

TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION. PART XII – THE GENERA *BOOPHILUS* *CURTICE*, 1891 AND *MARGAROPUS* *KARSCH*, 1879

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Minning (1934) revised the genus *Boophilus* and created a number of subgenera, species and subspecies. Anastos (1950) and Hoogstraal (1956) reduced this multiplicity of forms to three species, belonging to the one genus *Boophilus*, *B. annulatus* (Say, 1821), *B. decoloratus* (Koch, 1844) and *B. microplus* (Canestrini, 1887). Two new species have been described subsequently, *B. kohlsi* Hoogstraal & Kaiser, 1960, and *B. geigyi* Aeschlimann & Morel 1965.

The closely related genus *Margaropus* consists of two species, *M. winthemi* Karsch, 1879, and *M. reidi* Hoogstraal, 1956.

In the Republic of South Africa *Boophilus* is represented by *B. decoloratus* and *B. microplus* (= *B. fallax* of South African authors) and *Margaropus* by *M. winthemi*. Their distribution has been studied by Theiler (1949), Theiler & Salisbury (1958) and Gothe (1967).

In this article the descriptions of all stages of the three species, of material derived from South Africa, are brought up to date, the immature stages of *M. winthemi* being described for the first time.

BOOPHILUS DECOLORATUS

Male

Dorsal surface of the body: Small, straw-yellowish in colour, averaging 2.7 mm by 1.6 mm, with numerous white hairs, arranged in definite areas.

Conscutum: Widest about midlength, from 1.56 mm to 1.76 mm; the length, measured from the middle of the emargination to the posterior margin, ranges from 2.45 mm to 2.5 mm. It is yellow to pale brown; broadly rounded behind, then narrowing from about midlength to the strong scapulae. The cervical grooves are shallow, diverging posteriorly and reaching beyond eye-level. The punctations are moderate to large and shallow, distributed fairly uniformly. In line with the cervical grooves and at midlength there is a pair of short shallow and oval depressions. The posterior lateral grooves are short, wide, deep and convergent; the posterior median groove is long, narrow, deep and straight, reaching almost to scutal midlength. Grooves without hairs. The emargination is deep, well defined, ending in strong subtriangular scapulae. The eyes are yellow, small, flat and inconspicuous, situated at level of the anterior margin of coxa II.

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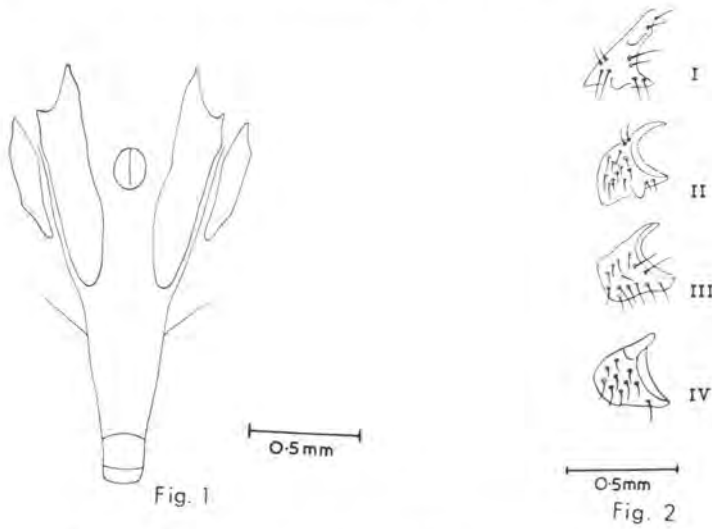


