

Three new species of the ant genera *Amblyopone* ERICHSON, 1842 and *Proceratium* ROGER, 1863 (Hymenoptera: Formicidae) from Yunnan, China

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Abstract

Three new species of the ant genera *Amblyopone* ERICHSON, 1842 and *Proceratium* ROGER, 1863 are described from Yunnan Province, China, i.e., *Amblyopone octodentata* sp.n., *Proceratium nujiangense* sp.n., and *Proceratium longmenense* sp.n. Gynes of *Amblyopone octodentata* sp.n. and *Proceratium nujiangense* sp.n. are also described. Keys to known Chinese species of the two genera are provided separately.

Key words: Formicidae, Amblyoponinae, Proceratiinae, Oriental, new species.

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Introduction

The ant genus *Amblyopone* ERICHSON, 1842 (Amblyoponinae, BOLTON 2003), is distributed in the world tropics and temperate zones. 62 species were known in the world (BOLTON 1995). BROWN (1960) had a revision on the genus and more than 30 species were treated. The Asian species were reported by FOREL (1900), BINGHAM (1903), WHEELER & CHAPMAN (1925), WHEELER (1928), KARAVAIIEV (1935), CHAPMAN & CAPCO (1951), BARONI URBANI (1978), TAYLOR (1978), TERAYAMA (1987), MORISITA & al. (1989), and ONOYAMA (1999). The Chinese species of the genus were treated by FOREL (1912), WHEELER (1930), TERAYAMA (1989), WU & WANG (1992), TANG & al. (1995), XU (2001), and ZHOU (2001). In this study, one new species of the genus is described from Yunnan Province. Up to date, nine species of the genus are known from China.

Proceratium ROGER, 1863 (Proceratiinae, BOLTON 2003), is a worldwide genus (BOLTON 1995) with 79 species (XU 2000, BARONI URBANI & DE ANDRADE 2003). BROWN (1958), and BARONI URBANI & DE ANDRADE (2003) had revisionary studies of the genus. The Asian species of the genus were treated by CHAPMAN & CAPCO (1951), MORISITA & al. (1989), ONOYAMA & YOSHIMURA (2002), and IMAI & al. (2003). The Chinese species of the genus were reported by TERAYAMA (1985, 1990), ONOYAMA (1991), WU & WANG (1995), TANG & al. (1995), and XU (2000). In this study, two new species of the genus are described from Yunnan Province. Up to date, six species of the genus are known from China.

Material and methods

Standard measurements and indices are as defined in BOLTON (1975), ML and ED are supplemented.

TL Total Length. Total outstretched length of the individual, from mandibular apex to gastral apex. When measuring a fixed individual, total length is obtained by adding the separate lengths of mandible + head, alitrunk, petiole, and gaster.

HL Head Length. Straight line length of head in perfect full face view, measured from mid-point of anterior clypeal margin to midpoint of occipital margin. In

species with a strongly concave occipital margin, the head length is measured to the midpoint of a line connecting posterolateral projections.

HW Head Width. Maximum width of head excluding eyes, measured in full face view.

CI Cephalic Index = $HW \times 100 / HL$.

SL Scape Length. Straight-line length of antennal scape, excluding basal constriction or neck.

SI Scape Index = $SL \times 100 / HW$.

ML Mandible Length. Straight-line length of mandible from apex to visible basal end, measured in dorsal view.

ED Eye Diameter. Maximum diameter of eye.

PW Pronotum Width. Maximum width of pronotum in dorsal view.

AL Alitrunk Length. Diagonal length of alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the posteroventral corner of propodeum.

PL Petiole Length. Length of petiole from anterior process to posteriormost point of tergite, where it rounds the gastral articulation.

sur-PH Petiole Height. Height of petiole measured in profile view from apex of subpetiolar process to dorsal-most point of node.

DPW Dorsal Petiole Width. Maximum width of petiole in dorsal view.

All measurements are expressed in millimeters.

