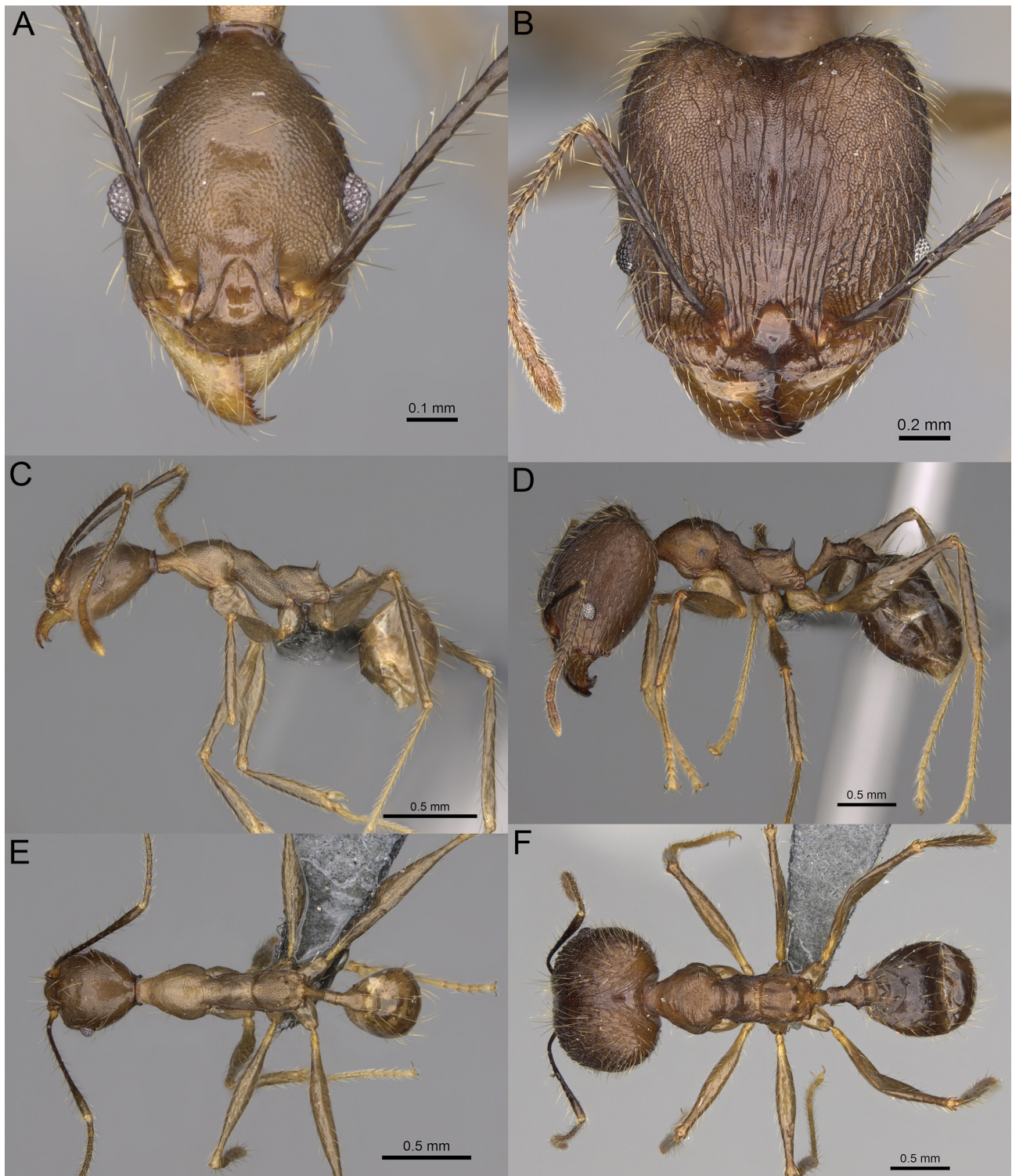
**Geographic range.** Madagascar, widely distributed in the central and eastern parts of the island.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins relatively straight; side of head with dense, long, suberect to erect pilosity; medial frons with moderately dense and thick costulae; interspaces between costulae distinctly punctate; frons laterally with thick and sparse rugae; interspaces between rugae distinctly punctate; occipital lobes punctate, sometimes with additional sparse and weakly developed rugae; scape, when laid back, exceeding the midlength of head by one-fifth of its length; inner hypostomal tooth distinct, small, and bulge-like, with top arching posteroventrally; outer hypostomal tooth lobe-like, moderately high, and wide, with top directed posteriorly; median tooth absent; promesonotum moderately long, angular, and very low; posterior mesonotum smoothly declining towards propodeum; mesonotal process weakly developed and tubercle-like; mesosoma punctate; lateral sides of pronotum, propodeum, and katapisternum with additional thin rugae; gaster indistinctly shagreened; body yellowish brown to brown. **Minor workers.** Occiput slightly elongated; nuchal collar indistinct; head sculpture punctate, gena mostly or entirely smooth; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small and thin; mesosoma punctate; body yellowish brown.

**Description. Major workers.** Measurements (n=10): HL: 1.56–1.73 (1.62); HW: 1.49–1.66 (1.55); SL: 1.04–1.18 (1.11); EL: 0.16–0.21 (0.19); WL: 1.54–1.68 (1.6); PSL: 0.19–0.27 (0.24); MTL: 1.14–1.38 (1.24); PNW: 0.52–0.65 (0.59); PTW: 0.15–0.18 (0.16); PPW: 0.36–0.45 (0.4); CI: 101.9–106.7 (104.4); SI: 69.3–75.6 (71.4); PSLI: 11.9–15.9 (15.1); PPI: 36.6–45.6 (40.9); PNI: 34.8–41.1 (38.0); MTI: 74.5–87.9 (79.8).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides relatively straight (Fig. 20B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with dense, long, suberect to erect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Medial frons with moderately dense and thick costulae; interspaces between costulae distinctly punctate. Frons laterally with thick and sparse rugae; interspaces between rugae distinctly punctate. Occipital lobes punctate, with sparse and sometimes weakly developed rugae. Gena with dense and moderately thick costulae; interspaces between costulae punctate. Sides posterolateral from eyes punctate and sometimes with additional network of thin and sparse rugulae. Center of clypeus shiny with weakly developed puncta, lateral sides with distinct rugulae; median notch present, moderately wide, and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by one-fifth of its length; pilosity subdecumbent to erect (Fig. 20B, D). Inner hypostomal tooth distinct, small, and bulge-like, with top arching posteroventrally; outer hypostomal tooth lobe-like, moderately high, and wide, with top directed posteriorly; median tooth absent (Fig. 27L). **Mesosoma.** In lateral view, promesonotum moderately long, angular, and very low; posterior mesonotum smoothly declining towards propodeum; mesonotal process weakly developed and tubercle-like; promesonotal groove absent; metanotal groove indistinct; propodeal spines moderately long with narrow base, and acute top; humeral tubercle weakly produced (Fig. 20D). Surface punctate; lateral sides of pronotum, propodeum, and katapisternum with additional thin rugae. Pilosity dense, long, and erect (Fig. 20D, F). **Gaster.** Shiny and indistinctly shagreened; pilosity moderately sparse, long, and erect (Fig. 20D, F). **Color.** Yellowish brown to brown, antennae and legs usually brighter (Fig. 20D, F).

**Description. Minor workers.** Measurements (n=10): HL: 0.73–0.82 (0.78); HW: 0.49–0.57 (0.53); SL: 1.03–1.17 (1.12); EL: 0.13–0.15 (0.14); WL: 1.02–1.14 (1.07); PSL: 0.11–0.14 (0.13); MTL: 0.9–1.07 (0.99); PNW: 0.37–0.42 (0.39); PTW: 0.07–0.11 (0.08); PPW: 0.14–0.2 (0.17); CI: 141.8–149.8 (147.0); SI: 200.6–216.2 (209.8); PSLI: 14.9–17.9 (16.2); PPI: 44.7–54.0 (50.4); PNI: 68.8–75.7 (72.6); MTI: 164.2–198.3 (185.6).



**FIGURE 20.** *Pheidole oswaldi*, full-face view (A), profile (C), and dorsal view (E) of minor worker (CASENT0275335) and full-face view (B), profile (D), and dorsal view (F) of major worker (CASENT0923266).

**Head.** In full-face view oval, posterior region slightly elongated; nuchal collar weakly developed (Fig. 20A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture punctate, gena mostly or entirely smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 20A, C). **Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small, thin, and triangular (Fig. 20C). Sculpture punctate. Pilosity sparse, long,



and erect (Fig. 20C, E). **Gaster.** With sparse and erect pilosity (Fig. 20C, E). **Color.** Yellowish brown (Fig. 20C, E).

**Biology.** The species was collected between 3–1490 m elevation, in rainforest, montane forest, littoral rainforest, montane rainforest, and montane shrubland. Nests were located in rotten logs, rotting tree stumps, and rotten sticks on the ground. Workers were collected from sifted litter, on low vegetation, and on tree trunks.

**Comments.** *Pheidole oswaldi* is most similar to sympatric *P. decollata*. Its major workers can be separated by moderately long, angular, and very low promesonotum and small inner hypostomal tooth. In contrast, majors of *P. decollata* have short, angular, and moderately low promesonotum and moderately large inner hypostomal tooth. Minors of *P. oswaldi* differ in slightly elongated posterior region of head and moderately long, angular, and very low promesonotum. Minor workers of *P. decollata* have posterior region of the head not elongated and the promesonotum is moderately long, moderately low, and angular.

### ***Pheidole ovalinoda* sp. nov.**

Figs 21A–F, 27M, 28M

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Sava Region: Parc National de Marojejy, Manantenina River, 27.9 km 24.3° NE Andapa, -14.43462 49.75853, 850 m, 9-Feb-2018, rainforest, ex tunelle on clay bark, B. L. Fisher *et al.* leg. BLF40902, CASENT0808080 (CASC). **PARATYPES:** 1w., the same data as holotype, CASENT0923277 (CASC).

**Other material.** Madagascar. Antsiranana: 3w., 2s., Sava Region: Parc National de Marojejy, Manantenina River, 27.9 km 24.3° NE Andapa, -14.43462 49.75853, 850 m, B. L. Fisher *et al.*, (CASC).

