

# A NEW SPECIES OF PREDATORY MITE (ACARINA : CHEYLETIDAE) ASSOCIATED WITH BOSTRICHID BEETLES ON DRIED CASSAVA

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MORPHOLOGY  
POSTEMBRYONAL  
DEVELOPMENT  
CHEYLETIDAE

**ABSTRACT :** A new species of mite belonging to the genus *Nodele* Muma has been found on cultures of tropical bostrichid beetles (*Dinoderus* spp.) infesting dried cassava. The species, *Nodele mu* n. sp., is described from the female, heteromorphic and homomorphic males, deutonymph, protonymph and larva. The most distinctive feature of the adult is the M-shaped peritremes. The species is compared with other *Nodele* species, and a key to the females is given.

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**RÉSUMÉ :** Une nouvelle espèce d'acararien qui appartient au genre *Nodele* Muma a été découverte dans des cultures de coléoptères bostrichides tropicaux (*Dinoderus* sp.) qui infestaient le manioc séché. L'espèce, *Nodele mu* n. sp., est décrite par la femelle, le mâle hétéromorphe, le mâle homéomorphe, la deutonymphe, la protonymph et la larve. Le caractère le plus distinctif de l'adulte est le péritrème en forme de M. Une comparaison est faite avec les autres espèces de *Nodele*, et une clef des femelles est donnée.

## INTRODUCTION

During 1984, a small culture of *Dinoderus minutus* (Fabricius) (Coleoptera : Bostrichidae) was sent to ODNRI Storage Department from BIOTROP, Bogor, W. Java. The beetles were originally collected from dried tubers of *Manihot esculenta* Crantz in Indonesia and were cultured in ODNRI at 27°C and 70% r.h. on dried cassava from Tanzania. Later, a small residual population of another bostrichid, *Rhyzopertha dominica* (Fabricius), was found on the Tanzanian cassava. In January 1985, two red mites were found clinging to the elytra of a *D. minutus* adult. After all *D. minutus* adults were removed, 39 females, homomorphic and hetero-

morphic males, and deutonymphs were extracted ; *Dinoderus distinctus* Lesne were then added and the mites continued to thrive. In March 1985, the mites were found on another culture of *D. distinctus*, and protonymphs and larvae were extracted. The geographical origin of the mites is therefore in some doubt : Tanzania would seem the most likely on the evidence, but Indonesia could possibly be the source. It is very unlikely that they are of UK origin : the apparent hosts, *Dinoderus* spp., are not established here and the mites were clearly thriving in tropical culturing conditions.

The mites all belong to the uncommon genus *Nodele* Muma, 1964. When compared with the known species of *Nodele*, however, the specimens

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were found to be distinctly different and are described below as a new species.

In the description, morphological terminology mainly follows that of SUMMERS and PRICE (1970), but FAIN (1979) and SMILEY and WHITAKER (1981) were consulted for some aspects of chaetotaxy of legs and ventrum. The following abbreviations are used for the four series of dorsal idiosomal setae (see Fig. 1) : PDL, propodosomal dorsolaterals; PDM, propodosomal dorsomedians; HDL, hysterosomal dorsolaterals; and HDM, hysterosomal dorsomedians.

Measurements in microns ( $\mu\text{m}$ ) are given for the female holotype and male allotypes, and the deutonymphal, protonymphal and larval paratypes selected for the drawings : averages are given for paired structures. Means and ranges are given (in square brackets) for samples of specimens from the type series (including holotype and allotypes), as follows : 8 females, 3 heteromorphic and 4 homomorphic males, 3 deutonymphs, 3 protonymphs and 3 larvae.

#### GENUS *NODELE* MUMA, 1964

*Nodele* MUMA, 1964 : 252.

*Neocheletophyes* VOLGIN, 1965 : 296-297; WAFI and SOLIMAN, 1968 : 223.

The genus *Nodele* is defined by characters of the female, as follows. Palp claw with a dorsomedian tooth. Palp tarsus with 2 comb-like and 2 sickle-like setae. Palp tibia without mesal flange covering tibiotarsal joint. Palp femur as long as wide, or longer. Propodosomal and hysterosomal plates feebly sclerotized, with indeterminate margins. Eyes present. Dorsal body setae long, rodlike and densely barbed. With 4 or 5 pairs of dorsomedian setae, which are similar in form to dorsolaterals; 2nd propodosomal dorsomedian setae, when present, close to 1st pair. Leg I similar in length to idiosoma, or slightly shorter : leg/idiosoma ratio 0.75-1.1. All legs with paired simple claws and rayed empodia.

*Type species* : *Nodele calamondin* Muma, 1964, by original designation.

#### *NODELE MU* n. sp.

The specific name refers to the M-shaped peritremes of the adults — a form unique amongst the present members of the genus.

In life, the bodies of the adults and nymphs are red, and the legs and palps are whitish.

FEMALE (Figs. 1-6) :

Body broadly oval with moderately prominent gnathosoma. Total body length 555 [566[542-595]] ; gnathosoma 157 [160[146-169]] long ; idiosoma 408 [419[396-442]] long, and widest (290 [301[264-336]]) before legs III. Except for dorsal sculpturing, cuticle finely striate (Figs. 1-2), striae 1-2  $\mu\text{m}$  apart ; most leg and palp segments with annular striae ; leg tarsi, most of palp tibia and part of palp genu with axial striation.

Rostrum subconical, narrowing in front of superior adoral setae ; superior adorals longer (27) than inferior adorals (18). Protegmen with a broadly curved anterior margin and a triangular projection each side of the mid-line ; posterior and lateral margins in a U-shape. Tegmen with pattern of elongate punctures, coarse and dense on median anterior, very faint and small near base. Peritremes an incurved M-shape with 12-17 (usually 13-14) links each side ; first 4 (sometimes 3) pairs of links form U-shaped ascending arms ; lateral descending arms with 7-11 (usually 8-9) links each side ; last 1 or 2 links point transversely inward. Maximal width across peritremes 81 [81[78-84]], maximal length 78 [78[68-83]].

Ventrum of gnathosoma with a pair of very long (126) flagelliform setae on basis capitulum.

Palps moderately robust, 157 [155[145-162]] from base of trochanter to claw apex (Fig. 6). Tarsus with 2 sickle-like setae (outer 57, inner 49) and 2 comb-like setae : outer comb 50 long, with 15-19 (usually 17-18) teeth, inner comb 37 long, with 20-22 teeth. Tibial claw 42 [43[39-45]] long, with a small truncate dorsomesal tooth at 25 [25[23-27]] from claw apex. Tibia without anterior dorsomesal flange ; 3 acicular tibial setae, the dorsomesal one with a few fine serrations. Genu with a rodlike

barbed dorsal seta, 71 [73[67-77]] long. Femur longer (65 [65[61-68]]) than wide (45 [47[43-52]]), with dorsolateral (38 long) and dorsal (100 [100[95-106]] long) rodlike barbed setae, and 2 slender acicular ventral setae.

