

Aenictus kodaguensis sp. nov. (Hymenoptera: Formicidae), a unique species from India

BIKASH SAHOO^{1*}, RAMAKRISHNAIAH SAHANASHREE², DHARMA RAJAN PRIYADARSANAN² AND ANIRUDDHA DATTA-ROY¹

¹School of Biological Sciences, National Institute of Science Education and Research, An OCC of Homi Bhabha National Institute, Khordha, Jatni, 752050, Odisha, India.

²Insect Biosystematics and Conservation Laboratory, Ashoka Trust for Research in Ecology and the Environment, Royal Enclave, Srirampura, Jakkur Post, Bengaluru, 560064, Karnataka, India.

*Corresponding author: bikash.sahoo@niser.ac.in

ABSTRACT. *Aenictus kodaguensis* sp. nov., a new species belonging to the *Aenictus pachycerus* species group, is described from India based on the worker caste. This species is morphologically most similar to *A. paracentatus* Jaitrong & Yamane, 2012. However, it is distinguishable by the presence of a distinct transverse carina along the lateral mesosoma and a comparatively shorter scape, among other discernible characteristics. Our study provides a detailed discussion of its morphology and characteristics that distinguish this species from its closely related species.

Keywords Western Ghats, Karnataka, *Aenictus pachycerus* species group, army ant

Zoobank <http://zoobank.org/4C0E9D1A-7A19-4362-A4DB-71B1BCE56BDE>

Citation Bikash Sahoo, Ramakrishnaiah Sahanashree, Dharma Rajan Priyadarsanan & Aniruddha Datta-Roy (2024). *Aenictus kodaguensis* sp. nov. (Hymenoptera: Formicidae), a unique species from India. *Asian Myrmecology* 17: e017003

Copyright This article is distributed under a Creative Commons Attribution License CCBY4.0

Communicating Editor Cong Liu

INTRODUCTION

Contemporarily, *Aenictus* Shuckard, 1840 is the most speciose genus of the Old World subfamily Dorylinae. Its primary distribution encompasses the Afrotropical and Southeast Asian regions, with a few species inhabiting the Australian and the southern parts of the Palearctic (Borowiec 2016). Currently, 201 valid species and 25 valid subspecies of *Aenictus* have been known worldwide (Bolton 2024). Among those, 36 species have been reported to date from India (Bharti et al. 2016; Antony & Prasad 2022; Dhadwal & Bharti 2023; Sahoo et al. 2023).

The distinguished characteristics of *Aenictus*, among other Dorylinae genera, include 8- 10 segmented antennae, an elevated propodeal

spiracle, and a binodal waist (Borowiec 2016). Phylogenetically, *Aenictus* is sister to a clade comprising *Aenictogiton* Emery, 1901 and *Dorylus* Fabricius, 1793 (Borowiec 2019). Like other army ants, *Aenictus* possesses a set of morphological, behavioral, and reproductive traits, collectively referred as the army ant syndrome. These traits, such as obligatory collective foraging, nomadism, and a specialized wingless queen, support their predatory nomadic lifestyle. Remarkably, these characteristics have remained consistent throughout their evolutionary history, a long-term evolutionary stasis (Brady 2003; Borowiec 2019). *Aenictus* species found in the eastern part of the Oriental, Indo-Australian, and Australasian regions are classified into 12 species groups (Jaitrong & Yamane 2011). In this study, we describe a new

species belonging to the *Aenictus pachycerus* species group from the Southwestern part of India. This species group is characterized by having long antenna with 10 segments, elongated scapes that reach or extend beyond the posterior margin of the head; a convex anterior clypeal margin devoid of denticles; presence of parafrontal ridge; occipital margin forming a collar; angular propodeal junction; concave declivity of propodeum, an indistinct metanotal groove; weakly developed subpetiolar process and absence of typhlata spot (Jaitrong & Yamane 2011).

MATERIALS AND METHODS

The specimens were collected during a field survey conducted at the Pushpagiri Wildlife Sanctuary and in the Honey Valley private estate in Kodagu district of Karnataka. Fieldwork was conducted during the day, between 11:00 and 16:00 hrs. Worker ants were collected from the ground using a plastic aspirator and stored in 70% ethanol at the collection site. The GPS coordinates of the collection site were recorded (Datum WGS 84). Subsequent card mounting and morphological observations were carried out at the National Institute of Science Education and Research (NISER), Odisha, using a ZEISS Stemi 508 stereo microscope equipped with an AxioCam 208 color camera. Photographic documentation was carried out using a Keyence VHX 6000 digital microscope at Ashoka Trust for Research in Ecology and the Environment (ATREE), Bengaluru. The holotype and paratypes are deposited in the ATREE Insect Museum, Bengaluru (AIMB), India.

