

***Tetraponera* (Hymenoptera: Formicidae) of the Oriental and Australian regions: key to species based on the worker caste**

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Introduction

This key treats 33 species of *Tetraponera* that are known to occur in the Oriental and Australian regions. The key is based exclusively on the worker caste and is taken from Ward (2001). Two additional species, known only from queens, are excluded. For keys to queens and males, see Ward (2001). The figures cited in the keys are placed at the end of this document. If you encounter difficulty using the key please send feedback to me (email: psward@ucdavis.edu).

The following metric measurements and indices are cited in the key. The first four measurements are taken with the head in full-face, dorsal view (head considered prognathous). This involves positioning the head so that its posterior margin and anterolateral corners (above the mandibular insertions) are in the same plane of view.

- HW Head width: maximum width of head, including the eyes.
- HL Head length: midline length of head proper, from the posterior margin to the anterior extremity of the clypeus.
- EL Eye length: length of compound eye, measured in the same view as HL (in taking this measurement it is important to have adequate lighting to discern the margins of the eye, since the outer circlet of ommatidia is usually darkened and inconspicuous).
- MFC Minimum frontal carinal distance: minimum distance between the frontal carinae.
- SL Scape length: length of the first antennal segment, excluding the radicle (Fig. 1).
- FL Profemur length: length of the profemur, measured along its long axis in posterior view (Fig. 2).
- FW Profemur width: maximum measurable width of the profemur, measured from the same view as FL, at right angles to the line of measurement of FL (Fig. 2).
- PrWM Pronotum width: maximum width of the pronotum at the dorsolateral margins; in species in which the lateral margins of the pronotum are not well defined, PrWM is measured at the point where the pronotal surface becomes vertical.
- PDH Propodeum height: height of the propodeum, measured in lateral view, from the base of the metapleuron to the maximum height of the propodeum, along a line orthogonal to the lower metapleural margin (Fig. 3).
- MTW Metapleural width: maximum distance between the metapleura, measured in dorsal view (Fig. 4).
- PL Petiole length: length of the petiole, measured in lateral view from the lateral flanges of the anterior peduncle to the posterior margin of the petiole (Fig. 3).
- PH Petiole height: maximum height of the petiole, measured in lateral view at right angles to PL (Fig. 3), but excluding any protruding anteroventral or posteroventral processes.

- DPW Dorsal petiole width: maximum width of the petiole, measured in dorsal view.
- LHT Length of the metatibia, excluding the proximomedial part of the articulation which is received into the distal end of the metafemur (Fig. 5).
- CI Cephalic index: HW/HL
- REL Relative eye length: EL/HL
- REL2 Relative eye length, using HW: EL/HW
- FCI Frontal carinal index: MFC/HW
- SI Scape index: SL/HW
- SI2 Scape index, using HL: SL/HL
- SI3 Scape index, using EL: SL/EL
- FI Profemur index: FW/FL
- PDI Propodeal index: PDH/MTW
- PLI Petiole length index: PH/PL
- PWI Petiole width index: DPW/PL
- CSC Cephalic setal count: number of standing hairs, i.e., those forming an angle of 45° or more with the surface, visible on the posterior half of the dorsum of the head, as seen in lateral and posterior views.
- MSC Mesosomal setal count: number of standing hairs visible in profile on the mesosoma dorsum.

The term *mesopropodeal impression* is used for the transversely depressed region on the mesosoma dorsum between the mesonotum and the propodeum. This is commonly referred to as the “metanotal groove”. In *Tetraponera* workers, however, there can be a small, raised welt-like structure in the middle of this impression (Fig. 44), which is here interpreted as the metanotum since it is flanked by the metathoracic spiracles. It is particularly well developed in some Malagasy and African species of *Tetraponera*, but also occurs in a few Asian taxa.

Reference Cited

- Ward, P. S. 2001. Taxonomy, phylogeny and biogeography of the ant genus *Tetraponera* (Hymenoptera: Formicidae) in the Oriental and Australian regions. *Invertebrate Taxonomy* **15**: 589-665.

Key to species, based on the worker caste

- 1 Head with 3 distinct ocelli; in dorsal view pronotal humeri appearing subangulate (Figs 59-60); head densely punctate, and lacking extensive shiny interspaces between the punctures; large species, HW 1.14-2.07 2
- 1' Head almost always lacking ocelli, very rarely with two or three faint ocelli (in a few large workers of *T. nigra* and *T. punctulata*); pronotal humeri varying from narrowly to broadly rounded (e.g., Figs 30-36), but not subangulate; head usually less densely punctate and with conspicuous shiny interspaces between the punctures (always the case in species with HW > 1.10); size variable (HW 0.49-1.48)..... 3
- 2 Larger species (HW 1.62-2.07), with smaller eyes (REL2 0.35-0.37) (Fig. 55); usually bicolored, the dark head and gaster contrasting with the orange-brown mesosoma (the latter