Dorsum with propodosomal and hysterosomal plates incompletely separated at sides (Fig. 1), covered with pattern of short lines, mainly longitudinal, but transverse in posterolateral 1/4 of propodosomal plate and anterior 1/8 of hysterosomal

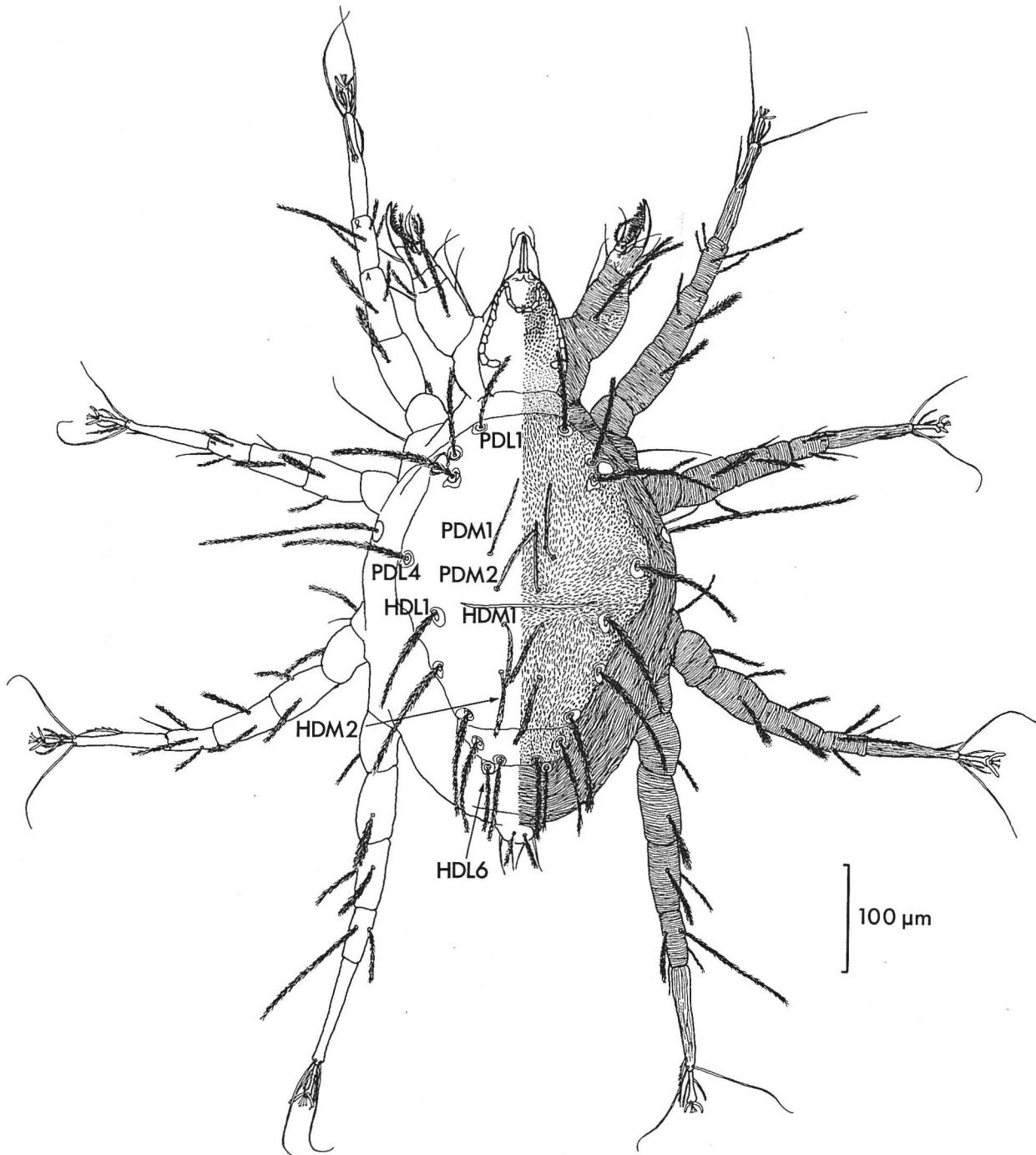


FIG. 1 : Dorsum of female *Nodel mu* n. sp. (holotype).

plate, irregular and merging with striation at margins. Propodosomal plate 176 [181[173-197]] long, 235 [232[218-258]] wide; hysterosomal plate 146 [160[146-168]] long, 186 [199[186-222]] wide.

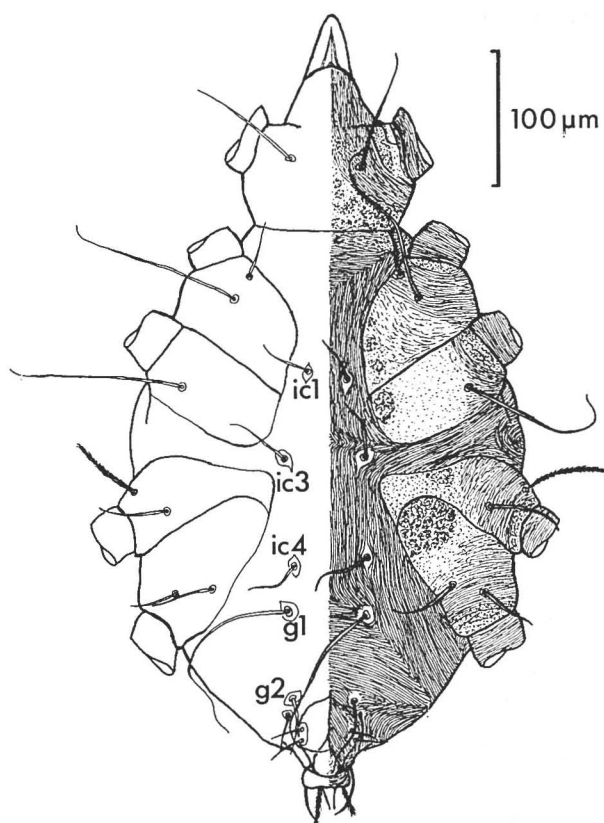


FIG. 2 : Ventrum of idiosoma and gnathosoma (legs and palps omitted) of female *Nodele mu* n. sp. (paratype).

Eyes of maximum diameter 18; interocular distance 138 [136[130-142]].

Idiosoma with 15 pairs of rodlike barbed dorsal setae: the 4 dorsomedians (PDM1-2, HDM1-2) less robust, and less densely and sharply barbed, than the 10 dorsolaterals (PDL1-4, HDL1-6) and 1 humeral. PDL1 70 [69[61-74]], PDL2 80 [78[69-83]], PDL3 114 [112[103-122]] and PDL4 111 [108[98-120]] long. PDM1 72 [69[61-77]] and PDM2 66 [64[50-70]] long; PDM1 only 32 [30[23-35]] from PDM2. Humeral setae 171 [167[139-185]] long, on small platelets. HDL1 101 [96[83-108]], HDL2 116 [110[96-118]], HDL3 94 [98[88-114]], HDL4 87 [82[72-90]], HDL5 75 [72[64-79]] and HDL6 63 [60[48-67]] long. HDL5 closer together (33 [31[26-38]]) than HDL6 (52 [56[48-62]]). HDM1 65 [63[53-68]] and HDM2

62 [61[52-67]] long; HDM1 reaching only 2/3-3/4 of distance (88 [92[87-101]]) to base of HDL3.

Ventrum (Figs. 2 and 5) with 3 pairs of intercoxal setae (ic1, ic3, ic4), 2 setae on coxae I, III and IV, 1 seta on coxa II, and 5 pairs of genital setae. Coxal seta II and posterior coxal seta I longer than others; anterior coxal seta III barbed and rodlike, others acicular and smooth. g1 very long; g2 longer than g3, g4 and g5. 3 pairs of anal setae (Fig. 4): a1 acicular, smooth; a2 longer, acicular, sparsely serrate; a3 rodlike, barbed, 35 [35[30-38]] long, clearly visible in dorsal view.

Legs with paired simple claws and rayed empodia. Leg lengths: I 336 [322[294-337]], II 288 [284[263-300]], III 333 [325[308-349]], IV 366 [360[334-373]]; leg/idiosoma ratios: I 0.83, II 0.71, III 0.83, IV 0.91. Tarsal lengths (including pretarsus): I 131 [125[119-131]], II 114 [112[102-116]], III 127 [123[118-128]], IV 138 [135[127-140]]. Numbers of setae and solenidia (in brackets) for legs I-IV: trochanters 1-1-2-1; femora 2-2-2-1; genua 2(1)-2-2-2; tibiae 5(1)-4(1)-4-4; tarsi 9(1)-7(1)-7-7. Setae on trochanters, femora and genua densely barbed, mostly rodlike but some either subclavate or tapering; anterior dorsolateral seta of genu II smooth and acicular. Ventral seta on tibiae I, III and IV, and both ventral setae on tibia II, acicular, smooth or sparsely serrate; other tibial setae densely barbed, mainly rodlike; dorsomedian seta on tibia I long (82), on tibia IV very long (124). Azygos seta of tarsus I (Fig. 3) and ventral (v) seta of all tarsi acicular, robust and coarsely serrate; both addorsal setae of all tarsi long and slender, equal to or longer than body of tarsus; guard seta on tarsus I fine and short [13[11-19]], arising from base of papilla bearing omega. Omega of tarsus I 38 [38[32-42]] long, 56 [53[48-56]] from base of tarsus, and almost reaching tarsal apex; omega of tarsus II also a tapering rod but ventral and shorter; phi of tibia I very short and stoutly clavate; sigma of genu I and phi of tibia II very short, narrow, peg-like.