A sample-plot investigation method for ant species diversity described by XU & al. (1999) was used for collecting ant specimens. A Chinese-made Jiangnan XTB-1 microscope was used for morphometrics with a micrometer under the magnification of 20×2.4 times. A Chinese Hongkong-made Motic M-700Z microscope was used for illustration with a mirror device under the magnification of 20×3 times.

The type specimens are deposited in the Insect Collection, Southwest Forestry College, Kunming, Yunnan Province, P. R. China.

Amblyopone ERICHSON, 1842

Amblyopone ERICHSON, 1842. Type-species: *Amblyopone australis* ERICHSON, 1842, by monotypy.

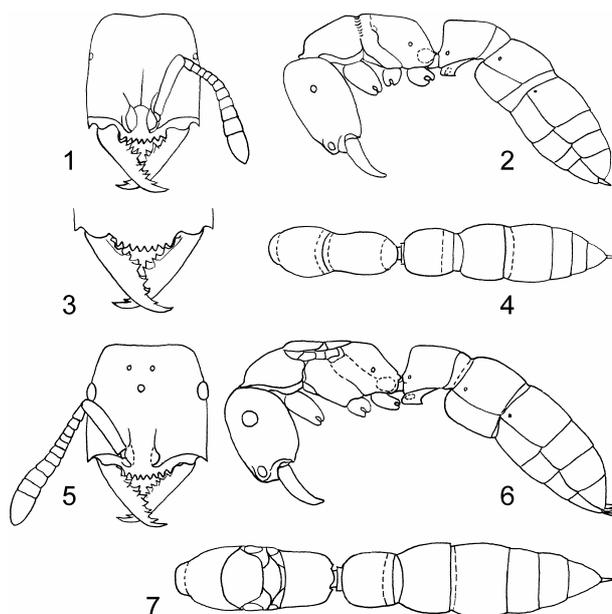
Key to Chinese species of *Amblyopone* based on worker caste

- 1 Antenna 11-segmented (see TERAYAMA 1989: figs. 1 - 2) (China: Taiwan Province; Japan). ...
..... *A. sakaii* TERAYAMA, 1989
- Antenna 12-segmented. 2
- 2 Anterior margin of clypeus divided into three lobes, middle lobe with four denticles, lateral lobes each with two denticles (see XU 2001: figs. 11 - 13) (China: Yunnan Province).
..... *A. triloba* XU, 2001
- Anterior margin of clypeus not divided into lobes. 3
- 3 Anterior margin of clypeus with 6 - 8 teeth. 4
- Anterior margin of clypeus with more than 10 teeth or denticles. 7
- 4 Anterior margin of clypeus with 6 teeth. 5
- Anterior margin of clypeus with 8 teeth. 6
- 5 Anterodorsal corner of petiolar node rounded. Subpetiolar process triangular (see WU & WANG 1992: fig. 4567) (China: Hunan Province.
..... *A. rubiginosa* WU & WANG, 1992
- Anterodorsal corner of petiolar node bluntly angled. Subpetiolar process nearly rectangular (see ZHOU 2001: figs. 4 - 5) (China: Guangxi Region). *A. eminia* ZHOU, 2001
- 6 Anterior face of petiolar node straight. Posteroventral corner of subpetiolar process bluntly angled (see TERAYAMA 1990: figs. 3 - 4) (China: Zhejiang and Taiwan Provinces; Korea Peninsula, Japan). *A. silvestrii* (WHEELER, 1928)
- Anterior face of petiolar node weakly concave. Posteroventral corner of subpetiolar process acutely toothed (Figs. 1 - 4) (China: Yunnan Province). *A. octodentata* sp.n.
- 7 Anterior margin of clypeus straight, with 12 rectangular teeth, flanked by triangular corner tooth on each side (China: Taiwan Province).
..... *A. bruni* (FOREL, 1912)
- Anterior margin of clypeus weakly or strongly convex, with 10 - 12 minute triangular denticles. 8
- 8 Eye with 100 - 120 facets. Total length 8 mm. Body in color brownish black (China: Macao; India). *A. rothneyi* FOREL, 1900
- Eye with 18 - 19 facets. Total length 6.7 - 7.4 mm. Body in color black (see XU 2001: figs. 18 - 20) (China: Yunnan Province).
..... *A. crenata* XU, 2001

