

ORIGINAL ARTICLE

A review of the ant genus *Prenolepis* (Hymenoptera: Formicidae) in China, with descriptions of four new species

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Abstract Species of the ant genus *Prenolepis* in China are reviewed. Seven species are treated, of which four are described as new, namely *P. angulinoda* **sp. nov.**, *P. cyclopia* **sp. nov.**, *P. quinquedenta* **sp. nov.** and *P. striata* **sp. nov.** A key to the known species in China based on the worker caste is provided, and the worker of each species is imaged.

Key words *Prenolepis*, taxonomy, key, China.

1 Introduction

The ant genus *Prenolepis* was erected by Mayr (1861) based on the type species *Tapinoma nitens* Mayr, 1853 (= *Prenolepis nitens*). Two years later, Motschoulsky (1863) described another genus *Paratrechina*, which was little concerned and synonymized with *Prenolepis* by Dalla Torre (1893). Then, Emery (1925) revalidated *Paratrechina* from *Prenolepis*. Now, it is one of the smallest genus in the family Formicidae.

LaPolla *et al.* (2010) investigated the phylogeny and taxonomy of the *Prenolepis* genus-group, raised *Nylanderia* and *Parapatrechina* to generic status, and provided a morphological diagnosis for the worker caste of all genera. Then, LaPolla *et al.* (2012) described another genus *Zatania*, and redefined the genus *Prenolepis*. In 2016, Williams and LaPolla revised the genus. They reported thirteen species globally, including four new species, provided a key for the worker caste and a morphological diagnosis for the genus, and proposed major taxonomic changes.

In China, three species were earliest described under the genus *Prenolepis* from Hong Kong and Taiwan (Forel, 1912, 1913), while *sauteri* was transferred to *Parapatrechina*, *emmae* and *formosae* were transferred to *Nylanderia* (LaPolla *et al.*, 2010; Blaimer *et al.*, 2015). Since 1995, two species, *melanogaster* and *naoroji*, and eight new species were reported in the Chinese ant fauna (Wu & Wang, 1995; Xu, 1995; Wang, 1997; Zhou & Zheng, 1998; Zhou, 2001; Wang & Wu, 2007). Among them, *sphingthoraxa* was synonymized with *flaviabdominis*, *nigriflagella* was synonymized with *melanogaster*, *longiventris* and *magnocula* were synonymized with *naoroji*; *septemdenta* was synonymized with *opisophthalmia*, and tranfered to *Nylanderia*, *umbra* was tranfered to *Paratrechina* (Williams & LaPolla, 2016). In the present paper, seven species in China are recognized, of which four are described as new to science. A key to the known species of the genus in China for the worker caste is provided.

2 Materials and methods

The specimens examined are deposited in Guangxi Normal University, Guilin, China (GXNU), Southwest Forestry

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University, Kunming, China (SWFU) and Hubei Institute of Nationality, Enshi, China (HBIN), respectively. Paratypes are partly deposited in the Insect Systematics Laboratory, Towson University, USA (ISLTU).

All measurements are expressed in millimeters (mm). Measurements were made under a Nikon SMZ 745 stereo-microscope with micrometer. Photographic images were made with a Nikon AZ100 microscope. The morphological abbreviations mostly follow LaPolla *et al.* (2011a, b):

TL—Total length, the total outstretched length of the individual, from the mandibular apex to the gastral apex;

HL—Head length, the length of the head proper, excluding the mandibles; measured in full face view from the midpoint of the anterior clypeal margin to a line drawn across the posterior margin from its highest points;

HW—Head width, the maximum width of the head in full face view;

CI—Cephalic index, $(HW/HL) \times 100$;

SL—Scape length, the maximum length of the antennal scape excluding the condylar bulb;

SI—Scape index, $(SL/HW) \times 100$;

PW—Pronotal width, the maximum width of the pronotum in dorsal view;

AL—Alitrunk length, the diagonal length of the alitrunk in lateral from the point at which the pronotum meets the cervical shield to the posterior basal angle of the metapleuron;

EL—Eye length, maximum length of the eye in full face view.

