

Taxonomy and biology of the supposedly lestoproctid ant genus *Paedalgus* (Hym.: Formicidae)

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Abstract. The taxonomy and biology of the supposedly lestoproctid ant genus *Paedalgus* is reviewed. Ten species are recognized, from Sri Lanka and the Afrotropical region, of which six are described here as new: *distinctus*, *octatus*, *pisinnus*, *rarus*, *robertsoni* and *saritus*. The genus is defined and an identification key to species is provided. Evidence for and against a lestoproctid lifeway is discussed and what is known of the biology of the species is reviewed.

Introduction

In myrmecology the term lestoproctid indicates a relationship between a smaller and a larger eusocial species, in which the smaller (lestoproctid) species nests next to or within the walls of the nest of the larger species, and enters that nest to prey upon its inhabitants. The first species described in this genus, *Paedalgus escherichi*, was declared by Forel (1911) to be 'lestoproctid with termites'. He added that it was 'in a mound of *Termes* [now *Odontotermes*] *obscuriceps*'.

There is no direct evidence that *Paedalgus escherichi* is lestoproctid in the sense of the above definition. It may merely have been utilizing the compacted walls of the termitarium as a suitable nesting site, and not necessarily interacting with the termites at all. Nevertheless, the idea of a lestoproctid lifeway for *Paedalgus* species had been established by Forel's statement, and later discoveries tended to reinforce the idea. For instance Wheeler (1922) described *P. termitolestes* from a mound of *Acanthotermes militaris*. Its name implies a lestoproctid association although such was not actually observed or noted. In fact Wheeler (1922) remarks that 'the interesting question as to whether the minute workers of *Paedalgus* feed on the termites, on the fungus mycelium, or on both, can be answered only by future observations on artificial compound nests of the ants and their hosts'. These experiments still remain to be performed.

Since then a number of observations have tended to support the hypothesis of a lestoproctid lifeway. For instance *P. distinctus* has been found nesting adjacent to a nest of a *Nasutitermes* species in Nigeria, and *P. pisinnus* has been collected from the nest of an unidentified termite

in Kenya. Hamish Robertson (SAM) informed us that the type-series of *P. robertsoni* was collected from a colony in association with a nest of the large ponerine ant species *Plectroctena mandibularis*. Thus, as five of the nine *Paedalgus* species known from workers have at one time or another been found nesting close to the nests of larger eusocial organisms, a lestoproctid lifeway may well be present, but not restricted to termites alone.

Set against this are the collections of workers of *P. distinctus*, *octatus*, *rarus* and *saritus* recovered from leaf litter samples. The last three are only known from such samples, and this implies that the link with other eusocial taxa may not be as strong as the lestoproctid hypothesis tends to imply. Finally, and most oddly, two worker samples of *P. distinctus* have been collected in Ghana tending coccids on cocoa trees. The gathering of honeydew certainly does not sit well with an hypothesis of lestoproctid.

So what conclusions can be drawn? The answer must be: very few. Obviously, a relationship with other ground-nesting eusocial insects (termites and ants) is apparent, at least for some species some of the time. But this association may be nothing more than the fact that the walls of their nests provide exactly the right substrate for a *Paedalgus* nest to be built in. Lestoproctid may be present, but has not been observed directly in the field, nor demonstrated experimentally. Certainly some species at least forage freely in the leaf litter, but their food there remains unknown. And one species, which has been found nesting in association with termites and freely in the leaf litter, also tends arboreal coccids for their sugary secretions. Preliminary results of leaf litter sampling in eastern Ghana indicates that the two *Paedalgus* species found there, *distinctus* and *saritus*, form a minor component of the ant fauna, constituting only 0.79 of 1% of the ants retrieved from the Winkler bag samples. This may indicate that leaf litter foraging is not the main food-acquiring technique for these species. Without doubt some simple observations on

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live colonies of *Paedalgus* would quickly repay a researcher who cared to investigate the lifeway of these strange little ants.

Ten species of *Paedalgus* are known, of which one (*sudanensis*) is represented only by the queen caste. All workers are minute, pale yellow to brownish ants with very reduced eyes, only 8 or 9 antennal segments, and a steeply sloping propodeum. Nine of the species are Afrotropical and one, the type-species, has only been recorded from Sri Lanka. This disjunct distribution is somewhat disturbing, but we are sure that careful collecting in the Indian subcontinent will reveal other representatives of *Paedalgus*.

In conclusion, this paper reviews and summarizes what is known of the taxonomy and biology of *Paedalgus* species, in the hope that it will stimulate some interest in the ecology and biology of these fascinating minute ants.

Standard measurements used in the taxonomy are as defined by Bolton (1987) for the solenopsidines, and abbreviations of museums' names are also as recorded in that paper.

Paedalgus

Paedalgus Forel, 1911: 217. Type-species: *Paedalgus escherichi* Forel, 1911: 218, by monotypy.

Diagnosis of worker (Figs 1–6)

Minute monomorphic subterranean, terrestrial or sub-arboreal myrmicine ants, with the following combinations of characters.