- infuscated in some populations); standing pilosity common on the mesosoma dorsum, including the propodeum, MSC 20-66 (Fig. 56) (Pakistan to southern China, south to Sumatra and Java; introduced into the Seychelles)**rufonigra (Jerdon)**
- 2' Smaller species (HW 1.14-1.51), with larger eyes (REL2 0.49-0.56) (Fig. 57); body unicolorous dark brown; standing pilosity sparse on the mesosoma dorsum, absent from the propodeum, MSC 3-6 (Fig. 58) (Myanmar to Vietnam, south to Palawan, Borneo, Sumatra and Java)**pilosa (F. Smith)**
- 3 Mandible slender, with 3 teeth on the masticatory margin, and 1-2 denticles on the basal margin (Fig. 7); basal margin of mandible much longer than masticatory margin; insertion of postpetiole into petiole shifted dorsad, and posteroventral margin of petiole in the form of a semi-translucent, ventrally protruding hood, which is distinctly separated from the helcium (Fig. 40) when the postpetiole is in its normal horizontal position; mesosternum densely pubescent; abdominal tergite IV sparsely pubescent, the appressed hairs separated by their lengths or more; relatively small species, HW 0.49-0.93 (*allaborans* group)..... 4
- 3' Mandible more robust, with 4 teeth on the masticatory margin, and 0-1 denticles on the basal margin (Fig. 6); basal margin of mandible subequal to, or shorter than, masticatory margin; insertion of postpetiole into petiole not shifted dorsad, the posteroventral margin of the petiole closely associated with the helcium (e.g., Figs 68, 94), although it may be flanked by ventrolateral flanges (Figs 79-84); most of the mesosternum devoid of pubescence; abdominal tergite IV usually densely pubescent; size variable, HW 0.63-1.48 (*nigra* group)..... 14
- 4 Small, black species (HW 0.58-0.61, LHT 0.50-0.52), with disproportionately small eyes (REL 0.32-0.34) (Fig. 13), short scapes (SI2 0.42-0.45) and broad profemur (FI 0.47-0.48); pronotal dorsum rounding into sides, lateral margins poorly developed (Fig. 24); mesopropodeal impression lacking a distinct metanotal plate but may be bisected by a weak transverse ridge that interrupts the longitudinally rugulate sculpture (Thailand).....
.....**connectens Ward**
- 4' Size, color, scapes and profemur variable but if small (HW < 0.65 and LHT < 0.55) and black, then eyes larger (REL 0.35-0.41); either lateral pronotal margins better developed or mesopropodeal impression with a distinct, flattened metanotal plate 5
- 5 Mesopropodeal impression with irregular longitudinal rugulae, interrupted by a small, raised transverse welt (metanotal plate), which is bounded laterally by the metanotal spiracles and which lacks rugulate sculpture (Fig. 44); pronotum lacking distinct lateral margins, the dorsum rounding gently into the sides, as seen in posterior view (Figs 20-23); profemur short and broad, FI 0.44-0.53; dark brown to black species 6
- 5' Mesopropodeal impression with irregular longitudinal rugulae, sometimes crossed at the midpoint by a broken transverse rugule, but lacking a raised metanotal plate; pronotum with more or less distinct lateral margins, which vary from sharp to blunt-edged; in posterior view pronotal dorsum meeting the sides at a sharply rounded angle (Figs 19, 25-29); profemur usually more slender (FI 0.36-0.48); color variable 9
- 6 Median clypeal lobe subtriangular, protruding, and pointed (Fig. 9); petiole narrow in dorsal view (DPW/MTW 0.61-0.64) (Borneo)**apiculata Ward**

- 6' Median portion of clypeus broadly convex, not prominently protruding and pointed (Figs 10-12); petiole broader in dorsal view (DPW/MTW 0.65-0.73)..... 7
- 7 Larger species, with broad head (HW 0.82, CI 0.92) and large eyes (REL 0.42); anterior clypeal margin edentate and non-protruding (Fig. 10); petiole slender (PLI 0.51) (Fig. 45); mesopleuron extensively longitudinally carinate (West Malaysia) **avia Ward**
- 7' Smaller, with more elongate head (HW 0.63-0.75, CI 0.73-0.84) and smaller eyes (REL 0.35-0.39); anterior margin of clypeus with a modestly protruding and crenulate median lobe (Figs 11-12); petiole more robust (PLI 0.58-0.67) (Figs 47-48); mesopleuron predominantly smooth and shining 8
- 8 Smaller species with more elongate head (HW 0.63-0.65, CI 0.73-0.75) (Fig. 11); eye larger in relation to scape length (SI3 1.19-1.21); petiole relatively slender (PLI 0.58-0.62) (Borneo, ?West Malaysia) **bita Ward**
- 8' Larger species with broader head (HW 0.73-0.75, CI 0.82-0.84) (Fig. 12); eye smaller in relation to scape length (SI3 1.25-1.30); petiole shorter and more robust (PLI 0.63-0.67) (West Malaysia)..... **brevis Ward**
- 9 Small species (HW 0.60-0.64), with short scapes (SI 0.52-0.57, SI2 0.41-0.44); median clypeal lobe bidentate (Fig. 18); pronotum relatively narrow (PrWM/MTW 1.14-1.21), with sharp, subparallel margins, as seen in dorsal view (Fig. 36), and appearing rather flattened in posterior view(Fig. 29); profemur broad (FI 0.42-0.48) (China, Vietnam) **microcarpa Wu & Wang**
- 9' Scapes longer (SI 0.57-0.68, SI2 0.45-0.57); median clypeal lobe usually with three or four teeth, or lacking teeth altogether, rarely with a pair of well developed teeth; size variable but if falling within the above range then usually the pronotal margins are soft-edged and convex in dorsal view (Figs 30-35) and the profemur is more slender; dorsal surface of pronotum more convex in posterior view (Figs 19, 25-28) 10
- 10 Larger species (HW 0.62-0.93, usually > 0.70); body predominantly black, although petiole, postpetiole and limb appendages may be lighter in color; propodeum typically low and broad, such that PDI 0.91-1.09 (Figs 38, 40); in one rare aberrant morph with HW > 0.79 the propodeum is inflated and prominently raised (Figs 37, 43); pronotal margin varying from sharp- to soft-edged, and maximum width of the pronotum generally occurring below the margin (Fig. 19) (widespread and highly variable species, distributed from India to southern China, south to New Guinea and northern Australia) **allaborans (Walker)**
- 10' Smaller species (HW 0.49-0.79), color variable but often with at least the postpetiole—and sometimes most of the body—yellow or orange-brown; if HW > 0.65 then body mostly dark brown to black but propodeum notably tall (lateral view) and slender (posterior view), such that PDI 1.12-1.24 (Figs 39, 50); pronotal margin usually relatively soft-edged and occurring at the point of maximum width of the pronotum (Figs 25-28)..... 11
- 11 Small species (HW 0.64) with large eyes (REL 0.42) (Fig. 14); propodeum conical in profile, the prominent apex located far forward, so that the short inclined dorsal face of the propodeum rounds into a much longer, sloping declivitous face (Fig. 52); petiole short and