FIG. 1.—*B. decoloratus*: Adanal and accessory anal plates

FIG. 2.—*B. decoloratus*: Male: Coxae I-IV

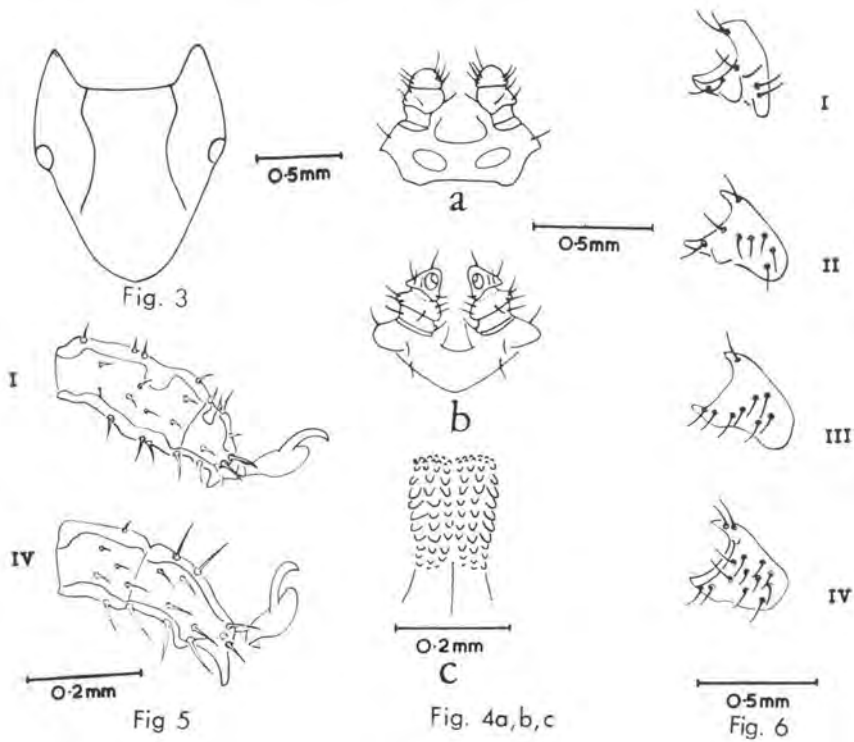


Fig. 3

a

b

c

Fig 5

Fig. 4a,b,c

Fig. 6

Rostrum: *Sub-collare* wide and longer than in the female, well developed. The *basis capituli*, measured from the base of the hypostome to the posterior margin is 0·182 mm to 0·202 mm long and from 0·460 mm to 0·520 mm wide. Dorsal surface hexagonal, antero-lateral margins shorter than postero-lateral margins, posterior margin almost straight with small cornua, approximately twice as broad as long, depressed and flat at the centre and slightly elevated at the sides, bearing numerous long white hairs.

Palpi short, from 0·175 mm to 0·185 mm in length. *Article II* from 0·091 mm to 0·101 mm in length and from 0·110 to 0·120 mm in width, measured about midlength. *Article III* from 0·059 mm to 0·069 mm in length and from 0·105 mm to 0·115 mm in width measured at posterior margin. Article III overlaps article II and article II overlaps article I slightly. Dorsally article II with distinct spur mesio-distally. Ventrally segments I to III show a retrograde spur. The inner margin of the palpal segment I has a bristle-bearing protuberance.

Hypostome from 0·175 mm to 0·185 mm in length, dentition 3/3, usually seven teeth per file.

Legs: Beaded, becoming progressively stouter (antero-posteriorly) and bearing numerous hairs dorsally, ventrally and laterally.

Tarsus I short, from 0·340 mm to 0·360 mm in length, tapering fairly rapidly towards rounded apex, with small subapical spur. Insertion of pulvillus apical. *Tarsus IV* somewhat shorter, from 0·320 mm to 0·340 mm in length, tapering gradually towards rounded apex, with two retrograde subapical spurs, insertion of pulvillus apical.

Ventral surface of the body (Fig. 1): *Genital opening* triangular, situated at level of coxa II and covered with a genital operculum. *Adanal plates*, reaching beyond posterior margin, elongate, with a longer internal spur and a shorter external spur, giving a concave posterior margin, punctate with setae. The *accessory anal plates* are shorter, isosceles-triangular in shape, bear setae and are punctate, ending in a sharp spur. Posterior margin with long caudal appendage. *Anal groove* obsolete.

Coxae (Fig. 2): *Coxa I* triangular, ending antero-distally in a long narrow projection, posteriorly with a long pointed internal and somewhat broader external spur, overlapping the posterior margin. *Coxa II* rectangular, with broad external spur, overlapping posterior margin. *Coxa III* similar to coxa II, with spur broader. *Coxa IV* rectangular, without spur.

Spiracular plate nearly circular.

Female

Dorsal surface of the body: Engorged specimens bluish, up to 11·2 mm in length and 7·2 mm in width.