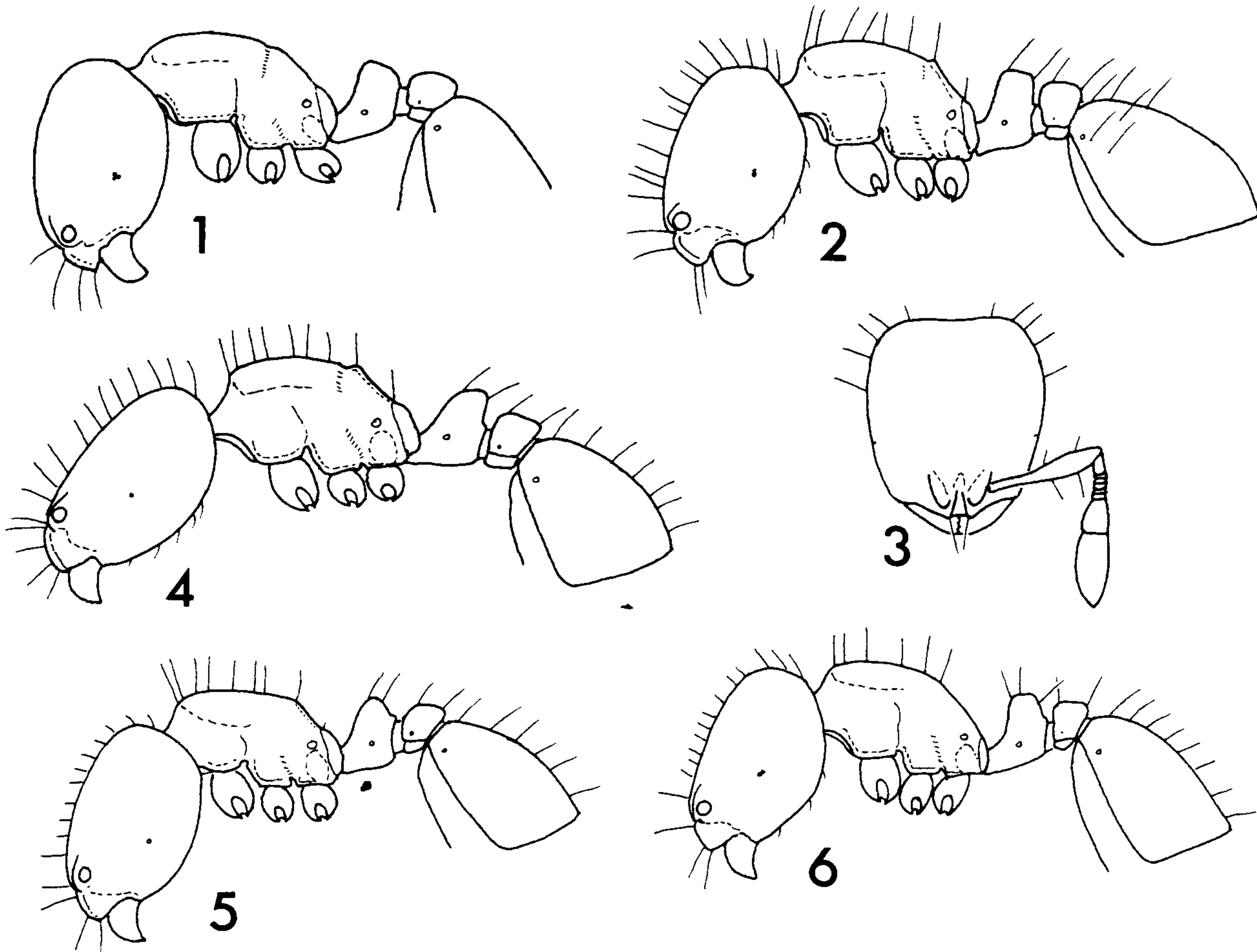
Palp formula 2.2 (*distinctus*, *saritus*, *robertsoni*).

Mandibles with 4 or 5 teeth which decrease in size from the apical: the basal tooth may be poorly defined.

Median portion of clypeus narrow posteriorly; narrowly inserted between the frontal lobes.

Median portion of clypeus sharply longitudinally bicarinate, the carinae arising close to the inner margin of each frontal lobe and running anteriorly, diverging slightly, almost or quite to the anterior clypeal margin.

Anterior clypeal margin with a pair of elongate projecting hairs straddling the midpoint of the margin.



Figs 1–6. *Paedalgus* workers. 1–2: body profiles of 1. *robertsoni*; 2. *distinctus*; 3. head of *distinctus*; 4–6: body profiles of 4. *rarus*; 5. *pisinnus*; 6. *saritus*.

Antennae 8- or 9-segmented, with a strongly differentiated club of 2 segments.
 Eyes present but small, reduced to 1–4 ommatidia.
 Frontal carinae and antennal scrobes absent.
 Alitrunk short and compact; promesonotal dorsum more or less flat, bluntly marginate laterally; metanotal groove absent to feebly present.
 Propodeum unarmed, its dorsum with a very short level anterior portion followed by a long slope down to the declivitous face proper; this section marginate on each side.
 Propodeal lobes (=metapleural lobes) present, narrow but deep, their posterior margins flattened to rounded.
 Propodeal spiracle low on side and close to posterior margin (discounting width of propodeal lobe); spiracle situated just above the bulla of the small metapleural gland, sometimes almost touching it.
 Petiole short-pedunculate, with a high narrow node in profile; petiolar spiracle at level of the node.
 Postpetiole small; smaller than the petiole in profile.
 First gastral tergite extensively overlapping the first sternite. Sting strongly developed and functional.
 Body size very small to minute: TL 1.0–1.5; scapes very short, SI 58–71.