- broad (PWI 0.54, PL/LHT 0.72), subtriangular in profile and without a well differentiated anterior peduncle (Fig. 52); castaneous brown (Borneo).....**conica Ward**
- 11' Eyes smaller (REL 0.34-0.41); propodeum not conical in profile, the dorsal face convex and rounding gradually into a steep declivitous face of approximately the same length (Figs 50, 53-54); petiole longer and narrower (PWI 0.38-0.54, PL/LHT 0.83-0.98), a differentiated anterior peduncle and posterior node evident in profile (Figs 50, 53-54); size and color variable (*modesta*-complex)..... 12
- 12 Small species (HW 0.53-0.61), with a relatively short, high petiole (PLI 0.60-0.68, PWI 0.46-0.54, PL/SL 1.09-1.19) (Fig. 53); body and legs dark to medium brown (pronotum, petiole and postpetiole may be lighter in color); standing pilosity tending to be rather common, with 8-10 long setae often visible in profile on the promesonotum (but sparse or abraded in some specimens) (Thailand, West Malaysia, Borneo, Sumatra)
..... **crassiuscula (Emery)**
- 12' Petiole more slender (PLI 0.45-0.59, PWI 0.38-0.48, PL/SL 1.20-1.41) (Figs 50, 54); standing pilosity relatively sparse, 1-2 pairs of long erect setae visible in profile on the pronotum, none on the mesonotum; size (HW 0.51-0.79) and color variable..... 13
- 13 Head, mesosoma, and most of gaster black or dark brownish black, the other body parts variable in color, postpetiole and tibiae often a contrasting lighter yellow or orange-brown; larger species, on average (HW 0.54-0.79, usually greater than 0.60) (Malay Peninsula south and east to Lombok, Sulawesi and the Philippines) **extenuata Ward**
- 13' Body color predominantly yellow- or orange-brown, the gaster sometimes partially or wholly dark brown; problematic specimens with more darkened head and mesosoma also occur; smaller species (HW 0.51-0.64) (northeast India to China, south to New Guinea).....
..... **modesta (F. Smith)**
- 14 Larger species (HW 0.95-1.48), with long legs (LHT/HL 0.80-0.97); standing pilosity common, MSC 6-71 (usually > 10) and CSC 10-40, the cephalic hairs scattered over the dorsal surface of the head and often grading into shorter, suberect pubescence; mesopropodeal impression flanked laterally by raised prominences (containing the metanotal spiracles) but otherwise more or less open, not bounded by lateral ridges that enclose a pit-like depression (a shallow pit present in *T. binghami*)..... 15
- 14' Smaller species, on average (HW 0.63-1.44); if HW >0.92, then standing pilosity less common (MSC 0-22, CSC 0-4) and the sparse cephalic hairs arranged in pairs on the dorsum of the head, distinct from the much shorter, appressed pubescence; legs generally shorter (LHT/HL 0.58-0.86, rarely >0.80); mesopropodeal impression partly or entirely flanked laterally by raised ridges that enclose a pit-like depression 18
- 15 Head elongate (CI 0.70-0.77) (Figs 61-62) and petiole very slender (PLI 0.34-0.43) (Figs 65-66)..... 16
- 15' Head broader (CI 0.76-0.94, usually >0.80) (Figs 63-64); petiole shape variable but if CI <0.80 (a few individuals of *T. nigra*) then petiole more robust (PLI > 0.50) 17
- 16 Smaller species (HW 0.96-0.97), with relatively large and conspicuous eyes (REL 0.40-0.42) (Fig. 62); profemur short and broad (FI 0.45-0.47) (Borneo)..... **buops Ward**

- 16' Larger species (HW 1.06-1.27), with relatively smaller eyes (REL 0.25-0.30) (Fig. 61); profemur slender (FI 0.37-0.40) (India and Nepal, east to southern China, south to West Malaysia).....***binghami* (Forel)**
- 17 Mesosoma, petiole and postpetiole, when viewed in profile, with scattered standing pilosity, accompanied by, and often grading into, a dense mat of shorter suberect hairs, present on all dorsal surfaces (Fig. 67); petiole slender, PLI 0.38-0.47, PL/HL 0.74-0.92 (Fig. 67) (northeast India to China, south to Sumatra, Java, Borneo and Palawan)....***attenuata* F. Smith**
- 17' Mesosoma, petiole and postpetiole, when viewed in profile, with standing pilosity and underlying suberect pubescence variably developed (and variably distinguishable), but at least the promesonotum and the anterior peduncle of petiole lacking a dense mat of short suberect hairs (Fig. 68); petiole shorter and higher, PLI 0.52-0.64, PL/HL 0.57-0.72 (Fig. 68) (Pakistan to Thailand, south to Borneo and Java)***nigra* (Jerdon)**
- 18 Petiole with a pair of acute, posteroventral teeth, formed from ventrolateral extensions of the petiolar sternite (Figs 79-84); pronotum with dense punctate sculpture on its anterior quarter which contrasts with the shiny (and less densely sculptured) posterior half of head and with the more sparsely punctate posterior regions of the pronotum; scapes shorter than eye length (SI3 0.83-0.98) 19
- 18' Petiole lacking a pair of posteroventral teeth (Figs 77-78, 91-99, 102-103); pronotal sculpture variable but punctures more evenly distributed, not concentrated solely on the anterior quarter (although they may be sparse medially) and usually not occurring in a density that contrasts strongly with that of the posterior half of the head; scapes longer than eye length (SI3 1.02-1.55) 22
- 19 Head elongate (CI 0.73-0.77) (Fig. 76); petiole very slender (PLI 0.43-0.49) (Fig. 84) (Thailand)***notabilis* Ward**
- 19' Head broader (CI 0.78-0.90) (Figs 71-75); petiole shorter (PLI 0.60-0.79) (Figs 79-83) ... 20
- 20 Larger species (HW 0.83-0.95), with dense pubescence on postpetiole and abdominal tergite IV, which obscures the sheen of the integument; frontal carinae more widely separated (MFC 0.12-0.15, FCI 0.15-0.16) (Fig. 75) (Borneo, Thailand)***nodosa* Ward**
- 20' Smaller species (HW 0.63-0.83), pubescence generally sparse on postpetiole and sparse to moderate on abdominal tergite IV, not obscuring the sheen of the integument; frontal carinae less widely separated (MFC 0.07-0.10, FCI 0.10-0.14) (Figs 71-74)..... 21
- 21 Short standing pilosity (0.03-0.05 mm in length) common on most body surfaces, including sides of head (Fig. 74), dorsum of head (CSC 15-25), and mesosoma (MSC 30-56) (Fig. 81) (northern Australia).....***nixa* Ward**
- 21' Standing pilosity much less common on head (CSC 0-6), absent or sparse on the sides when head is observed in full-face view (Figs 71-73); standing hairs generally sparse on mesosoma (MSC usually < 10), but occasionally quite common; if MSC > 20 then some hairs relatively long (0.10-0.20 mm in length) (India to southern China, south to northern Australia)***nitida* (F. Smith)**

