



Two new species of trap jaw ant *Anochetus* (Hymenoptera: Formicidae), with a key to known species from India

Himender Bharti*, Aijaz Ahmad Wachkoo

Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab 147002, India

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ABSTRACT

A key to the Indian species of the ponerine ant genus *Anochetus* Mayr, 1861 is presented and two new species are described: *Anochetus cryptus* sp. nov. and *Anochetus validus* sp. nov. collected from foothills of Himalaya, the Shivalik. *Anochetus cryptus* is a cryptobiotic species with minute eyes, light-pigmented integument, relatively reduced size and feeble sculpture; it most resembles *Anochetus evansi* Crawley, 1922. *Anochetus validus* is a member of the wide spread *graeffei* group, with strong sculpture and highly pigmented integument.

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Introduction

At present 94 extant and 8 fossil species are listed in the ant genus *Anochetus* from the Neotropical, Palearctic, Afrotropical, Malagasy, Oriental, Indo-Australian and Australian regions (Bolton et al., 2007; Bolton, 2012). Brown (1978) treated *Anochetus* globally. From Southeast Asia, significant contributions include Bingham (1903), Terayama (1989), Wang (1993), Zhou (2001), Terayama (2009) and Zettel (2012). In India, this genus is represented by nine species (Bharti, 2011).

Anochetus cryptus sp. nov. and *Anochetus validus* sp. nov. collected in the lower Shivalik range of Northwest Himalaya are reported here. *Anochetus cryptus* is the second member of the *evansi* group with only *Anochetus evansi*, which is endemic to Iran, known earlier. *Anochetus validus* marks the 3rd species of the *graeffei* group from India with *Anochetus graeffei* Mayr, 1870 and *Anochetus yerburyi* Forel, 1900 known earlier. In Brown's (1978) key *Anochetus validus* keys out to large *graeffei*, however, on examining specimens of the *graeffei* group species, morphological observations strongly suggest that *Anochetus validus* is a genuine species, and can be easily distinguished from the other congeners by the diagnosis presented here. *Anochetus graeffei* is one of the most common species of the genus with a wide distribution in India as well, while *Anochetus validus* is restricted to Northern India. The consistency in their altogether different morphology

is further supplemented by their distinct reproductive castes. Moreover, both species have been found to occur sympatrically in the northern region occupying different nests.

Materials and methods

The specimens were collected by soil core and hand picking methods. The morphological observation was conducted on a Nikon SMZ 1500 stereo zoom microscope. For digital images, MP evolution digital camera was used on the same microscope with Auto-Montage (Syncrosopy, Division of Synoptics, Ltd.) software. Later, images were cleaned as per requirement with Adobe Photoshop CS5. Holotype and paratypes of both species have been deposited in the Punjabi University Patiala Ant Collection (PUPAC). One paratype of both species will be deposited in the Natural History Museum, London (BMNH).

Morphological terminology for measurements (given in millimeters) and indices include:

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.

* Corresponding author. Tel.: +91 9356785454 (mobile).