***Amblyopone octodentata* sp.n.** (Figs. 1 - 7)

Holotype worker. China: Yunnan Province, Kunming City, Xishan Mountain Forest Park, Nie'ermu, *Pinus armandii* forest, 2150 m, 3.V.2001, leg. Yuxiang Zhao, No. A00476.

Paratypes. Same data as holotype, 4 workers and 1 gyne.



Figs. 1 - 7: Workers and gynes of *Amblyopone octodentata* sp.n.; (1 - 4) worker; (5 - 7) gyne. (1, 5) Head in full face view; (2, 6) body in profile view; (3) clypeus and mandibles in dorsal view; (4, 7) alitrunk, petiole and gaster in dorsal view.

Holotype worker (Figs. 1 - 4). TL 4.3, HL 0.93, HW 0.80, CI 86, SL 0.47, SI 58, ML 0.67, ED 0.06, PW 0.52, AL 1.20, PL 0.58, PH 0.43, DPW 0.50. Head nearly trapezoid and widened forward, longer than broad. In full face view, occipital margin weakly concave, occipital corners roundly prominent. Lateral sides of head relatively straight. Mandibles narrow and slender, with 8 teeth, the basal 2 teeth and the apical 2 ones simple, the middle 4 teeth each bifurcated, the apical tooth slender. Anterolateral corner of head elongated into an acute tooth. Anterior margin of clypeus roundly convex, with 8 simple teeth. Antennae 12-segmented, apices of scapes reached to 3/5 of the distance from antennal socket to occipital corner. Eyes small, with 5 - 6 facets, placed at posterior 2/5 of lateral side of head. In profile view, pronotum weakly convex. Promesonotal suture depressed. Mesonotum very short, with straight dorsum. Metanotal groove only visible on sides. Dorsum of propodeum very long, straight and sloped posteriad, posterodorsal corner rounded, declivity weakly convex. In profile view, petiole narrowed backward, anterior face weakly concave, dorsal face nearly straight, anterodorsal corner right-angled. Subpetiolar process cuneiform, with large elliptic translucent fenestra, anterior face roundly convex, ventral face straight, posteroventral corner acutely toothed. In dorsal view, petiole about as broad as long, anterior and lateral borders weakly convex, anterolateral corners rounded, posterior border straight.

Mandibles finely longitudinally striate. Head, pronotum, dorsal faces of mesonotum and propodeum densely and coarsely punctate, interstices appear as fine reticulations. Lateral sides of mesothorax, metathorax and propodeum densely, finely and longitudinally striate. Petiole and first gastral segment densely and finely punctate. Second gastral segment sparsely and finely punctate, interstices smooth.

Remaining gastral segments smooth and shining. Dorsal faces of head and body with dense erect or suberect short hairs and dense decumbent pubescence. Scapes and tibiae with sparse erect or suberect hairs and dense decumbent pubescence. Body color brown, legs brownish yellow.

Paratype workers. Measurements in order minimum to maximum, arithmetic means in parentheses. TL 4.2 - 4.5 (4.3), HL 0.87 - 0.93 (0.90), HW 0.77 - 0.78 (0.78), CI 84 - 88 (87), SL 0.43 - 0.47 (0.45), SI 57 - 60 (59), ML 0.63 - 0.67 (0.64), ED 0.05 (0.05), PW 0.52 - 0.53 (0.52), AL 1.17 - 1.20 (1.19), PL 0.47 - 0.53 (0.49), PH 0.42 - 0.47 (0.44), DPW 0.45 - 0.48 (0.48) (4 individuals measured).

