

## Revision of the dolichoderine ant genus *Axinidris* (Hymenoptera: Formicidae)

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**Abstract.** The Afrotropical ant genus *Axinidris* is revised. The previously known species *A. acholli* Weber is redescribed, as are *A. tridens* (Arnold) and *A. denticulatum* (Wheeler), species newly transferred to *Axinidris*. Lectotypes are also designated for these species. Ten new species (*bidens*, *ghanensis*, *hylekoites*, *kakamegensis*, *kinoin*, *murielae*, *nigripes*, *occidentalis*, *palligastriion* and *parvus*) are described. The queen and male of the genus are described for the first time. A key for the separation of workers is presented, and the known biology and distribution are summarized.

### Introduction

The genus *Axinidris* was established by Weber (1941) for the Sudanese species *A. acholli*, and no other species have been included since. The present study expands *Axinidris* considerably. Thirteen species are placed in the genus, ten are newly described and two are transferred from *Engramma*. The genus is now known to be distributed throughout sub-Saharan Africa, from Liberia east to Sudan and Kenya and south to South Africa (Fig. 35). The above data indicate that *Axinidris* is a much more diverse and widespread genus than originally thought.

Four characters define *Axinidris* and allow ready separation from related dolichoderine genera. Two of the eight characters listed by Weber as defining *Axinidris*, the presence of propodeal spines and a medial propodeal carina, are unique to the genus. I have also found two characters, the placement of the propodeal spiracles and the configuration of the petiolar node, which are unique to the genus. The remaining six characters listed by Weber are actually common throughout the subfamily Dolichoderinae and are of no value in characterizing this genus.

The new understanding of the genus *Axinidris* is likely to lead to the discovery of additional species. Five of the newly described species occur in the vicinity of Tafo, Ghana, suggesting significant species diversity in local areas. Additionally, the available biological information indicates that *Axinidris* species nest and forage arboreally. Detailed collecting of arboreal ants from throughout the known range of this genus should increase the number of *Axinidris* species considerably.

### Depositories

Material for this study was borrowed from the following Museums (with abbreviations): The American Museum of Natural History, New York, U.S.A. (AMNH); The Natural History Museum, London, England, U.K. (BMNH); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A. (MCZC); South African Museum, Cape Town, S.Afr. (SAMC).

### Measurements and Definitions

Surface sculpture is variable in these ants, and the terms used follow Harris (1979). Brief definitions are given here: colliculate: continuously

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covered with low, rounded elevations; coriaceous: leather-like, with minute cracks like the human skin; imbricate: partly overlapping and appearing similar to shingles on a roof; punctate: with fine, impressed points or punctures appearing as pin-pricks; scabriculous: with fine and regular, short, wrinkles and/or projections; strigulate: with numerous short and fine raised lines.

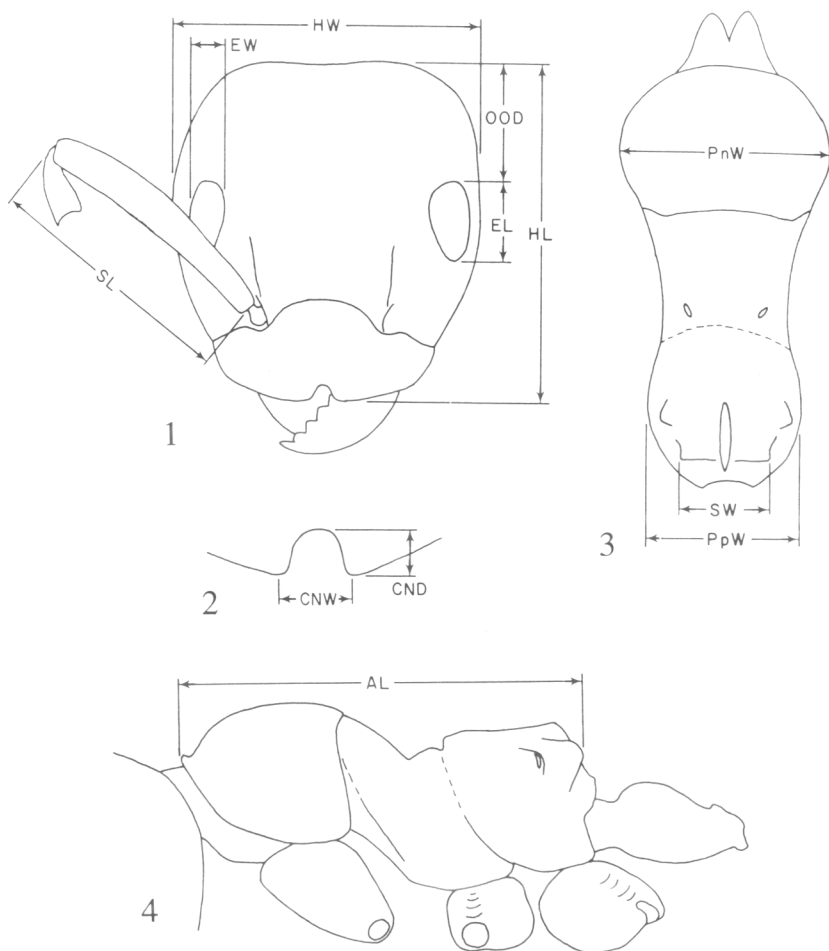
Morphological measurements were made at 50 $\times$  on a Wild stereo microscope, with a dual-axis stage micrometer wired to Autometronics

digital readouts. All measurements were recorded in thousandths of millimetres, but are expressed here to the nearest hundredth. All head measurements were taken in full-face (dorsal) view without moving the head between measurements (Fig. 1).

AL Alitrunk length measured from the anterior-most point of the pronotum to the posterior-most point of the propodeal spines (Fig. 4).

CI Cephalic index:  $HW/HL$ .

CND Clypeal notch depth measured from



**Figs 1–4.** Measurements taken during this study (*A. murielae*): 1, full face view; 2, anterior clypeal notch; 3, dorsal view of alitrunk; 4, lateral view of alitrunk.

the midpoint of a line drawn across the anterior-most projecting points of the clypeus to the posterior-most point of the concavity (Fig. 2).

Clypeal notch index: CND/CNW.

Clypeal notch width measured between the anterior-most projecting points (contact areas of a line drawn across the notch opening) of the clypeus (Fig. 2).

Maximum eye length measured in full face (dorsal) view (Fig. 1).

Maximum eye width measured in full face (dorsal) view (Fig. 1).

Maximum head length measured in full face (dorsal) view, from the anterior clypeal margin to the occipital margin (Fig. 1).

Maximum head width measured in full face (dorsal) view, excluding the eyes (Fig. 1).

Occiput-ocular distance: distance between the posterior margin of the eye and the posterior extremity of the occipital border measured in full face view (Fig. 1).

Pronotal width: maximum width of the pronotum measured in dorsal view (Fig. 3).

Propodeal width: maximum width of the propodeum measured in dorsal view (Fig. 3).

Relative eye length: EL/HW.

Scape index: SL/HW.

Maximum scape (first antennal segment) length excluding the basal radicle (Fig. 1).

Spine index: SW/PpW.

Spine width: maximum width of the propodeal spines measured distally (Fig. 3).

face (spines generally short and rounded, occasionally reduced to angles or elongate and curved dorsally); propodeal spiracle located near the dorsal surface of the propodeum, with at least the anterior border raised on a slight projection (thus directing the spiracular opening posteriorly); medial region of the propodeum (between the propodeal spines) with a longitudinal carina (occasionally the carina may be expanded into a dorsal flange, or may be absent); and the petiolar node broadly rounded dorsally and strongly inclined anteriorly.