#### HETEROMORPHIC MALE (Figs. 7-12) :

Body more broadly oval (almost round) than female, with very prominent gnathosoma (Fig. 7).

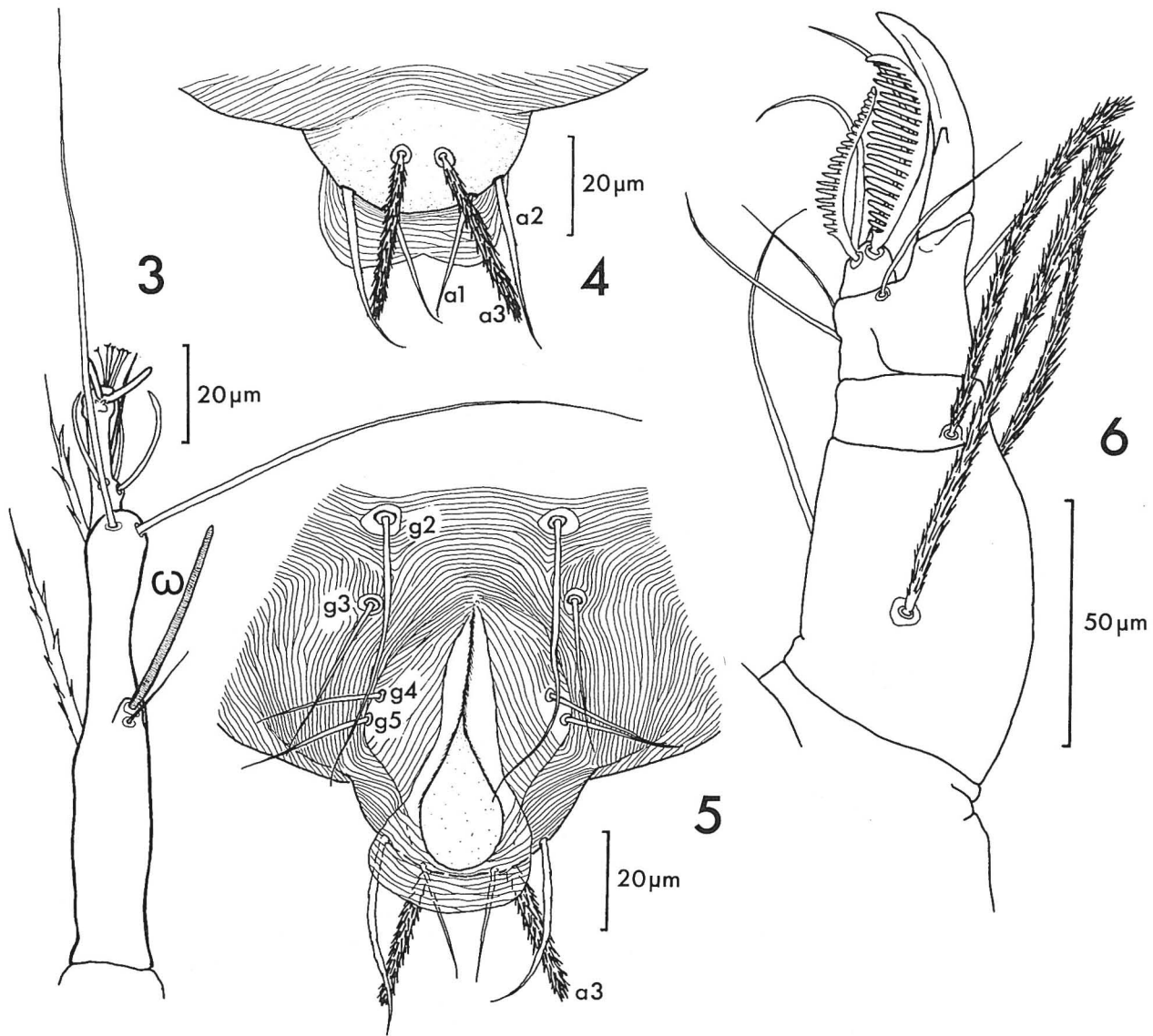


FIG. 3-6 : Female *Nodele mu* n. sp. : (3) dorsal view of right tarsus I (paratype); (4) dorsal detail of anal region (holotype); (5) ventral detail of genito-anal region, not including g1 setae (paratype); (6) dorsal view of right palp (paratype).

Body length 500 [496[492-500]]; gnathosoma 206 [211[206-218]] long; idiosoma 311 [310[306-312]] long, max. width 241 [233[229-241]]. Cuticular striation as in female, except for details of genito-anal region.

Rostrum with superior adoral setae longer (37) than inferior adorals (28). Protegmen narrowly domed, posterior margin strongly sinuous. Tegmen narrow, elongate. Dorsum with pattern of fine and coarse punctures, very faint and small towards

base. Peritremes a rounded M-shape with 14-15 (occasionally 13) links each side; first 2 pairs of links form small U-shaped ascending arms; descending arms with initial 1 or 2 links oblique, remainder parallel; last 1 or 2 links turning slightly inward. Peritreme shape much narrower and more parallel than that of female: max. width 44 [43[43-44]], max. length 77 [78[77-79]].

Ventrum of gnathosoma with a pair of very long (133) flagelliform setae on basis capitulum.