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- ← FIG. 3.—*B. decoloratus*: Female: Scutum
 FIG. 4a.—*B. decoloratus*: Female: Rostrum, dorsal surface
 FIG. 4b.—*B. decoloratus*: Female: Rostrum, ventral surface
 FIG. 4c.—*B. decoloratus*: Female: Hypostome
 FIG. 5.—*B. decoloratus*: Female: Tarsus I and IV
 FIG. 6.—*B. decoloratus*: Female: Coxae I–IV

TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION

Scutum (Fig. 3): Widest at eye-level, from 0·900 mm to 1·15 mm. The length measured from the middle of the emargination to the posterior margin ranges from 1·1 mm to 1·2 mm. The antero-lateral margins are slightly convergent or almost parallel, the postero-lateral margins are sinuous, the posterior margin narrowly rounded. The cervical grooves are broad, shallow and long, convergent anteriorly and divergent posteriorly, reaching the postero-lateral margins. The emargination is well defined, broad, ending in strong scapulae, which are almost straight laterally and broadly concave mesially. *Eyes* are oval and slightly bulging.

The *alloscutum* is finely striated, without punctations, bearing numerous white hairs. Postero-median groove and postero-lateral grooves long, reaching to anterior third.

Rostrum (Fig. 4a, b, c): *Subcollare* wide and short, not well developed.

The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0·180 mm to 0·200 mm long and from 0·498 mm to 0·608 mm wide. Dorsal surface hexagonal, antero-lateral margins shorter than postero-lateral margins. The *areae porosae* are elongate oval and of moderate size, widely separated and divergent. The posterior margin is almost straight, with small cornua.

Palpi short, from 0·240 mm to 0·260 mm. *Article II* from 0·110 mm to 0·120 mm in length and from 0·120 mm to 0·140 mm in width, measured at level of mid-length. *Article III* from 0·090 mm to 0·1 mm in length and from 0·112 mm to 0·120 mm in width, measured at posterior margin. *Article III* overlaps *article II* and *article II* overlaps *article I*. Dorsally *article II* with a small spur mesio-distally. Ventrally in segments I to III the posterior internal angle is thickened. The inner margin of segment I has a bristle-bearing protuberance.

Hypostome from 0·220 mm to 0·240 mm in length, dentition 3/3 with seven to ten teeth per file.

Legs (Fig. 5): Beaded, not as stout as in the male, pale yellow in colour.

Tarsus I short, from 0·420 mm to 0·440 mm in length, tapering rapidly towards rounded apex, with ventral subapical spur. Insertion of pulvillus apical. *Tarsus IV* short, from 0·370 mm to 0·380 mm, tapering fairly gradually towards rounded apex, with two ventral retrograde subapical spurs. Insertion of pulvillus apical.

Ventral surface of the body: *Genital opening* situated at level of coxa II, from whence the genital grooves run subparallel beyond the level of coxa IV, then diverge but do not reach the posterior margin.

Anal groove: Obsolete.

Coxae (Fig. 6): *Coxa I* triangular, with long broadly rounded internal and somewhat shorter external spur, separated by a narrow, deep inserted V-shaped cleft. *Coxa II* rectangular, with broadly rounded external spur. *Coxa III* and *IV* rectangular, with slight marginal saliences externally.

Spiracular plate nearly circular.

Nymph (description based on 10 specimens)

Dorsal surface of the body: Engorged specimens blue, pear-shaped, longer than wide, up to 3·0 mm in length, widest up to 1·8 mm at level of scapulae, tapering to a broadly rounded posterior margin.

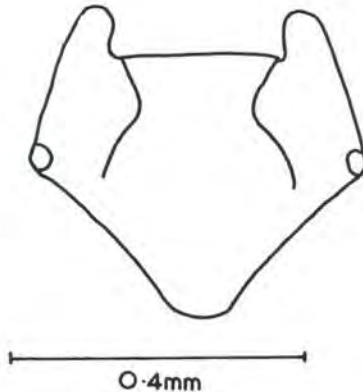


Fig. 7

FIG. 7.—*B. decoloratus*: Nymph: Scutum

Scutum (Fig. 7): Widest at eye-level, from 0·456 mm to 0·475 mm. The length, measured from the middle of the emargination to the posterior margin ranges from 0·332 mm to 0·3515 mm. The antero-lateral margin is convergent and slightly convex, the postero-lateral margin slightly concave, the posterior margin broadly rounded. The cervical grooves are shallow and convergent at first, then divergent, reaching half way down the scutum. *Eyes* oval, small, slightly bulging beyond the margin of the scutum.