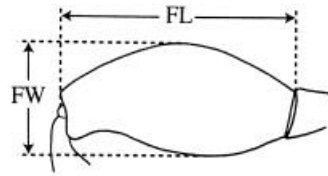
- 22 Mesopropodeal impression flanked more or less entirely by lateral ridges, so that the pit-shaped depression extends to the posterior margin of the mesonotum; species found east of Wallace's line (Australia, New Guinea, and adjacent islands)..... 23
- 22' Mesopropodeal impression with flanking ridges much reduced or lacking anteriorly, so that the pit-shaped depression is separated from the posterior margin of the mesonotum by an open, transverse strip of integument, with longitudinally rugulate sculpture; species found west of Wallace's line (India to the Philippines, Borneo, Sumatra and Java)..... 28
- 23 Petiole short and very broad (PL/HW 0.57-0.59; PWI 0.79-0.88) (Fig. 96); postpetiole about 1.4X broader than long; frontal carinae widely separated (FCI 0.19-0.20) (Fig. 90) (Australia).....*tucurua* **Ward**
- 23' Petiole longer and less broad (PL/HW 0.62-0.96; PWI 0.33-0.70) (Figs 91-95); postpetiole approximately as long as, or longer than, broad; frontal carinae less widely separated (FCI 0.12-0.19) (Figs 85-89) 24
- 24 Posterior half of petiolar sternite flat or weakly convex in profile (Figs 91-93); petiole relatively slender (PLI 0.37-0.61, PWI 0.33-0.57); eyes larger (REL 0.36-0.45); punctures on head between compound eyes relatively coarse, mostly 0.010-0.020 mm in diameter; propodeum somewhat elevated (PDI 1.10-1.34), its dorsal face usually convex in profile, inclined downward posteriorly, and grading insensibly into declivitous face (Figs 91-92) . 25
- 24' Posterior half of petiolar sternite with prominent ventral protrusion (Figs 94-95); petiole usually more robust (PLI 0.57-0.80, PWI 0.50-0.70) and eyes tending to be smaller (REL 0.30-0.41); punctures on head between compound eyes finer, mostly 0.005-0.015 mm in diameter; propodeum lower in profile (PDI 1.00-1.19), its dorsal usually flatter and more strongly differentiated from the declivitous face (Figs 94-95, 97-99)..... 27
- 25 Head densely punctate, opaque; larger species (HW 0.94-1.04, LHT 0.84-1.00), with long legs and scapes (LHT/HL 0.79-0.86; SI2 0.53-0.55) (New Guinea)*atra* **Donisthorpe**
- 25' Head less densely sculptured, the punctures separated by about their diameters and the interspaces shiny; smaller species (HW 0.75-0.94, LHT 0.63-0.78), with shorter legs and scapes (LHT/HL 0.65-0.74; SI2 0.43-0.50)..... 26
- 26 Frontal carinae widely separated (FCI 0.17-0.19) and eyes relatively small (REL 0.36-0.39, REL2 0.41-0.45) (Fig. 87), such that MFC/EL 0.38-0.45; pronotum slender, as seen in dorsal view (PrWM/MTW 1.04-1.16); petiole relatively short and broad (PLI 0.58-0.61, PWI 0.55-0.57) (Fig. 93) (New Guinea)*mimula* **Ward**
- 26' Frontal carinae less widely separated (FCI 0.12-0.16) and eyes larger (REL 0.40-0.45, REL2 0.47-0.53) (Fig. 86), such that MFC/EL 0.25-0.30; pronotum slightly to strongly expanded laterally (PrWM/MTW 1.15-1.37); petiole shape variable but generally longer and more slender (PLI 0.45-0.59, PWI 0.40-0.49) (Fig. 92) (New Guinea and adjacent islands; northern Australia).....*laeviceps* (**F. Smith**)
- 27 Small species (HW 0.73-0.81); petiole with short anterior peduncle and large globose node, with steep anterior and posterior faces (Fig. 95) (FW/PH 0.51-0.62); punctures on head and pronotum mostly very fine, about 0.005mm in diameter (New Guinea, northern Australia)*rotula* **Ward**

- 27' Larger species (HW 0.80-1.44), with less globose petiolar node, the anterior and posterior faces more gently sloping (Figs 94, 97-99) (FW/PH 0.60-0.88); punctures on head and mesosoma mostly larger, approximately 0.010-0.015mm in diameter (New Guinea, Australia) *punctulata* **F. Smith**
- 28 Standing pilosity common on head and mesosoma (CSC 18-28, MSC 26-54), including mesonotum and propodeum (Figs 77-78)..... 29
- 28' Standing pilosity sparse on head and mesosoma (CSC 2-4, MSC 1-5), absent from mesonotum and propodeum (Figs 102-103)..... 30
- 29 Eyes large (REL 0.41-0.44) (Fig. 69); lateral pronotal margin sharp-edged; appressed hairs present in moderate density on abdominal tergite IV, in addition to scattered standing hairs (India, West Malaysia)..... *aitkenii* (**Forel**)
- 29' Eyes smaller (REL 0.33-0.36) (Fig. 70); lateral pronotal margin not well developed; abdominal tergite IV with abundant, short standing pilosity but appressed hairs very sparse and inconspicuous (Borneo)..... *polita* **Ward**
- 30 Eyes larger (REL2 0.51-0.56) (Fig. 101); profemur shorter (FL/HL 0.53-0.62, EL/FL 0.74-0.82); petiolar node usually with a short, steep anterior face and much longer, more shallowly inclined posterior face (Fig. 103) (Borneo, Palawan) *inversinodis* **Ward**
- 30' Eyes smaller (REL2 0.44-0.48) (Fig. 100); profemur longer (FL/HL 0.60-0.67, EL/FL 0.60-0.66); anterior face of petiolar node usually not much steeper than posterior face (Fig. 102) (Malay Peninsula south and east to Sumatra, Java, Borneo and the Philippines) *difficilis* (**Emery**)