Additional, non-diagnostic characters include the following: erect hairs are present on the clypeus, maxillary and labial palps, distal end of the scape, and venter of the coxa and petiole. The anterior clypeal border possesses several elongate, downward-directed hairs, and a distinct central notch. Erect or suberect hairs are present or absent on the dorsum of the head, thorax and gaster, and all surfaces of the antennal scapes. Subdecumbent or decumbent hairs are present on the antennal scapes and the venter of the petiole. The masticatory margin of the mandible has *c.* 6 teeth in a graded size series distally, and *c.* 3 denticles proximally. The basal margin is denticulate and the basal angle is indistinct and without a tooth. The antennae are 12 segmented. The maxillary palps are 6 segmented, and the labial palps are 4 segmented. The mid and hind tibial spurs are pectinate. The seventh abdominal (fifth gastric) tergite is more or less vertical and narrowed longitudinally. The overall body length is from *c.* 2.9 to *c.* 4.5 mm.

The queen is similar to conspecific workers, but is slightly larger, has three ocelli, and an enlarged thorax. It has dorsal propodeal spiracles, distinct propodeal spines, and a medial propodeal carina (if present in the worker). The petiolar node is as in the worker, being rounded dorsally and strongly inclined anteriorly. The pilosity is also similar to the worker. Wings are fully developed, the forewing with a closed radial cell, one cubital and one discoidal cell, and the hindwing without closed cells.

The male is known from a single individual which can not be associated with any of the described workers. It is similar to most workers of *Axinidris* in the configuration of the clypeal notch, petiole and first gastric segment, and overall habitus (general size, colour, sculpturing

## Genus *Axinidris* Weber

*Axinidris* Weber 1941: 192. Type species: *Axinidris acholli* Weber 1941: 192 (by monotypy).

Workers of *Axinidris* may be recognized among the Dolichoderinae by the following characters: propodeum armed with spines located near the dorsal margin of the declivitous

and pilosity). It may be recognized among the Dolichoderinae by the following characters: anteromedial clypeal margin with a distinct notch separated from the general outline of the margin by distinct, angular corners; mandible with about 27 teeth; first gastric segment strongly inclined anteriorly (but not concealing the petiole in dorsal view), and with a groove or indentation for the reception of the basal portion of the petiole; petiolar node strongly inclined anteriorly and with the anterior face much shorter than the posterior face; hindwing without closed cells. The propodeal spiracle is lateral, not dorsal as in the worker and queen.

**Discussion.** *Axinidris* workers can be separated from other dolichoderines by the propodeal spiracles being dorsal and at least slightly raised above the surrounding propodeum; the low, rounded petiolar node; and the presence of spines or angles on the declivitous face of the propodeum. *A. acholli*, the type species, has extremely elongate propodeal spines, but this is not typical of the genus. The majority of species have the spines in the form of rounded knobs directed posteriorly or postero-laterally. In three species, *A. bidens*, *A. parvus* and *A. tridens*, the spines are reduced to angles. All species, however, share the set of characters listed above, and are distinct from related genera.

The medial propodeal plate is unique to the genus, but does not occur in all species. *A. acholli* has an enlarged and expanded medial propodeal plate, by far the most striking in the genus. In contrast, *A. bidens* and *A. parvus* lack any development of a medial carina; the area between the propodeal spines is smooth. The majority of species have the medial plate in the form of a low carina, expanded slightly near the propodeal angle.

*Axinidris* is closely related to the genera *Engramma*, *Tapinoma* and *Technomyrmex*. All have the basal mandibular angle indistinct, the basal mandibular margin denticulate, and the petiolar node reduced. However, these genera can be distinguished as follows.

*Axinidris* has a low but distinct petiolar node, angles or spines on the declivitous face of the propodeum, dorsally placed propodeal spiracles, and a nearly vertical and longitudinally narrowed seventh abdominal (fifth gastric) tergite.

*Tapinoma*, unlike *Axinidris*, has the petiolar node absent, the propodeum smooth and with-

out spines or angles, the propodeal spiracles ventral and near the hind coxae, and the seventh abdominal tergite ventral and not reduced. Additionally, *Tapinoma* is the only dolichoderine genus with elongate scapes in the male.

*Technomyrmex* is similar to *Tapinoma*, and differs from *Axinidris* in the structure of the petiolar node and propodeum. The propodeal spiracle is either lateral (but ventral of the dorsal surface) or ventral. This genus is unique in the dorsal placement of the seventh abdominal tergite.

*Engramma* is distinct from *Axinidris* and *Tapinoma*, but its separation from *Technomyrmex* is problematical. The configuration of the petiolar node and propodeum is similar to *Tapinoma* and *Technomyrmex*. However, the clypeal notch, head shape, eye placement, propodeal spiracle placement and thoracic profile suggest a close relationship between *Engramma* and *Technomyrmex*. The species currently placed in *Engramma* are variable in palp formula and the structure of the seventh abdominal tergite, and may be morphologically divergent *Technomyrmex*. A detailed examination of African *Technomyrmex* and *Engramma* species will be needed to resolve the status of these genera.

A notched anterior clypeal margin occurs in all four of these genera. However, the configuration of the notch in *Axinidris* differs from *Engramma* and *Technomyrmex* in being narrower and with well-defined lateral corners. The *Tapinoma* species with notched clypeal margins are similar to *Axinidris*, but occur north of the Sahara and are not sympatric with *Axinidris*. Thus the configuration of the notch can be used to separate these genera if combined with distribution.

*Axinidris* is now known to occur throughout sub-Saharan Africa. Collections have been made from vegetation or trees, suggesting these ants are arboreal. The larvae and pupae are unknown, as are details of nesting habits. All BMNH material examined in this study had been placed provisionally in *Axinidris* by Barry Bolton.

### Species included in *Axinidris*

*acholli* Weber

*bidens* sp.n.

*denticulatum* (Wheeler) comb.n.



*ghanensis* sp.n.  
*hylekoites* sp.n.  
*kakamegensis* sp.n.  
*kinoin* sp.n.  
*murielae* sp.n.  
*nigripes* sp.n.  
*occidentalis* sp.n.  
*palligastriion* sp.n.  
*parvus* sp.n.  
*tridens* (Arnold) comb.n.