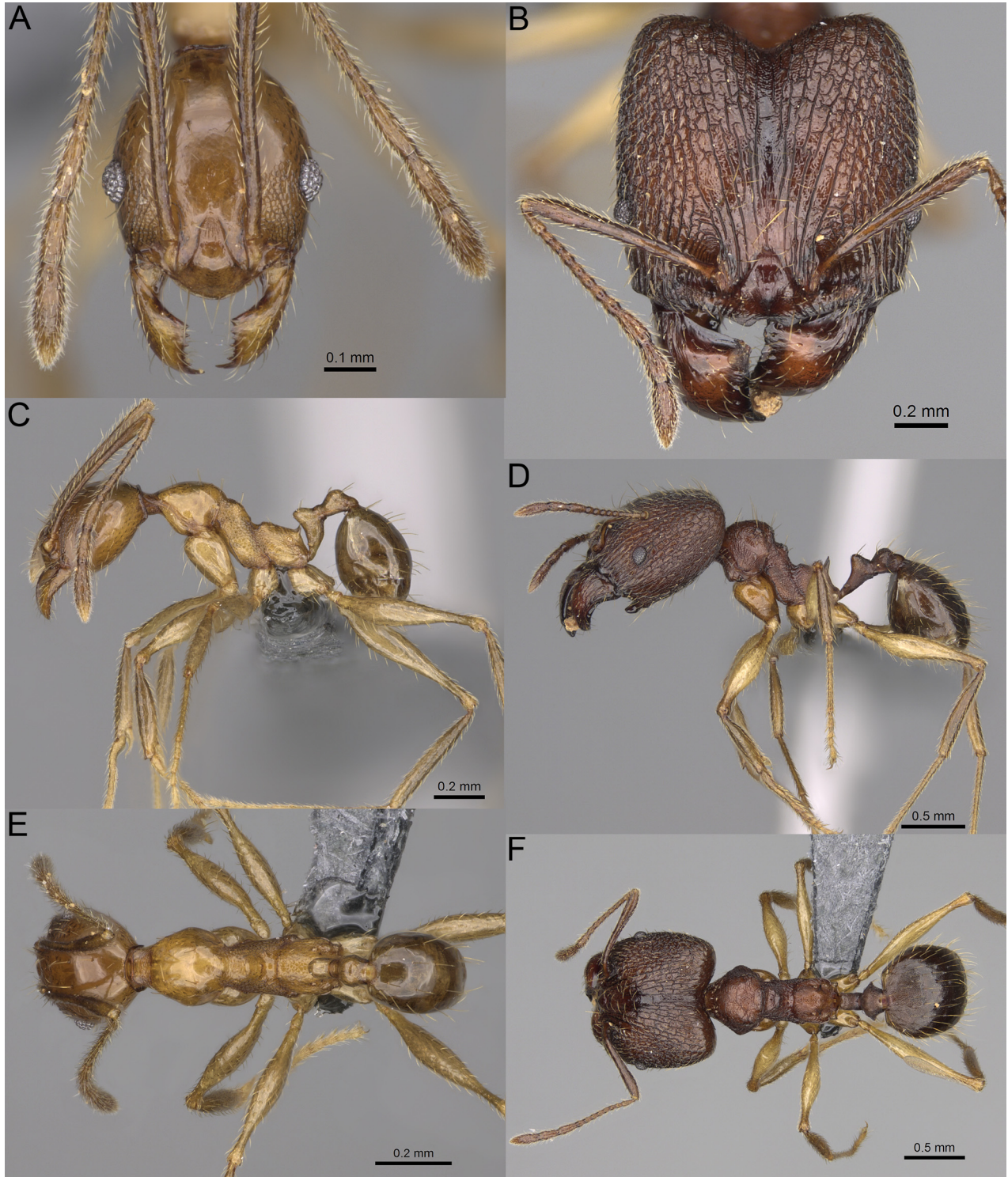
**Geographic range.** Madagascar, Antsiranana, Parc National de Marojejy.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins relatively straight; side of head with dense, short, decumbent to suberect pilosity; anteromedial frons with moderately dense and thick costulae; interspaces between costulae indistinctly rugulate; posteromedial frons rugulate; interspaces between rugulae more distinctly rugulate; frons laterally with thick and moderately dense rugae; interspaces between rugae indistinctly rugulate; occipital lobes with thick and moderately dense rugae; interspaces between rugae mostly smooth; scape, when laid back, exceeding the midlength of head by one-fifth of its length; inner hypostomal tooth distinct and bulge-like; outer hypostomal tooth absent to very indistinct; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct; mesosoma microreticulate, lateral sides of pronotum, propodeum, and katepisternum with additional thin rugae; pronotal dorsum with additional rugae; gaster shagreened; body brown. **Minor workers.** Occiput not elongated; nuchal collar indistinct; head sculpture smooth; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum moderately low, moderately long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines very small and thin; promesonotum smooth; anepisternum, katepisternum, and propodeum punctate; body yellowish brown; petiolar node high, triangular, and thick.

**Description. Major workers.** Measurements (n=4): HL: 1.35–1.5 (1.41); HW: 1.3–1.43 (1.36); SL: 0.92–0.98 (0.95); EL: 0.18–0.19 (0.18); WL: 1.25–1.35 (1.29); PSL: 0.2–0.23 (0.22); MTL: 0.95–1.02 (0.99); PNW: 0.53–0.57 (0.56); PTW: 0.17–0.19 (0.18); PPW: 0.33–0.42 (0.38); CI: 101.9–105.3 (103.9); SI: 68.5–71.1 (70.2); PSLI: 14.8–16.6 (15.7); PPI: 43.3–50.5 (46.3); PNI: 39.9–41.7 (41.0); MTI: 71.4–74.3 (73.1).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides relatively straight (Fig. 21B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with dense, short, decumbent to suberect pilosity; head dorsum with relatively dense, long, suberect to erect pilosity. Anteromedial frons with moderately dense and thick costulae; interspaces between costulae indistinctly rugulate; posteromedial frons rugulate; interspaces between rugulae more distinctly rugulate. Frons laterally with thick and moderately dense rugae; interspaces between rugae indistinctly rugulate. Occipital lobes with thick and moderately dense rugae; interspaces between rugae mostly smooth. Gena with dense and moderately thick costulae; interspaces between costulae mostly punctate. Sides posterolateral from eyes with thick rugulae; interspaces between rugulae distinctly rugulate. Center of clypeus shiny with weakly developed puncta, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by one-fifth of its length; pilosity subdecumbent to erect (Fig. 21B, D). Inner hypostomal tooth distinct, bulge-like; outer hypostomal

tooth absent to very indistinct; median tooth absent (Fig. 21M). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove indistinct; propodeal spines moderately long with moderately wide base and acute top; humeral tubercle weakly produced (Fig. 21D). Surface microreticulate; lateral sides of pronotum, propodeum, and katapisternum with additional thin rugae; pronotal dorsum with additional rugae. Pilosity moderately dense, long, and erect (Fig. 21D, F). **Gaster.** Shiny and shagreened; pilosity moderately sparse, long, and erect (Fig. 21D, F). **Color.** Brown, legs yellowish (Fig. 21D, F).



**FIGURE 21.** *Pheidole ovalinoda*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0923277) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0808080).



**Description. Minor workers.** Measurements (n=4): HL: 0.6–0.64 (0.62); HW: 0.46–0.49 (0.47); SL: 0.77–0.8 (0.79); EL: 0.11–0.13 (0.13); WL: 0.81–0.87 (0.84); PSL: 0.09–0.1 (0.09); MTL: 0.64–0.67 (0.65); PNW: 0.3–0.35 (0.33); PTW: 0.08–0.11 (0.09); PPW: 0.12–0.14 (0.13); CI: 127.6–134.7 (130.5); SI: 162.9–170.7 (166.1); PSLI: 14.1–15.7 (14.8); PPI: 59.4–79.9 (69.6); PNI: 64.4–73.8 (70.0); MTI: 134.5–138.6 (137.3).

**Head.** In full-face view oval, posterior region not elongated; nuchal collar weakly developed (Fig. 21A). Pilosity relatively sparse, moderately short, subdecumbent to erect. Sculpture mostly smooth; anterolateral frons punctate. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 21A, C). **Mesosoma.** In lateral view, promesonotum moderately low, moderately long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines very small, thin, and triangular (Fig. 21C). Promesonotum smooth; anepisternum, katepisternum, and propodeum punctate. Pilosity sparse, moderately long, and erect (Fig. 21C, E). **Gaster.** With sparse and erect pilosity (Fig. 21C, E). **Color.** Yellowish brown, gaster and head darker than mesosoma (Fig. 21C, E).

**Biology.** The species was collected at 850 m elevation, in rainforest. Nests were located in the soil and on clay banks.

**Comments.** *Pheidole ovalinoda* is known only from Parc National de Marojejy in Antsiranana. Its major workers can be confused with parapatric *P. flammea*, recorded only from Galoko Mountain. Majors of *P. ovalinoda* differ from *P. flammea* in the presence of dense, short and decumbent to suberect setae on the sides of the head, strongly reduced outer hypostomal tooth, and more distinctly sculptured interspaces between rugae on head. Majors of *P. flammea* have moderately dense, long and suberect to erect pilosity on the side of the head, large outer hypostomal tooth, and mostly smooth interspaces between rugae on head. Minors of *P. ovalinoda* are easy to separate from other *Pheidole* known from the island based on the combination of the following characters: petiolar node high, triangular, and thick; postpetiole short and moderately high; yellowish brown body coloration; neck absent, and nuchal collar indistinct; head and promesonotum mostly smooth; promesonotal and metanotal grooves distinct.

**Etymology.** Latin for oval and node, in reference to the high and spherical postpetiole of minor workers.

### *Pheidole similis* sp. nov.

Figs 22A–F, 27N, 28N

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, -13.41933 48.33117, 30 m, 19-Mar-2001, rainforest, ex rotten log, Fisher *et al.* leg. BLF03447, CASENT0427852 (CASC). **PARATYPES:** 2w., the same data as holotype, CASENT0427853, CASENT0427854 (CASC, MHNG).