Paratype gyne (Figs. 5 - 7). TL 5.2, HL 0.97, HW 0.82, CI 84, SL 0.48, SI 59, ML 0.67, ED 0.15, PW 0.60, AL 1.43, PL 0.53, PH 0.48, DPW 0.53 (1 individual measured). Similar to holotype, but body larger. Eyes normal, with 3 ocelli. Alitrunk with alary sclerites. Posterior margin of pronotum deeply emarginate. Anterior scutum of mesonotum large and trapezoid, lateral scutum small and nearly triangular, posterior margin of scutellum rounded. Dorsum of metanotum short and transverse. Head and alitrunk darkish brown, petiole and gaster brown. Antennae and legs yellowish brown, eyes and pteralia black.

Comparative notes. This new species is close to *A. silvestrii* (WHEELER, 1928), but with different mandibular dentation, in profile view anterior face of petiolar node weakly concave, posteroventral corner of subpetiolar process acutely toothed.

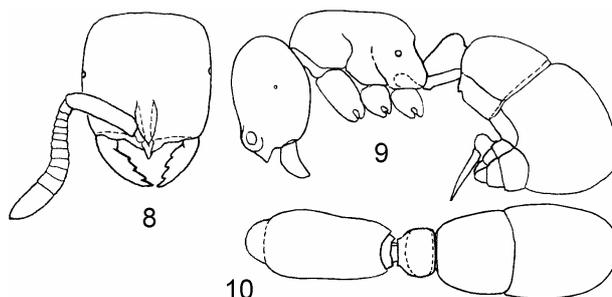
Etymology. The species name *octodentata* combines Latin *octo-* (eight) + word root *dent* (tooth) + suffix *-atus* (feminine form *-ata*, with), it refers to the eight teeth of the anterior margin of the clypeus.

Proceratium ROGER, 1863

Proceratium ROGER, 1863. Type-species: *Proceratium silaceum* ROGER, 1863, by monotypy.

Key to Chinese species of *Proceratium* based on worker caste

- 1 Anterior margin of clypeus with a triangular projection in the middle. Petiolar node low and inclined backward. 2
- Anterior margin of clypeus almost straight, without a triangular projection in the middle. Petiolar node high and erect. 5
- 2 Occipital margin weakly convex. Posterodorsal corner of propodeum rounded (see TERAYAMA 1990: figs. 10 - 11) (China: Zhejiang, Taiwan, and Hunan Provinces; Japan). . *P. itoi* (FOREL, 1918)
- Occipital margin straight. Posterodorsal corner of propodeum bluntly angled or toothed. 3
- 3 Subpetiolar process small and triangular. Dorsum of alitrunk straight (Figs. 8 - 10) (China: Yunnan Province). *P. nujiangense* sp.n.
- Subpetiolar process large and nearly rectangular. Dorsum of alitrunk weakly convex. 4
- 4 Middle projection of clypeus narrow and acute. Posterodorsal corner of propodeum bluntly angled. Posteroventral corner of subpetiolar process acutely toothed (see XU 2000: figs. 3 - 5) (China: Yunnan Province). *P. zhaoi* XU, 2000



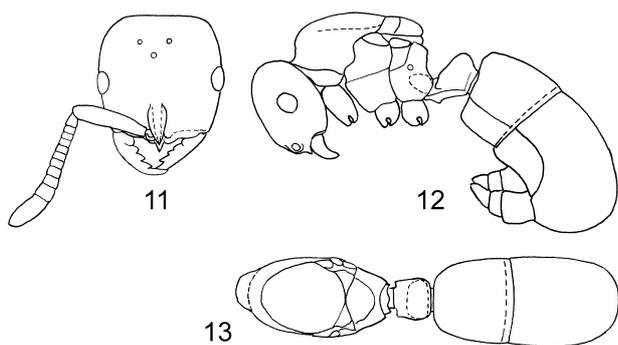
Figs. 8 - 10: Worker of *Proceratium nujiangense* sp.n. (8) Head in full face view; (9) body in profile view; (10) alitrunk, petiole and gaster in dorsal view.