3 Taxonomy

Prenolepis Mayr, 1861

Prenolepis Mayr, 1861: 52; LaPolla *et al.*, 2010: 129; LaPolla *et al.*, 2012: 204 (in the key); LaPolla *et al.*, 2014: 40 (in the key); Williams & LaPolla, 2016: 215. Type species: *Tapinoma nitens* Mayr, 1853 (= *Prenolepis nitens*).

Description (according to Williams & LaPolla, 2016). Monomorphic, medium to large in size. Head rounded in general appearance, with rounded, indistinct posterolateral corners. Antennae 12-segmented; scapes surpass the posterior margin of head. Eyes convex, placed posterior to the midline of the head. Mandibles with 5–7 teeth on the masticatory margin; apical tooth the longest, 3rd and 5th tooth from apical reduced and 6th tooth also reduced when 7 teeth present. Palp formula 6:4. In profile view, the mesonotum curved and depressed immediately posterior to the pronotum, which gives the appearance of a mesonotal constriction; mesosoma robust but sometimes much more gracile. Propodeum about the same height or slightly higher than mesonotum; propodeum either domed with a rounded dorsal face, or obtusely angled with a flat dorsal face. Mesonotal and metanotal sutures absent or in complete and shallow. Petiole typically forward-inclined and wedge-shaped, or elongate with a more rounded dorsal apex of the scale. Legs elongate.

Smooth and shining or rugose, longitudinal rugae that extend from the mesonotum to the mesopleuron present at the constriction. Head, mesosoma, and gaster typically covered in erect macrosetae that are thin and wispy, dense setation on scapes. Pairs of erect macrosetae run medially from the clypeus to the posterior margin of head. Pale yellow to dark brown in color.

Prenolepis angularis Zhou, 2001 (Figs 1–3)

Prenolepis angularis Zhou, 2001: 173, fig. 344 (w.).

Description. Clypeus without carina. Anterior margin of clypeus shallowly concave. Pronotum and mesonotum together form a convexity that is longer than the propodeal convexity, propodeum with dorsal face and declivous face straight, posterodorsal corner angulate. Colored yellowish brown to dark brown.

Measurements. Worker ($n=8$). TL 2.9–3.1, HL 0.75–0.79, HW 0.72–0.75, CI 94–96, SL 0.93–0.98, SI 129–130, PW 0.42–0.47, AL 0.91–1.06, EL 0.19–0.20.

Material examined. Holotype worker, Mao'er Mt. Nature Reserve (110°19.25'E, 25°44.21'N, elev. 934.5 m), Guangxi, China, 10.VII.1994, coll. S.Y. Zhou (GXNU). Paratypes. 7 workers, same data as holotype (5 in GXNU, 2 in ISLTU). Additional material. 3 workers, Huping Mt. (110°29.38'E, 29°50.26'N, elev. 722.7 m), Hunan, China, 9.X.2003, coll. J.H. Huang; 7 workers, Mang Mt. (112°43.19'E, 24°52.23'N, elev. 1068.9 m), Hunan, China, 8.VI.2004, coll. J.H. Huang; 5 workers, Qingliangfeng Nature Reserve (118°52.20'E, 30°04.32'N, elev. 865.0 m), Zhejiang, China, 27.VI.2012, coll. C.W. Lu (GXNU).

Distribution. China (Guangxi, Hunan, Zhejiang).

***Prenolepis angulinoda* sp. nov.** (Figs 4–6)

Description. Head broader than long or as broad as long, with convex sides, straight posterior margin, and rounded posterior corners. Anterior clypeal margin broadly convex, with strong longitudinal carina in the middle. Mandibles with 5 teeth, the 3rd reduced. Eyes ovate, convex, moderately large, placed behind the mid length of head; Antennae long, scapes extending slightly less than 1/2 of their length beyond posterior margin. Frontal carina short and diverging, reaching to anterior margin of eyes (Fig. 4). Mesosoma stout, strongly medially constricted; metanotal groove conspicuous; in lateral view pronotum and mesonotum together form a convexity, propodeum low, slightly shorter than pro-mesonotal convexity; in dorsal view propodeum convex laterally, flat in the middle, posterodorsal corner rounded. Petiolar node thick, with very short peduncle which at the same level with its anterior face, so that anterior face and posterior face form a right angle. Gaster about 1.5 times longer than head, gibbous (Figs 5–6).