### Key to species of *Axinidris* based on workers

- 1 Pronotum and antennal scapes without erect or suberect hairs ..... 2
- Pronotum with erect or suberect hairs; antennal scapes with or without erect hairs ..... 5
- 2 Medial propodeal carina an axe head-shaped projection (Figs 5–7); head (excluding clypeus) with a single pair of erect hairs; lateral pronotum margined; propodeal spiracle raised anteriorly and posteriorly (Sudan) ..... *acholli*
- Medial propodeal carina carinate (Figs 8–34); head (excluding clypeus) with more than 1 pair of erect hairs; lateral pronotum rounded; propodeal spiracle raised posteriorly only ..... 3
- 3 Medial propodeal carina tooth-like dorsally (Fig. 32); propodeal spines with the outer surfaces flat, narrower than the width of the propodeum, and with the area between them flat (Fig. 33) (Malawi, South Africa) ..... *tridens*
- Medial propodeal carina rounded dorsally (Figs 17, 26); propodeal spines with the outer surfaces concave, the same width as the propodeum, and with the area between them concave (Figs 18, 27) ..... 4
- 4 Body colour black, tarsi colour yellowish red; gastric tergites without erect hairs (Kenya) ..... *kakamegensis*
- Body colour yellowish red, tarsi colour light yellow; erect hairs present on gastric tergites 3 and 4 (Liberia) ..... *occidentalis*
- 5 Head (excluding clypeus) with two pairs of erect hairs; medial propodeal carina absent (Fig. 8); propodeal spines reduced to angles (Fig. 9) ..... 6
- Head (excluding clypeus) with more than two pairs of erect hairs; medial propodeal carina present (Figs 11, 14, 20, 23, 29); propodeal spines well developed (Figs 12, 15, 21, 24, 30) ..... 7
- 6 Head, alitrunk and gaster reddish brown; lateral

areas of head finely imbricate and with widely spaced punctures (Ghana) ..... *bidens*

- Head and alitrunk reddish yellow, contrasting with darker yellowish red gaster; lateral areas of head smooth, without sculpturing (Liberia) ..... *parvus*
- 7 Erect and suberect hairs very sparse or absent from antennal scapes (occasionally with 1 or 2 present) ..... 8
- Erect or suberect hairs present on antennal scapes (always with more than 4) ..... 11
- 8 Propodeal spines projecting posteriorly and with the outer surfaces flat (Figs 13, 22) ..... 9
- Propodeal spines projecting postero-laterally and with the outer surfaces concave (Fig. 31) ..... 10
- 9 Body colour reddish brown; proximal region of tarsi similar in colour to distal tibia (Zaire) ..... *denticulatum*
- Body colour dark reddish brown to reddish black; proximal region of tarsi much lighter than the distal tibia (Nigeria) ..... *kinoin*
- 10 Propodeal spines about the same width as the propodeum (Fig. 30); tarsi reddish brown (Ghana) ..... *palligastriion*
- Propodeal spines narrower than the width of the propodeum (similar to Fig. 24); tarsi light yellow (Ghana) ..... *ghanensis*
- 11 Propodeal spines about the same width as the propodeum (similar to Fig. 30); tarsi reddish brown; erect hairs present on gastric tergites 1–4 (Ghana) ..... *nigripes*
- Propodeal spines narrower than the width of the propodeum (Figs 15, 24); tarsi light yellow; erect hairs absent from gastric tergite 1 (present on gastric tergites 2–4) ..... 12
- 12 Body colour reddish yellow; gaster yellow, similar in colour to the posterior regions of the petiole (Ghana) ..... *hylekoites*
- Body colour reddish brown; gaster reddish brown, darker in colour than the posterior regions of the petiole (Ghana, Cameroun) ..... *murielae*

### *Axinidris acholli* Weber (Figs 5–7, 35)

*Axinidris acholli* Weber 1941: 193.

*Worker measurements* (n=2). OOD 0.36–0.39, EL 0.22–0.23, HL 0.96, EW 0.11–0.12, HW 0.86–0.88, CNW 0.05–0.07,

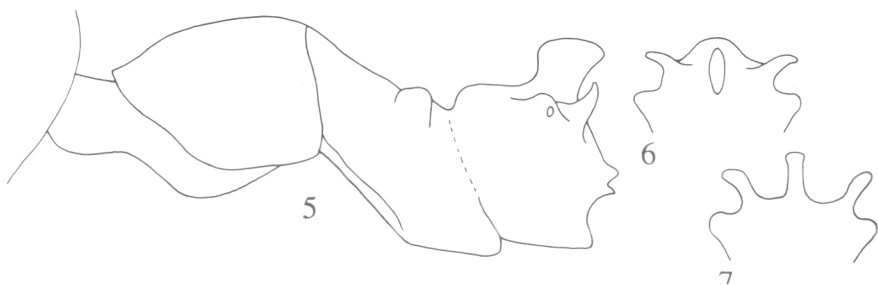
CND 0.06, SL 0.84, AL 1.16–1.19, PpW 0.36–0.38, SW 0.32–0.36, CI 0.90–0.92, CNI 0.84–1.10, REL 0.25–0.27, ScI 0.96, Spl 1.46–1.64.

*Worker diagnosis.* Posterior pronotum and mesonotum anterior of spiracles with c. 7 to c. 10 large, distinct rugae; medial propodeal carina expanded dorsally, taller than long and with the attachment narrower than the dorsal extremity.

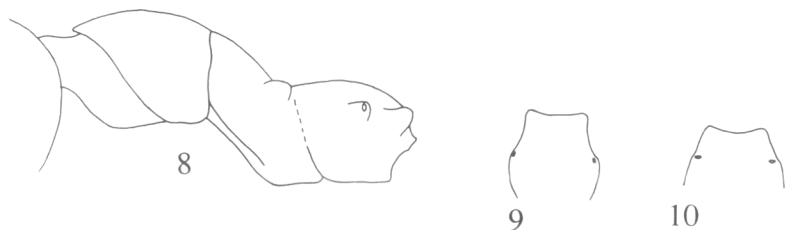
Head scabriculous with the interrugal spaces punctate, punctations stronger and scabriculations weaker laterally; the area near the mandibular insertion with a narrow area of strigulate sculpturing. Pilosity limited to one pair of short erect hairs on the frontal lobes. Erect or suberect hairs absent from the antennal scapes. The anterior regions of pronotum punctate, posterior dorsal regions and entire mesonotum smooth and with numerous longitudinal rugae; lateral edges of pronotum strongly margined. Dorsal pronotal surface lacking erect hairs. Propodeum smooth with small, widely spaced punctures. Propodeal spiracle raised

anteriorly and posteriorly above the surrounding propodeum and connected anteriorly by a ridge to the underlying propodeum. Medial propodeal carina expanded dorsally into an axe-head-like shape, with the attachment beginning just anterior of a line drawn between the spiracles and ending even with a line drawn between the propodeal spines. Propodeal spines elongate, curved postero-laterally, with the outer surfaces concave, the distal ends about the same width as the maximum propodeal width, and the area between them flat or slightly convex. Erect hairs present on gastric tergites 3 and 4. Body colour reddish brown, with the mandibles and antennae lighter, and the tarsi reddish yellow.

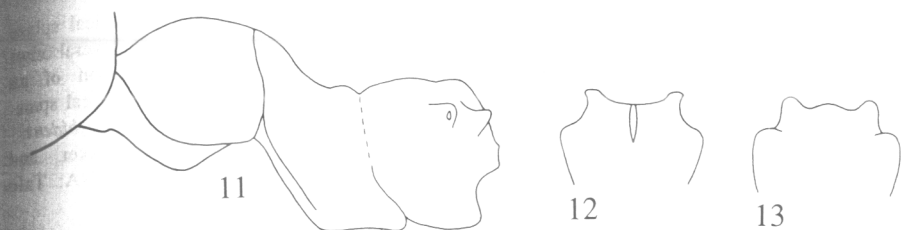
*Discussion.* *A. acholli* is recognizable by the peculiar formation of the propodeal spines and medial propodeal carina. These characters are developed to an extent not found in any of the other species. Both of the known collections were taken from vegetation above ground level (Weber, 1941).