- Middle projection of clypeus wide and triangular. Posterodorsal corner of propodeum bluntly toothed. Posteroventral corner of subpetiolar process bluntly angled (Figs. 14 - 16) (China: Yunnan Province). *P. longmenense* sp.n.
- 5 Occipital margin convex. Posterodorsal corner of propodeum very bluntly angled (see SANTSCHI 1937: fig. 1; TERAYAMA 1985: figs. 1 - 2) (China: Taiwan Province; Japan). *P. japonicum* SANTSCHI, 1937
- Occipital margin straight. Posterodorsal corner of propodeum distinctly toothed (see KARAVAEV 1935: fig. 2; XU 2000: figs. 15 - 17) (China: Yunnan Province; Vietnam). *P. longigaster* KARAVAEV, 1935

***Proceratium nujiangense* sp.n.** (Figs. 8 - 13)

Holotype worker. China: Yunnan Province, Baoshan City, Lujiang Town, Bawan, *Pinus yunnanensis* forest on east slope of Nujiang River Valley, 1500 m, 11.VIII.1998, leg. Qizhen Long, No. A98-1964. Paratypes. Same data as holotype, 3 workers and 1 gyne; same data as holotype but No. A98-1995, 1 worker; same data as holotype but No. A98-1997, 9 gynes; same data as holotype but No. A98-2010, 1 worker; same data as holotype but No. A98-2016, 1 worker; same data as holotype but No. A98-2029, 1 worker.

Holotype worker (Figs. 8 - 10). TL 2.5, HL 0.62, HW 0.55, CI 89, SL 0.35, SI 64, ML 0.30, ED 0.02, PW 0.38, AL 0.70, PL 0.22, PH 0.25, DPW 0.27. Head nearly square, slightly longer than broad. In full face view, occipital margin straight, occipital corners roundly prominent, lateral sides of head moderately convex. Masticatory margins of mandibles with 4 teeth, which reduced in size from apex to base. Anterior margin of clypeus with a narrow acute central projection. Antennae with 12 segments. Apices of scapes reach to 3/5 of the distance from antennal socket to occipital corner. Eyes minute, with 1 facet. In profile view, dorsum of alitrunk complete and straight, pronotum and propodeum convex, promesonotal suture and metanotal groove vanished on dorsal face. Posterodorsal corner of propodeum extrudent and bluntly angled. Lateral lobes of propodeum rounded. Petiolar node nearly triangular, anterior face long, straight and slope-like, dorsal face roundly convex, posterior face short and straight. Subpetiolar process short and small, nearly triangular. Constriction be-



Figs. 11 - 13: Gyna of *Proceratium nujiangense* sp.n. (11) Head in full face view; (12) body in profile view; (13) alitrunk, petiole and gaster in dorsal view.

tween the two basal segments of gaster distinct, deep and narrow. Second gastral segment very large, gastral segments 3 - 5 small. Sting extrudent.

Mandibles coarsely and longitudinally striate. Head, alitrunk, petiole and gaster densely and finely punctate, dull. The whole body with dense decumbent short pubescence, dorsal face of body without erect hairs. Mandibles, anterior margin of clypeus and ventral face of body with sparse erect hairs. The whole body brown. Eyes grey. Terminal segment of antenna brownish yellow.

Paratype workers. Measurements in order minimum to maximum, arithmetic means in parentheses. TL 2.4 - 2.8 (2.5), HL 0.62 - 0.68 (0.64), HW 0.53 - 0.62 (0.56), CI 86 - 90 (87), SL 0.33 - 0.38 (0.35), SI 61 - 66 (63), ML 0.30 - 0.37 (0.32), ED 0.02 (0.02), PW 0.37 - 0.43 (0.40), AL 0.70 - 0.80 (0.74), PL 0.23 - 0.28 (0.26), PH 0.23 - 0.30 (0.26), DPW 0.25 - 0.30 (0.26) (7 individuals measured).