All measurements are given in millimeters and recorded to the second decimal place. The abbreviations used for the measurements and indices follow Bharti et al. (2012).

- HL Head Length, measured in full-face view along the midline from anterior clypeal margin to occipital margin.
 HW Head Width. Maximum width of head, in full-face view.
 SL Scape Length. Length of antennal scape excluding condylar bulb and basal constriction.

- WL Weber's Length, measured from the point at which the pronotum meets the cervical shield to the posterior margin of the metapleuron in profile.
 GL Gaster Length in lateral view from the anteriormost point of the first gastral segment to the posteriormost point (excluding sting).
 PL1 Petiole Length. Maximum length of the petiole in dorsal view.
 PL2 Postpetiole Length. Maximum length of the postpetiole in dorsal view.
 TL Total Length. HL+WL+ PL1+ PL2+GL.
 CI Cephalic Index. HW/HL × 100.
 SI Scape Index. SL/HW × 100.

RESULTS

Aenictus kodaguensis sp. nov.

<http://zoobank.org/8052F8C8-E72B-4B76-B06C-5C182C2843F7>

(Figs. 1 (A-D), 2B)

Type material. Holotype worker (AIMB/Hy/ Fr 250014). India, Karnataka, Kodagu, Pushpagiri Wildlife Sanctuary, 12.662°N 75.687°E, 1476m, 26.iv.2022, aspirator, Bikash Sahoo leg., colony code KN32.

Paratypes: 101 paratype workers, same data as holotype.

Non-type material examined. 87 workers. India, Karnataka, Kodagu, Honey Valley private estate, 12.2186°N 75.6577°E, 1185m, 19.iv.2022, aspirator, Bikash Sahoo leg., colony code KN27.

Holotype and paratypes are deposited in AIMB, India.

Measurements and indices. Holotype: HL, 0.82; HW, 0.67; SL, 0.68; WL, 1.08; PL1, 0.3; PL2, 0.27; GL, 1.1; TL, 3.57; CI, 81.7; SI, 101.49.

Paratypes: HL, 0.81- 0.88; HW, 0.70- 0.76; SL, 0.76- 0.81; WL, 1.19- 1.28; PL1, 0.32- 0.37; PL2, 0.32- 0.36; GL, 1.15- 1.36; TL, 3.89- 4.21; CI, 82- 90; SI, 104-114.

Diagnosis *Aenictus kodaguensis* sp. nov. can be distinguished from other members of *A. pachycerus* species group by the combination of these characters: head rectangular, longer than broad; head, mesosoma, petiole, and postpetiole entirely microreticulate; lateral mesonotum, propodeum, and petiole with irregular rugulae; a peculiar transverse carina present across the lateral mesosoma. First gastral tergite shagreened.

Worker description

In full-face view, head rectangular, longer than broad, with lateral margins slightly convex; posterior margin straight to weakly convex; parafrontal ridge well developed, reaching almost midlength of the head (ca. 0.28mm). Antennae 10 segmented; scape long, reaching posterior margin of the head; anterior clypeal margin convex, produced in the middle and without teeth; mandible sub-triangular and thick, its masticatory margin with a large apical tooth followed by 5 denticles of similar size (Fig. 1A).

In profile, mesosoma compact; dorsal outline of promesonotum convex; metanotal groove weak; a groove separates the mesonotum from the mesopleuron; a distinct transverse carina present across the lateral mesosoma, dividing the mesopleuron from the metapleuron (Fig. 1B); propodeum lower to promesonotum; dorsal outline of propodeum weakly convex; declivity concave, encircled with a rim.

In profile, both petiole and postpetiole globular; slightly longer than broad, while in some paratypes, length and height are the same; dorsum convex, with dorsal outline elevated posteriorly. Petiole sessile; subpetiolar process present but indistinct, reduced with a straight ventral outline; petiolar spiracle, small, located anteriorly on lateral surface; post petiolar spiracle small, located near the middle on lateral surface. Gaster oval (Fig. 1D).