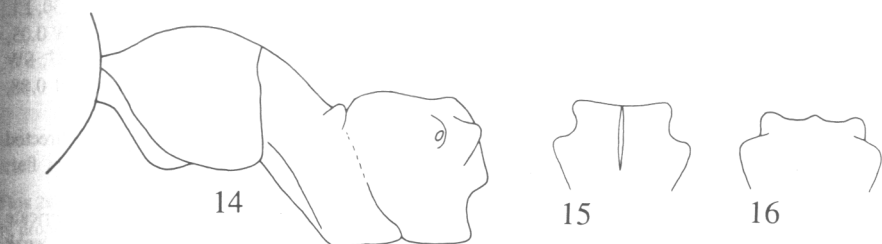
**Figs 5–7.** *A. acholli* (lectotype): 5, lateral view of alitrunk; 6, dorsal view of propodeum; 7, oblique anterior view of propodeum.



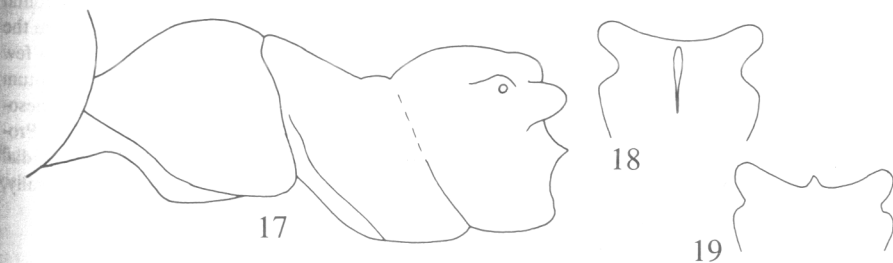
**Figs 8–10.** *A. bidens*: 8, lateral view of alitrunk; 9, dorsal view of propodeum; 10, oblique anterior view of propodeum.



**Figs 11–13.** *A. denticulatum*: 11, lateral view of alitrunk; 12, dorsal view of propodeum; 13, oblique anterior view of propodeum.



**Figs 14–16.** *A. hylekoites*: 14, lateral view of alitrunk; 15, dorsal view of propodeum; 16, oblique anterior view of propodeum.



**Figs 17–19.** *A. kakamegensis*: 17, lateral view of alitrunk; 18, dorsal view of propodeum; 19, oblique anterior view of propodeum.

**Type material.** Two worker syntypes from SUDAN: Imatong (=Matong) Mountains, 6200 and 4800 ft (N. A. Weber) (MCZC) [examined]. The specimen from 6200 ft is here designated as **LECTOTYPE**.

***Axinidris bidens* sp.n.** (Figs 8–10, 35)

**Worker measurements** ( $n=3$ ). OOD 0.22–0.25, EL 0.17–0.18, HL 0.61–0.68, EW 0.09–0.10, HW 0.53–0.58, CNW 0.06–0.07,

CND 0.04, SL 0.46–0.48, AL 0.84–0.87, PpW 0.24–0.25, SW 0.13–0.17, CI 0.86–0.90, CNI 0.61–0.67, REL 0.30–0.32, Scl 0.84–0.85, Spl 1.47–1.50.

**Worker diagnosis.** Small (HW <0.60); area between propodeal spines smooth, without a medial carina; pronotum with 2 elongate, erect hairs; each propodeal spine bearing a single distinct, erect hair; head, alitrunk and gaster reddish brown.

Head finely imbricate (including the area near the mandibular insertion), with the lateral areas nearly smooth and with widely spaced punctures; pilosity limited to one pair of erect hairs on the frontal lobes and one pair on the clypeus. Erect and suberect hairs absent from antennal scapes. Dorsum of pronotum and mesonotum, and entire propodeum, imbricate, with the lateral areas of the pronotum and mesonotum weakly imbricate. Pronotum with one pair of elongate hairs dorsally. Propodeal spiracles with the posterior surface only slightly depressed below the level of the anterior surface. Medial propodeal carina absent. Propodeal spines reduced to lateral angles partly connected by a carina, each bearing an elongate, erect setae, and with the area between them slightly concave. Erect hairs present on gastric tergites 2, 3 and 4. Body colour reddish brown, with the tibia, femur and antenna light reddish brown, the tarsi light yellow, and the mandibles yellowish red, darker basally.

**Discussion.** *A. bidens* is similar to *A. parvus* in its lack of both a medial propodeal carina and strigulate sculpturing near the mandibular insertion. It can be separated from *A. parvus* by its larger size, darker head and alitrunk colour, and stronger sculpturing on the lateral areas of the head. Additionally, *A. bidens* is similar

to *A. tridens* in having the propodeal spines reduced to angles, but differs in several other characters including the possession of an elongate erect hair on each propodeal spine. Nothing is known of the biology of *A. bidens*.

**Type material.** Holotype worker and two worker paratypes from GHANA: Tafo (*C. Campbell*) (BMNH).

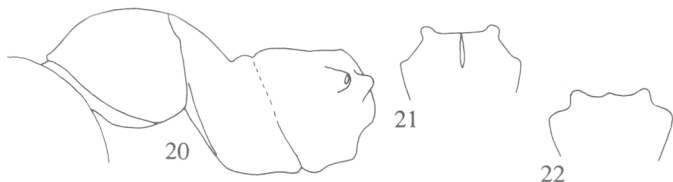
***Axinidris denticulatum* (Wheeler) comb.n.**  
(Figs 11–13, 35)

*Engramma denticulatum* Wheeler 1922: 205.

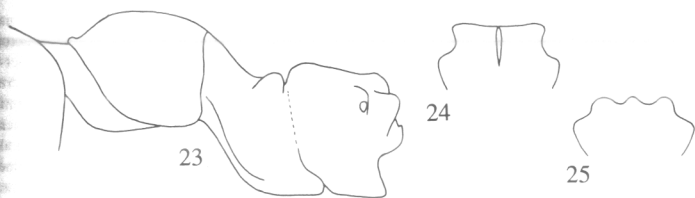
**Worker measurements** ( $n=1$ ). OOD 0.30, EL 0.19, HL 0.79, EW 0.10, HW 0.71, CNW 0.05, CND 0.08, SL 0.62, AL 0.91, PpW 0.37, SW 0.25, CI 0.90, CNI 1.53, REL 0.27, Scl 0.88, Spl 1.31.

**Worker diagnosis.** Propodeal spines directed posteriorly with the area between them flat; HW between 0.60 and 0.80; CNI >1.50.

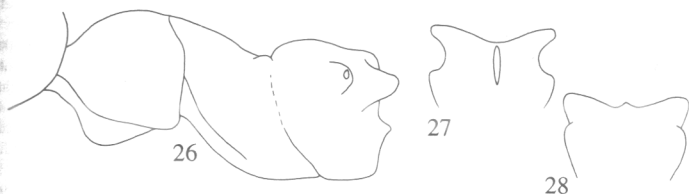
Head smooth posteriorly, weakly imbricate and superimposed with widely spaced, weak scabriculous sculpturing anteriorly; area posterior to eyes covered with large, widely spaced shallow punctures. Area near the mandibular insertion with a narrow area of strigulate sculpturing. Head with one pair of erect hairs posterior to the eyes and numerous erect hairs anterior to the posterior margin of the frontal lobes. Erect and suberect hairs absent from the antennal scapes. Pronotum smooth with a few widely-spaced erect hairs. Anterior mesonotum weakly imbricate, posterior and lateral mesonotum and entire propodeum punctate. Propodeal spiracles similar to *tridens*. Medial propodeal carina slightly expanded dorsally,



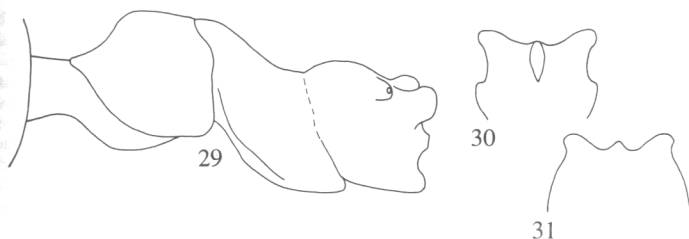
**Figs 20–22.** *A. kinoin*: 20, lateral view of alitrunk; 21, dorsal view of propodeum; 22, oblique anterior view of propodeum.