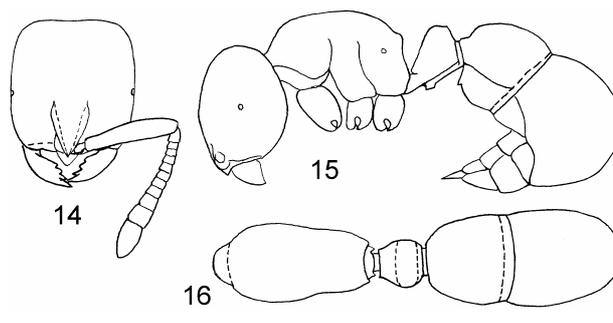
Paratype gynes (Figs. 11 - 13). Measurements in order minimum to maximum, arithmetic means in parentheses. TL 3.1 - 3.3 (3.2), HL 0.70 - 0.72 (0.70) HW 0.62 - 0.63 (0.62), CI 86 - 90 (88), SL 0.37 - 0.40 (0.39), SI 58 - 65 (63), ML 0.33 - 0.37 (0.35), ED 0.12 - 0.15 (0.14), PW 0.47 - 0.52 (0.49), AL 0.97 - 1.03 (0.99), PL 0.30 - 0.33 (0.32), PH 0.30 - 0.32 (0.31), DPW 0.30 - 0.32 (0.31) (10 individuals measured). Similar to holotype, but body much larger. Eyes normal, vertex with 3 ocelli. Alitrunk thick and massive. Posterior margin of pronotum deeply emarginate. Anterior scutum of mesonotum very large, lateral scutum small and triangular, scutellum fan-like. Both mesonotum and metanotum with pteralia, lateral side with a distinct oblique furrow. Posterodorsal corner of propodeum bluntly angled. Body brown. Eyes, ocellar area and pteralia black.

Comparative notes. This new species is close to *P. itoi* (FOREL, 1918), but posterodorsal corner of propodeum extrudent and bluntly angled, dorsum of body without erect hairs.

Etymology. The new species is named after the big river Nujiang, also called Thanlwin. In the valley of the river the new species was discovered.

***Proceratium longmenense* sp.n.** (Figs. 14 - 16)

Holotype worker. China: Yunnan Province, Kunming City, Xishan Mountain Forest Park, Longmen, subtropical evergreen broadleaf forest, 2050 m, 5.V.2001, leg. Zhenghui Xu, No. A00514.



Figs. 14 - 16: Worker of *Proceratium longmenense* sp.n. (14) Head in full face view; (15) body in profile view; (16) alitrunk, petiole and gaster in dorsal view.

Holotype worker. TL 3.2, HL 0.87, HW 0.73, CI 85, SL 0.50, SI 68, ML 0.40, ED 0.02, PW 0.52, AL 0.97, PL 0.35, PH 0.33, DPW 0.32. Head nearly square, slightly longer than broad. Occipital margin straight. Occipital corners rounded. Lateral sides weakly convex. Masticatory margins of mandibles with 4 teeth, which reduced in size from apex to base. Frontal carinae straight, convergent forward. Anterior margin of clypeus with a wide and triangular projection in the middle. Antennae thick, with 12 segments. Apices of scapes reached to 4/5 of the distance from antennal socket to occipital corner. Eyes with only one facet. In profile view, dorsum of alitrunk complete and weakly convex. Promesonotal suture and metanotal groove vanished on dorsum. Posterodorsal corner of propodeum extrudent into a right-angled tooth. Lateral lobes of propodeum blunt and rounded. Petiole roughly triangular and inclined backward, anterior and dorsal faces convex, anterodorsal corner rounded, posterior face short and straight. Subpetiolar process small and nearly rectangular, ventral face straight, anteroventral corner rightly angled, posteroventral corner bluntly angled. Constriction between the two basal segments of gaster distinct, second segment very large, apical three segments short and under the second one.