Rostrum (Fig. 8a, b): The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0·152 mm to 0·160 mm long and from 0·332 mm to 0·342 mm wide. Dorsal surface hexagonal and bulging. Posterior margin nearly straight.

Palpi short, from 0·128 mm to 0·146 mm in length. *Palpal segment I* apparently fused with article II. *Palpal article II* from 0·094 mm to 0·098 mm in length and from 0·048 mm to 0·052 mm in width, measured at level of the feathered bristle (ventro-mesial). *Palpal article III* from 0·034 mm to 0·038 mm in length and from 0·032 mm to 0·036 mm in width, measured at posterior margin. *Article IV* with several setae. In the other articles there are eight setae dorsally and five setae ventrally.

Hypostome from 0·144 mm to 0·152 mm in length, dentition 3/3 with eight denticles per file; one pair posthypostomal setae and one pair postpalpal setae.

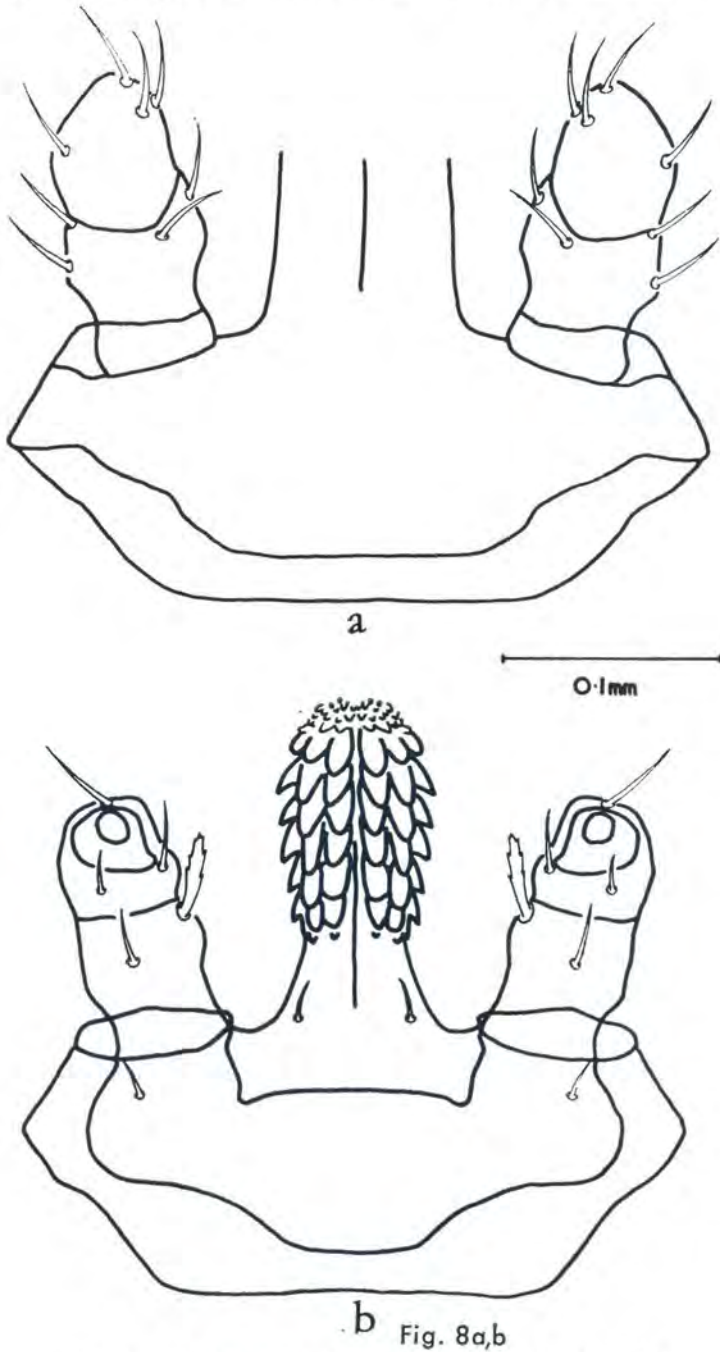


FIG. 8a.—*B. decoloratus*: Nymph: Rostrum, dorsal surface
FIG. 8b.—*B. decoloratus*: Nymph: Rostrum, ventral surface