Mandibles, clypeus and area in front of eyes of head finely and longitudinally striate; dorsum of head feebly reticulate; gena of head, mesosoma, petiole, and gaster smooth and shining except for the constriction of mesosoma where several short rugae existing. Setae soft, abundant on head and on gaster, sparse on mesosoma and on petiole. Yellowish brown, head darker, gaster blackish brown.

Measurements. Holotype. TL 3.2, HL 0.74, HW 0.77, CI 105, SL 0.85, SI 116, PW 0.48, AL 1.01, EL 0.20. Paratypes ($n=5$). TL 3.2–3.3, HL 0.71–74, HW 0.73–77, CI 100–106, SL 0.85–0.87, SI 113–116, PW 0.48–0.51, AL 1.01–1.02, EL



Figures 1–6. *Prenolepis* spp., worker. 1–3. *P. angularis* Zhou, 2001. 4–6. *P. angulinoda* sp. nov. 1, 4. Head in full-face view. 2, 5. Body in lateral view. 3, 6. Body in dorsal view. Scale bars: 1, 4=0.2mm; 2–3, 5–6=0.5mm.

0.20–0.21.

Material examined. Holotype worker. Maolan Mt. Nature Reserve (107°52.10'E, 25°09.50'N, elev. 647.1 m), Guizhou, 15.IV.2010, coll. Z.B. Xiong (GXNU). Paratypes. 5 workers, same data as holotype (3 in GXNU, 2 in ISLTU).

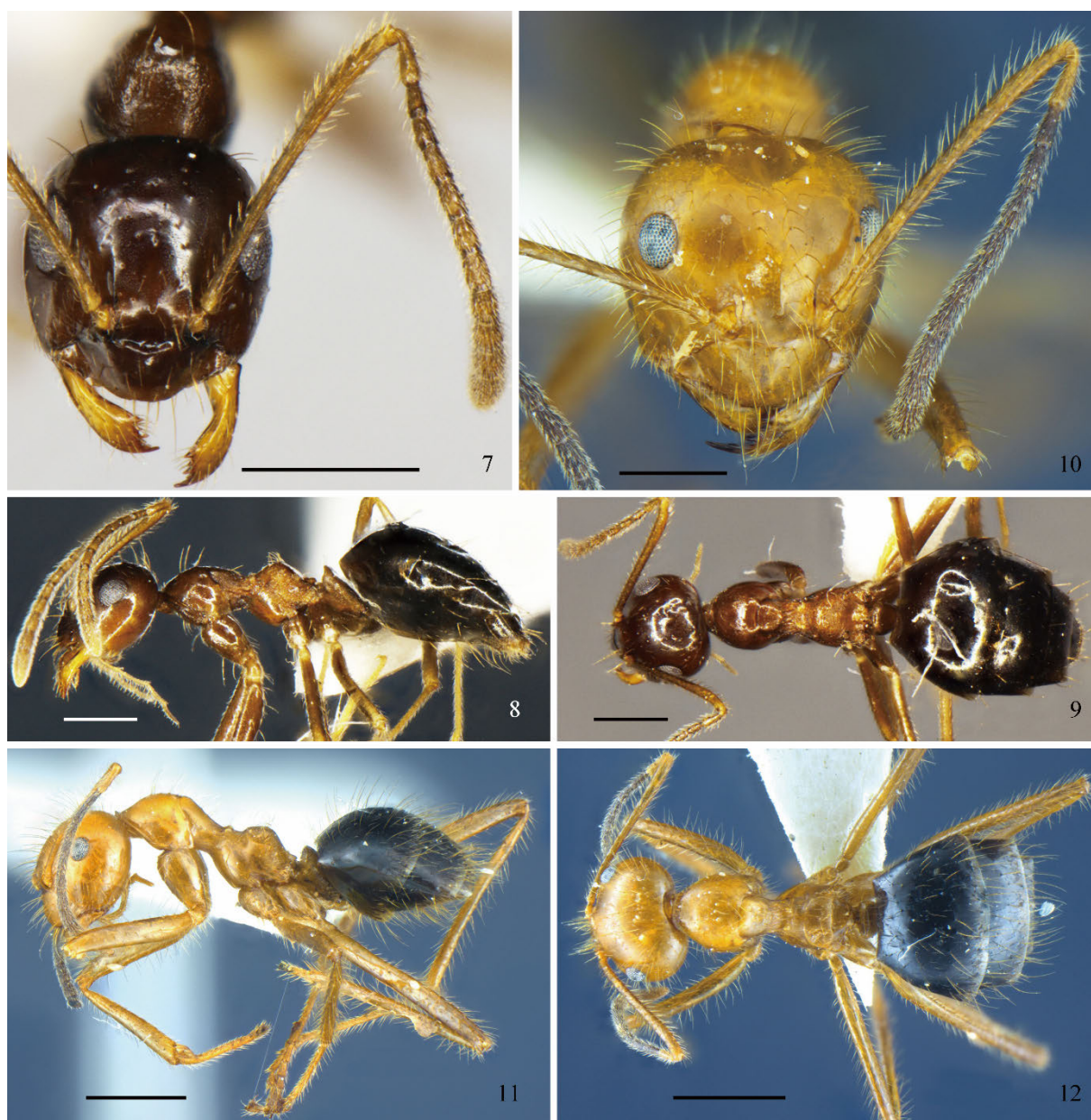
Remarks. This new species differs from any other described species by the anterior face of petiolar node at the same level with peduncle and form a right angle with posterior face.