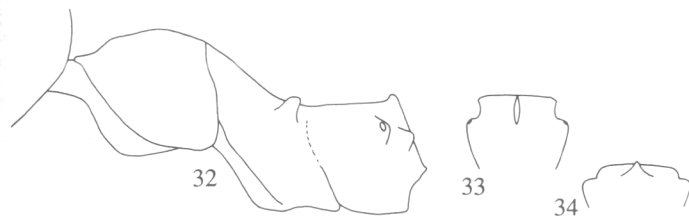
**Figs 23–25.** *A. murielae*: 23, lateral view of alitrunk; 24, dorsal view of propodeum; 25, oblique anterior view of propodeum.



**Figs 26–28.** *A. occidentalis*: 26, lateral view of alitrunk; 27, dorsal view of propodeum; 28, oblique anterior view of propodeum.



**Figs 29–31.** *A. palligastri*: 29, lateral view of alitrunk; 30, dorsal view of propodeum; 31, oblique anterior view of propodeum.



**Figs 32–34.** *A. tridens*: 32, lateral view of alitrunk; 33, dorsal view of propodeum; 34, oblique anterior view of propodeum.

located just anterior of a line drawn between the propodeal spiracles to just anterior of the petiolar insertion. Propodeal spines directed posteriorly, with the outer surfaces flat, the distal ends narrower than the width of the propodeum, and the area between them flat. Erect hairs present on gastric tergites 2, 3 and 4. Body colour reddish brown, with the mandibles and scapes slightly lighter, and the tarsi yellow.

*Discussion.* *A. denticulatum* is similar to *A. kinoin* in the pilosity of the head, pronotum and gaster, the sculpturing of the alitrunk, and the configuration of the propodeal spines and medial carina. However, *A. denticulatum* differs in having less developed scabriculous sculpturing and fewer punctures on the head, a lighter body and tarsal colour (see key couplet 8), and smaller size.

Wheeler (1922) described this species in *Engramma*, commenting on the unusual configuration of the thorax, the two denticles on the propodeum, and the sculpturing of the head and thorax. These characters are now known to occur in all species of *Axinidris*. Additionally, *A. denticulatum* possess all the characters used to diagnose the genus in this study, and therefore is transferred from *Engramma*.

*A. denticulatum* was described from two workers collected from fire wood. Two additional specimens, collected from swollen stems of *Cuviera* spp. at Masaki (between Masisi and Walikale, Zaire), were also examined by Wheeler. Only the syntype workers were found during this study.

*Type material.* Two worker syntypes from ZAIRE: between Lukolela and Basoko (*H. O. Lang*) (AMNH, MCZC) [examined]. The worker in MCZC is here designated as LECTOTYPE.

#### *Axinidris ghanensis* sp.n. (Fig. 35)

*Worker measurements* ( $n=1$ ). OOD 0.30, EL 0.21, HL 0.83, EW 0.10, HW 0.76, CNW 0.06, CND 0.09, SL 0.66, AL 0.98, PpW 0.34, SW 0.26, CI 0.91, CNI 1.44, REL 0.28, ScI 0.86, SpI 1.42.

*Worker diagnosis.* Pronotum with 2 erect hairs; erect hairs on gastric tergites limited to segment 4.

Head very finely colliculate to imbricate, superimposed with large, widely spaced punctures and very weak scabriculous sculpturing;

area near the mandibular insertion with a narrow band of strigulate sculpturing. Numerous erect hairs present from the occipital border to the anterior clypeal margin. Erect and suberect hairs absent from the antennal scapes. Entire pronotum and antero-dorsal region of mesonotum smooth to weakly coriarius; remainder of mesonotum and entire propodeum finely punctate; lateral areas of mesonotum more finely sculptured than propodeum. Pronotum with one pair of erect hairs. Propodeal spiracles as in *A. tridens*. Medial propodeal carina slightly expanded dorsally, and located posterior of a line drawn between the propodeal spiracles to just anterior of the petiolar insertion. Propodeal spines directed postero-laterally, with the outer surfaces concave, the distal ends narrower than the maximum width of the propodeum, and the area between them more or less flat. Erect hairs limited to gastric tergite 4. Body colour reddish brown with the propodeum darker, mandibles and antennae yellowish red, petiole reddish yellow anteriorly and translucent posteriorly, and tarsi yellow.

*Discussion.* *A. ghanensis* is similar to *A. murielae* in sculpturing, head pilosity, the configuration of the propodeal spines and medial carina, and body colour, but differs in lacking erect or suberect hairs on the antennal scapes and in having fewer erect hairs on the pronotum and gastric tergites. It occurs sympatrically with, and is larger than, *A. murielae* in Ghana. It is approximately the same size as *A. murielae* from Cameroun.

*Type material.* Holotype worker from GHANA: Mampong (*P. Room*) (BMNH).

#### *Axinidris hylekoites* sp.n. (Figs 14–16, 35)

*Worker measurements* ( $n=4$ ). OOD 0.25–0.27, EL 0.18–0.19, HL 0.76–0.79, EW 0.10, HW 0.69, CNW 0.05–0.07, CND 0.05–0.08, SL 0.57–0.61, AL 0.71–0.92, PpW 0.32–0.33, SW 0.23–0.26, CI 0.88–0.91, CNI 0.77–1.19, REL 0.25–0.28, ScI 0.83–0.88, SpI 1.47–1.49.

*Worker diagnosis.* Erect or suberect hairs present on the antennal scapes; body colour reddish yellow; HW between 0.60 and 0.75; CNI <1.40.

Head very finely colliculate to imbricate, superimposed with large, widely spaced punctures and weak scabriculous sculpturing; area

near the mandibular insertion with a narrow area of strigulate sculpturing. Head with numerous scattered, erect hairs on dorsal surface from the occipital border to the anterior clypeal margin. Erect or suberect hairs present on the antennal scapes. Entire pronotum and antero-dorsal region of mesonotum smooth, remainder of mesonotum moderately imbricate, and the entire propodeum finely punctate. Dorsum of the pronotum with 6–8 erect hairs. Propodeal spiracles as in *A. tridens*. Medial propodeal carina expanded dorsally, less so postero-ventrally, and beginning even with a line drawn between the propodeal spiracles and extending posteriorly to near the petiolar insertion. Propodeal spines projecting posteriorly with the outer surfaces generally flat (sometimes weakly concave), the distal ends narrower than the width of the propodeum, and the area between them more or less flat. Erect hairs present on gastric tergites 2, 3 and 4. Body colour reddish yellow with the head slightly darker; mandibles reddish brown basally, turning yellow distally; tarsi pale yellow.