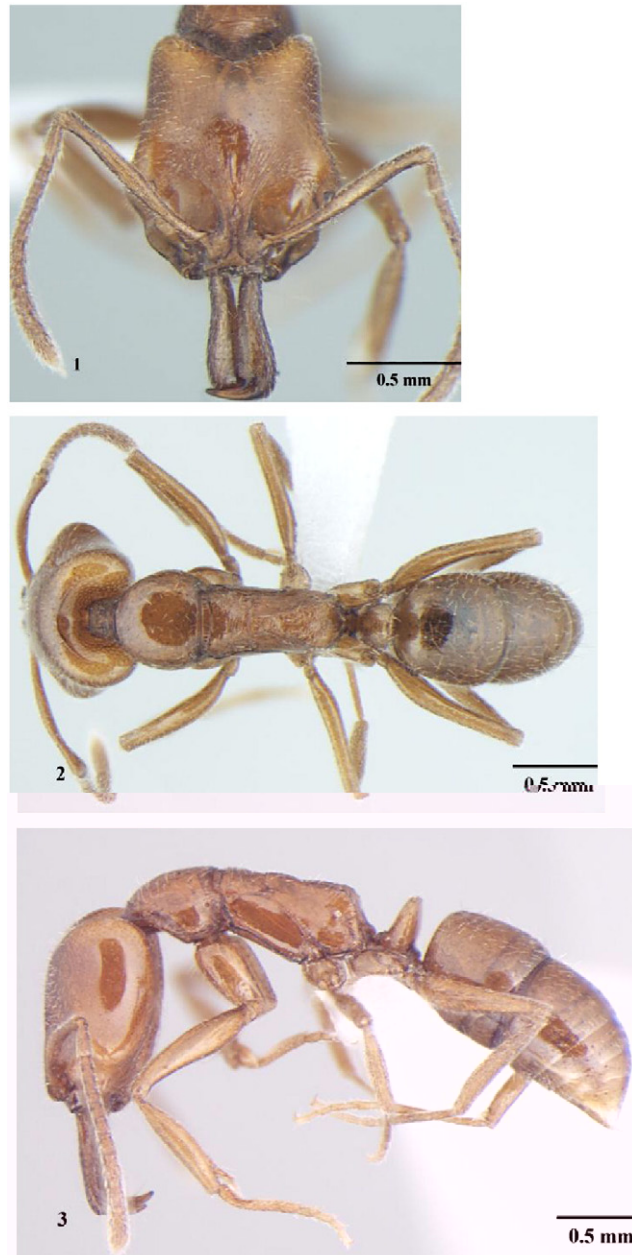
E-mail addresses: himenderbharti@gmail.com (H. Bharti), aijaz_shoorida@yahoo.co.in (A.A. Wachkoo).

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.	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.
PnW	Pronotum width. Maximum width of the pronotum in dorsal view.	CI	Cephalic index: $HW/HL \times 100$.
MsL	Mesosoma length. Maximum length of the mesosoma, measured in lateral view, diagonally from cervical shield to posterolateral propodeal edge.	SI	Scape index: $SL/HW \times 100$.
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 (see Sorger and Zettel, 2011: Fig. 2).	Mdl	Mandible index: $ML/HL \times 100$.
PtL	Petiole length. Measured in lateral view along the antero-dorsal outline of the petiole from the small antero-apical tooth to the apex (see Sorger and Zettel, 2011: Fig. 2).		
PtW	Petiole width. Maximum width of the petiole in dorsal view.		

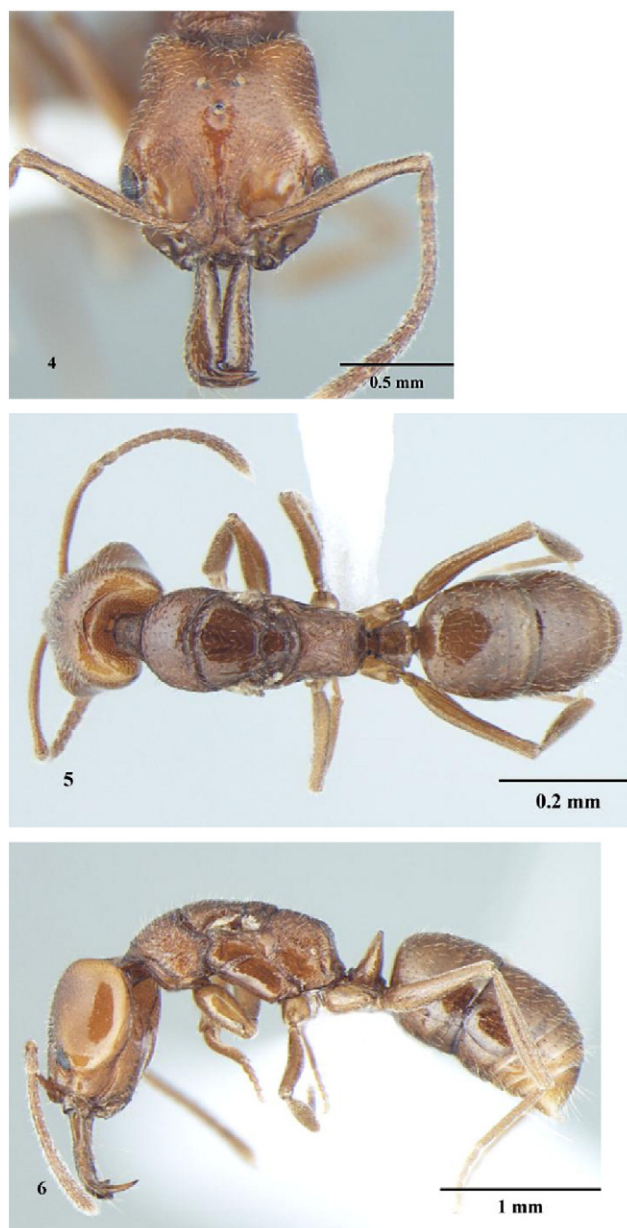
Systematic accounts

Anochetus cryptus sp. nov. (Figs. 1–6)