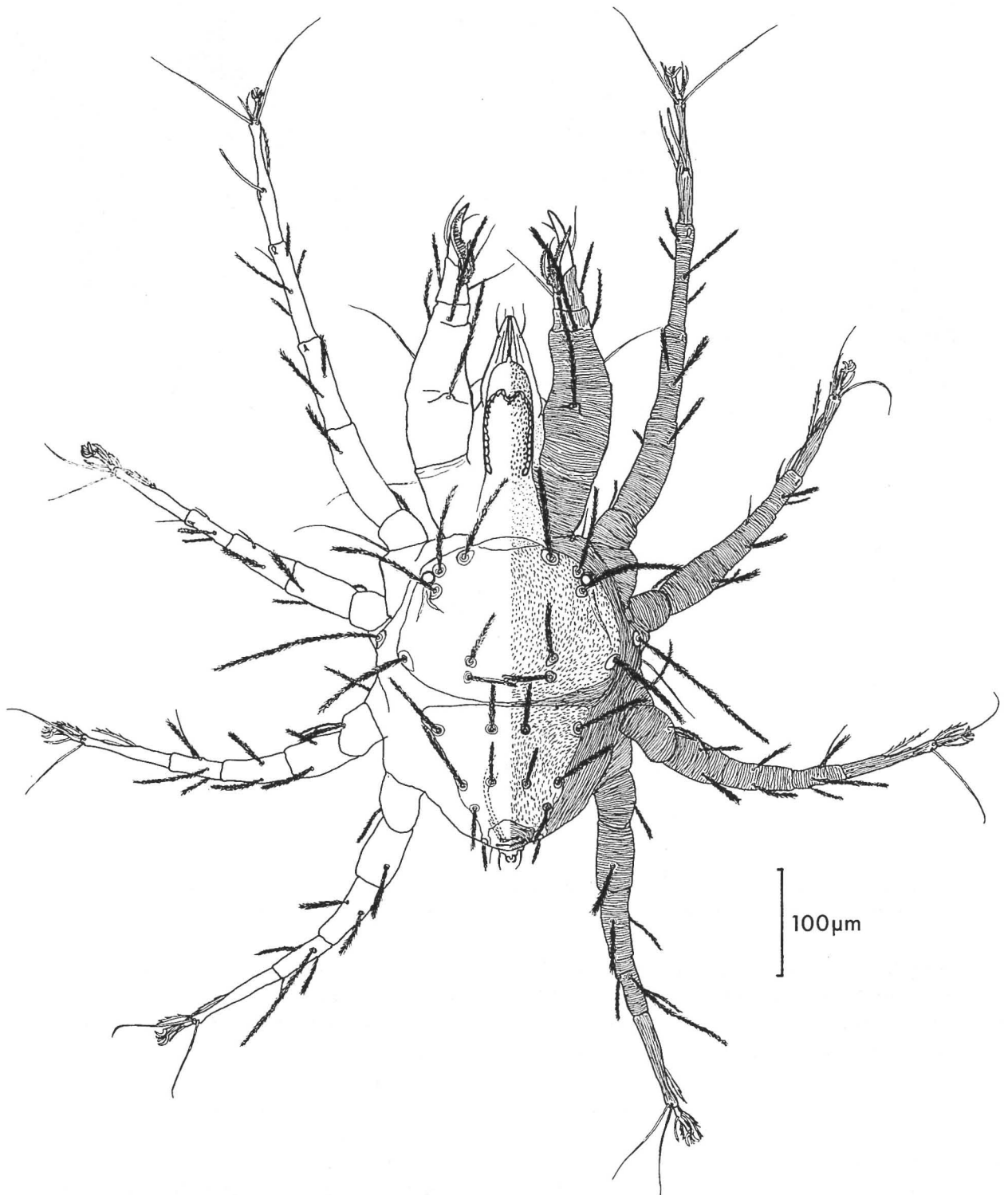
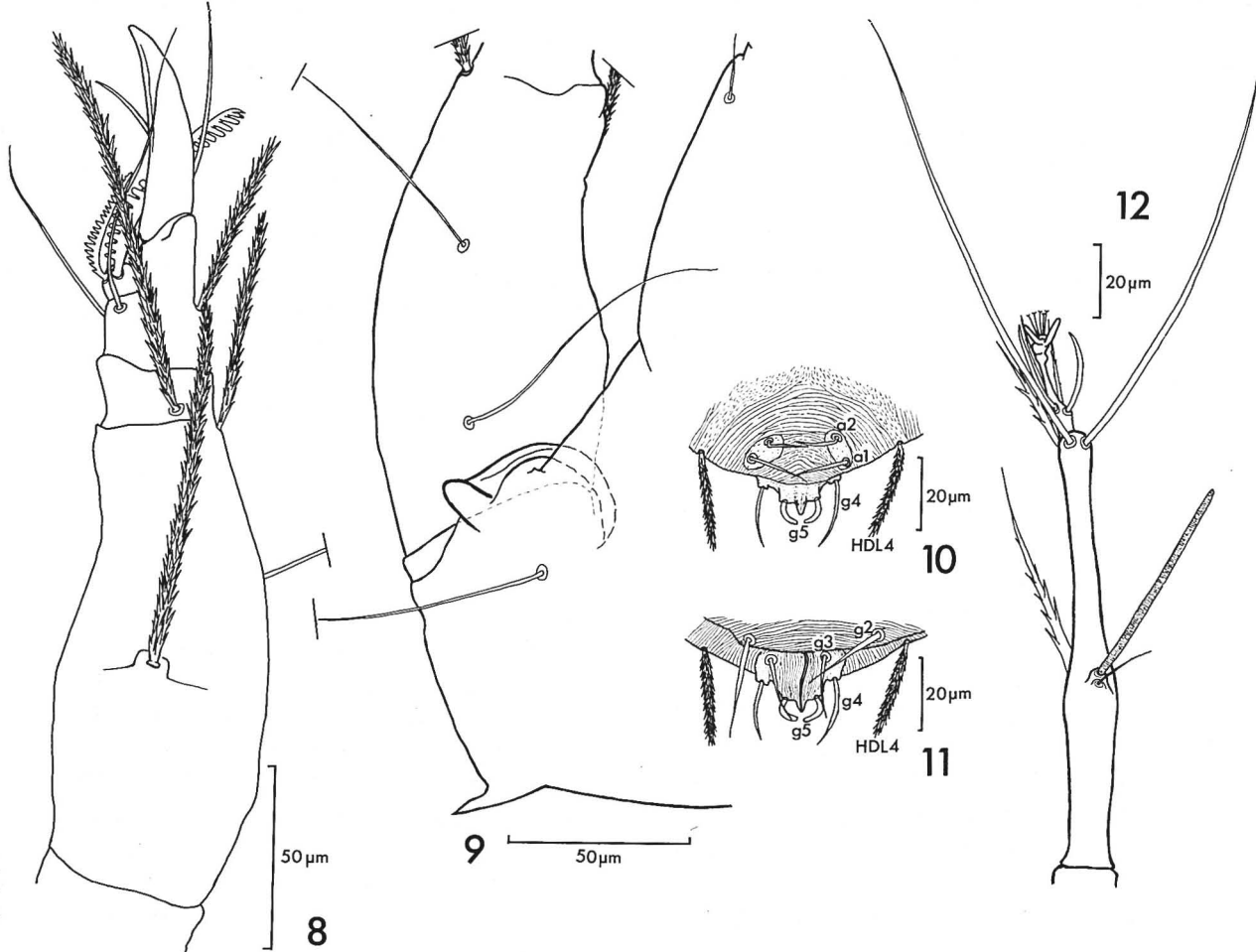


FIG. 7 : Dorsum of heteromorphic male *Nodele mu n. sp.* (allotype).



FIGS 8-12 : Heteromorph male *Nodele mu* n. sp. : (8) dorsal view of right palp (paratype); (9) ventral view of right palpfemur and basis capitulum (allotype); (10) dorsal detail of anal region, including 4th hysterosomal dorsolateral setae (allotype); (11) ventral detail of genito-anal region, including 4th hysterosomal dorsolateral setae (allotype); (12) dorsal view of right tarsus I (paratype).

Palps very prominent, 261 [264[256-274]] long from base of trochanter (Fig. 8). Outer comb of tarsus 60 long, with 21 teeth; inner comb 32 long, with 15-17 teeth; tarsus also with 2 sickle-like setae. Tibial claw 52 [52[51-53]] long, without mesal tooth. Tibia with smooth acicular dorsomesal and ventromesal setae, and with a barbed external lateral seta 50 long. Genu with a rodlike barbed dorsal seta, 107 [106[104-108]] long. Femur 133 [134[130-138]] long, 64 [63[59-65]] wide, with dorso-lateral (59 long) and dorsal (103 [110[101-124]] long) rodlike barbed setae, and 2 slender acicular ventral setae. Ventrum of trochanteral articulation (Fig. 9) partly covered by a curved double flange

projecting forward from the basis capitulum, with a lateral stout toothlike projection.

Dorsum with propodosomal and hysterosomal plates widely separated at sides (Fig. 7) and with pattern as in female. Propodosomal plate 146 [141[138-146]] long, 202 [197[192-202]] wide, more transverse than in female; hysterosomal plate 126 [123[120-126]] long, 154 [148[142-154]] wide.

Eyes of diameter 11; interocular distance 136 [132[129-136]].

Idiosoma with 13 pairs of rodlike barbed dorsal setae (HDL5 and HDL6 lacking) : PDM2 and HDM2 less robust and less barbed than others. PDL1 82 [84[80-85]], PDL2 82 [88[81-95]], PDL3



102 [102[98-107]] and PDL4 93 [94[89-100]] long. PDM1 53 [54[51-55]] and PDM2 45 [44[43-46]] long; PDM1 only 15 [16[13-21]] from PDM2. Humeral setae 157 [160[157-168]] long, on indistinct platelets. HDL1 70 [69[65-76]], HDL2 70 [66[62-72]], HDL3 41 [38[35-41]] and HDL4 26 [24[20-26]] long. HDM1 48 [49[47-50]] and HDM2 34 [31[25-35]] long; HDM1 close (22) to anterior of hysterosomal plate, but HDM2 47 [49[46-55]] behind HDM1.

Ventrum of idiosoma with intercoxal and coxal setae as in female. With 5 pairs of genital setae (Fig. 11) : g1 very long; g1, g2 and g3 smooth acicular; g4 and g5 on papillae, g4 acicular with a few very fine serrations, g5 stout, blunt and strongly curved. With 2 pairs of short acicular anal setae set on a pair of small indistinct platelets (Fig. 10); a3 lacking.