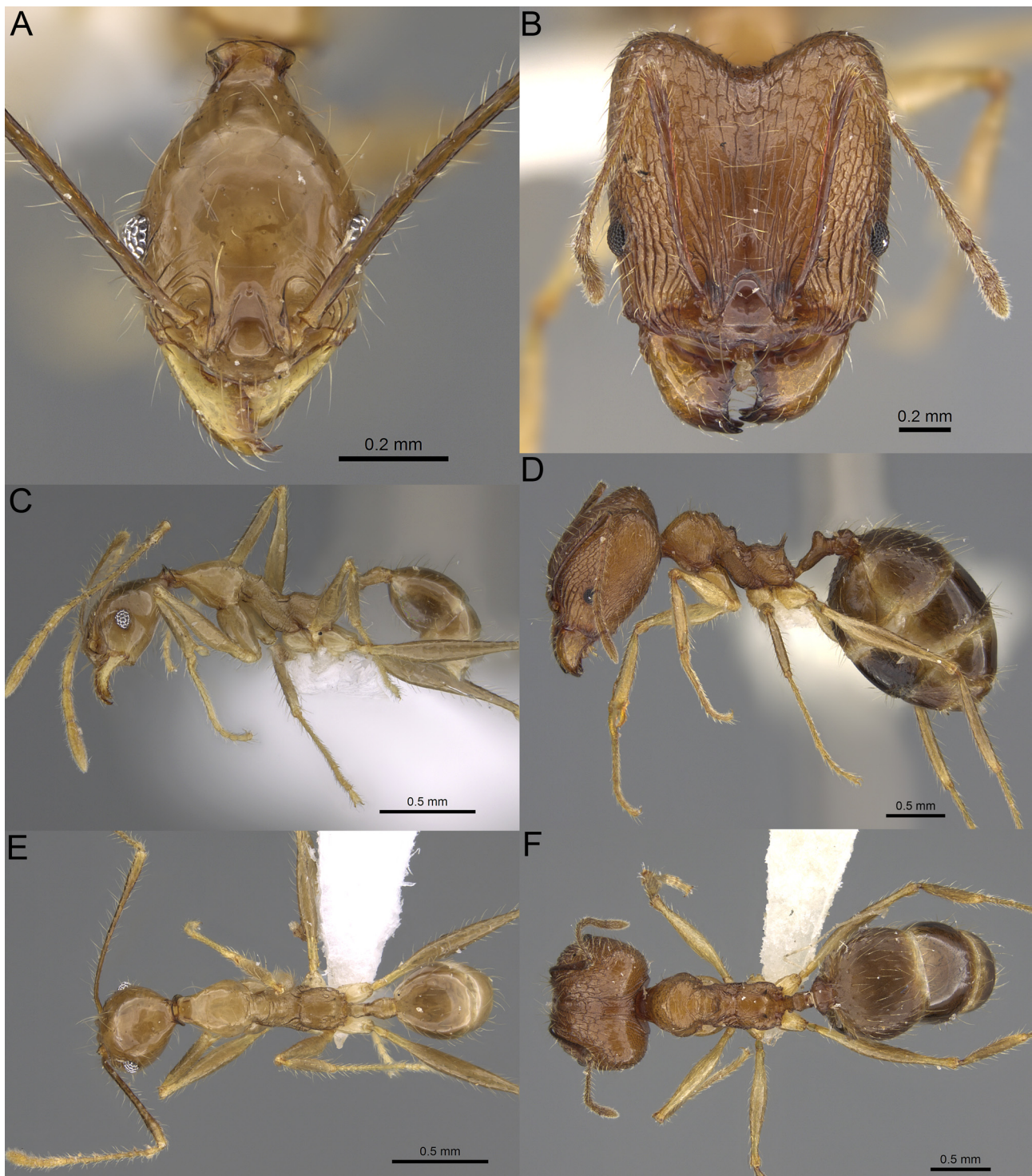
**Other material.** Madagascar. Antsiranana: 3w., Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, -13.41933 48.33117, 30 m, Fisher *et al.* leg. (CASC); 7w., 1s., Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, -13.41933 48.33117, 30 m, Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, Antsiranana, Nosy Be.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins relatively straight; side of head with moderately sparse, short, subdecumbent to suberect pilosity; medial frons with moderately sparse and thick costulae; interspaces between costulae smooth; frons laterally with thick rugo-costulae; interspaces between rugocostulae rugulate; occipital lobes with thick rugae; interspaces between rugae smooth; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth distinct, small, bulge-like, with top arching posteroventrally; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma microreticulate; promesonotal dorsum with sculpture reduced; gaster shagreened; body orange. **Minor workers.** Occiput elongated forming short and moderately narrow neck; nuchal collar distinct; head sculpture smooth; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderate with narrow base; promesonotum smooth; katepisternum and propodeum with sparse puncta; body yellow.

**Description. Major workers.** Measurements (n=2): HL: 1.55, 1.58; HW: 1.38, 1.47; SL: 1.18, 1.14; EL: 0.21,

0.21; WL: 1.46, 1.44; PSL: 0.3, 0.31; MTL: 1.17, 1.17; PNW: 0.56, 0.58; PTW: 0.21, 0.21; PPW: 0.43, 0.5; CI: 112.2, 107.7; SI: 85.5, 77.7; PSLI: 19.2, 19.3; PPI: 48.1, 41.8; PNI: 40.3, 39.7; MTI: 84.8, 79.9.



**FIGURE 22.** *Pheidole similis*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0427853) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0427852).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides relatively straight (Fig. 22B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of head with moderately sparse, short, subdecumbent to suberect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Medial frons with moderately sparse and thick costulae; interspaces between costulae smooth. Frons laterally with thick rugocostulae; interspaces between rugocostulae rugulate. Occipital lobes with thick rugae; interspaces between rugae smooth. Gena with dense and thick costulae;



interspaces between costulae smooth. Sides posterolateral from eyes with dense but very thin network of rugoreticulae; sculpture slightly weakening posteriorly. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina absent; lateral longitudinal carinae absent. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 22B, D). Inner hypostomal tooth distinct, small, bulge-like, with top arching posteroventrally; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent (Fig. 27N). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove present; propodeal spines moderately long, with narrow base and acute top; humeral tubercle weakly produced (Fig. 22D). Surface shiny and microreticulate; promesonotal dorsum with sculpture reduced. Pilosity moderately dense, moderately long, and erect (Fig. 22D, F). **Petiole.** In rear view node dorsoventrally slightly convex (Fig. 22D, F). **Gaster.** Shiny and shagreened; pilosity moderately sparse, long, and erect (Fig. 22D, F). **Color.** Orange, legs yellow, gaster darker than mesosoma (Fig. 22D, F).

**Description. Minor workers.** Measurements (n=10): HL: 0.7–0.89 (0.81); HW: 0.46–0.57 (0.52); SL: 1.01–1.28 (1.18); EL: 0.13–0.17 (0.14); WL: 0.89–1.24 (1.06); PSL: 0.12–0.17 (0.15); MTL: 0.79–1.2 (0.99); PNW: 0.32–0.44 (0.37); PTW: 0.07–0.12 (0.09); PPW: 0.12–0.21 (0.15); CI: 152.4–161.2 (156.0); SI: 220.8–237.2 (228.0); PSLI: 15.1–20.7 (18.2); PPI: 52.4–70.6 (61.6); PNI: 68.2–77.4 (71.5); MTI: 161.5–211.0 (190.5).

**Head.** In full-face view oval, posterior region elongated forming short and moderately narrow neck; nuchal collar distinct (Fig. 22A). Pilosity relatively sparse, long, and subdecumbent to erect. Sculpture shiny and mostly smooth; antennal sockets with few indistinct rugulae that are curved posterolaterally; interspaces between rugulae smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 22A, C). **Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines moderate and triangular, with narrow base (Fig. 22C). Promesonotum smooth; katepisternum and propodeum sparsely punctate. Pilosity very sparse, long, and erect (Fig. 22C, E). **Gaster.** With sparse and erect pilosity (Fig. 22C, E). **Color.** Yellow, gaster and head darker than mesosoma (Fig. 22C, E).

**Biology.** The species was collected at 30 m elevation, in rainforest. Nests were located in rotten logs. Workers were collected from sifted litter.

**Comments.** Among species known from Nosy Be islet, *Pheidole similis* is the only member of the *bessonii* group with both minor and major workers yellow to orange. It is most similar to two species known from the eastern parts of Antsiranana and the northernmost part of Toamasina: *P. clara* and *P. mantadioflava*. Its major workers differ from these two taxa in frons laterally with thick rugocostulae, and with rugulate interspaces between rugulae. Majors of *P. clara* and *P. mantadioflava* have frons laterally entirely punctate or rugulate with punctate interspaces between rugulae. Minor workers can be easily separated based on smooth promesonotum. *Pheidole similis* is morphologically most similar to *P. ragnax*, described by Fischer & Fisher from Mayotte island. Minors of *P. similis* can be separated based on longer and more narrow neck, and presence of sparse but distinct puncta on katepisternum and propodeum. Majors differ in more rugulate lateral frons, sparser setae on sides of head, more distinct and dense mesosomal sculpture, and shagreened gaster.

**Etymology.** Latin for similar, in reference to the morphological similarity of *P. similis* to *P. ragnax*.

### *Pheidole tenebrovulgaris* sp. nov.

Figs 23A–F, 27O, 28O

**HOLOTYPE:** 1s., Madagascar, Antananarivo, Ambohidratrimo, -18.821 47.44183, 1362 m, 8-May-2007, Urban garden, under stone, B. L. Fisher *et al.* leg. BLF17538, CASENT0128508 (CASC). **PARATYPES:** 1w., the same data as holotype, CASENT0235036 (CASC).

**Other material.** Madagascar. Antananarivo: 1w., Ilafy, -18.85415 47.56575, 1385 m, B. L. Fisher *et al.* leg. (CASC); 4w., Kaloy, -18.59568 47.65333, 1338 m, B. L. Fisher *et al.* leg. (CASC); 1w., Tsimbazaza, -18.928 47.527, 1300 m, B. L. Fisher *et al.* leg. (CASC). Antsiranana: 1w., Ampasindava, Forêt d'Ambilanivy, 3.9 km 181° S Ambaliha, -13.79861 48.16167, 600 m, B. L. Fisher *et al.* leg. (CASC); 3w., Forêt d'Andavakoera, 21.4 km 75° ENE Ambilobe; 4.6 km 356° N Betsiaka, -13.11833 49.23, 425 m, B. L. Fisher *et al.* leg. (CASC); 1w.,