Type material. Holotype worker. India, Jammu and Kashmir, Manda, 32.7496°N 74.8673 °E, 500 m, 15 July, 2009, soil core. Paratypes: 3 workers and 1 gyne, with same data as holotype; 2 workers, India, Himachal Pradesh, Chanaur, 31.9067°N 76.1428°E, 600 m, 5 June,



Figs. 1–3. Worker; *Anochetus cryptus* sp. nov., 1. head in full-face view; 2. dorsal view; 3. lateral view.



Figs. 4–6. Gyne; *Anochetus cryptus* sp. nov., 4. head in full-face view; 5. dorsal view; 6. lateral view.

2009, hand picking; 1 worker, India, Jammu and Kashmir, Surinsar, 32.7009°N 75.1512°E, 700 m, 1 August, 2010, soil core; 2 workers, India, Jammu and Kashmir, Billawar, 32.6141°N 75.6054°E, 840 m, 6 August, 2010, hand picking (coll. Aijaz A. Wachkoo).

Worker measurements. HL: 0.91–1.12; HW: 0.80–0.97; EL: 0.06–0.07; MdL: 0.45–0.54; SL: 0.69–0.84; PnW: 0.42–0.51; MsL: 1.04–1.24; PtW: 0.24–0.26; PtL: 0.23–0.28; PtH: 0.30–0.34; TL: 3.70–4.65. Indices: CI: 87.91–93.27; SI: 84.68–86.60; Mdl: 48.21–51.92 (n = 12).

Head. Eyes with 3–4 ommatidia across greatest diameter, filling less than half the length of the orbital fossae. Scape slightly curved, barely reaching the posterior margin of occipital lobe. Mandible slender, broadened in distal half; medial edge with 2 nearly straight margins extending to semicircular preapical excision; ventral margin dentate; with head in “full-face” view and mandibles closed, denticles invisible dorsally; apical triad of teeth variable in shape from sharply pointed to blunt.

Mesosoma. Slender, with well-marked pro-mesonotal and effaced meso-metanotal suture; pronotum rounded above, anterior border of pronotal dorsum marginate; mesonotal disc convex, wider than

long; propodeal dorsum triangular, depressed transversely behind metanotal spiracle, anteriorly narrow; in profile sloping behind into an oblique declivity. Propodeal angles divergent and bluntly rounded.

Petiole. Petiolar node in lateral view, thin and tapered apically. In anterior view petiole with round summit; lateral margins nearly parallel and straight.

Gaster. Cylindrical; weakly constricted between first two segments; base of cinctus of second gastral tergite with cross ribs.

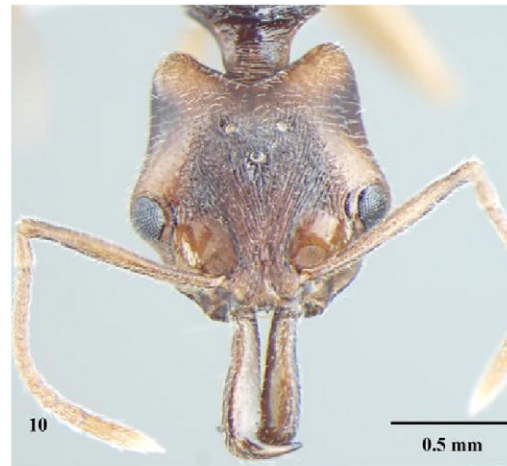
Sculpture. Head punctulate, smooth and shiny except frontal striation; striae fine but distinct, fanning out posterolaterally, barely extending to middle of head dorsum, laterally entering antennal socket but not exceeding posterior and lateral margins of head; 2–4 rugae present anteriorly in antennal sockets. Pronotum mostly smooth and shiny; cervix distinctly transversely striate with irregular ruga; anterior border of pronotal dorsum with few fine striae arched in parallel to margin; pronotum laterally smooth and shiny and patchily rugose; pro-mesonotal suture cross ribbed. Mesonotal disc shiny. Dorsum of propodeum and declivity rugo-striate and/or vermiculate. Mesopleuron and metapleuron smooth and shiny;