Mandibles finely longitudinally striate. Head, alitrunk, petiole, and gaster finely densely punctate and dim. Gastral segments 3 - 5 smooth and shining. Dorsum of whole body with sparse short erect hairs and dense decumbent pubescence. Erect hairs abundant on dorsum of alitrunk. Dorsal faces of scapes and tibiae with dense decumbent pubescence, but without erect hairs. The whole body yellowish brown. Mandibles, antennae, legs, and apex of gaster brownish yellow.

Comparative notes. This new species is close to *P. zhaoi* XU, 2000, but central clypeal process wide and triangular, subpetiolar process posteriorly without pointed tooth, propodeal teeth extrudent.

Etymology. The new species is named after the type specimen locality Longmen, a place of the Xishan Mountain Forest Park.

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estry College, Kunming) and Miss Qi-zhen Long (Student of Forest Protection, Faculty of Conservation Biology, Southwest Forestry College, Kunming) for collecting the type specimens of two species.

Zusammenfassung

Drei neue Arten der Ameisengattungen *Amblyopone* ERICHSON, 1842 und *Proceratium* ROGER, 1863 werden aus der Provinz Yunnan in China beschrieben, namentlich *Amblyopone octodentata* sp.n., *Proceratium nujiangense* sp.n. und *P. longmenense* sp.n. Von *Amblyopone octodentata* und *Proceratium nujiangense* werden auch die Gynen beschrieben. Zusätzlich werden Schlüssel zu den bekannten chinesischen Arten der beiden Gattungen vorgestellt.