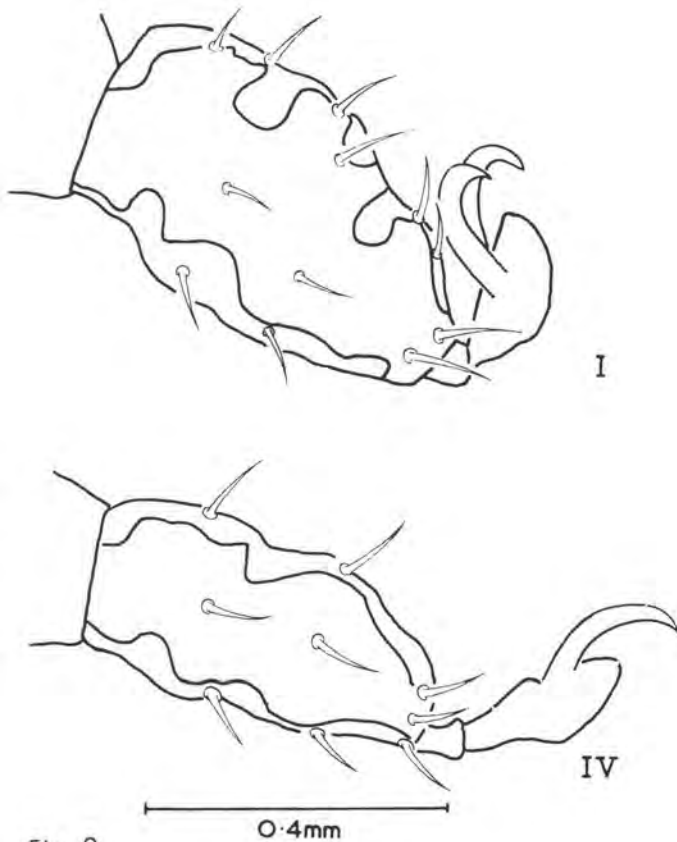


Fig. 9

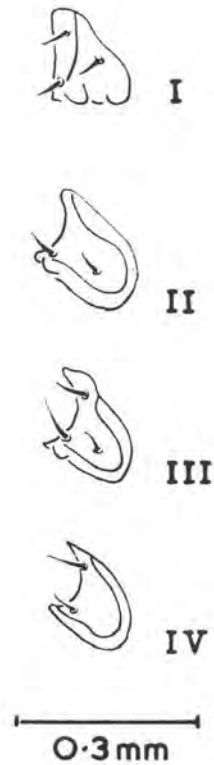


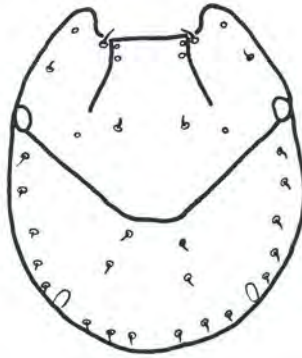
Fig. 10

FIG. 9.—*B. decoloratus*: Nymph: Tarsus I and IVFIG. 10.—*B. decoloratus*: Nymph: Coxae I-IV

Legs (Fig. 9): Beaded, moderate in length.

Tarsus I short and stumpy, from 0.137 mm to 0.147 mm long, tapering rapidly to a blunt point. *Tarsus IV* short and stumpy, from 0.132 mm to 0.142 mm, tapering rapidly toward distal end.