ventral extremity of metapleuron with few oblique rugae. Gaster smooth and shiny, sparsely punctulate. Mandibles and antennae punctulate, punctures denser on latter. Two of the specimens collected from Chanaur are comparatively smaller, less shiny and more sculptured. Mesosoma is entirely opaque and rugo-vermiculate except shiny pronotum and katepisternum.

Vestiture. Pilosity short and moderate overall, sub-decumbent on head and suberect on remainder, obsolescent on lateral mesosoma. Appendages covered by dense appressed to decumbent pubescence.

Color. Living individuals yellow with orange tint. Dry specimens brownish yellow; gaster with brownish shading; epistoma and tip of mandible brown.

Gyne measurements. HL: 1.13; HW: 1.05; EL: 0.18; MdL: 0.54; SL: 0.85; PnW: 0.68; MsL: 1.36; PtW: 0.30; PtL: 0.33; PtH: 0.42; TL: 4.86. Indices: CI: 92.92; SI: 80.95; Mdl: 47.78; (n = 1).



Figs. 10–12. Gyne; *Anochetus validus* sp. nov., 10. head in full-face view; 11. dorsal view; 12. lateral view.

As in worker, with modifications expected for this caste and the following differences: eyes with 10 ommatidia across greatest diameter; in front view dorsal margin of petiole concave. Propodeum obliquely striate; propodeal angles reduced; color darker than in corresponding workers

Distribution and habitat. This species seems to be rare in the Shivalik range of Northwest Himalaya and was collected from dry non-forested areas of the region. This is a hypogaeic species and was found mainly under large stones.

Etymology. The species epithet is Latin for cryptic, in reference to its cryptobiotic habitat.

Comparative notes. *Anochetus cryptus*, most resembles *Anochetus evansi*, but can be easily separated from it by dentate ventral margin of medial edge of mandible; strongly sculptured propodeum which in profile does not form a regular convexity with metanotum, whilst in the latter inner margin of medial edge of mandible is edentate;

Figs. 7–9. Worker; *Anochetus validus* sp. nov., 7. head in full-face view; 8. dorsal view; 9. lateral view.

sculpture is feebler; metanotum forms a regular convexity with propodeum. Morphometrically, *Anochetus evansi* is relatively larger with HL 1.16; HW 1.03; EL: 0.12; ML: 0.59; SL: 0.89 and WL: 1.45. However, *Anochetus schoedli* Zettel, 2012 also characterized by the absence of propodeal teeth or lobes and placed in the *longifossatus* group can be easily separated from *Anochetus cryptus* by striation of head extending barely past frontal carina, whereas in *Anochetus schoedli* striation reaches all the way to nuchal carina.

Anochetus validus sp. nov. (Figs. 7–12)

Type material. *Holotype worker.* India, Jammu and Kashmir, Manda, 32.7496°N 74.8673°E, 500 m, 15 July, 2009, hand picking. Paratypes: 10 workers, 4 August, 2010 and 1 gyne, with same data as of holotype; 1 worker, India, Jammu and Kashmir, Kathua, 32.3753°N 75.5184°E, 310 m, 27 July, 2010, soil core; 1 worker, India, Jammu and Kashmir, Jasrota, 32.4579°N 75.4044°E, 400 m, 28 July, 2010, soil core; 4 workers, India, Jammu and Kashmir, Billawar, 32.6141°N 75.6054°E, 840 m, 6 August, 2010, hand picking; 3 workers, India, Jammu and Kashmir, Samba, 32.5537°N 75.1317°E, 390 m, 11 July, 2009, hand picking; 1 worker, India, Jammu and Kashmir, Mansar, 32.6979°N 75.1489°E, 690 m, 13 July, 2009, soil core (coll. Aijaz A. Wachkoo).