Etymology. The species is named for its angular petiolar node.

Distribution. China (Guizhou).

***Prenolepis cyclopia* sp. nov.** (Figs 7–9)

Description. Head slightly longer than broad, sides and posterior margin convex, posterior corners rounded. Anterior clypeal margin sinuous, shallowly notched in the middle, without longitudinal carina. Mandibles with 6 teeth, the 3rd slightly smaller than the 4th, and the 5th very reduced. Eyes convex, moderately large, placed behind the mid length of head; Antennae stout and long, scapes extending about 1/2 of their length beyond posterior margin of head. Frontal carina short,



Figures 7–12. *Prenolepis* spp., worker. 7–9. *P. cyclopia* sp. nov. 10–12. *P. melanogaster* Emery, 1893. 7, 10. Head in full-face view. 8, 11. Body in lateral view. 9, 12. Body in dorsal view. Scale bars=0.5 mm.

reaching to anterior margin of eyes (Fig. 7). Mesosoma slender, strongly medially constricted; metanotal groove conspicuous; in lateral view pronotum and mesonotum together form a convexity, propodeum low, with declivous face slightly longer than dorsal face, posterodorsal corner angulate. Petiolar node low, subtriangular in lateral view. Gaster about two times longer than head, gibbous (Figs 8–9).

Mandibles, clypeus, head, and mesonotum smooth and shining, constriction of mesosoma with sparse coarse longitudinal rugae, mesopleuron and propodeum with fine longitudinal striations, and the latter combined with reticulations. Petiole and gaster smooth and shining. Dorsum of head and gaster with several soft long setae, combined with a few short setae. Setae on mesosoma: pronotum 0–4, mesonotum 0–4, propodeum 0–6, and petiolar node 0–2 (number of setae different in individuals: specimens collected from Hunan with abundant setae on whole body). Mesosoma, petiole, antennae, and legs yellow to yellowish brown, head and gaster black.

Measurements. Holotype. TL 3.6, HL 0.74, HW 0.73, CI 99, SL 0.97, SI 133, PW 0.45, AL 1.06, EL 0.23. Paratypes ($n=27$). TL 3.6–4.0, HL 0.73–0.79, HW 0.70–0.78, CI 95–99, SL 0.94–1.06, SI 132–136, PW 0.45–0.52, AL 1.01–1.25, EL 0.20–0.23.