1q., Forêt d'Ampondrabe, 26.3 km 10° NNE Daraina, -12.97 49.7, 175 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt d'Analabe, 30.0 km 72° ENE Daraina, -13.08333 49.90833, 30 m, B. L. Fisher *et al.* leg. (CASC); 1w., Forêt de Bekaraoka, 6.8 km 60° ENE Daraina, -13.16667 49.71, 150 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Masoala National Park, -15.32331 50.30751, 60 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Masoala, Cap Est, Forêt d'Andranoana, -15.26158 50.4758, 15 m, B. L. Fisher *et al.* leg. (CASC); 6w., Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, -13.41933 48.33117, 30 m, B. L. Fisher *et al.* leg. (CASC); 2w., Parc National Montagne d'Ambre, 12.2 km 211° SSW Joffreville, -12.59639 49.1595, 1300 m, Alpert *et al.* leg. (CASC); 4w., 1s., R.S. Manongarivo, 10.8 km 229° SW Antanambao, -13.96167 48.43333, 400 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, B. L. Fisher *et al.* leg. (CASC); 2w., 2s., Sahamalaza Peninsula, Forêt d'Anabohazo, 21.6 km 247° WSW Maromandia, -14.30889 47.91433, 120 m, B. L. Fisher *et al.* leg. (CASC). Fianarantsoa: 1w., Belle Vue trail, Ranomafana National Park, Fianarantsoa Prov., -21.2665 47.42017, 1020 m, R. Harin'Hala leg. (CASC); 4w., dry wash, 1 km E of Isalo National Park Interpretive Center, Fianarantsoa Prov., -22.62667 45.35817, 885 m, R. Harin'Hala leg. (CASC); 7w., 3s., Parc National d'Isalo, 9.1 km 354° N Ranohira, -22.48167 45.46167, 725 m, B. L. Fisher *et al.* leg. (CASC); 3w., Parc National d'Isalo, Sahanafa River, 29.2 km 351° N Ranohira, -22.31333 45.29167, 500 m, B. L. Fisher *et al.* leg. (CASC); 1s., R.S. Ivohibe, 6.5 km ESE Ivohibe, -22.49667 46.955, 1575 m, B. L. Fisher *et al.* leg. (CASC); 1w., Réserve Forestière d'Agnalazaha, Mahabo, 42.9 km 215° Farafangana, -23.19383 47.723, 20 m, B. L. Fisher *et al.* leg. (CASC); 1w., stream area, 900 m E of Isalo National Park Interpretive Center, Fianarantsoa Prov., -22.62667 45.35817, 750 m, R. Harin'Hala leg. (CASC). Mahajanga: 2w., Parc National de Baie de Baly, 12.4 km 337° NNW Soalala, -16.01 45.265, 10 m, B. L. Fisher *et al.* leg. (CASC); 8w., 5s., Parc National de Namoroka, 16.9 km 317° NW Vilanandro, -16.40667 45.31, 100 m, B. L. Fisher *et al.* leg. (CASC); 2w., Parc National Tsingy de Bemaraha, 10.6 km ESE 123° Antsalova, -18.70944 44.71817, 150 m, B. L. Fisher *et al.* leg. (CASC). Toamasina: 2w., 1s., Ambatovy, 12.4 km NE Moramanga, -18.85813 48.28488, 1040 m, B. L. Fisher *et al.* leg. (CASC); 2w., F.C. Didy, -18.19833 48.57833, 960 m, H. J. Ratsirarson leg. (CASC); 1w., 1s., Forêt d'Analava Mandrisky, 5.9 km 195° Antanambe, -16.48567 49.847, 10 m, B. L. Fisher *et al.* leg. (CASC); 2w., 2s., 1m., Menafotaka, village near Onibe, -17.75872 48.85178, 785 m, B. L. Fisher *et al.* leg. (CASC); 1w., 1s., Moramanga, -18.94417 48.23067, 922 m, B. L. Fisher *et al.* leg. (CASC); 1w., Reserve Betampona, Camp Rendrirendry 34.1 km 332° Toamasina, -17.924 49.19967, 390 m, B. L. Fisher *et al.* leg. (CASC). Toliara: 4w., Makay Mts., -21.13513 45.33098, 650 m, B. L. Fisher *et al.* leg. (CASC); 1w., Parc National de Zombitse, 17.7 km 98° E Sakaraha, -22.88833 44.70167, 760 m, B. L. Fisher *et al.* leg. (CASC); 4w., Parc National de Zombitse, 19.8 km 84° E Sakaraha, -22.84333 44.71, 770 m, B. L. Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale d'Ambohijanahary, Forêt d'Ankazotsihitafototra, 34.6 km 314° NW Ambaravarana, -18.26 45.41833, 1100 m, B. L. Fisher *et al.* leg. (CASC); 1w., southern Isoky-Vohimena Forest, 59 km NE Sakaraha, -22.46667 44.85, 730 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, species recorded from most of the island.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins relatively straight; side of head with moderately dense, short, and appressed to subdecumbent pilosity; medial frons with dense and thick costulae; interspaces between costulae smooth; frons laterally rugulate; interspaces between rugulae punctate; occipital lobes with thin rugae; interspaces between rugae indistinctly punctate to smooth; scape, when laid back, exceeding the midlength of head by one-fifth of its length; inner hypostomal tooth indistinct, small and bulge-like, with top directed posteriorly; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct; mesosoma punctate; promesonotum with additional transverse and thin rugae; katapisternum and lateral sides of propodeum with additional rugae; gaster shagreened; body dark brown. **Minor workers.** Occiput not elongated; nuchal collar distinct; head sculpture punctate; sometimes frons and vertex with puncta reduced or absent; scape, when laid back, exceeding the posterior head margin by two-fifths of its length; promesonotum moderately low, moderately long, and arched; promesonotal groove absent to indistinct; metanotal groove distinct; propodeal spines moderate and with narrow base; mesosoma punctate; body dark brown.

**Description. Major workers.** Measurements (n=10): HL: 1.65–1.85 (1.74); HW: 1.68–1.8 (1.74); SL: 0.92–0.99 (0.95); EL: 0.22–0.26 (0.23); WL: 1.38–1.53 (1.45); PSL: 0.25–0.31 (0.28); MTL: 0.94–1.1 (1.02); PNW: 0.7–0.78 (0.73); PTW: 0.21–0.31 (0.24); PPW: 0.58–0.71 (0.65); CI: 98.2–103.1 (100.6); SI: 52.6–57.6 (54.9); PSLI: 14.0–17.8 (15.8); PPI: 32.8–43.7 (37.2); PNI: 40.7–44.4 (42.2); MTI: 54.8–65.2 (58.4).





**FIGURE 23.** *Pheidole tenebrovulgaris*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0235036) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0128508).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides relatively straight (Fig. 23B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of head with moderately dense, short, and appressed to subdecumbent pilosity; head dorsum with relatively dense, long, and decumbent to erect pilosity. Medial frons with dense and thick costulae; interspaces between costulae smooth. Frons laterally rugulate; interspaces between rugulae punctate. Occipital lobes with thin rugae; interspaces between rugae indistinctly punctate to smooth. Gena with dense and thick costulae; interspaces between costulae distinctly punctate. Sides posterolateral from eyes with dense but very thin network of rugoreticu-

lae. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide, and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by one-fifth of its length; pilosity appressed and subdecumbent (Fig. 23B, D). Inner hypostomal tooth indistinct, small and bulge-like, with top directed posteriorly; outer hypostomal tooth lobe-like, high, and wide, with top directed posteriorly; median tooth absent (Fig. 27O). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove absent; propodeal spines moderately long, with moderately wide base and acute top; humeral tubercle weakly produced (Fig. 23D). Surface shiny and punctate; promesonotum with additional transverse and thin rugae; katapisternum and lateral sides of propodeum with additional rugae. Pilosity moderately dense, moderately long, and erect (Fig. 23D, F). **Postpetiole.** In dorsal view distinctly wider than long (Fig. 23D, F). **Gaster.** Dull and shagreened; pilosity moderately sparse, long, and erect (Fig. 23D, F). **Color.** Dark brown, legs slightly brighter, antennae yellowish (Fig. 23D, F).

**Description. Minor workers.** Measurements (n=10): HL: 0.62–0.79 (0.66); HW: 0.55–0.68 (0.59); SL: 0.73–0.85 (0.79); EL: 0.13–0.15 (0.14); WL: 0.78–0.93 (0.86); PSL: 0.13–0.19 (0.15); MTL: 0.58–0.75 (0.64); PNW: 0.36–0.48 (0.39); PTW: 0.07–0.11 (0.09); PPW: 0.13–0.2 (0.14); CI: 100.8–118.5 (133.3); SI: 115.6–142.8 (133.4); PSLI: 20.6–25.4 (22.8); PPI: 49.7–74.0 (62.0); PNI: 59.1–70.3 (66.7); MTI: 92.8–117.9 (109.7).

**Head.** In full-face view oval, posterior region not elongated; nuchal collar distinct (Fig. 23A). Pilosity relatively sparse, long, subdecumbent to absent. Sculpture shiny and punctate; sometimes frons and vertex with puncta reduced or absent. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by two-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 23A, C). **Mesosoma.** In lateral view, promesonotum moderately low, moderately long, and arched; promesonotal groove absent to indistinct; metanotal groove distinct; propodeal spines moderate and triangular, with narrow base (Fig. 23C). Sculpture punctate. Pilosity very sparse, short, and erect (Fig. 23C, E). **Gaster.** With sparse and erect pilosity (Fig. 23C, E). **Color.** Dark brown, legs and antennae brighter (Fig. 23C, E).

**Biology.** The species was collected between 10–1575 m elevation, in tropical dry forest, rainforest, gallery forest, gardens, and littoral rainforest. Nests were located in rotten logs, in soil, under stones, under root mats, and in dead twigs above the ground. Workers were collected from sifted litter and on tree bark.

**Comments.** *Pheidole tenebrevulgaris* is a common species widespread across the entire island. Its majors are most similar to majors of sympatric *P. bessonii*, *P. atsirakambiaty*, and *P. voreios*, and can be separated based on presence of dense and thick costulae with smooth interspaces on medial frons, and occipital lobes with rugae that never arch posterolaterally and most often not weaken posteriorly. Minors can be separated based on the combination of the following characters: lack of neck and distinct nuchal collar, entirely or predominantly punctate head, scape exceeding the posterior head margin by two-fifths of its length, moderate propodeal spines with narrow base, entirely punctate mesosoma, and dark brown body.

**Etymology.** Latin for dark and widespread, in reference to body coloration and distribution range of the species.

### *Pheidole uranus* sp. nov.

Figs 24A–F, 27P, 28P

**HOLOTYPE:** 1s., Madagascar, Toliara, Anosy Region, Anosyenne Mts, 31.2 km NW Manantenina, -24.13894 47.06804, 1125 m, 26-Feb-2015, rainforest, ex root mat, B. L. Fisher *et al.* leg. BLF36505, CASENT0704257 (CASC). **PARATYPES:** 1w., the same data as holotype, CASENT0923260 (CASC).

