Rhacophorids avail the opportunity of transitional aquatic habit during monsoon, and desiccation is a major factor for reduction of populations in tropical climate[4]. Therefore, foam nests are thought to be related to egg or tadpole protection against desiccation[1] and predators[20]. Thus, construction of foam nest in *Rhacophorus maximus* appears to have evolved mainly for protection against desiccation, predation on eggs or embryos in the aquatic media and thermal damage. A similar logic was put forward for foam nests in leptodactylids[3,20]. Further research on rhacophorids of NE India is needed so that more information about their evolution, ecology and reproductive strategies could be obtained.

1. Duellman, W. E. and Trueb, L., *Biology of Amphibians*, McGraw-Hill, New York, 1986.
2. Heyer, W. R., The adaptive ecology of the species group of the genus *Leptodactylus* (Amphibia, Leptodactylidae). *Evolution*, 1969, **23**, 421–428.
3. Downie, J. R., Functions of the foam in foam-nesting leptodactylids: the nest as a post-hatching refuge in *Physalaemus pustulosus*. *Herpetol. J*., 1993, **3**(1), 35–42.
4. Mohanty-Hejmadi, P. and Dutta, S. K., Life history of the common Indian tree frog, *Polypedates maculatus* (Gray, 1834) (Anura: Rhacophoridae). *J. Bombay Nat. Hist. Soc*., 1988, **85**(3), 512–517.
5. Kadadevaru, G. G. and Kanamadi, R. D., Courtship and nesting behavior of the Malabar gliding frog, *Rhacophorus malabaricus* (Jerdon, 1870). *Curr. Sci*., 2000, **79**(3), 377–380.
6. Dutta, S. K., Mishra, S. and Rath, S., Breeding and development of *Polypedates maculatus* (Anura: Rhacophoridae). *Pranikee – J. Zool. Soc*., 2001, spl. vol. pp. 121–134.
7. Reading, C. J., The effects of variation in climatic temperature (1980–2001) on breeding activity and tadpole stage duration in the commom toad, *Bufo bufo*. *Sci. Total Environ*., 2003, **310**(1–3), 231–236.
8. Roy, D., Choudhury, A. and Borah, B., Role of weather condition on the daily appearance and advertisement call initiation time of *Polypedates leucomystax* during the breeding season. *Zoo's Print J*., 2004, **19**(3), 1408–1410.
9. Deuti, K., Breeding ecology of Annandale's tree frog *Chirixalus simus* (Anura: Rhacophoridae) near Kolkata, West Bengal. *J. Bombay Nat. Hist. Soc*., 2001, **98**(3), 341–346.
10. Gibbs, J. P. and Breisch, A. R., Climate warming and calling phenology of frogs near Ithaca, New York, 1990–1999. *Conserv. Biol*., 2001, **15**, 1175–1178.
11. Mitchell, N. J., Nest-site selection in a terrestrially breeding frog with protracted development. *Aust. J. Zool*., 2002, **50**, 225–235.
12. Dutta, S. K. and Mohanty-Hejmadi, P., Breeding and life history of the Indian bull frog, *Rana tigerina* (Daudin). *Prakruti Utkal Univ. J. Sci*., 1976, **13**(1&2), 51–59.
13. Dutta, S. K., Jena, S. and Mohanty-Hejmadi, P., Breeding and development of *Ramanella variegata* (Anura: Microhylidae). *J. Zool. Soc. India*, 1990–91, **42–43**, 55–76.
14. Biju, S. D., A novel nesting behavior of a treefrog, *Rhacophorus lateralis* in the Western Ghats, India. *Curr. Sci*., 2009, **97**(3), 433–437.
15. Sinsch, U., Mini-review: the orientation behavior of amphibians. *Herpetol. J*., 1991, **1**, 541–544.
16. Davies, N. B. and Halliday, T. T., Competitive mate searching in male common toad, *Bufo bufo*. *Anim. Behav*., 1979, **27**, 1253–1267.
17. Giaretta, A. A. and Menin, M., Reproduction, phenology and mortality sources of a species of *Physalaemus* (Anura: Leptodactylidae). *J. Nat. Hist*., 2004, **38**, 1711–1722.
18. Eggert, C. and Guyétant, R., Reproductive behavior of spadefoot toads (*Pelobates fuscus*): daily sex ratios and males' tactics, ages, and physical condition. *Can. J. Zool*., 2003, **81**, 46–51.
19. Roy, D., Development of hearing in vertebrates with special reference to anuran acoustic communication. *J. Biosci*., 1994, **19**(5), 629–644.
20. Menin, M. and Giaretta, A. A., Predation on foam nests of leptodactyline frogs (Anura: Leptodactylidae) by larvae of *Beckeriella niger* (Diptera: Ephydridae). *J. Zool.*, 2003, **261**, 239–243.