**Queen measurements** ( $n=1$ ). OOD 0.29, EL 0.22, HL 0.86, EW 0.11, HW 0.74, CNW 0.07, CND 0.07, SL 0.59, AL 1.16, PpW 0.44, SW 0.33, CI 1.16, CNI 1.00, REL 0.29, ScI 0.80, Spl 1.34.

**Queen description.** Differing from the worker in its larger size, presence of ocelli, and the enlarged thorax. Other characters as in the worker. Although the single known specimen is dealate, it was apparently fully winged.

**Discussion.** *A. hylekoites* is similar to *A. murielae* in most characters, but differs in its lighter body colour (reddish yellow versus reddish brown), slightly more pronounced scabriculous sculpturing on the dorsum of the head, and the relatively wider propodeal spines (Spl >1.46 versus Spl <1.45). Of these, body colour is the most readily observable (see also key couplet 11).

This species has been collected from a nest in a rotten tree branch.

**Type material.** Holotype worker, and three worker and one queen paratype for GHANA: Tafo (B. Bolton) (BMNH).

***Axinidris kakamegensis* sp.n.** (Figs 17–19, 35)

**Worker measurements** ( $n=1$ ). OOD 0.34, EL

0.24, HL 0.96, EW 0.13, HW 0.97, CNW 0.05, CND 0.09, SL 0.69, AL 1.10, PpW 0.40, SW 0.38, CI 1.02, CNI 1.61, REL 0.24, ScI 0.71, Spl 1.46.

**Worker diagnosis.** Head very broad (HW >0.95, CI <1.00); area between propodeal spines concave; gastric dorsum without erect hairs; body colour black.

Head finely punctate and superimposed with fine strigulate sculpturing; area near the mandibular insertion with a narrow area of strigulate sculpturing. Head with a few erect hairs between the frontal lobes and on the clypeus. Erect and suberect hairs absent from antennal scapes. Pronotum weakly imbricate dorsally, nearly smooth laterally and lacking erect hairs. Mesonotum and propodeum finely and closely punctate. Propodeal spiracles similar to *tridens*. Medial propodeal carina expanded posteriorly and limited to the basal face of the propodeum. Propodeal spines projecting postero-laterally, with the outer surfaces concave, the distal ends approximately the same width as the maximum propodeal width, and the area between them concave. Erect hairs absent from gastric tergites. Body colour black; anterior and venter of head, legs and clypeus reddish black; mandibles reddish black posteriorly, yellowish red distally; tarsi dark yellowish red.

**Discussion.** This distinctive species, known from a single worker, is identifiable by its dark colour and broad head. Nothing is known of its biology.

**Type material.** Holotype worker from KENYA: Kakamega Forest (*A. E. Stubbs*) (BMNH).

***Axinidris kinoin* sp.n.** (Figs 20–22)

**Worker measurements** ( $n=2$ ). OOD 0.26–0.28, EL 0.22, HL 0.83–0.86, EW 0.12–0.13, HW 0.75–0.76, CNW 0.05–0.06, CND 0.07–0.08, SL 0.68–0.69, AL 1.01, PpW 0.37–0.38, SW 0.24–0.25, CI 0.88–0.91, CNI 1.28–1.31, REL 0.29, ScI 0.91, Spl 1.29–1.34.

**Worker diagnosis.** Antennal scapes without erect or suberect hairs; pronotum with c. 6 erect hairs; outer surface of propodeal spines flat; CNI <1.40.

Head smooth to weakly coriarius with widely spaced shallow punctures and weakly developed scabriculous sculpturing posteriorly and laterally (absent from vertex and area ventral of eye);

area near the mandibular insertion with a narrow area of strigulate sculpturing. Numerous erect hairs on the dorsal surface of the head from the occipital border to the anterior clypeal margin. Erect and suberect hairs absent from antennal scapes (occasionally 1 or 2 hairs present). Entire pronotum and antero-dorsal surface of mesonotum smooth, remaining mesonotum and entire propodeum finely punctate. Pronotum with c. 6 erect hairs. Propodeal spiracles as in *tridens*. Medial propodeal carina slightly expanded dorsally, and located posterior of a line drawn between the propodeal spiracles to just anterior of the petiolar insertion. Propodeal spines directed posteriorly with the outer surfaces flat, the distal ends narrower than the maximum width of the propodeum, and the area between them nearly flat. Erect hairs present on gastric tergites 2, 3 and 4. Body colour dark reddish brown to reddish black with the propodeum and gaster darker; petiole, antennae and mandibles yellowish red; tarsi reddish yellow.

*Discussion.* *A. kinoin* is similar to *A. denticulatum*; for similarities and differences, see discussion under *A. denticulatum*.

This species has been collected from roadside vegetation. The specific collection locality is unknown.

*Type material.* Holotype worker and one worker paratype from NIGERIA (specific locality not given, probably Gambari Experiment Station) (*B. Taylor*) (BMNH).

### *Axinidris murielae* sp.n. (Figs 23–25, 35)

*Worker measurements* ( $n=3$ ). OOD 0.24–0.31, EL 0.20–0.26, HL 0.76–0.91, EW 0.10–0.13, HW 0.66–0.81, CNW 0.05–0.08, CND 0.06–0.08, SL 0.56–0.66, AL 0.89–1.30, PpW 0.31–0.46, SW 0.22–0.30, CI 0.87–0.89, CNI 0.90–1.29, REL 0.26–0.34, ScI 0.80–0.85, SpI 1.33–1.44.

*Worker diagnosis.* Erect or suberect hairs present on antennal scapes; body colour reddish brown; HW <0.85.

Head very finely colliculate to imbricate, superimposed with large, widely spaced punctures and very weak scabriculous sculpturing; area near the mandibular insertion with a narrow area of strigulate sculpturing. Numerous erect hairs from the occipital border to the anterior clypeal margin. Erect or suberect hairs

present on the antennal scapes. Entire pronotum and antero-dorsal region of mesonotum smooth to weakly coriarius; remainder of mesonotum and entire propodeum finely punctate; lateral areas of mesonotum more finely sculptured than propodeum. Pronotum with between 4 and 6 erect hairs. Propodeal spiracles as in *A. tridens*. Medial propodeal carina slightly expanded dorsally, and located posterior of a line drawn between the propodeal spiracles to just anterior of the petiolar insertion. Propodeal spines directed postero-laterally, with the outer surfaces weakly concave, the distal ends narrower than the maximum width of the propodeum, and the area between them more or less flat. Erect hairs present on gastric tergites 2, 3 and 4. Body colour reddish brown with the propodeum darker, mandibles and antennae yellowish red, petiole reddish yellow anteriorly and translucent posteriorly, and tarsi yellow.

*Queen measurements* ( $n=1$ ). OOD 0.28, EL 0.26, HL 0.91, EW 0.13, HW 0.78, CNW 0.08, CND 0.08, SL 0.63, AL 1.30, PpW 0.46, SW 0.30, CI 1.16, CNI 1.05, REL 0.34, ScI 0.80, SpI 1.33.

*Queen description.* Differing from the worker in its larger size, presence of ocelli, enlarged thorax, and slightly reduced propodeal spine size. Other characters as in the worker. Although the single available specimen is dealate, it was apparently fully winged.

*Discussion.* *A. murielae* has been collected in Ghana and Cameroun. The specimen collected from Ghana is smaller than the specimens from Cameroun in eleven of thirteen metric measures and differs in all indices. However, these specimens are very similar in all qualitative characters, suggesting they represent a single species with geographic variation in size.