**Other material.** Madagascar. Toliara: 4w., 2s., 1m., 1q., Anosy Region, Anosyenne Mts, 31.2 km NW Manantenina, -24.13894 47.06804, 1125 m, B. L. Fisher *et al.* leg. (CASC); 2w., 1s., 1m., Anosy Region, Anosyenne Mts, 31.2 km NW Manantenina, -24.13632 47.05485, 1315 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, Toliara, Anosyenne Mts.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins slightly convex; side of head with dense, long, erect pilosity; medial frons with moderately sparse and thick rugae; interspaces between rugae smooth; frons laterally with dense rugae; interspaces between rugae reticulate; occipital lobes mostly smooth, posteriorly with sparse and weakly developed rugae; scape, when laid back, slightly



exceeding the midlength of head; inner hypostomal tooth distinct, moderate and bulge-like, with top arching posteroventrally; outer hypostomal tooth bulge-like, high, and wide, with top arching posteroventrally; median tooth absent; promesonotum short, angular, and moderately low; posterior mesonotum smoothly descending towards propodeum; mesonotal process very distinct and tubercle-like; mesosoma rugoreticulate; promesonotal dorsum with reduced rugoreticulae and few additional transverse and thick rugae; gaster indistinctly shagreened at base of first tergite; body brown. **Minor workers.** Occiput slightly elongated; nuchal collar indistinct; head sculpture mostly smooth; frons with weakly developed and sparse puncta; scape, when laid back, exceeding the posterior head margin by three-fifths of its length; promesonotum low, moderately long, and arched; promesonotal groove distinct; metanotal groove distinct; propodeal spines small and with wide base; mesosoma mostly smooth; pronotum, mesonotum, and propodeum with weakly developed and sparse puncta; body brown.

**Description. Major workers.** Measurements (n=4): HL: 2.08–2.16 (2.12); HW: 2.09–2.14 (2.11); SL: 1.19–1.24 (1.21); EL: 0.21–0.25 (0.23); WL: 1.82–1.91 (1.86); PSL: 0.33–0.37 (0.35); MTL: 1.38–1.41 (1.4); PNW: 0.81–0.97 (0.86); PTW: 0.26–0.29 (0.27); PPW: 0.69–0.76 (0.72); CI: 99.0–103.3 (100.4); SI: 56.5–59.0 (57.5); PSLI: 15.6–17.5 (16.6); PPI: 35.6–38.5 (37.3); PNI: 38.8–45.4 (40.8); MTI: 65.8–67.3 (66.5).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides slightly convex (Fig. 24B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth visible. Side of head with dense, long, and erect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Medial frons with moderately sparse and thick rugae; interspaces between rugae smooth. Frons laterally with dense rugae; interspaces between rugae reticulate. Occipital lobes mostly smooth; posteriorly with sparse and weakly developed rugae. Gena with dense and thick costulae; interspaces between costulae distinctly rugulate. Sides posterolateral from eyes with dense and thinner network of rugoreticulae. Center of clypeus shiny and smooth, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina absent; lateral longitudinal carinae present. Scape, when laid back, slightly exceeding the midlength of head; pilosity appressed and subdecumbent (Fig. 24B, D). Inner hypostomal tooth distinct, moderate and bulge-like, with top arching posteroventrally; outer hypostomal tooth bulge-like, high, and wide, with top arching posteroventrally; median tooth absent (Fig. 27P). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum smoothly descending towards propodeum; mesonotal process very distinct and tubercle-like; promesonotal groove absent; metanotal groove indistinct; propodeal spines long with narrow base and acute top; humeral tubercle weakly produced (Fig. 24D). Surface shiny and rugoreticulate; promesonotal dorsum with reduced rugoreticulae and few additional transverse, thick rugae. Pilosity moderately dense, moderately long, and erect (Fig. 24D, F). **Gaster.** Shiny and indistinctly shagreened at base of first tergite; pilosity moderately sparse, long, and erect (Fig. 24D, F). **Color.** Brown, legs and antennae slightly brighter (Fig. 24D, F).

**Description. Minor workers.** Measurements (n=5): HL: 0.79–0.95 (0.87); HW: 0.57–0.67 (0.62); SL: 1.11–1.19 (1.15); EL: 0.15–0.17 (0.16); WL: 1.13–1.32 (1.2); PSL: 0.1–0.14 (0.12); MTL: 0.95–1.09 (1.04); PNW: 0.41–0.51 (0.46); PTW: 0.09–0.13 (0.11); PPW: 0.17–0.22 (0.19); CI: 132.0–143.4 (139.3); SI: 178.8–193.7 (185.7); PSLI: 12.8–15.5 (14.2); PPI: 50.6–70.1 (57.4); PNI: 70.7–77.0 (73.5); MTI: 164.0–177.1 (167.3).

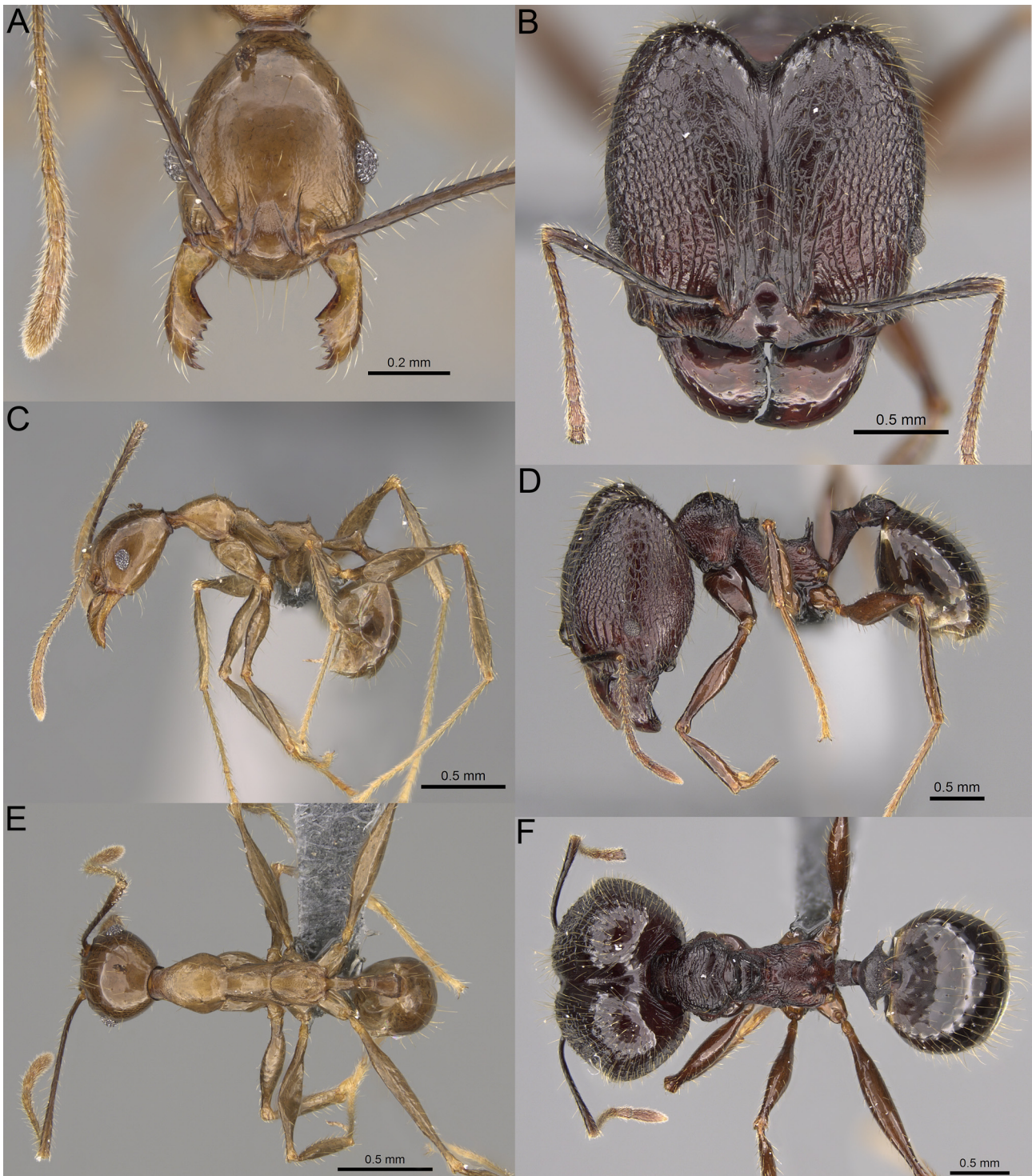
**Head.** In full-face view oval, posterior region slightly elongated; nuchal collar weakly developed (Fig. 24A). Pilosity sparse, moderately long and subdecumbent. Sculpture shiny and mostly smooth; frons with weakly developed and sparse puncta. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by three-fifths of its length; pilosity dense, subdecumbent to erect (Fig. 24A, C). **Mesosoma.** In lateral view, promesonotum low, moderately long, and arched; promesonotal groove distinct; metanotal groove distinct; propodeal spines small and triangular, with wide base (Fig. 24C). Sculpture mostly smooth; pronotum, mesonotum, and propodeum with weakly developed and sparse puncta. Pilosity very sparse, short, and erect (Fig. 24C, E). **Gaster.** With sparse and erect pilosity (Fig. 24C, E). **Color.** Bright brown (Fig. 24C, E).

**Biology.** The species was collected between 1125–1315 m elevation, in rainforest. Nests were located in rotten logs and root mats.

**Comments.** *Pheidole uranus* is known only from the Anosyenne Mts. in Toliara. Its major workers are most similar to two species known from northern parts of the island: *P. madecassa* and sympatric *P. maro*. Majors of *P. uranus* can be easily separated based on presence of dense rugae with reticulate interspaces on lateral frons, sparse and weakly developed rugae on posterior occipital lobes, dense pilosity on side of head, and darker body coloration. Majors of *P. madecassa* and *P. maro* have lateral frons with weaker sculpture, posterior occipital lobes with reduced

or absent sculpture, sparser pilosity on side of head, and orange to brownish orange body. Minors of *P. uranus* are most similar to *P. ovalinoda* and can be separated based on more elongated posterior portion of head, and mostly smooth mesosoma. Minors of *P. ovalinoda* have less elongated posterior portion of head, and partially sculptured mesosoma.

**Etymology.** Named after the Greek god of the sky, in reference to the high elevation of the type locality.



**FIGURE 24.** *Pheidole uranus*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0235036) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0704257).



***Pheidole voreios* sp. nov.**

Figs 25A–F, 27Q, 28Q

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, 10-Feb-2001, tropical dry forest, ex rotten log, Fisher *et al.* leg. BLF02932, CASENT0406635 (CASC). **PARATYPES:** 6w., 2s., the same data as holotype, CASENT0406634, CASENT0406636, CASENT0872257, CASENT0406633 (CASC, MHNG, PBZT).