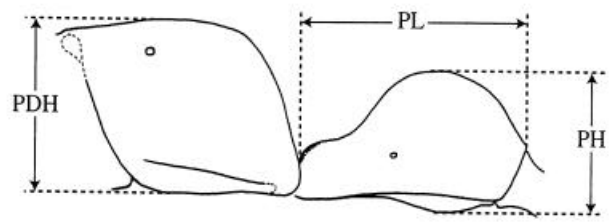
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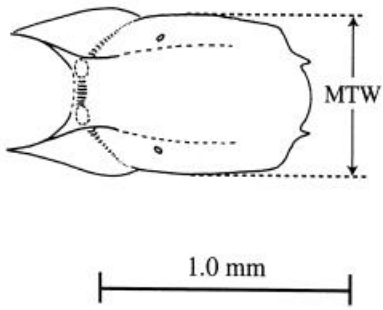
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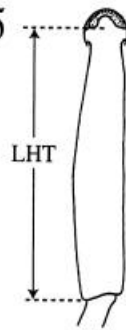
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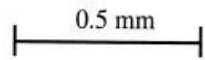
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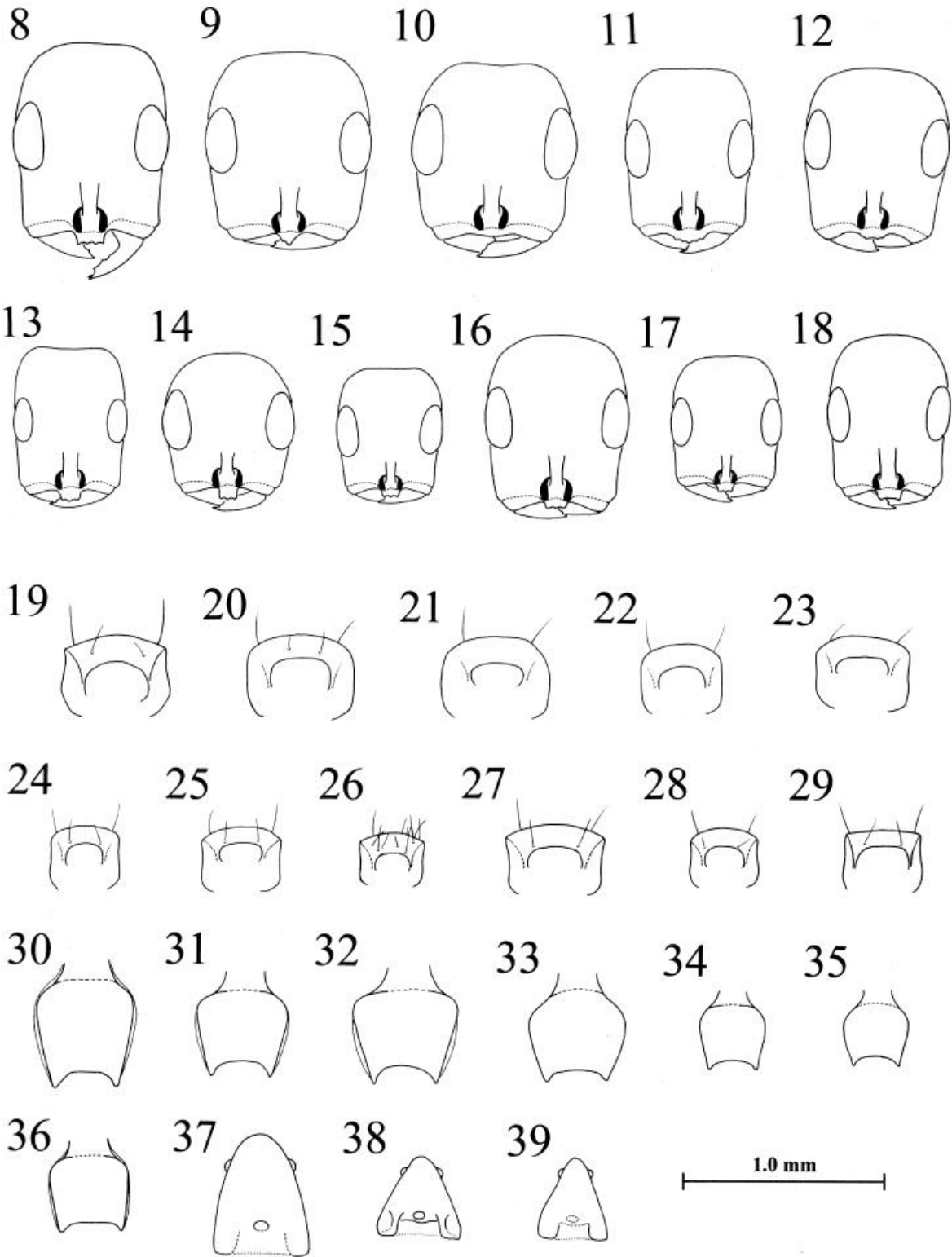


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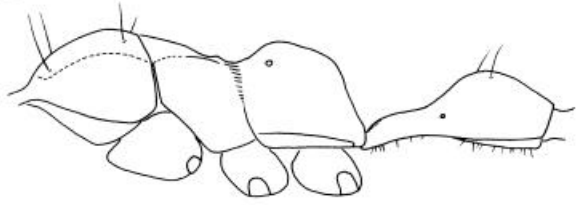