Material examined. Holotype worker. Tianmu Mt. Nature Reserve (119°23.47'E, 30°18.55'N, elev. 381.3 m), Zhejiang, 28.VII.2011, coll. Z.L. Chen (GXNU). Paratypes. 9 workers, same data as holotype; 3 workers, Fanjing Mt. Nature Reserve (108°45.55'E, 27°49.50'N, elev. 565.4 m), Guizhou, China, 29.V.2002, coll. S.Y. Zhou; 5 workers, Heng Mt. (112°33.25'E, 27°11.30'N, elev. 344.4 m), Hunan, China, 8.IX.2003, coll. J.H. Huang; 1 worker, Leigong Mt. Nature Reserve (108°03.25'E, 26°15.30'N, elev. 1009.2 m), Guizhou, 1.IV.2005, coll. L. Feng; 1 worker, Fengyang Mt. Nature Reserve (119°06.54'E, 27°46.33'N, elev. 276.1 m), Zhejiang, China, 28.VII.2007, coll. Z. Tan (2 in ISLTU, others in GXNU).

Remarks. This new species resembles *P. angularis* Zhou, but differs by the antennae stout and long, scapes extending about 1/2 of their length beyond posterior margin of head, mesopleuron and propodeum finely longitudinally striate and reticulate.

Etymology. The species is named for its cylindrical mesosoma.

Distribution. China (Zhejiang, Guizhou, Hunan).

***Prenolepis melanogaster* Emery, 1893** (Figs 10–12)

Prenolepis melanogaster Emery, 1893: 223 (w.). Type locality: Myanmar.

Prenolepis nigriflagella Xu, 1995: 338 (w.).

Description. Head, mesosoma, and petiole orange yellow except antennal segments 3–12 darker than the basal two segments, gaster black.

Measurements. Worker ($n=6$). TL 4.9–5.8, HL 1.23–1.33, HW 1.20–1.33, CI 98–102, SL 1.65–1.80, SI 129–142, PW 0.75–0.85, AL 1.75–2.00, EL 0.25–0.28.

Material examined. Holotype worker (of *Prenolepis nigriflagella*), Lincang County (100°04.22'E, 23°52.22'N, elev. 1540.5 m), Yunnan, China, 16.XI.1994, coll. Z.H. Xu (SWFU). Paratypes. 5 workers (of *Prenolepis nigriflagella*), same data as holotype (3 in SWFU, 2 in GXNU).

Distribution. China (Yunnan).

***Prenolepis naoroji* Forel, 1902** (Figs 13–15)

Prenolepis naoroji Forel, 1902: 290 (w.). Type locality: India.

Prenolepis magnocula Xu, 1995: 339.

Prenolepis longiventris Zhou, 2001: 173.

Description. Pronotum and mesonotum together form a convexity that is as long as propodeal convexity; propodeum low. Petiolar node low, subtriangular in lateral view. Head, mesosoma and petiole yellow, yellowish brown to brown; gaster brown to dark brown.

Measurements. Worker ($n=38$). TL 3.2–3.7, HL 0.70–0.75, HW 0.56–0.58, CI 74–82, SL 1.07–1.12, SI 187–189, PW 0.45–0.48, AL 1.00–1.16, EL 0.21–0.22.

Material examined. 14 workers, Huaping Nature Reserve (109°48.54'E, 25°10.10'N, elev. 534.0 m), Guangxi, China, 8.VIII.1995, coll. S.Y. Zhou; 5 workers, Shiwan Mt. Nature Reserve (107°29.59'E, 21°40.03'N, elev. 873.3 m), Guangxi, China, 24.VI.1998, coll. S.Y. Zhou; 3 workers, Mao'er Mt. Nature Reserve (110°19.25'E, 25°44.21'N, elev. 934.5 m), Guangxi, China, 19.VII.2003, coll. X.B. Yan; 10 workers, Jiangyong County (110°32.24'E, 24°55.26'N, elev. 125.6 m), Hunan, China, 20.IX.2004, coll. J.H. Huang; 1 worker, Wuzhi Mt. Nature Reserve (109°32.03'E, 18°48.59'N, elev. 698.3 m), Hainan, China, 10.VIII.2006, coll. F. Qian; 1 worker, Mayanghe Nature Reserve (108°19.45'E, 28°37.30'N, elev.

382.8 m), Guizhou, China, 28.IX.2007, coll. F. Qian (2 in ISLTU, others in GXNU).