Head entirely microreticulate; mandibles with striation and few punctures; mesosoma, petiole, and postpetiole entirely microreticulate. Lateral mesonotum, propodeum, petiole with few distinct, irregular superficial rugae, and postpetiole with light rugae (Fig. 1A, D).

Dorsum promesonotum, propodeum, petiole, and postpetiole with light superficial rugae (Fig. 1C). Rugae absent on lateral pronotum (Fig. 1B). First gastral tergite superficially shagreened with smooth and shining interspaces; legs and antennae finely microreticulate (Fig. 1D).

Whole body with sparse, suberect hairs; longer hairs present on scape, occiput, dorsum of petiole, and postpetiole; relatively shorter hairs present on lateral sides of mesosoma, petiole, postpetiole and short decumbent hairs on gaster. Hairs relatively denser on the gaster, funiculus of antenna, tibia, and tarsus. (Fig. 1A, C, D).

Head and mandible dark reddish brown; head with a black patch on vertex; body dark reddish brown to black; gaster black with yellow apical end; legs and antennae light brown (Fig. 1A, C, D).

Etymology The species is named after its type locality, the district Kodagu in Karnataka state, where Pushpagiri Wildlife Sanctuary is situated.

Distribution India (Karnataka). Known only from the type locality and nontype locality so far.

Natural history

Pushpagiri Wildlife Sanctuary is a significant forest area in Karnataka situated within the central Western Ghats, features a distinctive landscape comprising evergreen forests and grassland shola habitat, typical of the higher elevations of the Western Ghats. Annual rainfall is 6000- 7000 mm, with an average annual temperature ranging from 10- 34°C (Mallesha 2008).

In the type locality, specimens were collected from under a large rotting log where the bivouac was present. The non-type specimens from the Honey Valley estate were collected from leaf litter. Both collections were made in April, prior to the monsoon season.