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A new ant species of the genus *Anochetus* (Hymenoptera: Formicidae) from India with a remarkable nest entrance architecture

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A new ant species, *Anochetus daedalus*, is described based on worker caste collected from a nest in secondary tropical semi-evergreen forest from Sirsi, Karnataka, India, part of the Western Ghats biodiversity hotspot. It is very similar to *Anochetus nietneri* Roger, but is distinctly different in shape of the petiole. The species is notable for constructing elaborate nest entrance which resembles 'fort nests' constructed by some *Pheidole* spp.

Keywords: *Anochetus daedalus*, labyrinthine fortification, nest entrance, worker caste.

THE ant genus *Anochetus* Mayr (sub-family Ponerinae) has 119 extant and eight fossil species[1], predominantly distributed within the tropics and warm temperate regions[2]. So far 11 species have been reported from India[3], out of which 9 are found in the Western Ghats biodiversity hotspot. In this communication we describe *Anochetus daedalus* sp. nov. collected from the tropical evergreen forests of Sirsi, Karnataka, India in the central Western Ghats. This species is notable for conspicuous labyrinthine fortification at the nest entrance constructed using excavated mud or clay (Figure 1 *a*).

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The specimens were collected on excavation of a nest, preserved in 70% alcohol and later point-mounted. Morphological observations were done using Microtek binocular stereo-zoom microscope and measurements were recorded using calibrated ocular micrometer. Images were taken using Canon 50D camera and Canon MP-E 65 mm macro-lens with a twin flash, mounted on a rail and stacked using 'Combine ZM' software[4]. Initial identification was done using keys prepared by Brown[5]. A detailed comparison with *Anochetus nietneri* Roger was done using the original description of the species[6] and photographs of the holotype, provided by Museum fuer Naturkunde, Berlin (MNB), Germany.

The morphological terminology for measurements and indices are same as used by Bharti and Wachkoo[7] and are given below.

HL (head length): Maximum longitudinal length of the head in dorsal view, measured in a straight line from the anterior-most portion of the projecting mandible joint (the dorsal socket where the mandible turns) to the midpoint of a line across the posterior margin.

HW (head width): Maximum width of the head in dorsal view.

MdL (mandible length): Straight line length of the mandible from apex to the anterior clypeal margin, measured in dorsal view.

SL (scape length): Maximum length of the scape, excluding the basal neck and condyle.

EL (eye length): Maximum length of the eye as measured normally in oblique view of the head to show the full surface of the eye.

PnW (pronotum width): Maximum width of the pronotum in dorsal view.

MsL (mesosoma length): Maximum length of the mesosoma, measured in lateral view, diagonally from cervical shield to posterolateral propodeal edge.

PtH (petiole height): Maximum height of the petiole, measured in lateral view as a straight line from the bottom edge of the petiole, perpendicular to the petiolar apex.

PtL (petiole length): Measured in lateral view along the anterodorsal outline of the petiole from the small anteroapical tooth to the apex.

PtW (petiole width): Maximum width of the petiole in dorsal view.

TL (total length): Length of the entire ant measured in dorsal view with the head stretched out, from the anterior margin of the mandible to the apex of the gaster.

CI (cephalic index): HW/HL × 100.

SI (scape index): SL/HW × 100.

MdI (mandible index): ML/HL × 100.

Systematic account: *Anochetus daedalus* sp. nov.

Description of worker (Figure 1 *b*). Measurements (mm): HL: 1.7–1.75; HW: 1.5–1.55; EL: 0.3–0.35; MdL: 1.2–1.35; SL: 1.7–1.95; PnW: 0.75–0.9; MsL: 2.2–2.6; PtW: 0.25–0.3; PtL: 0.6–0.65; PtH: 0.5–0.6; TL: 7.7–8.35. Indices: CI: 88.75–91.1; SI: 109.67–113.33; MdI: 74.28–74.41 (n = 3).