Leg pretarsi as in female. Leg lengths : I 460 [460[452-464]], II 314 [318[310-327]], III 324 [327[318-334]], IV 359 [356[346-360]]; leg/idiosoma ratios : I 1.58, II 1.07, III 1.11, IV 1.23. Tarsal lengths : I 146 [148[146-152]], II 114 [118[113-122]], III 122 [122[120-124]], IV 126 [130[126-133]]. Numbers of setae and solenidia as in female, except for the presence of solenidion omega on tarsus III of the male. Anterior dorsolateral seta of genu II with a swollen base. Dorsomedian seta of tibia IV very long (112). Addorsal setae of tarsi nearly as long as body of tarsus (Fig. 12); guard seta on tarsus I short (18-25 in paratypes). Omega of tarsus I 54 [59[52-64]] long, 53 [53[52-54]] from base of tarsus, and nearly reaching tarsal apex; omega of tarsi II and III also tapering rods but ventral and shorter; phi of tibia I very short and stoutly clavate; sigma of genu I and phi of tibia II very short, narrow, slightly clavate.

#### HOMOMORPHIC MALE (Figs. 13-15) :

Body oval, as in female, with prominent gnathosoma (Fig. 13). Body length 430 [423[414-431]]; gnathosoma 167 [159[151-167]] long; idiosoma 292 [291[285-293]] long, max. width 210 [215[205-228]]. Cuticular striation as in heteromorphic male.

Rostrum with superior adoral setae longer (29) than inferior adorals (20). Tegmen domed, almost semicircular, with a pair of anterior triangular

projections and a sinuous posterior margin. Tegmen narrower and more parallel than in female, less elongate than in heteromorph. Dorsal pattern as in heteromorph. Peritremes a rounded M-shape with 14-16 (occasionally 13) links each side; first 3 or 4 pairs form a shallow cusp; 10-13 links in descending arms parallel to sides of tegmen except for 1-2 terminal links that turn inward. Peritreme shape narrower and more parallel than in female, less narrow and elongate than in heteromorph : max. width 51 [52[49-56]], max. length 66 [62[60-66]].

Ventrum of gnathosoma with a pair of long (105) flagelliform setae on the basis capitulum.

Palps (Fig. 14) 180 [172[158-182]] long from base of trochanter. Outer comb of tarsus 44 long, with 16-17 (occasionally 18-19) teeth; inner comb 29 long, with 17-18 (occasionally 15-16) teeth; tarsus also with 2 sickle-like setae. Tibia as in heteromorph, but claw length 44 [43[40-44]] and barbed seta 39 long. Rodlike barbed dorsal seta of genu 81 [78[70-84]] long. Femur 85 [80[73-85]] long, 50 [46[41-50]] wide, with setae as in heteromorph : dorsolateral 37 long, dorsal 98 [93[89-98]] long. Internal third of trochanteral articulation (Fig. 15) covered ventrally by a short straight flange from the basis capitulum, with a stout toothlike projection : flange and tooth less conspicuous than in heteromorph.

Dorsum with propodosomal and hysterosomal plates clearly separated (Fig. 13) and with pattern as in female. Propodosomal plate 147 [137[126-147]] long, 163 [170[163-179]] wide; hysterosomal plate 102 [103[100-107]] long, 113 [120[113-127]] wide.

Eyes of diameter 12; interocular distance 106 [109[106-112]].

Idiosoma with 13 pairs of dorsal setae (HDL5 and HDL6 lacking) as in heteromorph. PDL1 67 [65[58-70]], PDL2 75 [74[68-81]], PDL3 86 [86[80-92]] and PDL4 81 [80[75-84]] long. PDM1 49 [44[33-50]] and PDM2 42 [37[31-43]] long; PDM1 only 16 [14[11-18]] from PDM2. Humeral setae 140 [139[132-145]] long, on indistinct platelets. HDL1 72 [67[58-72]], HDL2 67 [59[50-68]], HDL3 37 [33[30-38]] and HDL4 25 [23[18-25]] long. HDM1 49 [41[32-49]] and HDM2 31 [29[25-31]] long;