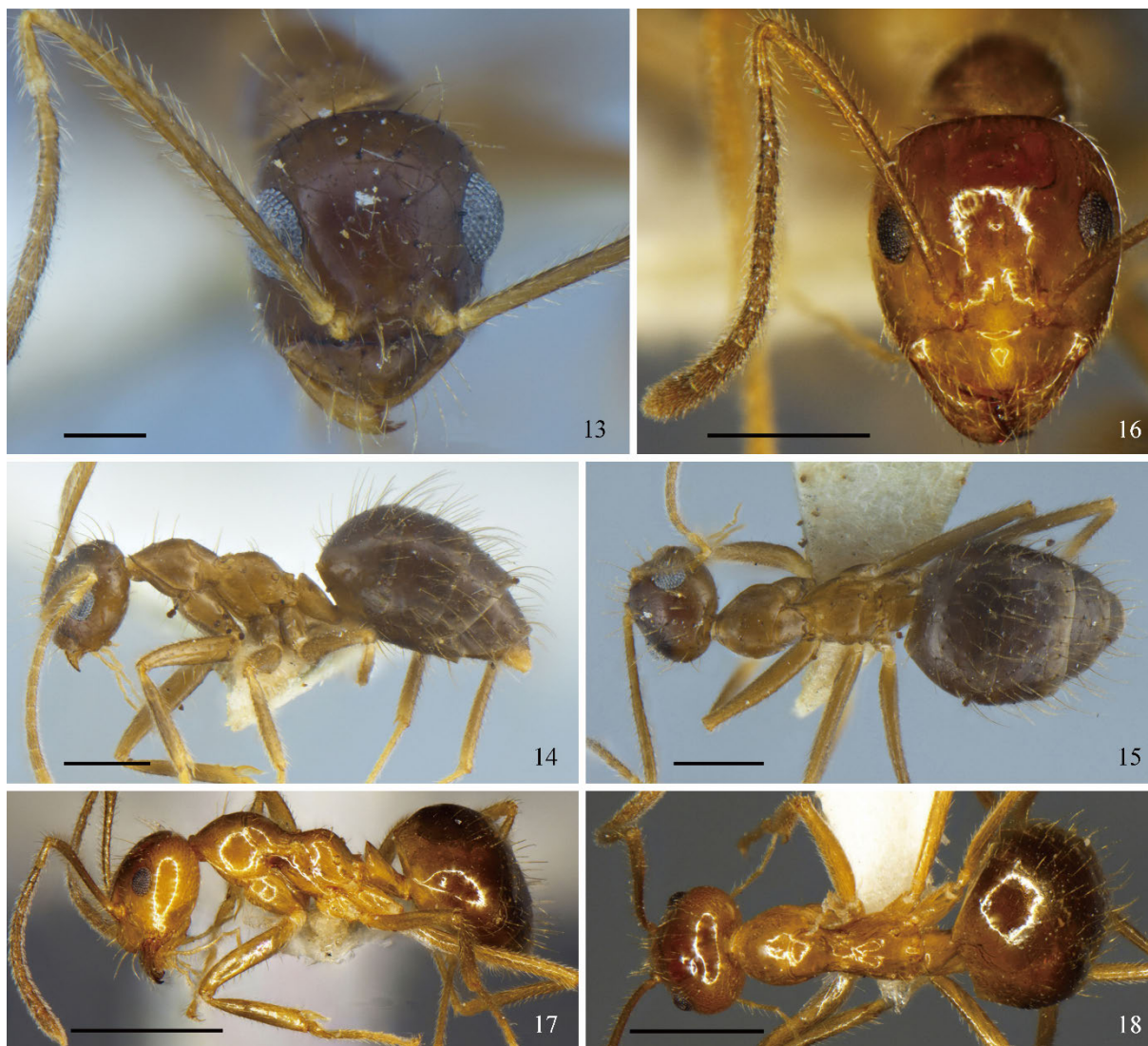
Distribution. China (Guangxi, Hunan, Hainan, Guizhou, Yunnan).