It is possible that the geographic variation in size noted above is in response to the presence of *A. ghanensis*. *A. murielae* is similar to and sympatric with *A. ghanensis* in Ghana (see discussion under *A. ghanensis* for differences between these taxa). The available collections indicate that allopatric populations of *A. murielae* and *A. ghanensis* are more similar in size than sympatric populations, a possible result of character displacement. Additional material of both species will be required to determine the presence and extent of this phenomenon.

*Type material.* Holotype worker, and one worker and one queen paratype from



CAMEROON: Nkoemvon (D.Jackson)  
(BMNH).  
Other material examined. GHANA:  
Mampong (P.Room) (BMNH).

*Axinidris nigripes* sp.n. (Fig. 35)

**Worker measurements** ( $n=1$ ). OOD 0.33, EL 0.30, HL 1.06, EW 0.17, HW 0.97, CNW 0.06, CND 0.12, SL 0.78, AL 1.27, PpW 0.50, SW 0.41, CI 0.91, CNI 1.95, REL 0.31, Scl 0.80, Spl 1.24.

**Worker diagnosis.** Erect hairs present on gastric tergites 1–4; body reddish brown, the gaster darker.

**Head sculpture** similar to *A. kakamegensis*, but with strigulate sculpturing less well developed posterior of the eyes. Head with numerous short erect hairs distributed from the occipital border to the anterior clypeal margin. A limited

number of erect or suberect hairs present on the antennal scapes. Entire alitrunk smooth to imbricate and very finely punctate. Pronotum with c. 6 short, erect hairs. Propodeal spiracle similar to *A. tridens*, but less raised anteriorly. Medial propodeal carina expanded medially and located posterior of a line drawn between the propodeal spiracles to just anterior of the petiolar insertion. Propodeal spines directed posterolaterally, with the outer surfaces concave, the distal ends approximately the same width as the maximum propodeal width, and the area between them more or less flat. Erect hairs present on gastric tergites 1–4. Body colour light yellowish brown with the mandibles and antenna lighter, and the legs (including tarsi) and gaster slightly darker.

**Discussion.** *A. nigripes* is similar to *A. palligastriion*, but differs in its larger size, deeper clypeal notch, and its body colour (head and

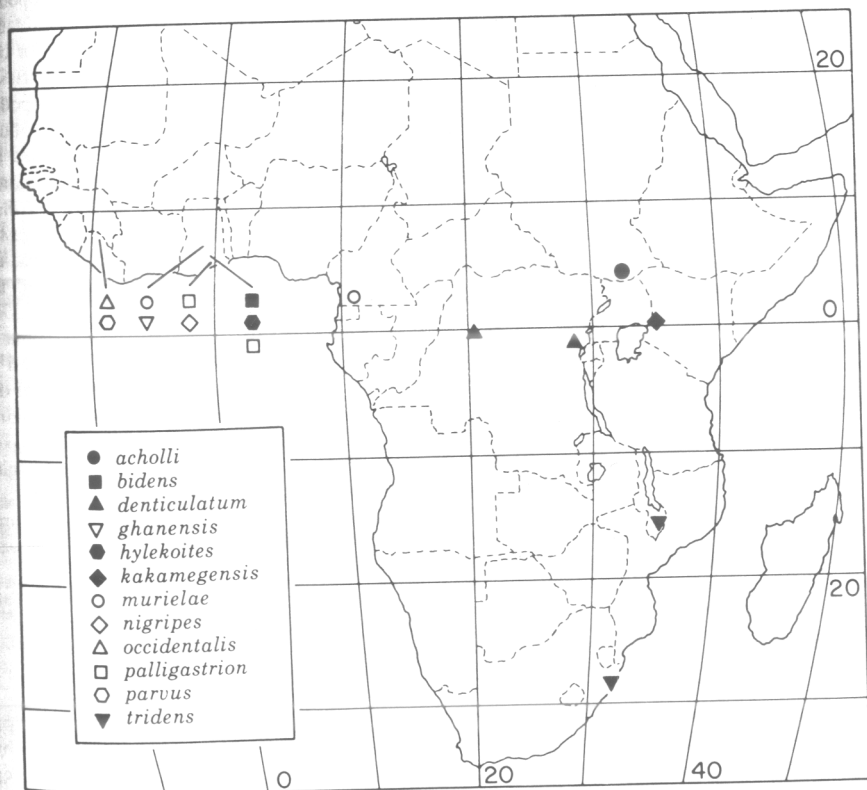


Fig. 35. Distribution of *Axinidris* studied.

thorax light, gaster dark). Nothing is known of its biology.

*Type material.* Holotype worker from GHANA: Aburi (P.Room) (BMNH).

***Axinidris occidentalis* sp.n.** (Figs 26–28, 35)

*Worker measurements* ( $n=4$ ). OOD 0.31–0.35, EL 0.21–0.23, HL 0.88–0.95, EW 0.10–0.13, HW 0.88–0.96, CNW 0.05, CND 0.07–0.08, SL 0.57–0.65, AL 1.02–1.10, PpW 0.34–0.41, SW 0.36–0.41, CI 0.99–1.01, CNI 1.33–1.53, REL 0.23–0.25, Scl 0.64–0.69, Spl 1.37–1.57.

*Worker diagnosis.* Pronotal hairs absent; body yellowish red, the tarsi light yellow; HW >0.85; SL <0.66.

Head sculpture similar to *A.palligastri*on. Head with two pairs of short erect hairs (one pair near the vertex, one pair on the frontal lobes), and one pair of long hairs on the clypeus. Erect and suberect hairs absent from the antennal scapes. Entire alitrunk weakly punctate to weakly imbricate. Pronotum lacking erect hairs. Propodeal spiracles as in *A.tridens*. Medial propodeal carina expanded slightly near the propodeal angle and located just anterior of a line drawn between the propodeal spiracles posterior to a line drawn between the propodeal spines. Propodeal spines directed postero-laterally with the outer surfaces concave, the distal ends approximately the same width as the maximum propodeal width, and the area between them concave. Erect hairs present on gastric tergites 3 and 4. Body colour yellowish red with the gaster, clypeus, mandibles and antenna lighter, and the tarsi yellow.

*Discussion.* *A.occidentalis* can be separated from other species by the combination of no erect hairs on the pronotum, the propodeal spine width subequal to the propodeal width, and the presence of erect hairs on the gaster. It is also the western-most species in the genus.

*A.occidentalis* was collected from an unidentified ant-plant. This habit is similar to that of several other species, including *A.denticulatum*.

*Type material.* Holotype worker and seven worker paratypes from LIBERIA: Paiata (=Payeta) (*J.Bequaert*) (MCZC).

***Axinidris palligastri*on sp.n.** (Figs 29–31, 35)

*Worker measurements* ( $n=5$ ). OOD

0.29–0.32, EL 0.26–0.30, HL 0.87–0.93, EW 0.12–0.14, HW 0.81–0.85, CNW 0.04–0.06, CND 0.05–0.06, SL 0.61–0.67, AL 1.05–1.16, PpW 0.42–0.45, SW 0.35–0.37, CI 0.91–0.94, CNI 1.07–1.34, REL 0.31–0.35, Scl 0.72–0.78, Spl 1.22–1.29.

*Worker diagnosis.* Erect hairs present on gastric tergites 1–4; body colour reddish brown, gaster lighter.