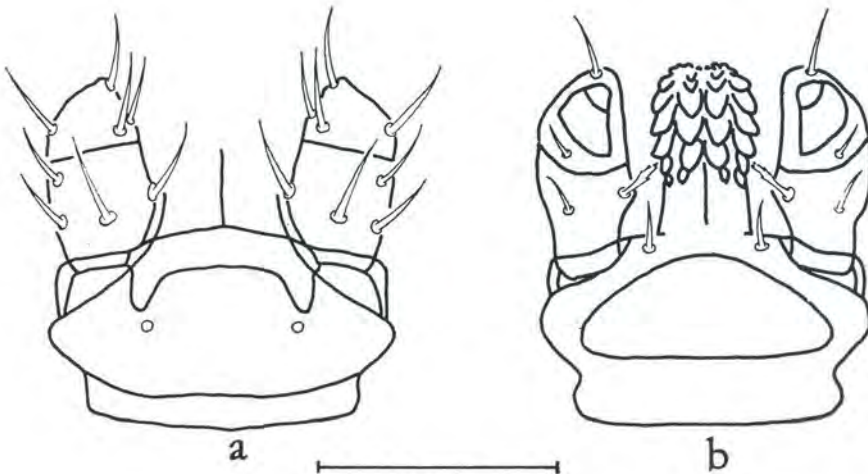
Ventral surface of the body: *Coxae* (Fig. 10): *Coxa I* triangular with internal and external spur, overlapping the posterior margin. *Coxa II* elongate rectangular, with small external spur only. *Coxa III* similar to coxa II, but not so elongate. *Coxa IV* similar in shape to coxa III, but without spur.



0.4 mm

Fig. 11

FIG. 11.—*B. decoloratus*: Larva: Body, dorsal surface



0.1 mm

Fig. 12 a, b

FIG. 12a.—*B. decoloratus*: Larva: Rostrum, dorsal surface

FIG. 12b.—*B. decoloratus*: Larva: Rostrum, ventral surface

Larva (description based on 12 specimens, reared from three females)

Dorsal surface of the body (Fig. 11): Unengorged specimens approximately as wide as long, widest midway between eyes and posterior end of the scutum, ranging from 0.418 mm to 0.437 mm in width and from 0.456 mm to 0.465 mm in length measured from the middle of the emargination to the posterior margin. There is one pair of sensilla sagittiformia on the dorso-lateral body surface. On the dorsal surface there are two pairs of central dorsal setae*, eight pairs of marginal dorsal setae, five pairs of which are anterior to the dorso-lateral sensilla sagittiformia.

Scutum: Widest at eye-level, from 0.3705 mm to 0.3895 mm. The length, measured from the middle of the emargination to the posterior margin ranges from 0.275 mm to 0.294 mm. The posterior margin is broadly pointed. The cervical grooves are shallow and at first run parallel, then somewhat divergent and reach halfway down the scutum. One pair of setae external to the anterior end of the cervical grooves, one pair in front of the eyes near the margin and one pair in the central field about half way back. *Eyes* oval, bulging beyond the margin of the scutum.

Rostrum (Fig. 12a, b): The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.084 mm to 0.092 mm long and from 0.136 mm to 0.144 mm wide. Dorsal surface quadrangular and bulging, with lateral margins broadly rounded. Posterior margin nearly straight.

Palpi short, from 0.084 mm to 0.092 mm in length. *Article I* apparently fused with article II. *Article II* from 0.046 mm to 0.050 mm in length and from 0.036 mm to 0.040 mm in width, measured at level of the feathered bristle (ventro-mesial). *Article III* from 0.038 mm to 0.042 mm in length and from 0.028 mm to 0.032 mm in width, measured at posterior margin. *Article IV* with several setae; in the other articles eight setae dorsally and four setae ventrally.

Hypostome from 0.084 mm to 0.092 mm in length, dentition 2/2, with six denticles per file; one pair of posthypostomal setae.

Legs (Fig. 13): *Tarsus I* long, from 0.16 mm to 0.168 mm tapering gradually distally. Laterally there are dorsally one pair non parallel prehalleral setae, one seta of the halleral pair, and three setae each of the three posthalleral pairs; ventrally there are two each of the terminal, median and basal group. *Tarsus III* long, from 0.152 mm to 0.156 mm, tapering gradually toward distal end, with three dorsal, three lateral and three ventral setae.

Ventral surface of the body: There are three pairs of sensilla sagittiformia, one pair posterior to each coxa. There are three pairs of sternal setae, two pairs of preanal setae, four pairs of premarginal setae and five pairs of marginal ventral setae. The anal opening is circular, with one seta on each anal valve.