Colour and pilosity: Mesosoma and abdomen dark red, head and mandibles paler, legs yellow, pilosity moderate, erect and denser on legs, small scattered hairs present inside the antennal grooves.

Head (Figure 1 *c*): Slightly longer than broad. Mandibles narrower near the articulation than at the apex, anterior 70% of the length broader than the rest; first and third apical teeth large; second tooth very small, appears as a small projection on inner margin of first; fourth and fifth pairs of teeth, present on the inner margin of the mandibles, gradualy declining in size. Clypeus bilobed with the lobes blunt and projecting over the mandibles at the base. Frontal lobes large, striate, appear as two near vertical ridges converging posteriorly, not covering the antennal insertions completely and projecting over the clypeus in front. Ridges of the frontal lobes continue as striae extending slightly beyond the upper margin of eyes, along with 5–6 parallel striae on the inner side. Eyes large and situated on the anterior half of the head on the dorsal surface, with the inner margin delineated by a carina. Scape extending a little beyond the top of the head and slightly curved. Occiput prominent and bluntly emarginate, posterior margin of the head bears a prominent carina.

Mesosoma (Figure 1 *b* and *d*): Pronotum broader than the rest of the mesosoma, flat above; pro-mesonotal and meso-metanotal sutures distinct; mesonotum rounded; propodeum convex above and unarmed; ventral margin of episternum as well as propodeum marked by prominent carinae.

Petiole (Figure 2 *b*): The sub-petiolar process triangular in lateral view; the node roughly triangular or conical, the

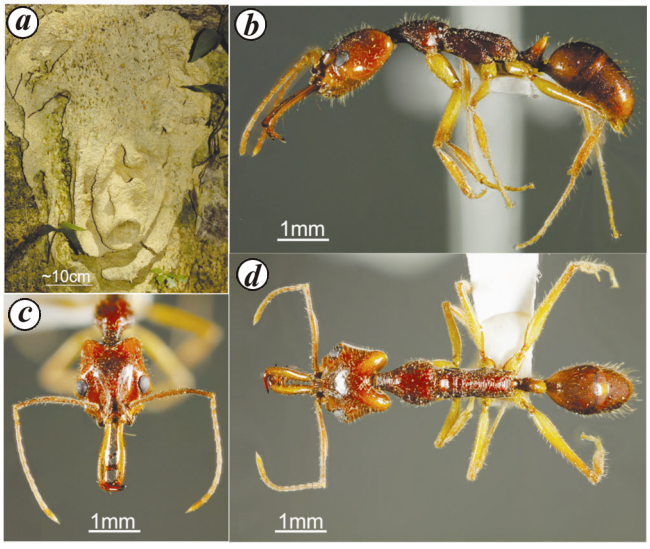

Figure 1. *Anochetus daedalus* sp. nov.: ***a***, nest entrance; ***b***, lateral view; ***c***, head in full face view; ***d***, dorsal view.

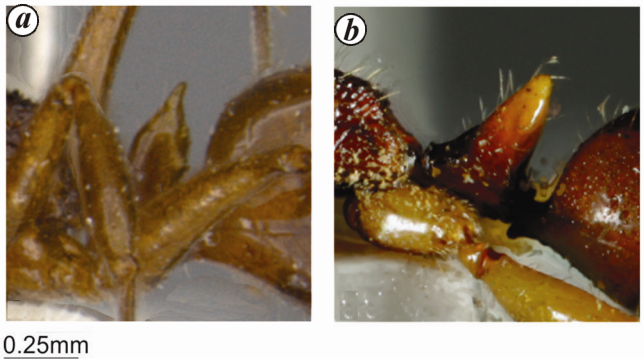

Figure 2. Petiole of (***a***) *Anochetus nietneri* Roger. and (***b***) *A. daedalus* sp. nov.

side towards the mesosoma slanting and the side facing the gaster steep.

Abdomen: Rounded on both sides, with a prominent carina at the articulation with the petiole.