***Prenolepis quinquedenta* sp. nov.** (Figs 16–18)

Description. Head longer than broad, or as broad as long. Clypeus convex, with a strong longitudinal carina in the middle, anterior margin shallowly and broadly concave. Mandibles with 5 teeth, the 3rd reduced. Eyes ovate, feebly convex, moderately large, placed behind the mid length of head. Antennae long, scapes extending about 1/3 of their length beyond posterior margin of head. Frontal carina short, reaching to anterior margin of eyes (Fig. 16). Mesosoma stout, strongly medially constricted; in lateral view pronotum and mesonotum together form a convexity; propodeum low, broadly rounded with declivous face obliquely truncate, the latter longitudinally impressed in the middle; petiolar node inclined forward, posterodorsal corner rounded, dorsal face longitudinally concave in the middle when view from behind. Gaster slightly longer than head (Figs 17–18).

Smooth and shining; mandibles weakly striate, frontal area of head without reticulations, several short longitudinal striations present on posterior portion of mesonotum where it joins propodeum. Setae soft, weak, and short, the longest setae are on clypeus, reaching up to 0.175 mm. Colored yellowish brown, gaster brown.

Measurements. Holotype. TL 3.4, HL 0.88, HW 0.83, CI 94, SL 1.12, SI 134, PW 0.53, AL 1.18, EL 0.18. Paratypes ($n=5$). TL 3.1–3.6, HL 0.73–0.88, HW 0.70–0.83, CI 92–96, SL 0.93–1.12, SI 133–136, AL 1.10–1.18, EL 0.16–0.18.



Figures 13–18. *Prenolepis* spp., worker. 13–15. *P. naoroji* Forel, 1902. 16–18. *P. quinquedenta* sp. nov. 13, 16. Head in full-face view. 14, 17. Body in lateral view. 15, 18. Body in dorsal view. Scale bars: 13=0.2 mm; 14–16=0.5 mm; 17–18=1 mm.

Material examined. Holotype worker. Huping Mt. (110°29.38'E, 29°50.26'N, elev. 722.7 m), Hunan, China, 8.X.2003, coll. J.H. Huang (GXNU). Paratypes. 4 workers, same data as holotype; 1 worker, Yongshun County (109°57.53'E, 29°00.48'N, elev. 594.4 m), Hunan, China, 21.X.2003, coll. J.H. Huang (3 in GXNU, 2 in ISLTU).

Remarks. This new species is similar to *P. fisheri* Bharti & Wachkoo, but differs by the anterior clypeal margin shallowly and broadly concave, declivous face and dorsal face of propodeum longitudinally impressed in the middle when view from behind, frontal area of head without reticulations.

Etymology. The species is named for its 5 teeth on masticatory margin of mandibles.

Distribution. China (Hunan).

***Prenolepis striata* sp. nov.** (Figs 19–21)

Description. Head as long as broad, sides convex, posterior margin almost straight, posterior corners rounded. Anterior clypeal margin produced in the middle and straight, with a longitudinal carina. Mandible with 6 teeth, the 3rd reduced, the 5th as large as the 4th and the basal tooth. Eyes ovate, convex, moderately large, placed slightly behind the mid length of head. Antennal scapes extending about 2/5 of their length beyond posterior margin of head. Frontal carina short, reaching to anterior margin of eyes (Fig. 19). Mesosoma slender, strongly medially constricted; metanotal groove conspicuous; in lateral view pronotum and mesonotum together form a convexity; propodeum with dorsal face straight, elevated backward, declivous face truncate and slightly concave, posterodorsal corner angulate. Petiolar node high, subtriangular, anterior face slightly convex, posterior face straight. Gaster about 1.5 times longer than head (Figs 20–21).

Mandibles longitudinally striate, clypeus coarsely longitudinally rugose; head, mesosoma and petiole finely and densely striate and punctate, dull; striations on constriction of mesosoma coarser; sides of propodeum densely reticulate. Gaster smooth and shining. Setae soft and long, abundant on head and on gaster, anterior portion of pronotum and mesonotum with short setae. Colored chestnut, gaster black.