Queen

Based on queens of *escherichi*, *robertsoni* (both worker-associated), *sudanensis* (worker unknown) and an unnamed isolated queen from Uganda (MCZ).

Much larger than worker:

	TL	HL	AL
<i>escherichi</i>			
worker	<1.4	<0.35	<0.40
queen	6.4	1.00	2.10
<i>robertsoni</i>			
worker	<1.6	<0.35	<0.45
queen	>6.9	>1.00	>2.00

Palp formula 3,2 or 2,2 (*in situ* counts).
 Mandible with 6–7 teeth.
 Median portion of clypeus raised and convex, not bicarinate, broadly inserted between the frontal lobes posteriorly.
 Midpoint of anterior clypeal margin straddled by a pair of setae, without an isolated median seta.
 Antennae 10-segmented, with a 2-, 3- or weakly 4-segmented club.
 Parapsidal grooves present.
 Pterostigma large and conspicuous.
 Vein Rs on forewing curving anteriorly apically and meeting R on the anterior wing margin; radial (=marginal) cell closed.
 Petiole pedunculate, narrowly nodiform in profile; its spiracle close to or at the level of the node.
 Postpetiole nodiform and very broadly attached to gaster.
 Pygidium large, biconvex.

Notes

Apart for the usual differences between queens and workers, and the massive size-difference exhibited, these castes in *Paedalgus* also exhibit antennal segment polymorphism; the queen apparently always has one more segment than her workers.

Little can be said regarding identification of queens as only two worker-associated species are known. Of the four queens so far recorded, the following salient features separate them.

P. escherichi: mandible with 6 teeth; antennal club conspicuously of 3 segments; posteromedian portion of clypeus sculptured; standing hairs present on scapes, tibiae and first gastral tergite.

P. robertsoni: mandible with 7 teeth; antennal club 2-segmented; posteromedian portion of clypeus smooth; standing hairs absent from scapes and tibiae, present on first gastral tergite.

P. sudanensis: mandible with 6 teeth; antennal club weakly 4-segmented; posteromedian portion of clypeus smooth; standing hairs absent from scapes, tibiae and first gastral tergite.

Uganda queen (MCZ): mandible with 7 teeth; antennal club 3-segmented; posteromedian portion of clypeus sculptured; standing hairs present on scapes, tibiae and first gastral tergite.

Male

Based on worker-associated males of *distinctus* and *pisinnus*. Much larger than worker, on a par with the queens.

Palp formula 3,2 (*distinctus*).

Mandibles with 4 teeth.

Median portion of clypeus inflated and strongly bulging (but not bicarinate) in both full-face view and profile.

Antennae 13-segmented, filiform; the scape shorter than the second funicular segment; first funicular segment shorter than the scape.

Ocelli large and located on a low median turret.

Head broader than long in full-face view; deeper than long in profile.

Mesoscutum somewhat overhanging pronotum anteriorly.

Notauli absent; parapsidal grooves present.

Venation as queen.

Petiole short-pedunculate, with a low node.

Postpetiole very broadly attached to gaster.

Cerci present.

Notes

The two males known are very similar and obviously closely related. Apart from the above features they share a

lack of standing pilosity on the first gastral tergite and a lack of long projecting hairs on the middle and hind tibiae; the latter being present in the workers of both species. The two males are separable as the scape in *pisinnus* is 0.20–0.22 mm long, whilst that of *distinctus* is shorter, SL about 0.17.

Relationships

Within the tribe Pheidologetonini, as noted in Bolton (1987), *Paedalgus* is extremely closely related to *Carebara* in all aspects of its morphology (Ettershank, 1966). Consistent characters separating the two genera are now reduced to the following:

(i) Presence of eyes and reduced propodeum in *Paedalgus* workers, as opposed to absence of eyes and propodeum in proportion to remainder of alitrunk in *Carebara*.

(ii) Presence of a distinctly differentiated antennal club in *Paedalgus* queens and its weak or non-development in *Carebara* (but note that club morphology is variable in *Paedalgus* queens).

(iii) Anterior curvature of wing vein Rs to meet R and close the radial cell in sexuals of *Paedalgus*, as opposed to the even convergence on, or slight posterior curvature of, Rs to meet R in *Carebara*.

These are extremely feeble characters on which to differentiate genera within the Myrmicinae, and despite the fact that eye loss is apomorphic in *Carebara* and propodeal reduction is apomorphic in *Paedalgus*, there are many synapomorphies uniting the two taxa. We almost took the step of synonymizing the two names, but were restrained by a wider consideration: both genera share many characters with, and are very closely related to, *Oligomyrmex*. This is a much larger genus and all its known species are sharply dimorphic in the worker, with major and minor castes. On casual observation this is the only feature by which *Oligomyrmex* can consistently be separated from the monomorphic *Carebara* and *Paedalgus*. Given the remarkable size-differences between workers and queens in these two genera, it is possible that both represent groups in which an originally-present major worker caste has dropped out, leaving only the minors. If so, the feature is apomorphic and may serve to keep *Carebara* and *Paedalgus* separate from *Oligomyrmex*, though not from each other, but the number of genera involved here must await a full study of the pheidologetonine genera, before accurate results can be obtained. We have therefore chosen to retain *Paedalgus* as a separate genus, although weak, until such a formal study can be undertaken.