Coxae (Fig. 14): *Coxa I* triangular, with broadly rounded spur, overlapping the posterior margin slightly; one anterior lateral seta, one median mesial seta and one posterior lateral seta. *Coxa II* almost rectangular, with one anterior lateral seta and one posterior lateral seta. *Coxa III* similar to *Coxa II* but slightly plumper.

* Glaschinskaja-Babenko (1949) and Clifford (1958) proposed a system for naming setae in larval ticks. Their terminology is adopted in this article.

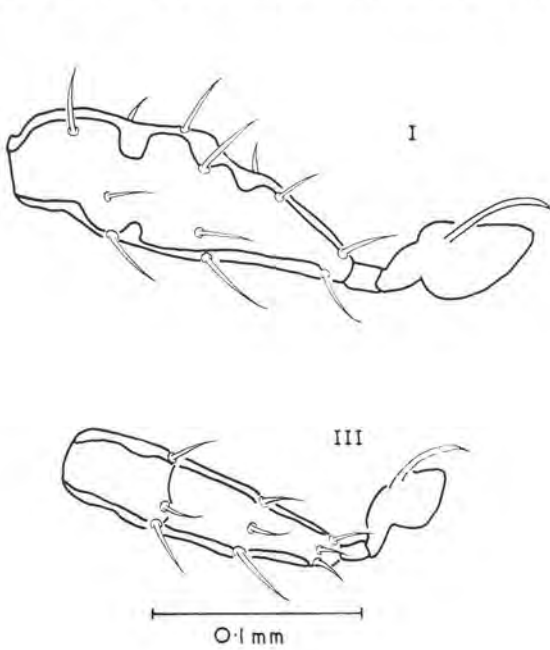


Fig. 13



Fig. 14

FIG. 13.—*B. decoloratus*: Larva: Tarsus I and III

FIG. 14.—*B. decoloratus*: Larva: Coxae I-III

BOOPHILUS MICROPLUS

Male

Dorsal surface of the body: Small, yellowish to reddish brown, averaging 2.6 mm by 1.3 mm, with numerous white hairs, arranged in definite areas.

Conscutum: Widest about midlength, from 1.2 mm to 1.36 mm. The length, measured from the middle of the emargination to the posterior margin ranges from 2.0 mm to 2.32 mm [larger than in Australian specimens (Roberts, 1964)]. It is yellow to reddish brown, broadly rounded behind, then narrowing from about midlength to the strong scapulae. Its surface is granulated and shows a few medium punctations between the cervical grooves. The cervical grooves are wide and shallow, diverging posteriorly and reaching beyond eye-level. In line with the cervical grooves and at midlength there is a pair of short, shallow and oval depressions. The posterior lateral grooves are short, wide, deep, and convergent, the posterior median groove is long, narrow, deep and straight, reaching almost scutal midlength. Grooves without hairs. The emargination is deep, well defined, ending in strong subtriangular scapulae. The eyes are pale, small, flat and inconspicuous, situated at level of the anterior margin of Coxa II.

Rostrum: *Subcollare* wide and longer than in the female, well developed.

The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.178 mm to 0.198 mm long and from 0.515 mm to 0.535 mm wide. Dorsal surface hexagonal, antero-lateral margins shorter than postero-lateral margins, more than twice as broad as long, depressed and flat at the centre and slightly elevated at the sides, bearing numerous white hairs. Posterior margin almost straight with small cornua.

Palpi short, from 0.175 mm to 0.185 mm in length. *Article II* from 0.080 mm to 0.090 mm in length and from 0.110 mm to 0.120 mm in width, measured about midlength. *Article III* from 0.060 mm to 0.070 mm in length and from 0.105 mm to 0.115 mm in width, measured at posterior margin. Article III overlaps article II and article II overlaps article I slightly. Ventrally in articles I to III the posterior internal angle is thickened. The inner margin of article I is concave.

Hypostome from 0.210 mm to 0.220 mm in length, dentition 4/4, usually eight teeth per file.

Legs: Beaded, becoming progressively stouter antero-posteriorly, and bearing numerous hairs dorsally, ventrally and laterally.

Tarsus I short, from 0.380 mm to 0.400 mm in length, tapering fairly rapidly towards rounded apex, with subapical spur. Insertion of pulvillus apical. *Tarsus IV* somewhat shorter, from 0.360 mm to 0.380 mm, tapering gradually towards rounded apex, with two ventral retrograde subapical spurs. Insertion of pulvillus apical.