**Other material.** Madagascar, Antsiranana: 1w., 1s., Forêt d'Andavakoera, 21.4 km 75° ENE Ambilobe; 4.6 km 356° N Betsiaka, -13.11833 49.23, 425 m, Fisher *et al.* leg. (CASC); 1w., Forêt d'Ampombofofo, -12.09949 49.33874, 25 m, Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale de l'Ankarana, 13.6 km 192° SSW Anivorano Nord, -12.86361 49.22583, 210 m, Fisher *et al.* leg. (CASC); 2w., Réserve Spéciale de l'Ankarana, 13.6 km 192° SSW Anivorano Nord, -12.86361 49.22583, 210 m, Fisher *et al.* leg. (CASC); 3w., Réserve Spéciale de l'Ankarana, 13.6 km 192° SSW Anivorano Nord, -12.86361 49.22583, 210 m, Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale de l'Ankarana, 13.6 km 192° SSW Anivorano Nord, -12.86361 49.22583, 210 m, Fisher *et al.* leg. (CASC); 2w., Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, Fisher *et al.* leg. (CASC); 6w., 4s., Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, Fisher *et al.* leg. (CASC); 1w., Réserve Spéciale de l'Ankarana, 22.9 km 224° SW Anivorano Nord, -12.90889 49.10983, 80 m, Fisher *et al.* leg. (CASC); 1w., Sahamalaza Peninsula, Forêt d'Anobohazo, 21.6 km 247° WSW Maromandia, -14.30889 47.91433, 120 m, Fisher *et al.* leg. (CASC); 2w., Sahamalaza Peninsula, Forêt d'Anobohazo, 21.6 km 247° WSW Maromandia, -14.30889 47.91433, 120 m, Fisher *et al.* leg. (CASC)

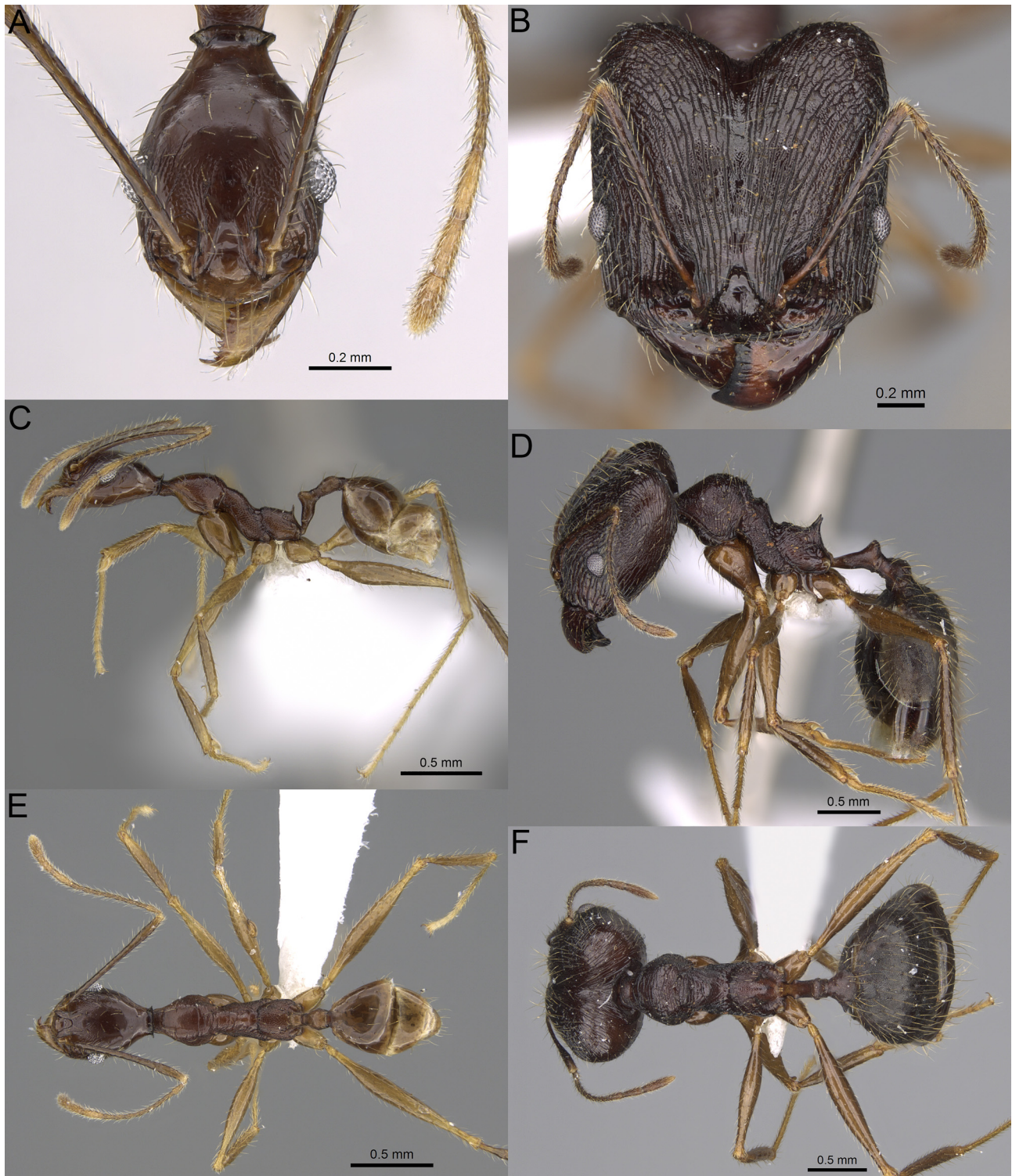
**Geographic range.** Madagascar, Antsiranana, Réserve Spéciale de l'Ankarana, Forêt d'Andavakoera, Forêt d'Ampombofofo, and Forêt d'Anobohazo.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, not widening posteriorly, with lateral margins relatively straight; side of head with sparse, long, suberect to erect pilosity; medial frons with moderately thick and dense costulae; interspaces between costulae distinctly punctate; frons laterally with sparser costulae; interspaces between costulae distinctly punctate; occipital lobes with thin and sparse rugulae that arch posterolaterally; interspaces between rugulae punctate; sculpture weakening posteriorly; scape, when laid back, exceeding the midlength of head by two-fifths of its length; inner hypostomal tooth very small and bulge-like; outer hypostomal tooth lobe-like, high, and wide, with top arching posteroventrally; median tooth present and indistinct; promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; mesosoma punctate; promesonotum with additional thin, sparse, and transverse rugae; katapisternum and propodeum with additional sparse rugae; gaster shagreened; body brown. **Minor workers.** Occiput elongated; nuchal collar distinct; head sculpture mostly smooth; anterior frons with sparse puncta; scape, when laid back, exceeding the posterior head margin by half of its length; promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small and narrow; mesosoma microreticulate; promesonotum with sparser sculpture; promesonotal dorsum mostly to entirely smooth; body brown.

**Description. Major workers.** Measurements (n=9): HL: 1.65–1.81 (1.74); HW: 1.5–1.68 (1.6); SL: 1.15–1.24 (1.19); EL: 0.23–0.27 (0.24); WL: 1.62–1.74 (1.68); PSL: 0.21–0.31 (0.27); MTL: 1.34–1.42 (1.37); PNW: 0.61–0.66 (0.63); PTW: 0.19–0.27 (0.22); PPW: 0.49–0.63 (0.57); CI: 106.4–112.1 (109.2); SI: 69.7–79.0 (74.9); PSLI: 13.0–17.4 (15.4); PPI: 34.4–42.9 (38.0); PNI: 37.4–41.3 (39.3); MTI: 80.9–93.7 (86.0).

**Head.** In full-face view sub-rectangular, not widening posteriorly, with lateral sides relatively straight (Fig. 25B). In lateral view sub-oval, not depressed posteriorly; ventral and dorsal margins convex; inner hypostomal tooth not visible. Side of head with sparse, long, suberect to erect pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Medial frons with moderately thick and dense costulae; interspaces between costulae distinctly punctate. Frons laterally with sparser costulae; interspaces between costulae distinctly punctate. Occipital lobes with thin and sparse rugulae that arch posterolaterally; interspaces between rugulae punctate; sculpture weakening posteriorly. Gena with dense and thick costulae; interspaces between costulae distinctly punctate. Sides posterolateral from eyes with dense but thin rugoreticulae. Center of clypeus shiny and mostly smooth, lateral sides with distinct rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding the midlength of head by two-fifths of its length; pilosity subdecumbent to erect (Fig. 25B, D). Inner hypostomal tooth very small and bulge-like; outer hypostomal

tooth lobe-like, high, and wide, with top arching posteroventrally; median tooth present and weakly developed (Fig. 27Q). **Mesosoma.** In lateral view, promesonotum short, angular, and moderately low; posterior mesonotum moderately steep; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove present; propodeal spines moderately long with wide base and acute top; humeral tubercle weakly produced (Fig. 25D). Surface shiny and punctate; promesonotum with additional, thin, sparse, and transverse rugae; katapisternum and propodeum with additional sparse rugae. Pilosity moderately dense, long, and erect (Fig. 25D, F). **Petiole.** In rear view node dorsoventrally slightly convex (Fig. 25D, F). **Gaster.** Dull and shagreened; pilosity moderately sparse, long, and erect (Fig. 25D, F). **Color.** Brown, antennae and legs yellowish brown (Fig. 25D, F).



**FIGURE 25.** *Pheidole voreios*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0406636) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0406635).



**Description. Minor workers.** Measurements (n=8): HL: 0.77–0.85 (0.81); HW: 0.53–0.59 (0.56); SL: 1.09–1.2 (1.15); EL: 0.16–0.18 (0.17); WL: 1.08–1.21 (1.15); PSL: 0.11–0.13 (0.12); MTL: 1.01–1.1 (1.05); PNW: 0.39–0.44 (0.42); PTW: 0.09–0.11 (0.1); PPW: 0.14–0.18 (0.17); CI: 142.6–148.3 (145.3); SI: 202.6–209.9 (206.3); PSLI: 12.8–16.6 (15.4); PPI: 52.9–66.4 (59.4); PNI: 71.2–77.3 (74.6); MTI: 184.7–194.9 (188.8).

**Head.** In full-face view oval, posterior region elongated; nuchal collar distinct (Fig. 25A). Pilosity relatively sparse, moderately long, subdecumbent to erect. Sculpture shiny and mostly smooth; anterior frons with sparse puncta. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin by half of its length; pilosity dense, subdecumbent to erect (Fig. 25A, C).

**Mesosoma.** In lateral view, promesonotum low, long, and arched; promesonotal groove present; metanotal groove distinct; propodeal spines small and triangular, narrow (Fig. 25C). Sculpture microreticulate; promesonotum with sparser sculpture and mostly to entirely smooth dorsum. Pilosity very sparse, long, and erect (Fig. 25C, E). **Gaster.** With sparse and erect pilosity (Fig. 25C, E). **Color.** Brown, legs and antennae yellowish (Fig. 25C, E).