Key to workers

- 1 Dorsum of head behind level of frontal lobes, entire dorsal alitrunk, and basal half of first gastral tergite, entirely lacking standing hairs (Fig. 1); appressed short pubescence may occur on any or all surfaces 2
 - Either dorsum of head behind level of frontal lobes, or dorsal alitrunk, or basal half of first gastral tergite, or two or all three of these, with conspicuous erect to suberect standing hairs which clearly project through any appressed short pubescence that may be present (Figs 2, 4–6) 3
- 2 Mandible with 4 teeth. Eyes with a single ommatidium. HW 0.28–0.29. With alitrunk in profile the propodeum continuing the line of the mesonotum, without an impression or short downward step between the dorsa of the two sclerites. (Guinea) *infirmus*
 - Mandible with 5 teeth. Eyes with 2–3 (rarely 4) ommatidia. HW 0.32–0.34. With alitrunk in profile the propodeum not continuing the line of the mesonotum, with a shallow impression or short downward step between the dorsa of the two sclerites (Fig. 1). (South Africa) *robertsoni*
- 3 Dorsal (outer) surfaces of middle and hind tibiae with short curved pubescence only; pubescence may be suberect to appressed but is always directed apically; tibiae without long straight erect projecting hairs which are directed outwards at right-angles to the tibial length 4
 - Dorsal (outer) surfaces of middle and hind tibiae with short curved decumbent to appressed pubescence which is directed apically, the tibiae also with a number of long straight erect projecting hairs that are directed outwards at right-angles to the tibial length and are usually about as long as the maximum tibial width 6
- 4 Leading edge of antennal scape with 2 long straight hairs that are directed forward and upward; these hairs freely projecting beyond any fine pubescence that may be present (as in Fig. 3). (Zaire) *termitolestes*
 - Leading edge of antennal scape with fine apically curved pubescence only; without long straight hairs that are directed forward and upward 5
- 5 Antennae with 8 segments. HW 0.25–0.26, SL 0.16 (Kenya). *octatus*
 - Antennae with 9 segments. HW 0.31–0.32, SL 0.19–0.21. (Sri Lanka) *escherichi*
- 6 Erect to suberect hairs on first gastral tergite confined to the basal half of the sclerite (Fig. 2). (Ivory Coast, Ghana, Nigeria) *distinctus*
 - Erect to suberect hairs on first gastral tergite more or less evenly distributed over the entire surface of the sclerite (Figs 4–6) 7
- 7 Head and body uniformly dark brown, the legs much lighter, pale yellow. Propodeal lobes short and narrow (Fig. 6). Sides of steeply descending face of propodeum angular but without raised marginations. Disc of promesonotum evenly finely punctulate. SI 58–60. (Ghana) *saritus*
 - Head and body uniformly yellow, the legs slightly paler yellow. Propodeal lobes long and broad (Figs 4, 5). Sides of steeply descending face of propodeum with raised marginations. Disc of promesonotum not evenly finely punctulate. SI 64–69 8
- 8 With head in profile the dorsum behind the level of the frontal lobes with short erect hairs, the longest of them shorter than the length of funicular segments 2–6 inclusive and shorter than the hairs on the alitrunk (Fig. 5). With alitrunk in profile the propodeal outline not raised into a triangular peak at the top of the declivitous slope. Pronotal humeri rounded in dorsal view. HW 0.29–0.31. (Kenya) *pisinnus*

- With head in profile the dorsum behind the level of the frontal lobes with long erect hairs, the longest of them at least equal to the length of funicular segments 2–6 inclusive; as long as the hairs on the alitrunk (Fig. 4). With alitrunk in profile the propodeal outline raised into a distinct triangular peak at the top of the declivitous slope. Pronotal humeri sharply angular in dorsal view. HW 0.33–0.34. (Kenya)..... *rarus*

The species

Paedalgus distinctus sp.n. (Figs 2, 3)

Holotype worker: TL 1.4, HL 0.40, HW 0.34, CI 85, SL 0.22, SI 65, PW 0.26, AL 0.36.

Leading edge of antennal scape with 2 long straight projecting hairs which are directed upwards and forward; these hairs about as long as the maximum scape width. Trailing edge of scape with 2 long hairs, directed almost vertically. Dorsum of head behind level of frontal lobes with numerous long straight to slightly curved hairs which are very conspicuous. With head in full-face view the sides behind the eye with 3–4 long hairs projecting laterally on each side. Promesonotal dorsum with numerous long standing hairs, the propodeal dorsum with a single pair at its highest point. Propodeal lobes dorsally each with a single long vertically directed hair. Petiole and postpetiole with standing hairs. First gastral tergite with standing hairs restricted to the basal half of the sclerite; apical half hairless. Dorsal (outer) surfaces of middle and hind tibiae with numerous hairs which project straight out, the longest of them about equal in length to the maximum tibial width. All dorsal surfaces of head and body also with very short sparse appressed pubescence. Eye with 2–3 ommatidia. Mandible with 5 teeth. Dorsum of head densely sculptured with shallow foveolate punctures whose diameters are greater than the spaces separating them. Dorsal alitrunk with crowded and somewhat irregular foveolate punctures, which are smaller than those on the head. First gastral tergite smooth and shining. Colour yellow throughout.