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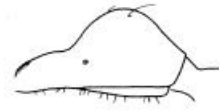
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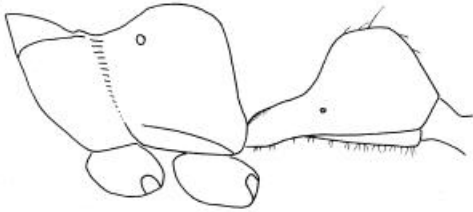
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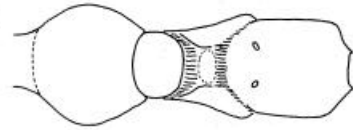
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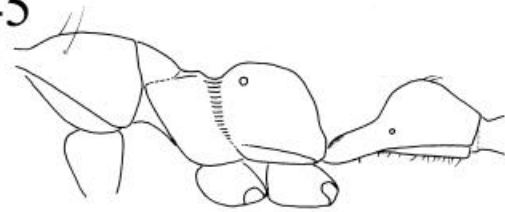
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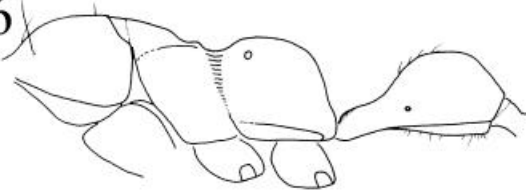
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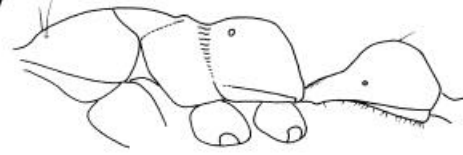
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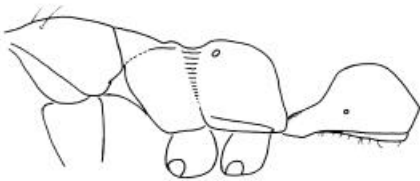
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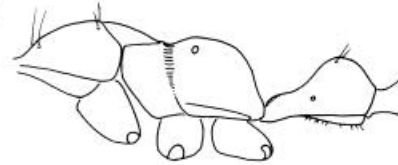
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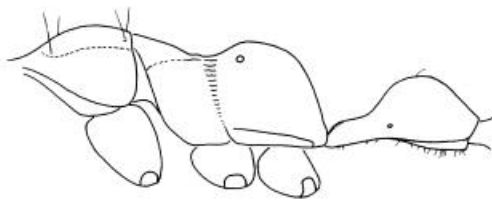
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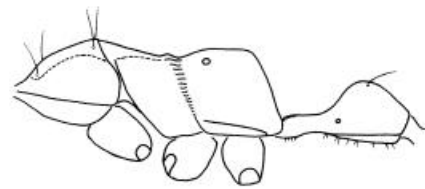
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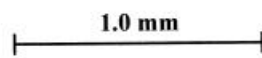
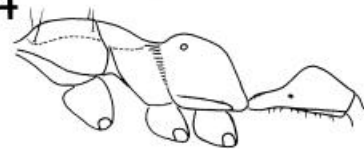
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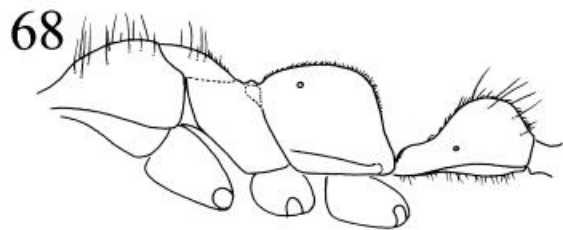
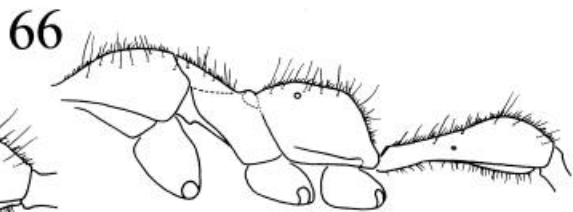
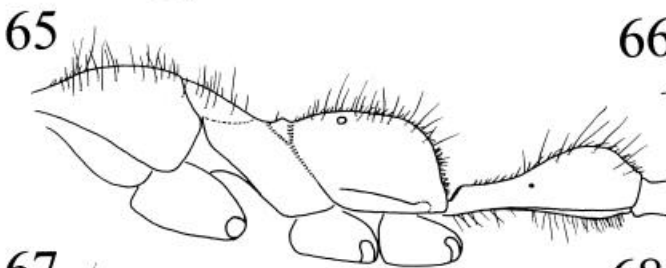
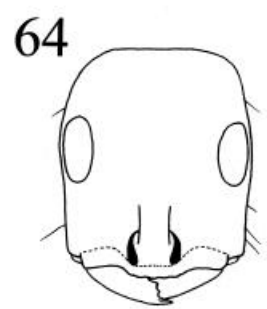
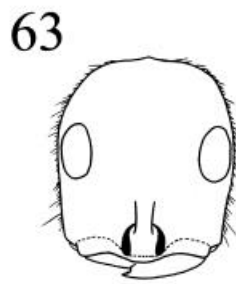
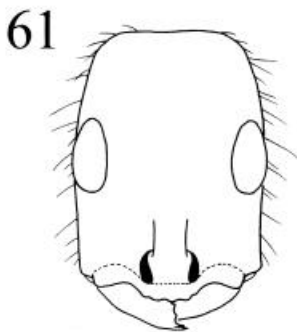
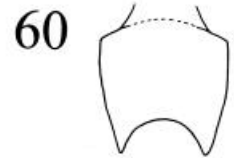
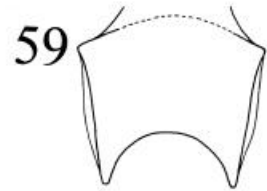
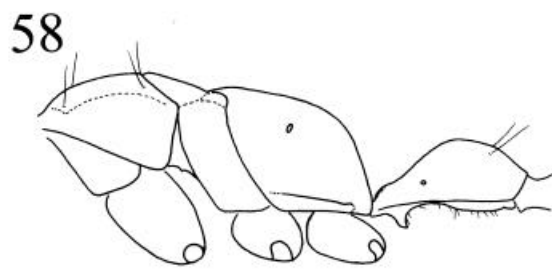
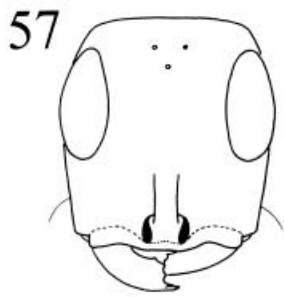
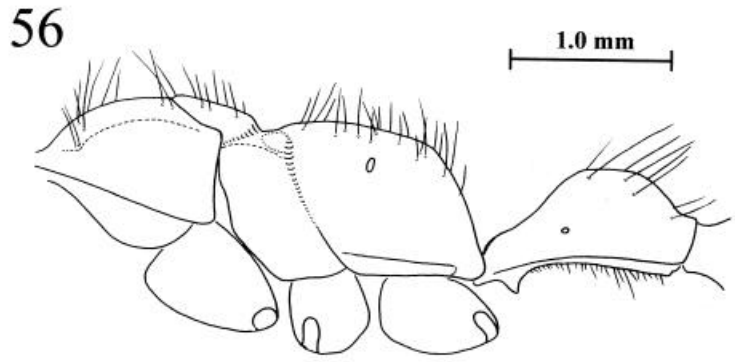
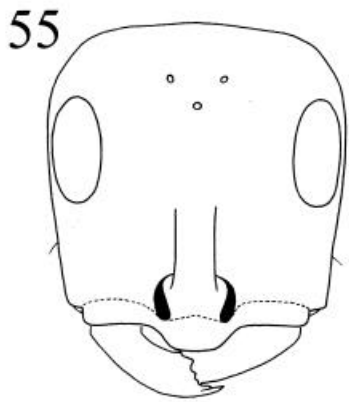