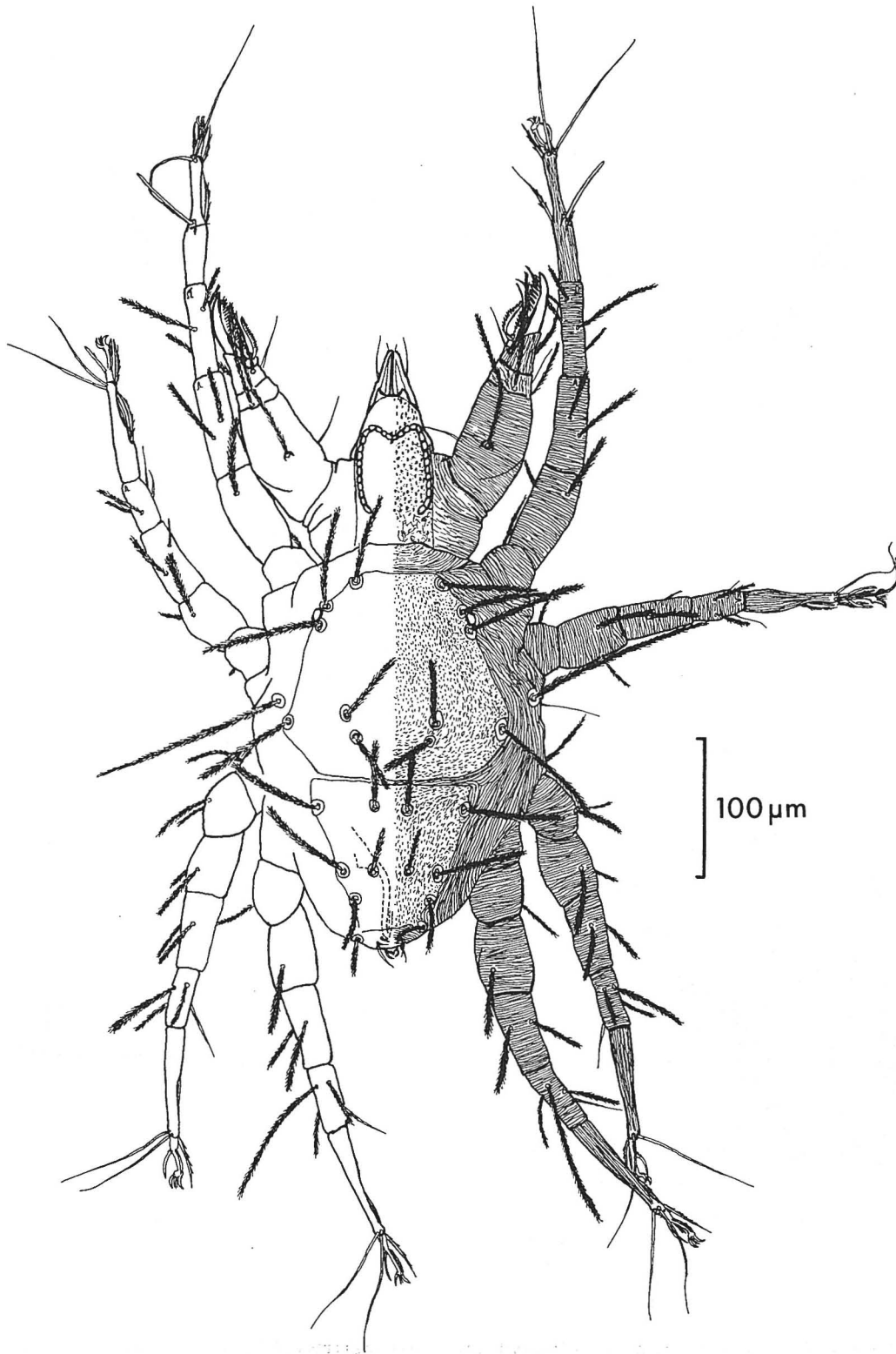
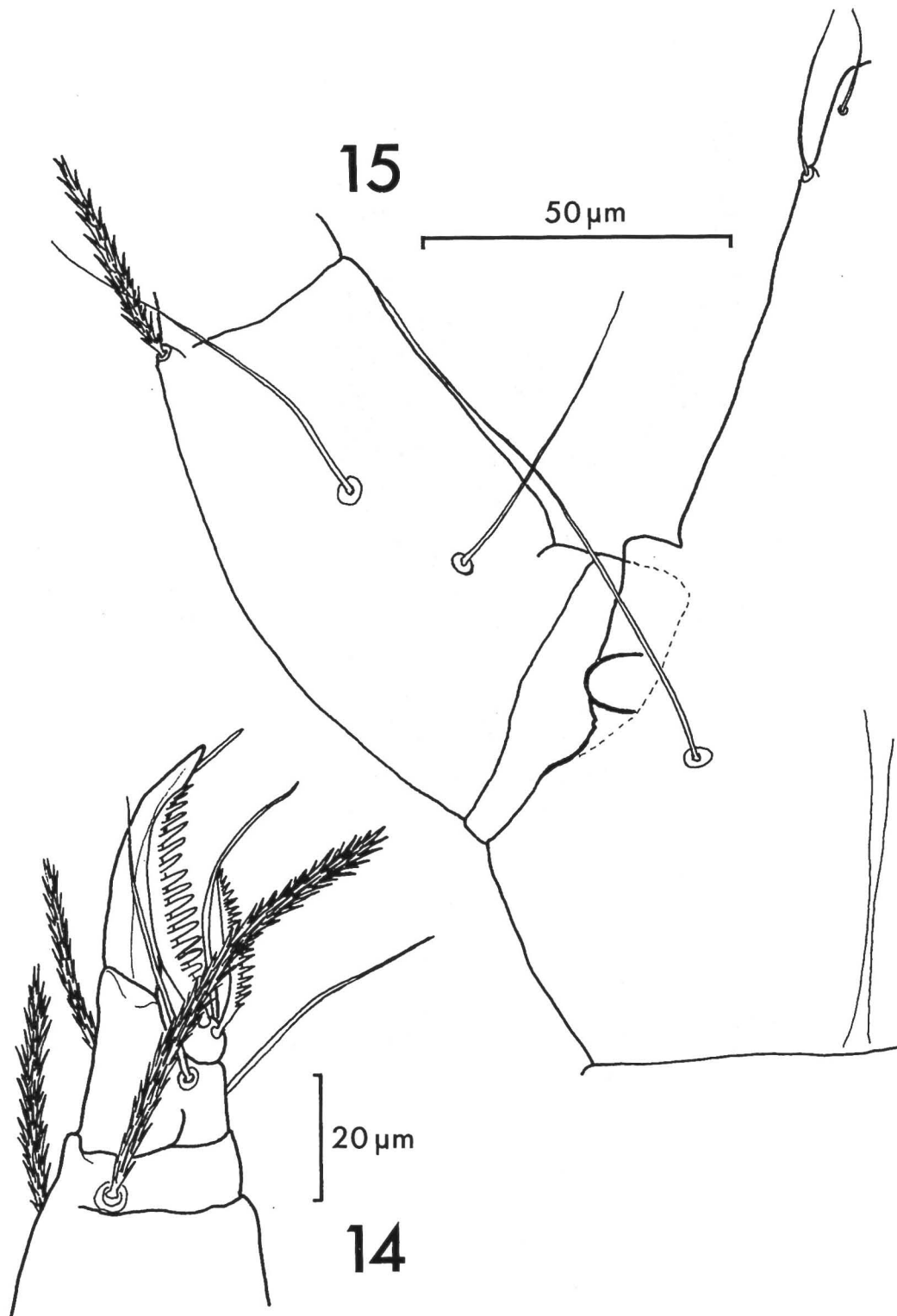


FIG. 13 : Dorsum of homomorphic male *Nodele mu n. sp.* (allotype).



FIGS. 14-15 : Homomorphic male *Nodele mu* n. sp. : (14) dorsal view of distal segments of left palp (paratype) ; (15) ventral view of right palpfemur and basis capitulum (allotype).

HDM1 close (23) to anterior of hysterosomal plate, but HDM2 44 [43[36-51]] behind HDM1.

Ventrum of idiosoma, including genito-anal region, as in heteromorph.

Leg pretarsi as in female. Leg lengths : I 346 [341[330-348]], II 263 [262[259-266]], III 288 [284[276-294]], IV 317 [304[292-317]] ; leg/idiosoma ratios : I 1.27, II 0.97, III 1.06, IV 1.17. Tarsal lengths : I 125 [123[120-125]], II 107 [102[97-107]], III 115 [113[108-115]], IV 122 [119[115-122]]. Numbers of setae and solenidia as in heteromorph. Dorsomedian seta of tibia IV long (102). Addorsal setae of tarsi nearly as long as body of tarsus ; guard seta on tarsus I short [17[16-17]]. Omega of tarsus I 52 [48[43-53]] long, 48 [47[46-49]] from base of tarsus, and reaching bases of addorsals near tarsal apex. Other solenidia as in heteromorph.

DEUTONYMPH (Fig. 16) :

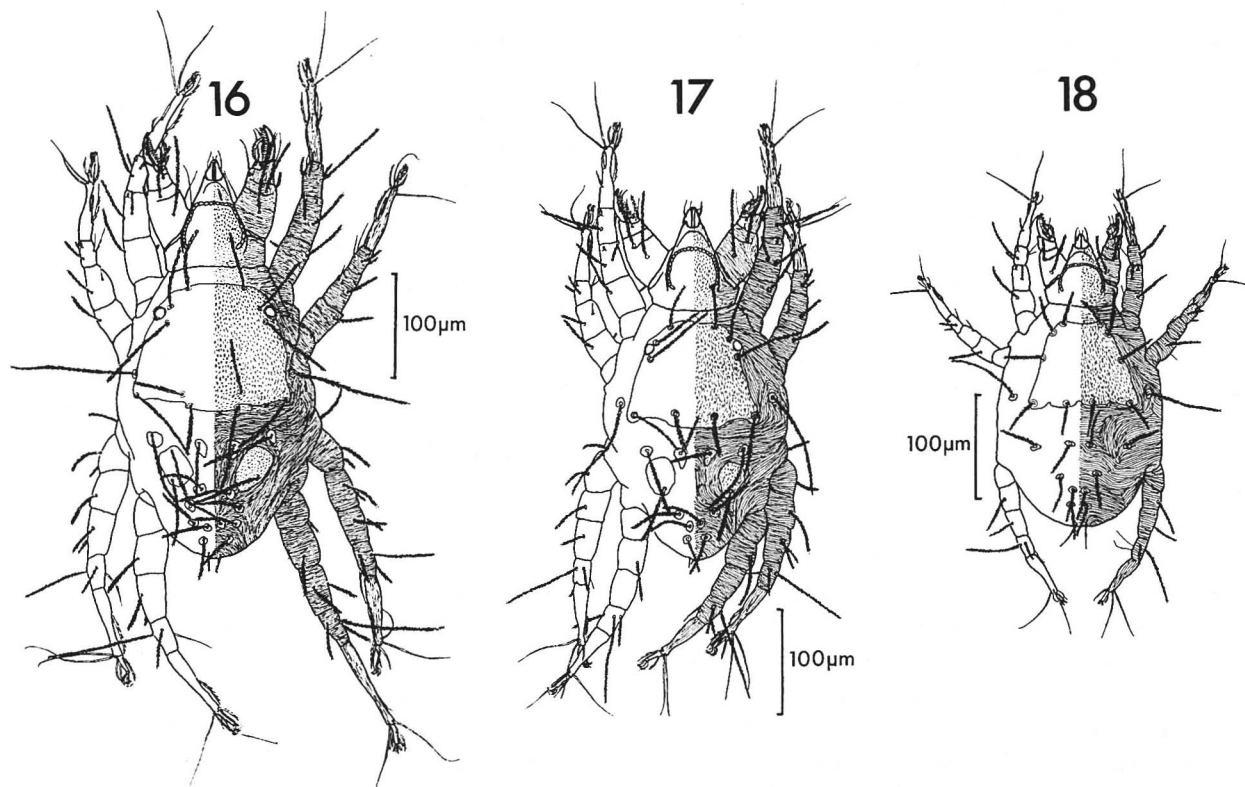
Body length 385 [433[385-480]] ; gnathosoma 114 [119[114-121]] long ; idiosoma variable, depending

on dilation of hysterosoma, length 277 [316[277-359]], widest (191 [227[191-271]]) before legs III.