Paratype workers: TL 1.3–1.4, HL 0.38–0.40, HW 0.32–0.34, CI 80–87, SL 0.21–0.22, SI 62–69, PW 0.24–0.26, AL 0.34–0.36 (11 measured). As holotype.

Holotype worker. GHANA: Tafo (Cocoa Research Institute), secondary forest, leaf litter, 23.xii.1991, no. 9 (*R. Belshaw*) (BMNH).

Paratypes, 11 workers with same data as holotype (BMNH; MCZ; NMB; SAM).

Non-paratypic material, TL 1.1–1.5, HL 0.35–0.42, HW 0.29–0.35, CI 80–87, SL 0.18–0.23, SI 62–69, PW 0.22–0.28, AL 0.30–0.37 (20 measured). As holotype.

Queen: unknown.

Male: described in detail by Bolton (1969), but misidentified at that time as *termitolestes*. For notes see diagnosis of the genus, above.

P. distinctus is apparently the commonest and most widely distributed *Paedalgus* species in West Africa. It is immediately characterized by its conspicuous pilosity and is diagnosed by the presence of standing hairs on the basal half of the first gastral tergite but their absence from the apical half of that sclerite.

The species is apparently very versatile. It was found by one of us (Bolton) in association with a *Nasutitermes* nest in rotten wood at Gambari, Nigeria. The nest, which contained several workers and males, but no apparent queens, was located in three small chambers adjoining the much larger nest chamber of the termite species. It could not be ascertained if the ants preyed on or otherwise interacted with the termites, or whether they were merely utilizing the same piece of rotten wood as a nest site. W. L. Brown, recorded by Ettershank (1966: 129), found a nest in a tall red-rotten tree stump near Abidjan, Ivory Coast. This nest consisted of five or six chambers, each about 1 cm in diameter, lined with a 'grey, sheer, fungus-like substance'. Brown found no queens and did not mention termites, although Ettershank (1966) adds without evidence 'I would expect that the stump was also infested with termites'. That *distinctus* also forages in leaf litter has been discovered by Belshaw (unpublished), who found workers in litter samples at a number of localities in Ghana.

Finally, and most oddly, there are two samples from Tafo, in Ghana, which indicate that this species also forages in trees. The first, collected by Amoah (BMNH) carries the note 'associated with *Pseudococcus* [now *Planococcoides*] *njalensis* on cocoa.' The second, collected by Cambell (BMNH) states 'tending *Stictococcus* on cocoa pod stems.'

Non-paratypic material examined

IVORY COAST: Tai Forest (*J. Piart*); Tai Forest (*Mahnert & Perret*); Sassandra (*I. Löbl*); Gregbeu (*Mahnert & Perret*); Adiopodoume (*Mahnert & Perret*); Dropleu (*Mahnert & Perret*); nr Abidjan (*W. L. Brown*); Nzi Noue (*W. L. Brown*). GHANA: Tafo (*H. M. Amoah*); Tafo (*C. Campbell*); Kibi (*D. Leston*); Bunso (*D. Leston*); Mampong (*P. Room*); Mankrang (*R. Belshaw*); Asiakwa (*R. Belshaw*). NIGERIA: Gambari (*B. Bolton*); Ibadan (*B. Cruchley*).

Paedalgus escherichi Forel

Paedalgus escherichi Forel, 1911:218. Syntype workers and queen, SRI LANKA: Peradeniya, 25.ii.1910 (*Escherich*)

Worker: TL 1.26–1.32, HL 0.38–0.40, HW 0.31–0.32, CI 78–82, SL 0.19–0.21, SI 61–66, PW 0.21–0.23, AL 0.34–0.36 (7 measured).

Antennal scapes with fine dense somewhat elevated pubescence which is curved towards the scape apex; straight projecting hairs absent. Dorsum of head behind level of frontal lobes with fine dense curved elevated pubescence and numerous short straight suberect to erect hairs which are partly masked by the pubescence. With head in full-face view the sides behind the eyes with 2 pairs of long laterally projecting hairs, close to the occipital corners. Promesonotal dorsum with fine elevated curved pubescence and numerous short standing hairs. Propodeal dorsum with a single pair of erect hairs; erect hairs present on petiole, postpetiole, and entire surface of first gastral tergite. Dorsal (outer) surfaces of middle and hind tibiae with elevated curved pubescence which is directed towards the apex; without outstanding straight setae. Eyes of a single ommatidium. Mandible apparently 4-toothed. Dorsal surfaces of head and alitrunk densely sculptured with small foveolate punctures, those on the promesonotum smaller and more dense than on the cephalic dorsum. Petiole, postpetiole and gaster unsculptured. Metanotal groove not impressed. Sloping face of propodeum distinctly marginate. Colour uniform yellow.

Queen: TL 6.4, HL 1.00, HW 1.00, CI 100, SL 0.58, SI 58, AL 2.1. See diagnosis of genus for characters.

Male: unknown.

The type-series was discovered in a cavity in a nest of *Odontotermes obscuriceps*. Forel noted that they were 'leptobiotic upon termites' but, as discussed in the introduction, this has never been proved.

This is the only species of *Paedalgus* known from outside the Afrotropical region, and it remains known only from the type-series. There is little doubt that detailed collecting in the Indian subcontinent will disclose other species of this genus.

Paedalgus infimus (Santschi)

Oligomyrmex infimus Santschi, 1913: 459 (diagnosis in key). Syntype workers, GUINEA: Kindia (*Silvestri*) (BMNH; SAM; NMB) [examined].