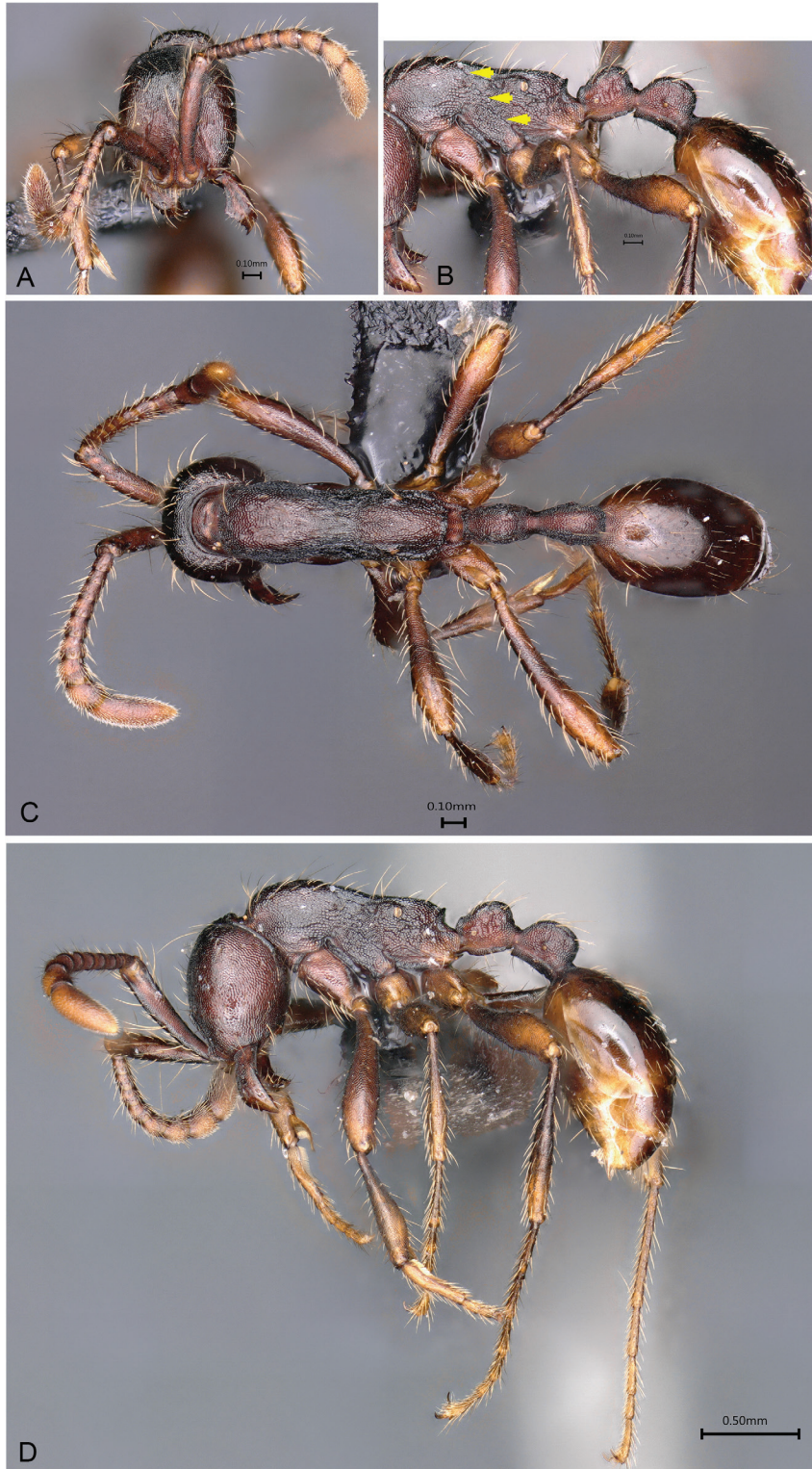


Fig. 1. *Aenictus kodaguensis* sp. nov., worker (holotype). A. Head in full-face view B. Mesosoma with lateral carinae (marked with arrows); shagreened gaster C. Body in dorsal view D. Body in profile.

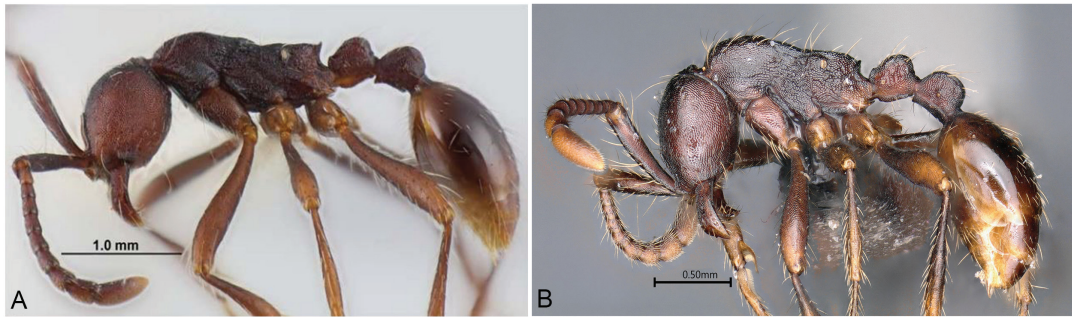


Fig. 2. A. *A. parudentatus* (image from Jaitrong & Yamane 2012), B. *A. kodaguensis* **sp.nov.**

Table 1. List of worker-based species of Oriental *A. pachycerus* species group and its distributions (type localities are marked with *).

Specific names	Distributions
<i>A. aitkenii</i> Forel, 1901	India (Karnataka*) and Sri Lanka (Shattuck 2008)
<i>A. aratus</i> Forel, 1900	Australia (Mackay*, Queensland) (Shattuck 2008)
<i>A. bobaiensis</i> Zhou & Chen, 1999	South China (Guangxi*, Hainan, and Hong Kong) and Vietnam (Jaitrong & Wiwatwitaya 2013)
<i>A. carolianus</i> Zettel & Sorger, 2010	Philippines (Cebu*) (Zettel & Sorger 2010)
<i>A. dentatus</i> Forel, 1911	Malay Peninsula (Southern part of Thailand and Malaysia*), Sumatra, Borneo (Sabah, Sarawak, Brunei, and Kalimantan), and Java (Jaitrong Wiwatwitaya 2013), India
<i>A. kutai</i> Jaitrong & Wiwatwitaya, 2013	Borneo (E. Kalimantan*) (Jaitrong & Wiwatwitaya 2013)
<i>A. levior</i> Karavaiev, 1926	Borneo (Sabah, Sarawak and Brunei), Malay Peninsula (Malaysia), and Buru Island* (Jaitrong & Wiwatwitaya 2013)
<i>A. nesiotis</i> Wheeler & Chapman, 1930	Philippines (Negros*, Luzon and Palawan), Sulawesi, and Australia (Jaitrong & Wiwatwitaya 2013)
<i>A. pachycerus</i> Smith, 1858	India (after Bingham 1903)
<i>A. parudentatus</i> Jaitrong & Yamane, 2012	Vietnam, Laos, Thailand (Chiang Mai prov*) (Jaitrong & Yamane 2012)
<i>A. philiporum</i> Wilson, 1964	Australia (Iron range*, Queensland), Papua New Guinea (Shattuck 2008)
<i>A. powersi</i> Wheeler and Chapman, 1930	Philippines (Negros*) (Jaitrong & Wiwatwitaya 2013)
<i>A. prolixus</i> Shattuck, 2008	Australia (Northern Territory*) (Shattuck 2008)
<i>A. punensis</i> Forel, 1901	India (Maharashtra*) (Forel 1901)
<i>A. reyesi</i> Chapman, 1963	Philippines (Negros*) (Jaitrong & Wiwatwitaya 2013)
<i>A. sirenicus</i> Yamane & Wang, 2015	E. Malaysia (Borneo*) (Yamane & Wang 2015)
<i>A. sulawesiensis</i> Jaitrong & Wiwatwitaya, 2013	Sulawesi* (Jaitrong & Wiwatwitaya 2013)
<i>A. kadalarensis</i> Sahoo et al., 2023	India (Kerala*) (Sahoo et al. 2023)
<i>A. kodaguensis</i> sp. nov.	India (Karnataka*)