Worker measurements. HL: 1.28–1.34; HW: 1.20–1.32; EL: 0.22–0.24; MdL: 0.70–0.72; SL: 1.04–1.06; PnW: 0.68–0.72; MsL: 1.52–1.55; PtW: 0.32–0.36; PtL: 0.33–0.36; PtH: 0.40–0.45; TL: 5.50–5.66. Indices: CI: 93.75–98.50; SI: 78.79–86.67; Mdl: 53.03–56.25 (n = 12).

Head. Eyes with 10–12 ommatidia across greatest diameter, filling more than half the length of the orbital fossae; some minute setae present on eyes. Scape slightly curved, just reaching the posterior margin of occipital lobe. Mandible slender, broadened at distal half; medial edge with 2 nearly straight margins extending to semicircular preapical excision; ventral margin dentate; with head in “full-face” view and mandibles closed, denticles invisible dorsally; apical triad of teeth variable in shape from pointed to blunt.

Mesosoma. Stout, pro-mesonotal suture well defined; meso-metanotal suture faintly marked or absent altogether; pronotum rounded above; mesonotal disc convex, wider than long; propodeal dorsum flat to slightly depressed transversely behind metanotal spiracle, widened posteriorly; declivity oblique. Propodeal angles reduced, divergent and bluntly rounded.

Petiole. Petiolar node triangular in lateral view, thin and tapered apically. In anterior view apex of summit shallowly concave to convex; lateral margins straight to convex.

Gaster. Sub-cylindrical; weakly constricted between first two segments; base of cinctus of second gastral tergite with cross ribs.

Sculpture. Head punctulate, smooth and shiny except frontal striation; striae coarse fanning out posterolaterally, extending almost to level of nuchal carina, replaced over the last 0.10 mm or so before nuchal carina by a strip of smooth, shining surface, laterally entering antennal socket but not exceeding posterior and lateral margins; 2–4 rugae present anteriorly in antennal sockets. Pronotum opaque, cervix distinctly transversely striate; anterior border of pronotal dorsum with arched rugae, pronotal disc obliquely rugo-vermiculate; laterally longitudinally rugo-vermiculate; pro-mesonotal suture cross ribbed. Mesonotal disc transversally rugose. Dorsum of propodeum rugo-reticulate; apex and declivity of propodeum transversally rugo-striate. Katepisternum and metakatepisternum smooth and shiny; propodeal sides obliquely rugose. Gaster smooth and shiny, basally punctulate. Mandibles shiny with very sparse punctures; antennae finely and densely punctulate.

Vestiture. Pilosity moderate overall; shorter and sub-decumbent on head, suberect on remainder, obsolescent on lateral face of mesosoma. Appendages covered by dense appressed to decumbent pubescence.

Color. Head, petiole and appendages red brown; mesosoma and gaster blackish brown.

Gyne measurements. HL: 1.32; HW: 1.26; EL: 0.27; MdL: 0.67; SL: 0.99; PnW: 0.83; MsL: 1.60; PtW: 0.40; PtL: 0.43; PtH: 0.54; TL: 5.72. Indices: CI: 98.32; SI: 78.57; Mdl: 53.35 (n = 1).

As in worker; with modifications expected for this caste and the following differences: eyes with 15 ommatidia across greatest diameter. Scutum obliquely rugo-vermiculate; scutellum and metanotum smooth and shiny. In front view petiole with rounded dorsal margin and feebly convex sides. Mandibles, head, petiole and appendages darker than in corresponding workers.

Distribution and habitat. This species appears to be uncommon and restricted to Jammu region of the Shivalik range in Northwest Himalaya. It was collected under small stones and by sieving moist soil. Three of the foraging workers were collected over grass during the evening time.

Etymology. The species epithet is a Latin for valid, in reference to its legitimate species status.