Paedalgus infimus (Santschi); Santschi, 1914: 364, fig. 27 (description of workers).

Worker: TL 1.00–1.10, HL 0.34–0.35, HW 0.28–0.29, CI 82–83, SL 0.18–0.19, SI 64–66, PW 0.20, AL 0.29–0.30 (5 measured).

All dorsal surfaces of head and body with extremely short, fine, appressed pubescence. Standing hairs of any description are absent from the antennal scapes, dorsum of head behind level of frontal lobes, sides of head behind eyes (full-face view), dorsal alitrunk, petiole, postpetiole, first gastral tergite and dorsal (outer) surfaces of middle

and hind tibiae. Mandibles with 4 teeth. Eyes of a single small and rather pale ommatidium. Dorsum of head with shallow crowded tiny punctures, and very finely shagreenate. Promesonotal dorsum not as strongly sculptured as head; weakly shining. Propodeal dorsum finely reticulate. Metanotal groove absent. Colour uniform dull yellow.

Queen and male: unknown.

This species is known only from its type-series. The closest relative is the larger (compare measurements) *robertsoni*. The two are separable by the characters noted in the key and by the fact that, at present, *infimus* is only known from Guinea and *robertsoni* from South Africa. The two species are linked by their remarkable reduction in standing pilosity and form a small group which is rather isolated from the remainder of the genus, where pilosity ranges from moderate to abundant.

Paedalgus octatus sp.n.

Holotype worker: TL 1.00, HL 0.30, HW 0.25, CI 83, SL 0.16, SI 64, PW 0.17, AL 0.28.

Antennae with 8 segments (9 in all other known *Paedalgus* species). Antennal scapes with apically curved fine pubescence, without standing straight hairs. Dorsal surfaces of head, alitrunk, petiole, postpetiole and gaster with fine pubescence and sparse but conspicuous elongate erect to suberect standing hairs on all surfaces. The dorsal alitrunk with 6 pairs: 3 pairs on pronotum, 2 pairs on mesonotum, one pair on propodeum. Sides of head behind eyes with 1–2 pairs of hairs that project upwards and feebly outwards. Dorsal (outer) surfaces of middle and hind tibiae with fine apically curved pubescence only, without long projecting straight hairs. Eyes of a single ommatidium. Metanotal groove absent. Descending slope of propodeum above propodeal lobes marginate but without raised cuticular crests. Dorsum of head with close-packed small low foveolate punctures. Dorsal alitrunk with similar but smaller punctures. Colour light yellowish brown.

Paratype workers: TL 1.00, HL 0.30–0.32, HW 0.25–0.26, CI 81–83, SL 0.16, SI 62–64, PW 0.17–0.18, AL 0.28 (8 measured). As holotype.

Holotype worker, KENYA: Lamu, nr Witu, 26.x.1977, forest litter (*V. Mahnert & J.-L. Perret*) (MHN).

Paratypes, 8 workers with same data as holotype (MHN; BMNH; MCZ; SAM; NMB)

Queen and male. Unknown.

A very distinctive species, immediately isolated by its 8-segmented antennae, lack of projecting straight hairs on

the tibiae and antennal scapes, and presence of such hairs on the dorsal surfaces of the head and body.

All nine workers were retrieved from a single sample of Kenyan forest leaf litter; the species was not recorded as being associated with termites or other ants.

***Paedalgus pisinnus* sp.n.** (Fig. 5)

Holotype worker: TL 1.3, HL 0.36, HW 0.30, CI 83, SL 0.20, SI 67, PW 0.23, AL 0.34.

Antennal scapes with fine curved pubescence which is directed apically, the leading edge of the scape with two long straight hairs which project upwards and forwards. Dorsum of head behind level of frontal lobes with numerous short straight hairs which project through the sparse curved pubescence; the straight hairs shorter than the length of funicular segments 2–6 inclusive, and much shorter than the hairs on the dorsal alitrunk. Head behind eyes with 2 elongate hairs on each side which project upwards and slightly outwards, close to the occipital corners. Dorsal alitrunk with 8–10 pairs of erect hairs which are distinctly longer than those on the head. Similar hairs present on petiole, postpetiole, and distributed evenly over the surface of the first gastral tergite. Dorsal (outer) surfaces of middle and hind tibiae with short apically-curved pubescence and several long straight hairs which project out at right-angles. Eye very small, of a single ommatidium. Pronotal humeri rounded in dorsal view. Metanotal groove not impressed. Dorsum of propodeum rounding into the descending portion. Sculpture on head and alitrunk of small shallow crowded foveolate punctures; those on the former larger than on the latter. Colour yellow.

Paratype workers: TL 1.3–1.4, HL 0.36–0.39, HW 0.29–0.31, CI 79–83, SL 0.19–0.21, SI 64–69, PW 0.22–0.23, AL 0.34–0.36 (8 measured). As holotype.

Paratype males: TL 5.0–5.3, HL 0.66–0.68, HW 0.70–0.74, CI 106–109, SL 0.20–0.22, SI 24–27, PW 0.94–1.02, AL 1.60–1.80 (4 measured). For discussion see under diagnosis of the genus.

Holotype worker, KENYA: Ruaraka, 17.xi.1983 (*J. Darlington*) (BMNH).