Rostrum with superior adoral setae 19 and inferiors 14 long. Protegmen with a domed anterior margin and a strong triangular anterior projection each side. Tegmen wider, posteriorly, than long. Dorsal pattern as in female. Peritremes lacking M-shape of adults ; 12-16 (usually 13-14) links each side ; first 3-4 pairs form a straight anterior line ; 9-12 (usually 10-11) links in descending arms, last link pointing obliquely inward. Max. width across peritremes 65 [67[65-70]], max. length 49 [50[49-50]].

Ventrum of gnathosoma with a pair of long (80) flagelliform setae on the basis capitulum.

Palps 113 [118[112-122]] long from base of trochanter. Outer sickle of tarsus slightly longer than inner ; outer comb with 14-17 (usually 16-17) teeth, 1/3 longer than inner comb with 18-20 (occasionally 17) teeth. Tibial claw 33 [33[32-34]] long, with a dorsomesal tooth at 19 [19[18-20]] from claw apex. All 3 tibial setae acicular and



FIGS. 16-18 : Dorsal views of immature stages of *Nodele mu n. sp.* (paratypes) : (16) deutonymph ; (17) protonymph ; (18) larva.

smooth. Rodlike barbed dorsal seta of genu 53 [55[52-60]] long. Femur stout, 43 [46[43-48]] long, 42 [44[42-47]] wide, with setae as in female : dorsolateral 22 long, moderately barbed, tapering, and dorsal 79 [82[79-85]] long.

Propodosomal plate trapezoidal, 129 [134[129-144]] long, 151 [156[151-161]] wide, truncate behind PDL4, with a slight posteromedian projection bearing PDM2, and with pattern as in female. Hysterosoma with a pair of minor plates bearing HDL2, and 7 pairs of small platelets bearing the other hysterosomal dorsal setae.

Eyes of diameter 9; interocular distance 94 [97[94-101]].

Idiosoma with 15 pairs of dorsal setae as in female : dorsomedians as robust and densely barbed as dorsolaterals. PDL1 53 [55[53-58]], PDL2 57 [63[56-68]], PDL3 81 [83[77-85]] and PDL4 72 [77[70-83]] long. PDM1 52 [56[50-61]] and PDM2 49 [50[48-55]] long; PDM1 only 13 [15[12-16]] from PDM2; PDM2 on margin of plate. Humeral setae 126 [135[123-144]] long, on indistinct platelets. HDL1 74 [79[72-84]], HDL2 68 [73[65-78]], HDL3 59 [63[58-69]], HDL4 44 [47[43-51]], HDL5 44 [50[42-54]] and HDL6 38 [39[37-42]] long. HDL5 closer together (12 [13[12-14]]) than HDL6 (24 [23[22-24]]). HDM1 52 [57[49-61]] and HDM2 47 [53[46-61]] long.

Ventrum of idiosoma with intercoxal and coxal setae as in female. With 3 pairs of smooth acicular genital setae; g1 long, flagelliform; g2 longer than g3, which is just in front of the anus. With 3 pairs of anal setae; a1 smooth acicular; a2 sparsely serrate, acicular, stouter; a3 rodlike, barbed, short (17 [17[16-18]]), visible in dorsal view.

Leg pretarsi as in female. Leg lengths : I 238 [244[234-248]], II 209 [214[208-223]], III 242 [248 [240-253]], IV 252 [261[251-272]]; leg/idiosoma ratios : I 0.86, II 0.75, III 0.87, IV 0.91. Tarsal lengths : I 101 [101[100-101]], II 88 [89[88-91]], III 99 [99[97-102]], IV 102 [104[100-107]]. Numbers of setae and solenidia as in female. Dorsomedian seta of tibia IV long (103). Guard seta on tarsus I on separate papilla proximal to omega, 16 [17[16-19]] long, reaching base of omega, with sparse coarse serrations. Omega of tarsus I 18 [18[18-19]] long, 48 [51[47-58]] from base of tarsus; omega of tarsus II similar,

17 long, distal to base of ventral (v) seta; other solenidia as in female.

#### PROTONYMPH (Fig. 17) :

Body length 340 [329[321-340]]; gnathosoma 102 [99[97-102]] long; idiosoma 247 [239[232-247]] long, widest (178 [171[165-178]]) in front of legs III.

Rostrum with superior adoral setae 19 and inferiors 13 long. Anterior angles of tegmen more rounded than in deutonymph. Peritremes with 13-16 links each side; first 5-6 (occasionally 4) pairs form a slightly curved anterior line; 9-10 (occasionally 8) links in descending arms, last link pointing obliquely inward. Max. width across peritremes 54 [54[54-55]], max. length 40 [39[38-40]].

Ventrum of gnathosoma with a pair of long (70) flagelliform setae on the basis capitulum.

Palps 103 [98[95-103]] long from base of trochanter. Tarsal outer comb with 13-14 teeth, inner with 15-16. Tibial claw 28 [27[26-28]] long, with a dorsomesal tooth at 17 [16[15-17]] from claw apex. Barbed dorsal seta of genu 46 [44[42-46]] long. Femur stout, 39 [37[35-39]] long and wide; with a barbed dorsal seta 66 [65[58-67]] long; without a dorsolateral seta; with only one long acicular ventral seta.

Propodosomal plate 103 [104[102-107]] long, 125 [122[119-125]] wide. Hysterosoma with a pair of minor plates bearing HDL2, and 5 pairs of small platelets bearing the other hysterosomal dorsal setae.

Eyes of max. diameter 9; interocular distance 78 [76[74-78]].

Idiosoma with 12 pairs of dorsal setae (PDM2, HDL4 and HDM2 lacking) : dorsomedians densely barbed, slightly more robust than dorsolaterals. PDL1 43 [43[40-46]], PDL2 50 [51[49-53]], PDL3 68 [63[58-68]] and PDL4 59 [54[49-59]] long. PDM1 42 [43[41-48]] long, close to posterior margin of plate. Humeral setae 105 [98[91-106]] long, tapering. Pattern and lengths of hysterosomal setae indicate that HDL4 is missing. HDL1 67 [59[50-68]], HDL2 53 [52[48-55]], HDL3 51 [46[40-52]], HDL5 40 [40[36-43]] and HDL6 34 [32[27-36]] long. HDL5 closer together (12 [11[10-12]]) than HDL6 (17 [14[11-17]]). HDM1 45 [42[36-45]] long.

Ventrum of idiosoma with no seta on coxa IV, intercoxal and coxal setae otherwise as in female. No genital setae. With 3 pairs of smooth or very slightly serrate acicular anal setae; a3 only 10 [10[9-12]] long but visible in dorsal view.

Leg lengths : I 205 [197[185-205]], II 170 [167 [163-170]], III 206 [203[194-206]], IV 197 [193[186-198]]; leg/idiosoma ratios : I 0.83, II 0.69, III 0.83, IV 0.80. Tarsal lengths : I 84 [80[76-84]], II 72 [68[65-72]], III 79 [78[74-79]], IV 78 [75[71-78]]. Numbers of setae and solenidia (in brackets) for legs I-IV : trochanters 0-0-1-0; femora 2-2-1-1; genua 2(1)-2-2-0; tibiae 4(1)-4(1)-4-4; tarsi 8(1)-7(1)-7-5. Dorsomedian seta of tibia IV long (86). Guard seta on tarsus I as in deutonymph, 16 [16[15-17]] long. Omega of tarsus I 14 [14[12-16]] long, 41 [39[37-41]] from base of tarsus; omega of tarsus II 14 long, ventral; phi of tibiae I and II and sigma of genu I, as in female.