Head finely punctate and superimposed with fine strigulate sculpture (stronger on the clypeus than posteriorly); the area near the mandibular insertion with a narrow area of strigulate sculpturing. Head with numerous short erect hairs distributed from the occipital border to the anterior clypeal margin. Erect and suberect hairs absent from antennal scapes. Entire alitrunk smooth to imbricate and very finely punctate, and with the area between the metanotal spiracles containing several short carina. Pronotum with 2–8 short, erect hairs. Propodeal spiracle as in *A.tridens*. Medial propodeal carina expanded medially and located posterior of a line drawn between the propodeal spiracles to just anterior of the petiolar insertion. Propodeal spines directed postero-laterally, with the outer surfaces slightly concave, the distal ends approximately the same width as the maximum propodeal width, and the area between them more or less flat. Erect hairs present on gastric tergites 1–4. Body colour reddish brown, the mandibles and tarsi slightly lighter, and the gaster yellowish red.

*Discussion.* *A.palligastri*on is very similar to *A.nigripes*, but can be separated based on its smaller size, shallower clypeal notch, and differing colour pattern (head and thorax dark, gaster light). This species has been collected from tree trunks where it was sharing foraging trails with *Crematogaster clariventris*.

*Type material.* Holotype worker and three worker paratypes from GHANA: Nswam (=Nsawam) (P.Room) (BMNH).

*Other material examined.* GHANA: Tafo (*B.Bolton*) (BMNH).

***Axinidris parvus* sp.n.**

*Worker measurements* ( $n=2$ ). OOD 0.22, EL 0.13–0.17, HL 0.53–0.61, EW 0.06–0.09, HW 0.45–0.52, CNW 0.05, CND 0.03–0.04, SL 0.38–0.42, AL 0.72–0.76, PpW 0.21–0.24, SW 0.14, CI 0.85–0.86, CNI 0.65–0.74, REL

0.29–0.32, ScI 0.81–0.83, Spl 1.49–1.52.

**Worker diagnosis.** Small (HW <0.53); area around propodeal spines smooth, without a medial carina; pronotum with 2 elongate, erect hairs; each propodeal spine bearing a single distinct, erect hair; head and alitrunk reddish yellow, contrasting with darker yellowish red gaster.

Head weakly coriarius dorsally, smooth laterally and ventrally; pilosity limited to one pair of erect hairs on the frontal lobes and one pair on the clypeus. Erect and suberect hairs absent from antennal scapes. Pronotum smooth; mesonotum and propodeum imbricate (weaker on anterior and lateral mesonotum). Pronotum with one pair of elongate hairs dorsally. Propodeal spiracles with the posterior surface only slightly depressed below the level of the anterior surface. Medial propodeal carina absent. Propodeal spines reduced to lateral angles partly connected by a carina, each bearing an elongate, erect setae, and with the area between them slightly concave. Erect hairs present on all gastric tergites. Head and alitrunk reddish yellow, gaster yellowish red, legs, petiole, antennae and mandibles yellow.

**Discussion.** *A. parvus* is similar to *A. bidens* in the setal pattern of the head and alitrunk, and the configuration of the propodeal angles and medial propodeal carina. It differs in being smaller, with weaker sculpturing, and is lighter in colour. Collections have been made from plants.

**Type material.** Holotype worker from LIBERIA: Paiata (=Payeta) (J. Bequaert) (MCZC).

**Other material examined.** LIBERIA: Du River, Camp No. 3 (J. Bequaert) (MCZC).

### *Axinidris tridens* (Arnold) comb.n. (Figs 32–35)

*Engramma tridens* Arnold, 1946: 58.

**Worker measurements** ( $n=2$ ). OOD 0.33, EL 0.20–0.25, HL 0.86–0.95, EW 0.13–0.16, HW 0.81–0.88, CNW 0.06–0.07, CND 0.05, SL 0.72–0.82, AL 1.07, PpW 0.31–0.34, SW 0.23–0.26, CI 0.93–0.94, CNI 0.64–0.95, REL 0.24–0.28, ScI 0.88–0.93, Spl 1.67–1.73.

**Worker diagnosis.** Propodeal spines reduced to angles; medial propodeal carina present, tooth-like dorsally.

Head colliculate to imbricate, dorsal surface superimposed with fine scabriculous sculpturing; area near the mandibular insertion with a narrow area of strigulate sculpturing. Erect hairs limited to one pair medial and posterior of the compound eyes and one pair near the anterior clypeal margin. Erect and suberect hairs absent from antennal scapes. Anterior and lateral areas of pronotum smooth and lacking erect hairs, postero-dorsal regions colliculate to imbricate. Extreme anterior margin of mesonotum smooth, remainder of mesonotum and entire propodeum scabriculous. Anterior edge of propodeal spiracles even with propodeum, posterior edge depressed relative to the anterior surface of propodeum and thus directing the spiracular opening posteriorly. Medial propodeal carina weak, tooth-like dorsally, and located on the declivitous face only. Propodeal spines reduced to angles and with the area between them flat. Erect hairs absent from gastric tergites. Body colour reddish yellow with the head and legs slightly darker (tarsi pale yellow); mandibles yellow.

**Discussion.** *A. tridens* can be distinguished from other species by the tooth-like configuration of the medial propodeal carina.

*A. tridens* was originally described in *Engramma* by Arnold (1946). He commented that it was allied to *denticulatum* (then in *Engramma*), but differed in the structure of the medial propodeal carina and the thoracic sculpturing. He also recognized this species as being similar to *A. acholli*, but believed they differed in the form of the petiolar node and the palp formula, and therefore were not congeneric. Upon examination, *A. tridens* was found to possess the following *Axinidris* characters: propodeal spines (reduced to angles), dorsal propodeal spiracles, medial propodeal carina, and broadly rounded and strongly inclined dorsum of petiole. It is clear *A. tridens* should be transferred from *Engramma* to *Axinidris*.

*A. tridens* has been collected foraging on a partially decayed tree in a primary forest.

**Type material.** Three syntype workers from MALAWI: Mlanje (=Mulanje) (SAMC) [examined]. The upper right specimen (the only individual possessing a head) is here designated as LECTOTYPE.

**Other material examined.** SOUTH AFRICA: Natal: St. Lucia Estuary (D. J. Brothers) (BMNH).

### Unplaced material

The following queens and male are known from isolated individuals only, and can not be confidentially associated with workers. They are not formally described here because of the lack of worker association.

Four alate queens representing two species are present in MCZC. One species (three specimens, two from Divo, Ivory Coast, one from 17 km W Abidjan, Ivory Coast) are possibly the queens of *A. parvus*. They are slightly larger than *A. parvus* workers (but smaller than the workers of most other species), with similar colour pattern, setal number and placement, and propodeal spine and medial carina configuration. The remaining queen (from Plateau d'Ipassa, Gabon) is unlike any known worker. The declivitous face of the propodeum is strongly concave, the propodeal spines are rounded laterally and flattened dorso-ventrally, and the medial carina is limited to the dorsal propodeal face and expanded into a broad, shallow tooth. Additionally, the dorsal margin of the petiolar scale is bifurcate, a condition unknown in any worker.

The single male (from 17 km W Abidjan, Ivory Coast) was collected from the same locality as a queen, but is apparently not conspecific. It is much larger and darker in colour. The evidence for placing this specimen in *Axinidris*, together with its description, are found above in the generic description.

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