**Biology.** The species was collected between 25–487 m elevation, in tropical dry forest and rainforest. Nests were located in rotten logs and rotten sticks on the ground. Workers were collected from sifted litter and on low vegetation.

**Comments.** *Pheidole voreios* is known from the northern part of the island and is most similar to the widespread and parapatric *P. bessonii*. Majors of *P. voreios* can be distinguished based on rugulate occipital lobes, and frons laterally with sparse costulae and distinctly punctate interspaces. In contrast, *P. bessonii* has punctate occipital lobes and frons laterally rugocostulate. Minors can be separated based on more elongated posterior region of head, microreticulate mesosoma with sculpture weakening on promesonotum, and small and narrow propodeal spines. In contrast, *P. bessonii* has less elongated posterior region of head, mostly smooth promesonotum, and very small propodeal spines.

**Etymology.** Greek for northern, in reference to the range of the species.

### *Pheidole zirafy* sp. nov.

Figs 26A–F, 27R, 28R

**HOLOTYPE:** 1s., Madagascar, Antsiranana, Sava Region: Parc National de Marojejy, Manantenina River, 28.0 km 24.8° NE Andapa, -14.43461 49.76074, 780 m, 13-Feb-2018, rainforest, ex rotten log, B. L. Fisher *et al.* leg. BLF41182, CASENT0923249 (CASC). **PARATYPES:** 3w., 1m.: the same data as holotype, CASENT0807266, CASENT0807267, CASENT0807268 (CASC, MHNG, PBZT).

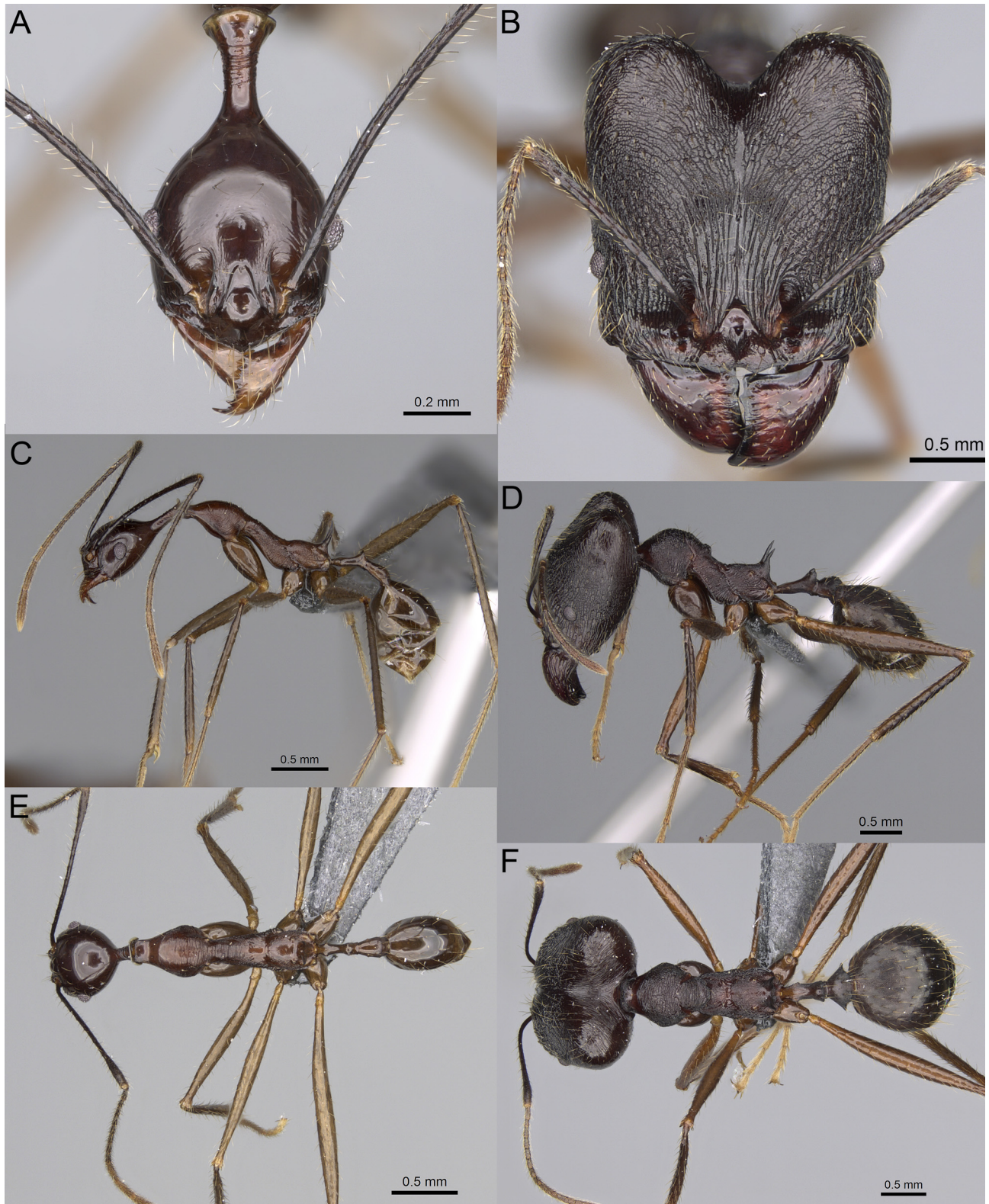
**Other material.** Madagascar. Antsiranana: 4w., Parc National de Marojejy, Manantenina River, 28.0 km 38° NE Andapa, 8.2 km 333° NNW Manantenina, -14.43667 49.775, 450 m, B. L. Fisher *et al.* leg. (CASC); 6w., SAVA Region, District of Sambava, Marojejy National Park, 5 km W of Manantenina village, 1st Camp site (Mantella), -14.43817 49.774, 487 m, M. Rin'Ha leg. (CASC); 1w., Sava Region: Parc National de Marojejy, near Manantenina River, -14.43677 49.77541, 475 m, B. L. Fisher *et al.* leg. (CASC).

**Geographic range.** Madagascar, Antsiranana, Sava Region.

**Diagnosis. Major workers.** Head in full-face view sub-rectangular, widening posteriorly, with lateral margins relatively straight and very deep posteromedian concavity; side of head with moderately sparse, short, appressed to decumbent pilosity; anteromedial part of frons with moderately thick and dense costulae; interspaces between costulae smooth; posteromedial frons with thinner rugocostulae that arch posterolaterally; interspaces between rugocostulae rugulate; frons laterally with denser and thicker rugae; interspaces between rugae with dense and thin rugulae; occipital lobes with thin rugocostulae that weaken posteriorly and arch posterolaterally, interspaces between rugocostulae mostly smooth; scape, when laid back, exceeding the midlength of head by three-fifths of its length; inner hypostomal tooth distinct, low, wide, closely spaced and bulge-like; outer hypostomal tooth lobe-like and higher than inner tooth, with top directed posteriorly; inner and outer hypostomal tooth closely spaced and not connected by concavity; promesonotum short, angular and low; posterior mesonotum smoothly declining towards propodeum; mesonotal process distinct and tubercle-like; mesosoma with dense and thin rugopuncta; pronotum with additional thin, moderately dense, and transverse rugae; anepisternum, katapisternum, and lateral sides of propodeum with rugae that are more vertical; gaster shagreened; body brownish black. **Minor workers.** Occiput elongated, terminated by distinct nuchal collar; head sculpture mostly smooth with few rugae on gena and transverse rugae on neck; scape, when laid back, exceeding the posterior head margin by half of its length; promesonotum very

low, long, and slightly arched; promesonotal groove present; metanotal groove indistinct; propodeal spines long and thin; promesonotal and propodeal dorsum mostly smooth with sparse and transverse rugae, and lateral sides of propodeum, anepisternum, and katepisternum with dense and thin rugoreticulae; body dark brown.

**Description. Major workers.** Measurements (n=1): HL: 2.44; HW: 2.21; SL: 1.8; EL: 0.246; WL: 2.19; PSL: 0.57; MTL: 2.22; PNW: 0.8; PTW: 0.28; PPW: 0.69; CI: 110.5; SI: 81.4; PSLI: 23.4; PPI: 40.6; PNI: 36.0; MTI: 100.7.

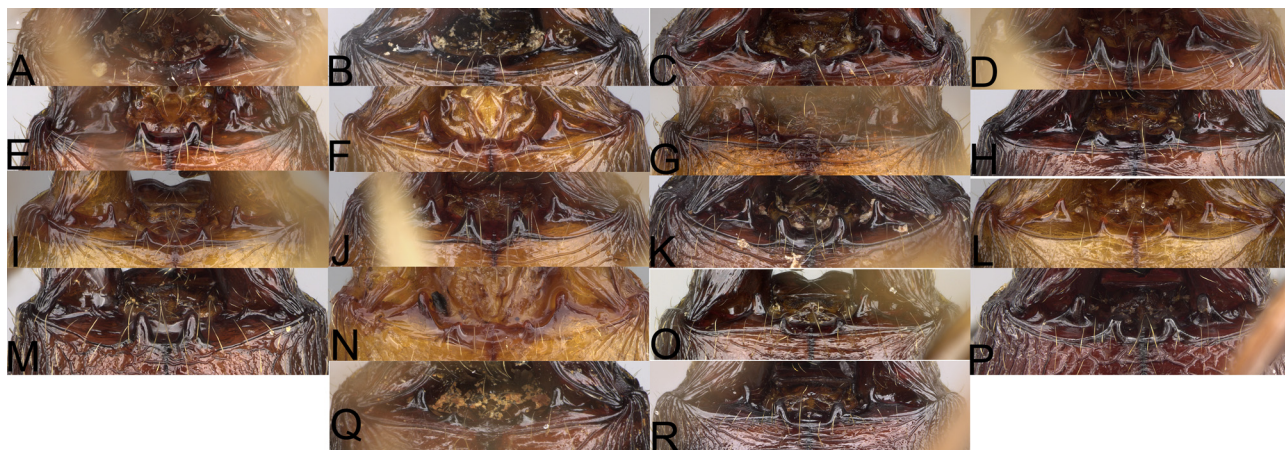


**FIGURE 26.** *Pheidole zirafy*, full-face view (A), profile (C), and dorsal view (E) of paratype minor worker (CASENT0807268) and full-face view (B), profile (D), and dorsal view (F) of holotype major worker (CASENT0923249).