#### LARVA (Fig. 18) :

Body length 287 [289[283-301]]; gnathosoma 73 [76[73-78]] long; idiosoma 214 [219[214-229]] long, widest (158 [155[152-158]]) just before legs III.

Rostrum with superior adoral setae 14 and inferiors 11 long. Protegmen and tegmen as in protonymph, except both areas more transverse and anterior projections of protegmen slightly more prominent. Peritremes with 13-15 (occasionally 16) links each side; first 4-6 pairs form a slightly curved line; 8-10 links in descending arms, last link pointing slightly inward. Max. width across peritremes 44 [44[43-44]], max. length 29 [30[29-31]].

Ventrum of gnathosoma with no setae on basis capitulum.

Palps 74 [75[73-77]] long from base of trochanter. Tarsal outer comb with 13-14 (occasionally 12) teeth, inner with 15-16. Tibial claw 20 [22[20-23]] long, with a mesal tooth at 12 [12[12-13]] from claw apex. Barbed dorsal seta of genu 25 [26[23-29]] long. Femur very stout, 22 [25[23-26]] long, 30 [32[30-35]] wide; with a barbed dorsal seta 39 [41[38-44]] long; without dorsolateral or ventral setae.

Propodosomal plate 83 [88[83-90]] long, 98 [102 [98-104]] wide; without eyes. Hysterosoma with

5 pairs of small platelets bearing the hysterosomal dorsal setae.

Idiosoma with 11 pairs of setae (PDM2, HDL3, HDL4 and HDM2 lacking) : dorsomedians and dorsolaterals equally robust and barbed. PDL1 34 [37[33-41]], PDL2 38 [41[37-44]], PDL3 40 [42[40-45]] and PDL4 37 [39[36-41]] long. PDM1 35 [37[34-40]] long, on posterior margin of plate. Humeral setae 74 [80[73-86]] long, tapering. Pattern of hysterosomal setae indicates that missing setae are HDL3 and HDL4. HDL1 37 [40[36-42]], HDL2 36 [39[35-42]], HDL5 37 [39[34-43]] and HDL6 35 [37[35-38]] long. HDL5 closer together (10 [10[10-11]]) than HDL6 (17 [19[17-21]]). HDM1 35 [37[34-40]] long.

Ventrum of idiosoma with 2 pairs of intercoxal setae (ic1, ic3) and 1 pair of coxal setae (on coxa I). No genital setae. With 3 pairs of smooth acicular anal setae, very small, a3 7 [7[6-7]] long. With a pair of bluntly serrate postanal setae, 27 long, often visible in dorsal view.

Leg lengths : I 136 [144[134-150]], II 120 [126 [120-131]], III 151 [163 [150-174]]; leg/idiosoma ratios : I 0.64, II 0.56, III 0.70. Tarsal lengths : I 57 [62[55-65]], II 50 [53[49-56]], III 60 [63[59-66]]. Numbers of setae and solenidia (in brackets) for legs I-III : trochanters 0-0-0; femora 2-2-1; genua 1(1)-1-1; tibiae 4(1)-4(1)-4; tarsi 7(1)-5(1)-5. Both ventral setae of tibiae I, II and III, ventral seta of femora I and II, and anterior dorsolateral seta of genu II, are smooth and acicular; other setae of these segments are rodlike or tapering, moderately to densely barbed. Ventral (v) seta of tarsus I and addorsal setae of tarsi as in female. Dorsomedian seta of tibia III long (63). Guard seta of tarsus I with a few serrations, 11 [12[11-13]] long, not reaching base of omega. Omega of tarsus I 10 [10[10-11]] long, 32 [34[31-36]] from base of tarsus, not reaching bases of addorsal setae; omega of II 13 long, ventral; phi of tibiae I and II, and sigma of genu I, as in female.

TYPE MATERIAL : The holotype female, allotype heteromorphic male, allotype homomorphic male and a selection of paratypes of all life stages will be deposited at the British Museum (Natural History).

COMPARISON WITH OTHER *NODELE* SPECIES

The females of five known species of the genus *Nodele* — *N. philippinensis* (Baker), *N. calamondin* Muma, *N. coccineae* Thewke and Enns, *N. simplex* Wafa and Soliman, and *N. superba* Kuznetsov — were described by BAKER (1949), MUMA (1964), THEWKE and ENNS (1968), Wafa and SOLIMAN (1968), and KUZNETSOV (1977), respectively. *N. philippinensis* and *N. calamondin* were redescribed and included in keys to cheyletid females by VOLGIN (1969) and SUMMERS and PRICE (1970): the latter also included *N. coccineae* and *N. simplex* in their key. The male of *N. coccineae* was also described by THEWKE and ENNS (1968), and the immatures, though not the male, of *N. simplex* were later described by MOHAMED and SOLIMAN (1983). Comparison of *N. mu* with these known species will therefore be restricted to the females.

*Nodele mu* resembles *N. philippinensis* and *N. coccineae* in having on tarsus I a slender guard seta that arises from the same papilla as solenidion omega and is about half as long as the solenidion. In *N. calamondin* and *N. simplex* the guard seta is longer than the solenidion, and in *N. superba* it is absent according to the original description of KUZNETSOV (1977). Specimens from Cairo were identified as *N. philippinensis* by ELBADRY (1968), who described and figured their guard setae as barbed and longer than the solenidion. BAKER's (1949) original description of this species and the holotype redescription by SUMMERS and PRICE (1970) clearly define the guard seta of *N. philippinensis* as short and slender; the Cairo specimens must therefore be a different species, possibly *N. simplex*.

*Nodele mu* can be distinguished from all other *Nodele* species by four distinctive characteristics, as follows. *N. mu* has four pairs of dorsomedian setae, two on each plate, whereas other species have three pairs on the hysterosoma and usually two (one in *N. superba*) on the propodosoma. In *N. mu* the first pair of dorsomedians on the hysterosoma are short, only just reaching the bases of the second dorsomedians and failing to reach the second dorsolaterals; in the other species these setae are longer, reaching

or nearly reaching the third dorsolaterals, or reaching the fifth dorsolaterals. The number of links in the peritreme of *N. mu* (12-17) is high; descriptions and redescrptions of the other species refer to 3, 5, 6, 7, 8 or 9 links. The most distinctive feature of *N. mu* is the M-shape of its peritremes: the peritremes of other *Nodele* species are a simple shape, either a flattened semicircle or a broad arc.

KEY TO FEMALES OF *NODELE*

1. — Peritremes M-shaped with acute anterior flexures, each peritreme with many (12-17) links; only 2 pairs of dorsomedian hysterosomal setae, 1st pair short, just reaching 2nd pair ..... *mu* n. sp.  
     — Peritremes a simple curved shape without anterior flexures, each peritreme with fewer (3-9) links; 3 pairs of dorsomedian setae on hysterosoma, 1st pair long or very long, reaching 3rd or 5th pairs of dorsolaterals ..... 2
2. — Peritremes a broad arc, with 3 pairs of links; 1st dorsomedian setae of hysterosoma very long, reaching 5th dorsolaterals ..... 3  
     — Peritremes almost semicircular, with more (5-9) pairs of links; 1st dorsomedian setae of hysterosoma not so long, reaching 3rd dorsolaterals... 4
3. — Five pairs of dorsomedian setae (2 pairs on propodosoma); guard seta on tarsus I small but present ..... *coccineae* Thewke & Enns  
     — Four pairs of dorsomedian setae (only 1 pair on propodosoma); guard seta absent from tarsus I ..... *superba* Kuznetsov
4. — Guard seta on tarsus I short, less than half length of solenidion omega; guard seta and solenidion on same papilla ..... *philippinensis* (Baker)  
     — Guard seta on tarsus I about twice as long as solenidion omega; guard seta and solenidion on separate papillae ..... 5
5. — Guard seta on tarsus I smooth ..... *calamondin* Muma  
     — Guard seta on tarsus I barbed ..... *simplex* Wafa and Soliman

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