Comparative notes

The *Aenictus pachycerus* species group comprises 18 species (Jaitrong & Yamane 2011; Jaitrong et al. 2012; Jaitrong & Wiwatwitaya 2013; Yamane & Wang 2015; Sahoo et al. 2023; Antwiki 2024), of which five species have been reported from India: *A. pachycerus* Smith, 1858; *A. aitkenii* Forel, 1901; *A. punensis* Forel, 1901; *A. dentatus* Forel, 1911; and *A. kadalarensis* Sahoo et al., 2023 (status of *A. aratus* Forel, 1900 in India is uncertain (Shattuck 2008; Bharti et al. 2016; Sahoo et al. 2023)). A table listing *A. pachycerus* group species and their distributions is provided (Table 1).

Aenictus kodaguensis **sp. nov.** is different from all other *Aenictus* species reported from India by having a shagreened gaster and a peculiar transverse ridge in lateral mesosoma. It shares a close resemblance to *A. paradentatus* Jaitrong & Yamane, 2012, by having a shagreened gaster. However, *A. kodaguensis* **sp. nov.** differs from *A. paradentatus* in having a shorter scape (measuring <0.82 mm; with SI <115) compared to *A. paradentatus*, which measures more than 0.92 mm, with SI >117. The masticatory margin of the mandible in the former bears 5 denticles, while the latter bears 11–12 denticles. Further distinctions lie in the absence of longitudinal rugae on the dorsal and lateral promesonotum of *A. kodaguensis* **sp. nov.**, in contrast to the presence of multiple distinct longitudinal rugae on the dorsal and lateral promesonotum of the latter (Fig. 2).

A. kodaguensis **sp. nov.** also exhibits similarities with *A. dentatus* Forel, 1911 and *A. bobaiensis* Zhou & Chen, 1999 by having a microreticulated head and mesosoma. However, *A. dentatus* can be differentiated by having a much longer scape (SI > 142) (Jaitrong & Wiwatwitaya 2013) and a smooth first gastral tergite (Jaitrong et al. 2012), while *A. kodaguensis* **sp. nov.** has a shagreened gaster and a shorter scape (SI < 115). Similarly, *A. bobaiensis* is a larger species (TL 4.85–5.10 mm; HW 0.90–0.98 mm) (Jaitrong & Wiwatwitaya 2013) compared to *A. kodaguensis* **sp. nov.** (TL 3.57–4.21; HW 0.67–0.76).

ACKNOWLEDGEMENTS

Bikash and Aniruddha thank the Forest Department of Karnataka (No. PCCF (WL)/E2/CR-10/2021-22 dated 09.03.2022) for granting permission and providing field support. Bikash acknowledges CSIR-UGC JRF and NISER for funding. Bikash thanks Avrajjal and Vivek for their help during fieldwork. Sahanashree and Priyadarsanan acknowledge Global Conservation, USA, for the financial assistance and the Department of Biotechnology, Government of India, for the lab infrastructure through a major research project on “Bio-resource and Sustainable livelihoods in North East India (BT/01/17/NE/TAX)”.