Comparative notes. *Anochetus validus* resembles *Anochetus graeffei* and *Anochetus yerburyi*. It can be easily distinguished from *Anochetus yerburyi* by frontal striation reaching all the way to nuchal carina or most of the way; larger size (HW: 1.20–1.32); relatively small eyes (EL: 0.22–0.24); smooth and shiny meso-metapleuron and strongly pigmented body, while in the latter the frons are smooth and shiny, the frontal striation extends only a short distance beyond the level of eyes; slender (HW: 0.95–1.15); eyes larger (EL 0.26–0.28); metapleuron sculptured and body pigmentation lighter with head, petiole and appendages honey yellow. However, it most resembles *Anochetus graeffei* but can be fairly separated from the latter by scape reaching occipital lobe; relatively very large size; deep emargination of vertex and undivided mesopleuron whereas in the latter scape fails to reach the occipital lobe; much smaller size (HW: 0.84–1.01), shallow emargination of vertex (see Zettel, 2012: Fig. 24) and mesopleuron divided into anepisternum and katepisternum. It can also be easily separated from *Anochetus ruginotus* Stitz, 1925 recently revived from synonymy (Zettel, 2012) by dense irregular vermiculate short rugae on pronotum and transverse rugae on mesonotum while in *Anochetus ruginotus* striation is distinctly longitudinal on pro-mesonotum.

Key to Indian species of *Anochetus* based on worker caste (Brown, 1978; modified)

1. Pronotal disc (at least a broad central field) and all of first gastral tergum smooth and shining when clean, with at most fine, spaced punctures.....2
Pronotal disc coarsely striate or punctate-rugulose; smooth interspaces, if any, narrow and usually coarsely punctate; first gastral tergum rugulose, striate or smooth, with or without coarse punctures6
2. Modest or small sized, lightly pigmented species with reduced eyes: maximum measurable compound eye length < 0.15 mm, their greatest diameter < maximum width of a mandible.....3
Large species with large eyes: maximum measurable eye length > 0.25 mm and > maximum width of a mandible.....5
3. Propodeal angles produced as a pair of short teeth.....4
Propodeal angles unarmed.....*A. cryptus* sp. nov.
4. Tiny species; HL + ML < 1.25 mm.....*A. pupulatus* Brown
Relatively larger species; HL + ML > 1.55 mm.....*A. myops* Emery
5. Petiolar node axially compressed above; anterior slope concave, and summit rather bluntly rounded as seen from the side, but strongly transverse as seen from above; body with very numerous short, fine, erect hairs; appressed pubescence scarcely developed on head, mesosoma, petiole and gaster; with head in full face view, antennal scapes surpass posterior borders of occipital lobes by at least an apical scape width.....*A. rufus* (Jerdon)
Petiolar node thick, erect, barrel-shaped; anterior slope convex, summit broadly rounded in both directions and only slightly

- broader than long; body with few or no erect hairs, except on apex and underside of gaster (0–9 standing hairs on mesosoma and first gastral tergum), but with abundant and conspicuous appressed pubescence; with head in full-face view, antennal scapes do not reach, or at least do not distinctly surpass, posterior borders of occipital lobes.....*A. sedilloti* Emery
6. Petiolar node in profile thin, tapered to a very narrowly rounded, or even sharp, apical scale-like part near its base not more than 0.20 mm long.....7
 Petiolar node in profile thick, with broadly rounded summit, about as thick as near base of erect part of node.....9
7. HL + ML < 1.50 mm; maximum measurable eye length < 0.15 mm*A. graeffei* Mayr
 HL + ML > 1.50 mm; maximum measurable eye length > 0.15 mm8
8. Frons smooth and shining, the frontal striations extending only a short distance beyond the level of eyes; body yellowish; EL > 0.25.....*A. yerburyi* Forel
 Frontal striation reaching all the way to nuchal carina, or most of the way; body red brown; EL < 0.25
*A. validus* sp. nov.
9. First gastral tergum densely and more or less opaquely sculptured over at least the anterior half.....10
 First gastral tergum smooth and shining, with only scattered, fine piligerous punctures.....*A. madaraszii* Mayr
10. Anterodorsal margin of petiolar node slightly produced anteriorly, overhanging the anterior slope, which tends to be concave; mesosoma red; first gastral tergum black or piceous, coarsely punctate-striate and opaque to near posterior border.....
*A. kanariensis* Forel
 Anterodorsal margin of petiolar node broadly rounded, like posterodorsal margin; anterior slope of node convex or straight

as seen from the side; mesosoma, petiole and gaster piceous or blackish, often with bluish opalescence; the first gastral tergum with punctate-rugulose sculpture diminishing to nearly smooth and shining on posterior half or third of the segment*A. obscurior* Brown

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