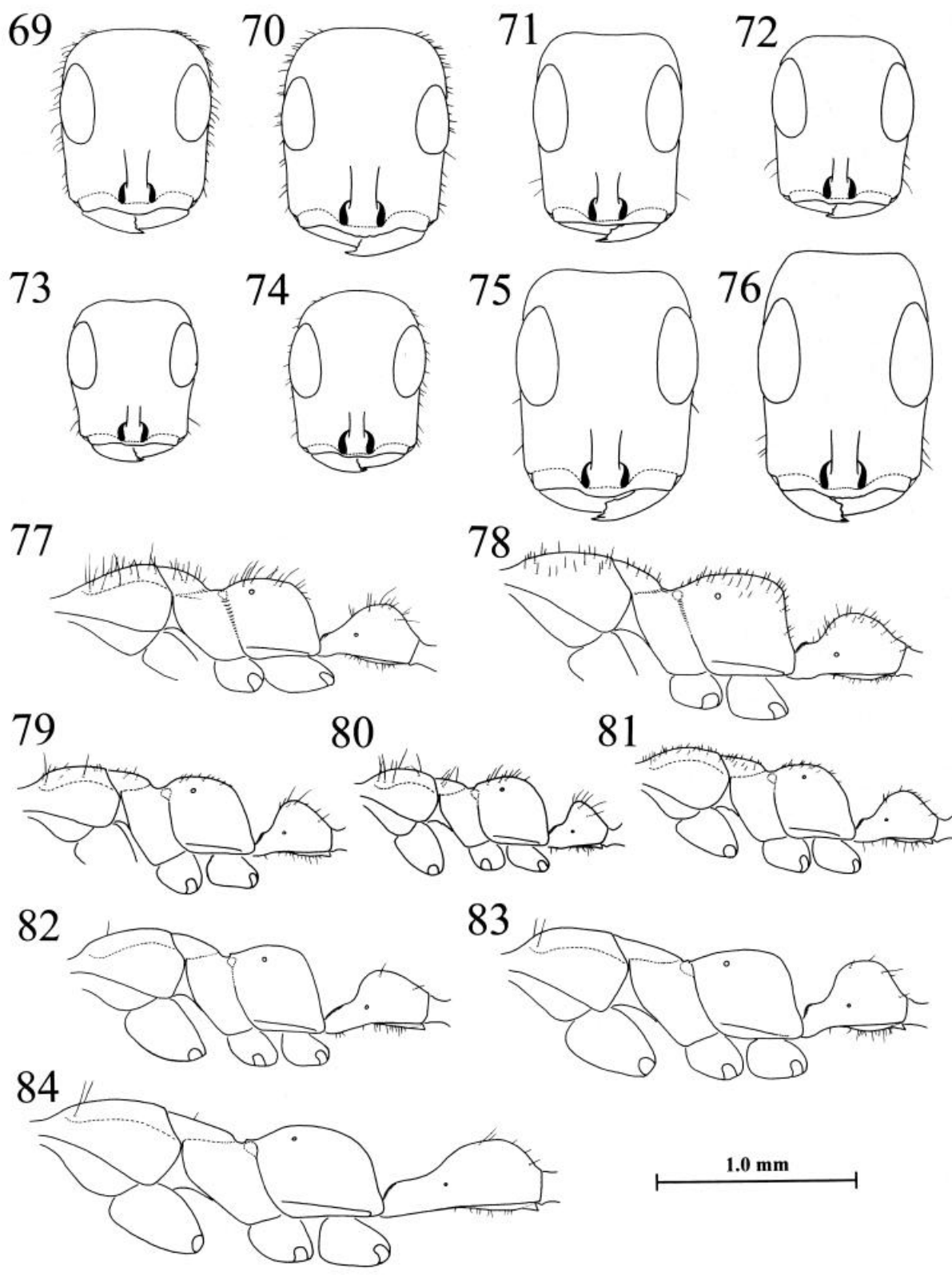
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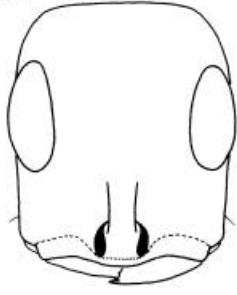
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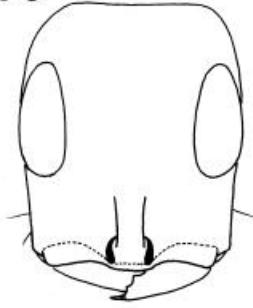