Sculpture: Head in full face view mostly smooth, except for the striations between the eyes; pronotum reticulate on sides, pronotal-plate smooth and rounded, transverse striations present near articulation with head; propodeum with transverse striations on dorsal surface, changing into reticulations posteriad, striae thick and rounded, the last two striae more prominent and straight; katepisternum smooth. Petiole reticulate at base in lateral view, smooth above. Abdomen smooth and shining.

We observed a labyrinthine fortification with magnificent architecture at the entrance of the nest from where the type materials were collected (Figure 1 *a*). We also noticed five similar nests in the Myristica swamp forest nearby. The entrance was always situated on a small, near-vertical plane with a single large entrance pointing downwards. The entrance was surrounded by elaborate channels constructed from mud. Certain seed harvesting *Pheidole* spp. construct such fortifications at the nest entrances but in a horizontal plane. To our knowledge this is the only species in the subfamily known to construct such an nest entrance. There are no data available on the method of construction or possible advantages of such a construction. This fortification could be helping the ants to prevent surface water run-off from entering the nest or to prevent raids by predators.

Etymology: This species is named after the Greek mythological character Daedalus the master craftsman and architect of the 'labyrinth'.

Holotype, worker (in the Museum of the Zoological Survey of India, Western Ghats Regional Centre at Kozhikode, Kerala, No. ZSI/WGRS/IR/INV/3286) and five paratype workers (in ATREE-Insect Museum No. AIM-B/Hy/Fr23001-05), all collected from India, Karnataka, tropical evergreen forest in Sirsi (14.448°N and 74.691°E). 25. ii. 2014. Coll. DRP&AM; two workers (in ATREE-Insect Museum (AIM-B/Hy/Fr23006-7)), collected in pitfall traps, India, Karnataka, natural shade coffee plantation in Kodagu (12.47715N, 75.70937E). 20. ii. 2014. Coll. Clarisse Mancion.

A. daedalus sp. nov is the first species of the genus described from the Western Ghats after the monograph by Brown[5]. This species is very similar to *A. nietneri* Roger. *A. nietneri* was described based on a single specimen in 1891 from erstwhile Ceylon (Sri Lanka)[6]. Since then, there has been no report of this species to date, except a mention in a species list[8]. Smooth pronotal plate, bilobed clypeus, sculpture of the dorsal mesosoma and the arrangement of the denticles are similar in both species. However, *A. daedalus* is distinct from *A. nietneri* in shape of petiole, which, in lateral view, is rounded on the top in case of *A. daedalus* and is shaped like a pointed nib in case of *A. nietneri* (Figure 2 *a* and *b*). MdI of *A. nietneri* is much less (67.5 mm) than *A. daedalus* (74.28–74.41 mm). This species can be easily distinguished from all other Indian species by the presence of two pairs of denticles on the inner mandibular margin.

1. Bolton, B., *Bolton's Catalogue and Synopsis Version*, 1 July 2014; http://www.antwiki.org/wiki/New_General_Catalogue (accessed on 15 July 2014).
2. Shattuck, S. O. and Slipinska, E., Revision of the australian species of the ant genus *Anochetus* (Hymenoptera Formicidae). *Zootaxa*, 2012, **3426**, 1–28.
3. Bharti, H., List of Indian ants (Hymenoptera: Formicidae). *Halteres*, 2011, **3**, 79–87.
4. Hadley, A., Combine zp v1.0. 2008; http://hadleyweb.pwp.blueyonder.co.uk/CZM/News.htm (accessed on 13 March 2013).
5. Brown, W. L., Contributions toward a reclassification of the Formicidae. Part VI. Ponerinae, tribe Ponerini, subtribe Odontomachiti. Section b. Genus *Anochetus* and bibliography. *Stud. Entomol.*, 1978, **20**, 549–652.
6. Roger, J., Die ponera-artigen ameisen. *Berl. Entomol. Z.*, 1861, **5**, 1–54.
7. Bharti, H. and Wachkoo, A. A., Two new species of trap jaw ant *Anochetus* (Hymenoptera: Formicidae), with a key to known species from India. *J. Asia-Pac. Entomol*, 2013, **16**, 137–142.
8. Gunawardene, N. R., Majer, J. D. and Edirisinghe, J. P., Correlates of ant (Hymenoptera: Formicidae) and tree species diversity in Sri Lanka. *Myrmecol. News,* 2012, **17**, 81–90.

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