REFERENCES

- Antony AK and Prasad GC, 2022. Two new species of army ants of the *Aenictus ceylonicus* group (Hymenoptera: Formicidae) from Kerala, India. *Journal of Threatened Taxa* 14(3): 20780 – 20785.
- Antwiki, 2024. *Aenictus* species group. Available from <https://www.antwiki.org>. Accessed on 13th February 2024.
- Bharti H, Guénard B, Bharti M, and Economo EP, 2016. An updated checklist of the ants of India with their specific distributions in Indian states (Hymenoptera, Formicidae). *ZooKeys* 551: 1 – 83.
- Bharti H, Wachoo AA and Kumar R, 2012. Two remarkable new species of *Aenictus* (Hymenoptera: Formicidae) from India. *Journal of Asia-Pacific Entomology* 15: 291 – 294.
- Bingham CT, 1903. *The fauna of British India, including Ceylon and Burma. Hymenoptera, Vol. II. Ants and Cuckoo-wasps*. Taylor and Francis, London, 506 pp.
- Bolton B, 2024. An online catalog of the ants of the world. Available from <http://antcat.org>. Accessed on 13 Feb 2024.
- Borowiec ML, 2016. Generic revision of the ant subfamily Dorylinae (Hymenoptera, Formicidae). *ZooKeys* 608: 1 – 280.
- Borowiec ML, 2019. Convergent evolution of the army ant syndrome and congruence in big-data phylogenetics. *Systematic biology* 68(4): 642 – 656.

- Brady SG, 2003. Evolution of the army ant syndrome: the origin and long-term evolutionary stasis of a complex of behavioral and reproductive adaptations. *Proceedings of the National Academy of Sciences of the United States of America* 100: 6575 – 6579.
- Dhadwal T and Bharti H, 2023. *Aenictus dirangensis* sp. nov. (Hymenoptera: Formicidae), a new species of *A. ceylonicus* group from India. *Journal of the Entomological Research Society* 25(2): 387 – 403.
- Forel A, 1901. Les Formicides de l'Empire des Indes et de Ceylan. Part VIII. *The Journal of the Bombay Natural History Society* 13: 462 – 477.
- Jaitrong W and Wiwatwitaya D, 2013. Two new species of the *Aenictus pachycerus* species group (Hymenoptera: Formicidae: Aenictinae) from Southeast Asia. *The Raffles Bulletin of Zoology* 61: 97 – 102.
- Jaitrong W and Yamane S, 2011. Synopsis of *Aenictus* species groups and revision of the *A. currax* and *A. laeviceps* groups in the eastern Oriental, Indo-Australian, and Australasian regions (Hymenoptera: Formicidae: Aenictinae). *Zootaxa* 3128: 1 – 46.
- Jaitrong W and Yamane S, 2012. Review of the Southeast Asian species of the *Aenictus javanus* and *Aenictus philippinensis* species groups (Hymenoptera, Formicidae, Aenictinae). *ZooKeys* 193: 49 – 78.
- Jaitrong W, Yamane S and Tasen W, 2012. A sibling species of *Aenictus dentatus* Forel, 1911 (Hymenoptera: Formicidae) from continental Southeast Asia. *Myrmecological News* 16: 133 – 138.
- Mallesha BB, 2008. Management Plan For Pushpagiri Wildlife Sanctuary. Plan Period: 2008 – 09 to 2017 – 18. Downloaded from https://www.aranya.gov.in/downloads/PushpagiriWLS_MgmtPlan.pdf.
- Sahoo B, Ramakrishnaiah S, Dharma Rajan P, and Datta-Roy A, 2023. A New Species of Army Ant Genus *Aenictus* (Hymenoptera: Formicidae) from India. *Journal of the Entomological Research Society* 25(3): 615 – 622.
- Shattuck S, 2008. Review of the ant genus *Aenictus* (Hymenoptera: Formicidae) in Australia with notes on *A. ceylonicus* (Mayr). *Zootaxa* 1926: 1 – 19.
- Yamane S, and Wang W, 2015. Description of a new species of the *Aenictus pachycerus* group from Borneo. *Asian Myrmecology* 7: 53 – 56.
- Zettel H, and Sorger DM, 2010. Three new species of the army ant genus *Aenictus* Shuckard, 1840 (Hymenoptera: Formicidae: Aenictinae) from Borneo and the Philippines. *Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen* 62: 115 – 125.