Paratypes. 8 workers and 4 males, with same data as holotype (BMNH; MCZ; MHN; SAM).

Queen: unknown.

P. pisinnus is related to *distinctus*, *rarus* and *saritus*. All share the same basic pilosity, with projecting hairs conspicuous on dorsal surfaces of the head and body, and on the scapes and tibiae. *P. distinctus* is immediately identified by its lack of hairs on the apical half of the first gastral tergite, and *saritus* is isolated by its dark colour and

shorter antennal scapes. *P. rarus*, also from Kenya, emerges as the closest relative of *pisinnus*, but the characters noted in the final key couplet quickly separate the species.

The type-series was collected from a termite nest, though the relationship of the ants to the termites is not known.

***Paedalgus rarus* sp.n.** (Fig. 4)

Holotype worker: TL 1.4, HL 0.40, HW 0.34, CI 85, SL 0.22, SI 65, PW 0.25, AL 0.34.

Scapes with fine short pubescence which is directed apically, and the leading edge with two long straight hairs that are directed upwards and forwards. Dorsum of head with sparse pubescence and with numerous straight standing hairs which are about as long as those on the alitrunk. With head in full-face view the sides behind the eyes with 3–4 pairs of projecting long hairs that are directed outwards and upwards, close to the occipital corners. Dorsal alitrunk with curved fine pubescence and with numerous pairs (8 or more) of erect straight hairs. Propodeal lobes with a pair of hairs dorsally. Petiole and postpetiole with standing hairs, and first gastral tergite with such hairs more or less evenly distributed over its entire surface. Dorsal (outer) surfaces of middle and hind tibiae with short apically-curved pubescence and with a number of straight hairs which project at right-angles to the tibial shaft. Eyes very small, of a single ommatidium. Pronotal humeri angulate in dorsal view. Site of metanotal groove feebly marked and the propodeal dorsum distinctly peaked and angular before the steeply descending portion. Head and alitrunk sculptured with small crowded foveolate punctures, those on the former larger than on the latter. Colour yellow.

Paratype workers: TL 1.4, HL 0.40–0.41, HW 0.33–0.34, CI 83–85, SL 0.22, SI 65–67, PW 0.25–0.26, AL 0.34–0.36 (2 measured). As holotype.

Holotype worker, KENYA: Embu, Kimeri Forest, W. of Runyenje, 1500 m 3.x.1977 (*V. Mahnert & J.-L. Perret*) (MHN).

Paratypes, 2 workers with same data as holotype (BMNH).

Queen and male: unknown.

P. rarus forms a close species-pair with *P. pisinnus*, also from Kenya. The two are separated by the characters given in the final couplet of the key. Apart from this *rarus* has a stout hair dorsally on each propodeal lobe, where there is only a minute pubescent hair in *pisinnus*. These two species together share the basic pilosity pattern and colour of *distinctus*, but in the last the apical half of the first gastral tergite lacks standing hairs.

The type-series was retrieved from a sample of leaf litter.

***Paedalgus robertsoni* sp.n.** (Fig. 1)

Holotype worker: TL 1.5, HL 0.40, HW 0.33, CI 83, SL 0.23, SI 70, PW 0.23, AL 0.38.

All dorsal surfaces of head and body with extremely short, fine, decumbent to appressed pubescence. Standing hairs of any description are absent from the antennal scapes, dorsum of head behind the level of the frontal lobes, sides of head behind eyes, dorsa of alitrunk, petiole, postpetiole, first gastral tergite, and dorsal (outer) surfaces of middle and hind tibiae. Mandible with 5 teeth. Eyes of 2–3 (rarely 4) ommatidia. Dorsum of head finely shagreenate to striolate between shallow small punctures. Disc of pronotum smooth except for scattered small pits; mesonotum more densely and finely punctulate. Propodeal dorsum superficially reticulate. Promesonotal dorsum in profile separated from the propodeum by a shallow metanotal impression or short step between the two surfaces.

Paratype workers: TL 1.4–1.5, HL 0.38–0.41, HW 0.32–0.34, CI 83–85, SL 0.22–0.24, SI 65–71, PW 0.22–0.24, AL 0.38–0.40 (15 measured). As holotype.

Paratype queens: TL 7.0–7.2, HL 1.10–1.14, HW 1.14, CI 96–100, SL 0.68–0.70, SI 60–61, PW 1.20, AL 2.10–2.30 (2 measured). For discussion of queens see under the diagnosis of the genus.

Holotype worker, SOUTH AFRICA: Transvaal. Weltevreden Farm (=Pullen's Farm), 25°34'S, 31°11'E, 22.vii.1987, SAM-HYM.COOO412 (*H. G. Robertson*) (SAM).

Paratypes, 27 workers and 2 queens (dealate), with same data as holotype (SAM; BMNH; MCZ; MHN; NMB).

Male: unknown.

The type-series was found by Hamish Robertson (South African Museum) who informs us that the nest of *robertsoni* was in association with a nest of the large ponerine ant species *Plectroctena mandibularis*. *P. robertsoni*, the only known South African species of this genus, forms a close species-pair with the Guinean *P. infimus*, characterized by their remarkable reduction in pilosity. It seems reasonable to infer that other species of this group remain undiscovered in the vast area between these states. The two species are quickly separated by the characters given in the key.