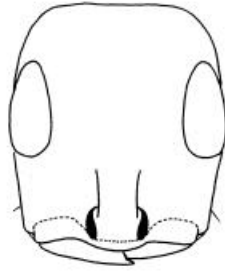
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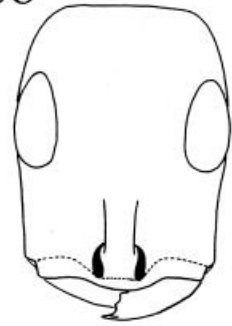
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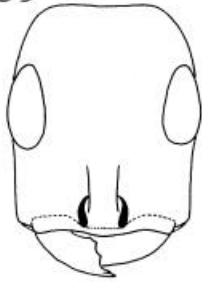
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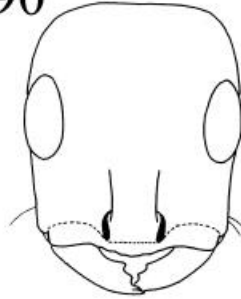
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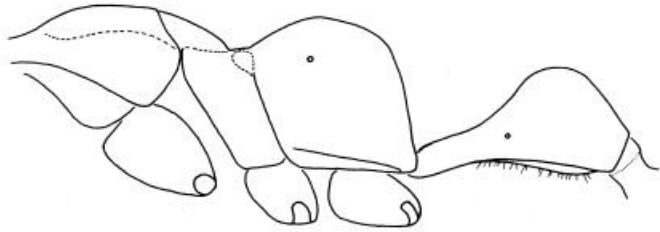
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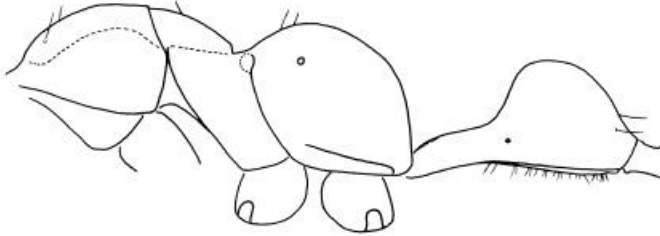
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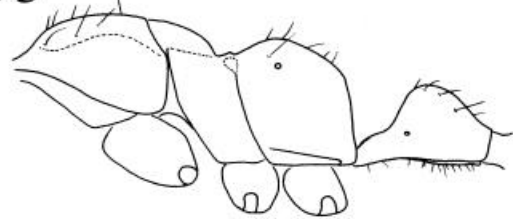
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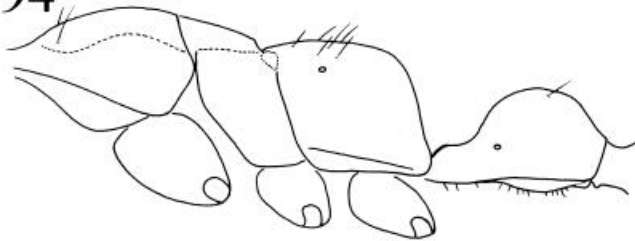
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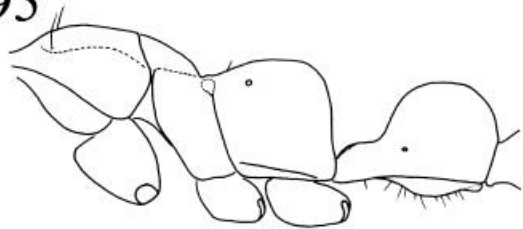
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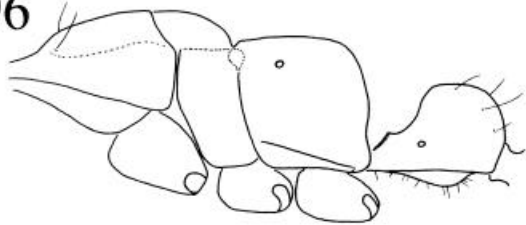
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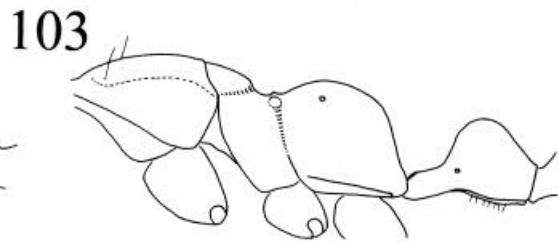
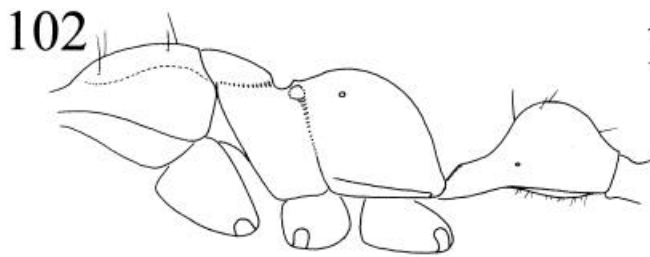
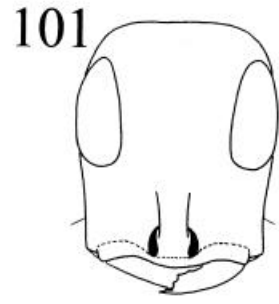
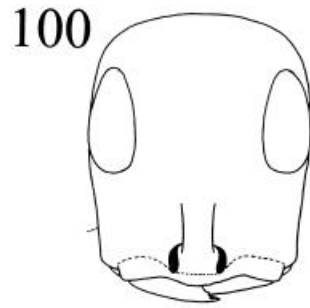
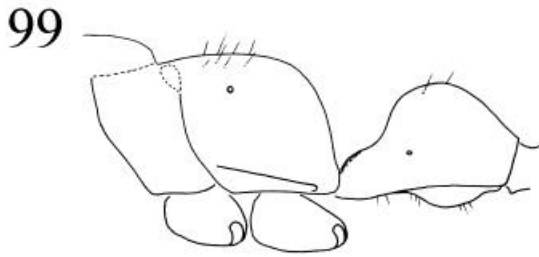
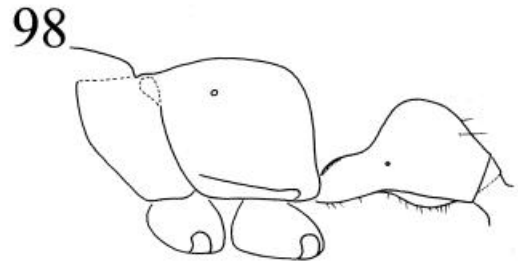
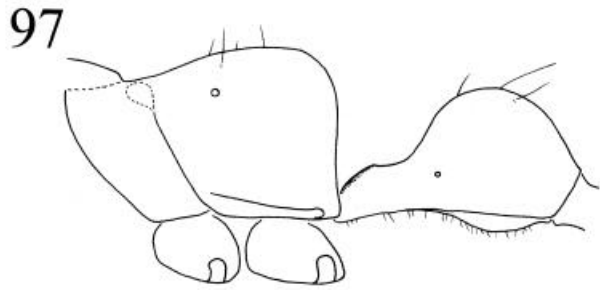
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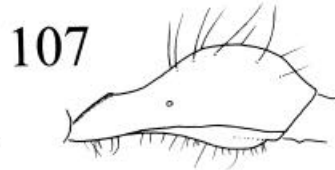
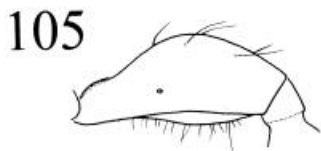
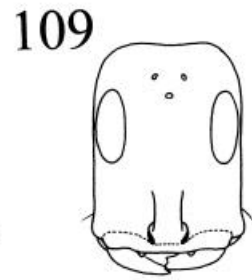
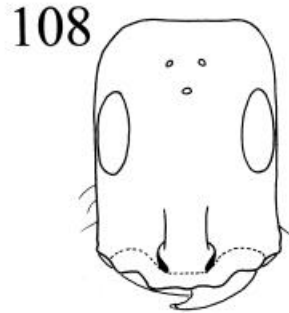
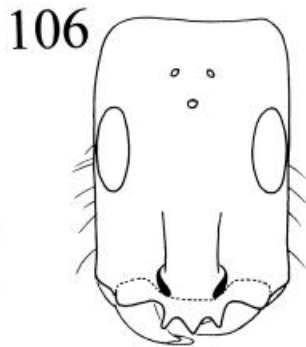
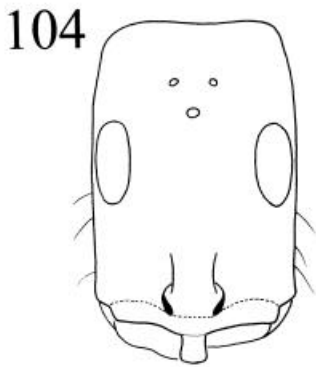
96



1.0 mm



1.0 mm



1.0 mm