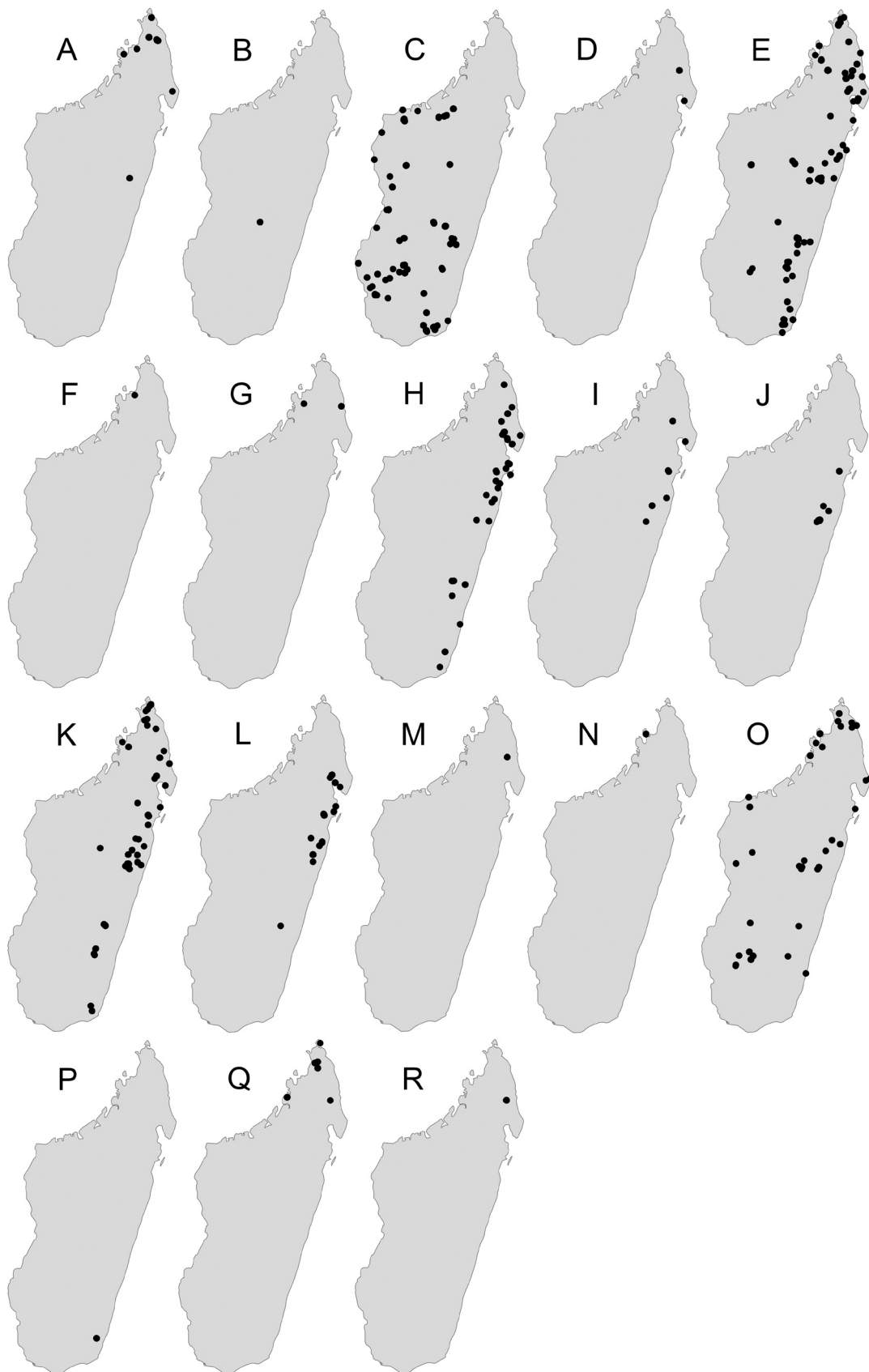
**Head.** In full-face view sub-rectangular, side relatively straight, posteromedian concavity very deep (Fig. 26B). In lateral view sub-oval, not depressed posteriorly, ventral and dorsal margin convex; inner hypostomal tooth visible. Side of head with moderately sparse, short, appressed to decumbent pilosity; head dorsum with relatively dense, long, decumbent to erect pilosity. Anteromedial part of frons with moderately thick and dense costulae; interspaces between costulae smooth; posteromedial frons with rugocostulae that are thinner and arch posterolaterally; interspaces between rugocostulae rugulate; frons laterally with dense and thick rugae; interspaces between rugae rugulate. Occipital lobes with thin rugocostulae that weaken posteriorly and arch posterolaterally; interspaces between rugocostulae mostly smooth. Gena with dense and thick costulae; interspaces between costulae distinctly rugulate. Sides posterolateral from eyes with dense and thin rugae; interspaces between rugae distinctly rugulate. Center of clypeus shiny and indistinctly rugulate, lateral sides with weakly developed rugulae; median notch present, moderately wide and shallow; median longitudinal carina present; lateral longitudinal carinae present. Scape, when laid back, exceeding midlength of head by three-fifths its length; pilosity subdecumbent to erect (Fig. 26B, D). Inner hypostomal tooth distinct, low, wide, closely spaced and bulge-like; outer hypostomal tooth lobe-like, higher than inner tooth, top directed posteriorly; inner and outer hypostomal tooth closely spaced and not connected by concavity (Fig. 27R). **Mesosoma.** In lateral view, promesonotum short, angular and low; posterior mesonotum smoothly declining towards propodeum; mesonotal process distinct and tubercle-like; promesonotal groove absent; metanotal groove present; propodeal spines long, narrow and with acute top; humeral tubercle weakly produced (Fig. 26D). Surface shiny and with dense and thin rugopuncta; pronotum with additional thin, moderately dense, and transverse rugae; anepisternum, katepisternum, and lateral sides of propodeum with rugae that are more vertical. Pilosity moderately dense, short, and erect (Fig. 26D, F). **Petiole.** Shagreened (Fig. 26D, F). **Postpetiole.** Shagreened; dorsum with slightly sparser sculpture (Fig. 26D, F). **Gaster.** Dull and shagreened; pilosity moderately sparse, long, and erect (Fig. 26D, F). **Color.** Brownish black, antennae and legs dark brown, mandibles reddish brown (Fig. 26D, F).

**Description. Minor workers.** Measurements (n=10): HL: 1.17–1.44 (1.29); HW: 0.6–0.75 (0.66); SL: 1.83–2.13 (1.95); EL: 0.14–0.22 (0.18); WL: 1.53–1.91 (1.69); PSL: 0.34–0.45 (0.38); MTL: 1.85–2.37 (2.03); PNW: 0.45–0.58 (0.52); PTW: 0.11–0.16 (0.13); PPW: 0.19–0.24 (0.22); CI: 188.4–200.0 (193.8); SI: 282.2–302.6 (293.2); PSLI: 26.7–31.3 (29.2); PPI: 49.6–70.6 (58.1); PNI: 74.5–79.5 (77.5); MTI: 290.9–314.9 (305.2).



**FIGURE 27.** Major worker, hypostomal tooth. *Pheidole antsahabe* (A). *Pheidole atsirakambiaty* (B). *Pheidole bessonii* (C). *Pheidole clara* (D). *Pheidole decollata* (E). *Pheidole flammea* (F). *Pheidole flavodepressa* (G). *Pheidole grallatrix* (H). *Pheidole madecassa* (I). *Pheidole mantadioflava* (J). *Pheidole maro* (K). *Pheidole oswaldi* (L). *Pheidole ovalinoda* (M). *Pheidole similis* (N). *Pheidole tenebrovulgaris* (O). *Pheidole uranus* (P). *Pheidole voreios* (Q). *Pheidole zirafy* (R).

**Head.** In full-face view oval, posterior region elongated into long and narrow neck terminated by distinct nuchal collar (Fig. 26A). Pilosity relatively sparse, moderately long, and subdecumbent to erect. Sculpture shiny and mostly smooth with few rugae on gena and transverse rugae on neck; antennal sockets with few weakly developed rugulae that curve posterolaterally; interspaces between rugulae smooth. Clypeus with median longitudinal carina absent; two lateral longitudinal carinae absent. Scape, when laid back, exceeding the posterior head margin, neck not included, by half of its length; pilosity dense and subdecumbent to erect (Fig. 26A, C). **Mesosoma.** In lateral view, promesonotum very low, long, and slightly arched; promesonotal groove present; metanotal groove in



**FIGURE 28.** Distribution. *Pheidole antsahabe* (A). *Pheidole atsirakambiaty* (B). *Pheidole bessonii* (C). *Pheidole clara* (D). *Pheidole decollata* (E). *Pheidole flammea* (F). *Pheidole flavodepressa* (G). *Pheidole grallatrix* (H). *Pheidole madecassa* (I). *Pheidole mantadioflava* (J). *Pheidole maro* (K). *Pheidole oswaldi* (L). *Pheidole ovalinoda* (M). *Pheidole similis* (N). *Pheidole tenebrovulgaris* (O). *Pheidole uranus* (P). *Pheidole voreios* (Q). *Pheidole zirafy* (R).



distinct; propodeal spines long, thin, and triangular (Fig. 26C). Promesonotal and propodeal dorsum mostly smooth with sparse and transverse rugae; lateral sides of propodeum, anepisternum, and katepisternum, with dense and thin rugoreticulae. Pilosity very sparse, short, and erect (Fig. 26C, E). **Petiole.** Peduncle with ventral face straight (Fig. 26C, E). **Gaster.** With sparse and erect pilosity (Fig. 26C, E). **Color.** Dark brown, legs and antennae brighter (Fig. 26C, E).

**Biology.** The species was collected between 450–780 m elevation, in low elevation rainforest and rainforest. Nests were located in rotten logs, and workers were collected from sifted litter and on the ground.

**Comments.** Majors of *P. zirafy* are most similar to parapatric *P. flavodepressa* and differ in blackish brown body, presence of moderately sparse, short, and appressed to decumbent pilosity on side of head, occipital lobes with thin rugae that weaken posteriorly and arch posterolaterally, and mostly smooth interspaces between rugae. In contrast, *P. flavodepressa* has orange body coloration, side of head with moderately dense, long, subdecumbent to suberect pilosity, and occipital lobes with thick and dense rugae and distinctly rugulate interspaces between rugae. Minors of *P. zirafy* are most similar to sympatric *P. grallatrix* and differ in presence of dense and thin rugoreticulae on lateral sides of propodeum, anepisternum, and katepisternum. Minors of *P. grallatrix* have entirely smooth mesosoma.

**Etymology.** Malagasy for giraffe, in reference to the very long neck of minor workers.

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