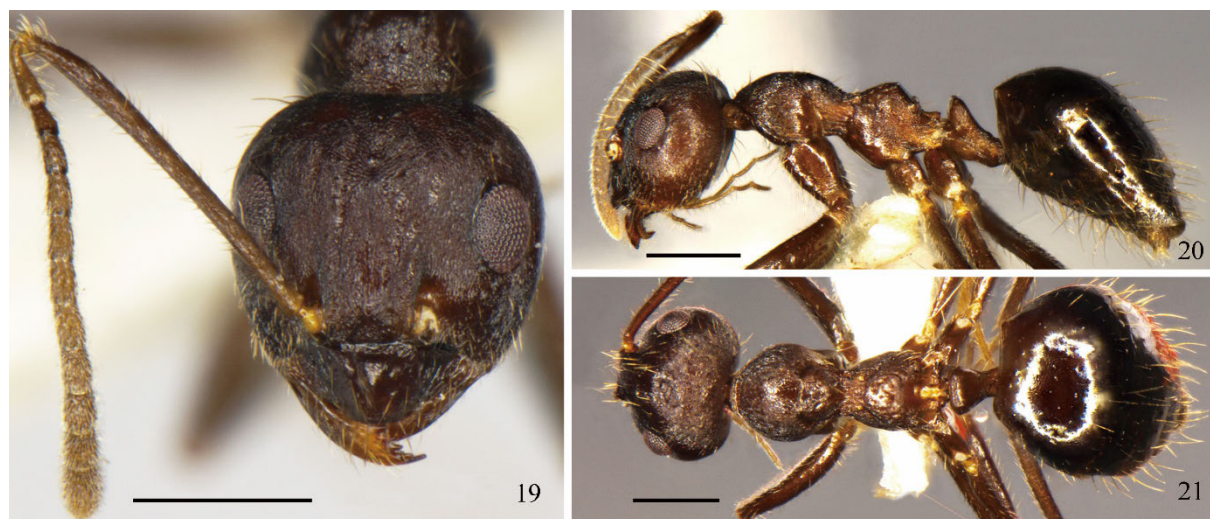
Measurements. Holotype. TL 3.7, HL 0.87, HW 0.87, CI 100, SL 1.08, SI 124, PW 0.56, AL 1.25, ED 0.26. Paratype. TL 3.6, HL 0.88, HW 0.88, CI 100, SL 1.06, SI 120, PW 0.54, AL 1.21, EL 0.25.

Material examined. Holotype worker. Anning County (102°28.44'E, 24°55.23'N, elev. 1942.2 m), Yunnan, 5.VIII.2005, coll. S.L. Hu (GXNU). Paratype. 1 worker, same data as holotype (ISLTU).

Remarks. This new species is similar to *P. angularis* Zhou, but differs by the head, mesosoma and petiole finely and densely striate and punctate, dull; striations on constriction of mesosoma coarser; sides of propodeum densely reticulate.

Etymology. The species is named for its striations on head and on mesosoma.

Distribution. China (Yunnan).



Figures 19–21. *Prenolepis striata* sp. nov., worker. 19. Head in full-face view. 20. Body in lateral view. 21. Body in dorsal view. Scale bars = 0.5mm.

Key to the known *Prenolepis* species in China based on the worker caste.

1. Mandible with 5 teeth 2
- Mandible with 6 teeth 3

2. Head smooth and shining; petiolar node scale-like, peduncle much lower than anterior face of the node, anterior face and posterior face of the node form a triangle in lateral view *P. quinquedenta* sp. nov.
Head feebly punctate; petiolar node thick, peduncle at the same level with the anterior face of the node, so that the anterior face of the node cannot be separated from peduncle, form a right-angle with the posterior face of the node *P. angulinoda* sp. nov.
3. Posterodorsal corner of propodeum in lateral view angulate or nearly angulate 4
Posterodorsal corner of propodeum in lateral view rounded, not angulate 6
4. Head finely and densely striate and punctate, dull *P. striata* sp. nov.
Head smooth and shining 5
5. Mesopleuron and propodeum smooth and shining *P. angularis* Zhou, 2001
Mesopleuron and propodeum finely longitudinally striate and reticulate *P. cyclopia* sp. nov.
6. Head broader than long or as broad as long. Eyes moderately large, not prominent *P. melanogaster* Emery, 1893
Head distinctly longer than broad. Eyes large and prominent *P. naoraji* Forel, 1902

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