***Paedalgus saritus* sp.n.** (Fig. 6)

Holotype worker: TL 1.2, HL 0.36, HW 0.30, CI 83, SL 0.18, SI 60, PW 0.14, AL 0.22.

Antennal scape with short apically directed pubescence, the leading edge also with two long straight hairs which are

directed upward and forward. Trailing edge of scape also with two vertically-directed straight hairs. Dorsum of head with curved fine pubescence and with numerous straight standing hairs. With the head in full-face view the sides behind the eyes with 2–3 hairs which project outwards and upwards, close to the occipital corners. Dorsal surfaces of promesonotum, propodeum, petiole, postpetiole and gaster all with conspicuous, relatively long straight erect to suberect hairs; those on the first gastral tergite evenly distributed all over the sclerite. Propodeal lobes short and narrow without a single long vertically-directed straight hair. Dorsal (outer) surfaces of middle and hind tibiae with short apically curved pubescence, and with a number of long straight hairs that project out at right-angles to the tibial length. Eye with two ommatidia. Metanotal groove absent. Strongly sloping area of propodeum marginate laterally but without raised cuticular flanges. Dorsum of head with small crowded foveolate punctures. Dorsal alitrunk finely punctulate everywhere. Colour brown to dark brown, the legs much lighter.

Paratype workers: TL 1.2–1.4, HL 0.35–0.38, HW 0.30–0.32, CI 82–86, SL 0.18–0.19, SI 58–60, PW 0.14–0.15, AL 0.22–0.23 (10 measured). As holotype but eye with one or two ommatidia.

Holotype worker, GHANA: Nkawanda, nr Nkawkaw, leaf litter, secondary forest, 12.xii.1991, sample 9 (*R. Belshaw*) (BMNH).

Paratypes, 5 workers with same data as holotype; 1 worker with same data but sample 4; 3 workers with same data but sample 3; 1 worker GHANA: Atewa Forest Reserve, leaf litter, primary forest, 24.iii.1992, sample 9 (*R. Belshaw*) (BMNH; MCZ; MHN; NMB; SAM).

Queen and male: unknown.

This distinctive darkly coloured species is related by its distribution of pilosity to *distinctus*, *rarus* and *pisinnus*. All these species, however, are yellow and have better developed propodeal lobes which are both longer and broader than in *saritus*, and have a tendency to develop a hair dorsally where the lobe meets the propodeal declivity (compare Figs 2, 4, 5, 6).

The specimens which constitute the type-series were all taken from leaf litter samples in Ghanaian forests by Winkler bag technique; this species has not been found in association with any other eusocial species.

***Paedalgus sudanensis* Weber**

Paedalgus sudanensis Weber, 1943: 365, pl. 15, figs 12, 15. Holotype queen (alate), SUDAN: east base of Imatong Mts, 22.vii.1939, no. 1293 (*N. A. Weber*) (MCZ) [examined].

The holotype is the only known specimen. It does not

match any other known queens (see notes under diagnosis of queens). Its standard measurements are: TL 5.4, HL 0.86, HW 0.86, CI 100, SL 0.52, SI 60, PW 0.84, AL 1.70.

It must be born in mind that the queen-based *sudanensis* may be conspecific with one of the worker-based east African species (*octatus*, *pisinnus*, *rarus*) but this cannot be demonstrated nor disproved until queen-associated workers of all the taxa involved have been discovered.

Paedalgus termitolestes Wheeler

Paedalgus termitolestes Wheeler, W.M. 1918: 301, fig. 5. Syntype workers and larvae, ZAIRE: Malela (*Lang*) (BMNH: MCZ) [workers examined].

Paedalgus termitolestes Wheeler, W.M.; Wheeler, W.M. 1922: 177, figs 42, 43 (detailed description of workers).

Paedalgus termitolestes Wheeler, W.M.; Wheeler G.C. & Wheeler, J. 1954: 143 (redescription of larvae).

Worker: TL 1.2–1.3, HL 0.36–0.38, HW 0.29–0.32, CI 79–84, SL 0.19–0.22, SI 63–69, PW 0.22–0.23, AL 1.28–1.30 (10 measured).

Antennal scapes with fine apically curved pubescence, the leading edge of each scape also with two straight hairs which project forward and upward. Dorsum of head behind level of frontal lobes without standing hairs, with short curved pubescence only. Sides of head behind eyes with 2 straight hairs on each side in full-face view, the hairs situated close to the occipital corners and directed upwards and outwards. Dorsal alitrunk with fine curved pubescence and with 6 pairs of hairs: a row of 4 across the anterior pronotal margin, a pair on the mesonotum, and a pair on the propodeum. A short curved pubescent hair occurs dorsally on the propodeal lobes. Short standing hairs evenly distributed over the surface of the first gastral tergite. Tibiae of middle and hind legs with apically curved pubescence, but without straight hairs that project directly outward from the tibiae. Eye of 1–2 ommatidia. Metanotal groove absent. Propodeal lobes short and narrow. Dorsum of head with crowded small foveolate punctures. Colour yellow.

Queen and male: unknown.

The unique distribution of pilosity immediately separates *termitolestes* from its congeners. Its closest relative appears

to be *saritus*, but this species has prominent tibial pilosity and is much darker in colour.

Wheeler (1922: 178) records that the type and only known series of this species was collected from a mound of the termite *Acanthotermes militaris*. The relationship of the ant to the termite, if any, remains unknown.

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