References

- BARONI URBANI, C. 1978: Contributo alla conoscenza del genere *Amblyopone* ERICHSON (Hymenoptera: Formicidae). – Mitteilungen der Schweizerischen Entomologischen Gesellschaft 51: 39-51.
- BARONI URBANI, C. & DE ANDRADE, M.L. 2003: The ant genus *Proceratium* in the extant and fossil record (Hymenoptera: Formicidae). – Museo Regionale di Scienze Naturali Monographie 36: 1-492.
- BINGHAM, C.T. 1903: The fauna of British India, including Ceylon and Burma. Hymenoptera 2. Ants and cuckoo-wasps. – Taylor and Francis, London, 506 pp.
- BOLTON, B. 1975: A revision of the ant genus *Leptogenys* ROGER in the Ethiopian region, with a review of the Malagasy species. – Bulletin of the British Museum (Natural History) (Entomology) 31: 235-305.
- BOLTON, B. 1995: A new general catalogue of the ants of the world. – Harvard University Press, Cambridge, MA, 504 pp.
- BOLTON, B. 2003: Synopsis and classification of Formicidae. – Memoirs of the American Entomological Institute 71: 1-370.
- BROWN, W.L. 1958: Contributions toward a reclassification of the Formicidae. II. Tribe Ectatommini (Hymenoptera). – Bulletin of the Museum of Comparative Zoology at Harvard College 118: 175-355.
- BROWN, W.L. 1960: Contributions toward a reclassification of the Formicidae. 3. Tribe Amblyoponini. – Bulletin of the Museum of Comparative Zoology at Harvard College 122: 145-230.
- CHAPMAN, J.W. & CAPCO, S.R. 1951: Check list of the ants of Asia. – Monographs of the Institute of Science and Technology, Manila 1: 1-327.
- FOREL, A. 1900: Les formicides de l'Empire des Indes et de Ceylan. Part 6. 3^{me} sous famille Ponerinae. – Journal of the Bombay Natural History Society 13: 52-65.
- FOREL, A. 1912: H. Sauter's Formosa-Ausbeute. Formicidae (Hym.). – Entomologische Mitteilungen 1: 45-81.
- IMAI, H.T., KIHARA, M. & KONDOH, M. 2003: Ants of Japan. – Gakken, Tokyo, 225 pp.
- KARAVAEV, W. 1935: Neue Ameisen aus dem Indo-Australischen Gebiet, nebst Revision einiger Formen. – Treubia 15: 57-117.
- MORISITA, M., KUBOTA, M., ONOYAMA, K., OGATA, K., TERAYAMA, M., KONDOH, M. & IMAI, H.T. 1989: A guide for the identification of Japanese ants. 1. Ponerinae, Cerapachyinae, Pseudomyrmecinae, Dorylinae and Leptanillinae. – Myrmecological Society of Japan, Tokyo, 42 pp.
- ONOYAMA, K. 1991: A new synonym of the ant *Proceratium japonicum*. – Japanese Journal of Entomology 59: 695-696.
- ONOYAMA, K. 1999: A new and newly recorded species of the ant genus *Amblyopone* (Hymenoptera: Formicidae) from Japan. – Entomological Science 2: 157-161.
- ONOYAMA, K. & YOSHIMURA, M. 2002: The ants of the genus *Proceratium* (Hymenoptera: Formicidae) in Japan. – Entomological Science 5: 29-49.
- TANG, J., LI, S., HUANG, E., ZHANG, B. & CHEN, Y. 1995: Economic insect fauna of China. Fasc. 47 Hymenoptera: Formicidae (1). – Science Press, Beijing, 134 pp.
- TAYLOR, R.W. 1978: Melanesian ants of the genus *Amblyopone* (Hymenoptera: Formicidae). – Australian Journal of Zoology 26: 823-839.
- TERAYAMA, M. 1985: Description of a new species of the genus *Proceratium* ROGER from Taiwan (Hymenoptera, Formicidae). – Kontyu 53: 406-408.
- TERAYAMA, M. 1987: A new species of *Amblyopone* (Hymenoptera, Formicidae) from Japan. – Edaphologia 36: 31-33.
- TERAYAMA, M. 1989: The ant tribe Amblyoponini (Hymenoptera, Formicidae) of Taiwan, with description of a new species. – Japanese Journal of Entomology 57: 343-346.
- TERAYAMA, M. 1990: A list of Ponerinae of Taiwan (Hymenoptera: Formicidae). – Bulletin of Toho Gakuen 4: 25-49.
- WHEELER, W.M. 1928: Ants collected by Professor F. Silvestri in Japan and Korea. – Bollettino del Laboratorio di Zoologia generale e agraria del R. Istituto Superiore agrario di Portici 21: 96-125.
- WHEELER, W.M. 1930: A list of the known Chinese ants. – Peking Natural History Bulletin 5: 53-81.
- WHEELER, W.M. & CHAPMAN, J.W. 1925: The ants of the Philippine Islands. Part 1. Dorylinae and Ponerinae. – Philippine Journal of Science 28: 49-73.
- WU, J. & WANG, C. 1992: Hymenoptera: Formicidae. In: PENG, J. & LIU, Y. (Eds.): Iconography of Forest Insects in Hunan China. – Hunan Science and Technology Press, Changsha, pp. 1301-1320.
- WU, J. & WANG, C. 1995: The ants of China. – China Forestry Publishing House, Beijing, 214 pp.
- XU, Z. 2000: A systematic study of the ant genus *Proceratium* ROGER from China (Hymenoptera: Formicidae). – Acta Zootaxonomica Sinica 25: 434-437.
- XU, Z. 2001: A systematic study on the ant genus *Amblyopone* ERICHSON from China (Hymenoptera: Formicidae). – Acta Zootaxonomica Sinica 26: 551-556.
- XU, Z., ZENG, G., LIU, T., & HE, Y. 1999: A study on communities of Formicidae ants in different subtypes of vegetation in Xishuangbanna District of China. – Zoological Research 20: 118-125.
- ZHOU, S. 2001: Ants of Guangxi. – Guangxi Normal University Press, Guilin, 255 pp.