Ventral surface of the body (Fig. 15a, b): *Genital opening* triangular, situated at level of coxa II and covered with a genital operculum. *Adanal plates*, not reaching beyond posterior margin, elongate, with longer blunt internal spur and mostly a shorter external spur, giving a concave posterior margin; punctate with setae. The *accessory anal plates* are shorter, bent isosceles triangle in shape, bear setae and are punctate. *Posterior margin* with long caudal appendage. *Anal groove* obsolete.

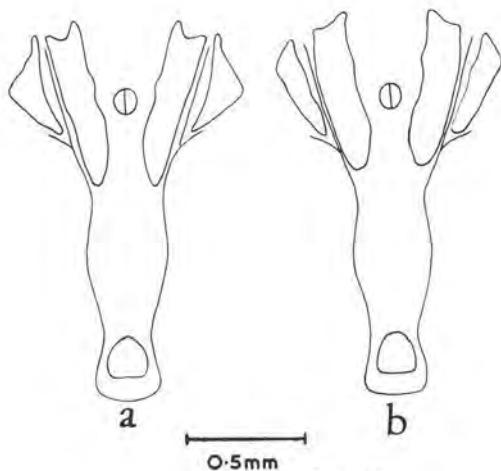


FIG. 15

FIG. 15a.—*B. microplus*: Adanal and accessory anal plates

FIG. 15b.—*B. microplus*: Adanal and accessory anal plates

FIG. 16.—*B. microplus*: Male: Coxae I-IV



FIG. 16

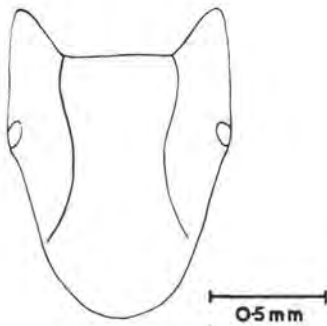


Fig. 17

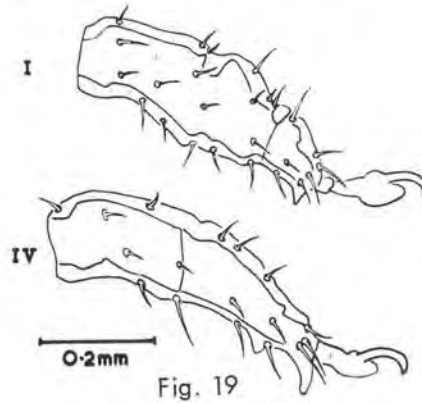


Fig. 19

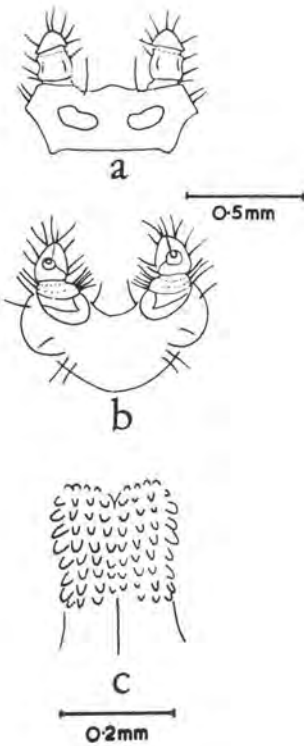


Fig. 18a, b, c

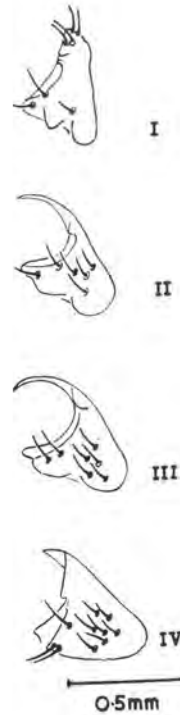


Fig. 20

- FIG. 17.—*B. microplus*: Female: Scutum
 FIG. 18a.—*B. microplus*: Female: Rostrum, dorsal surface
 FIG. 18b.—*B. microplus*: Female: Rostrum, ventral surface
 FIG. 18c.—*B. microplus*: Female: Hypostome
 FIG. 19.—*B. microplus*: Female: Tarsus I and IV
 FIG. 20.—*B. microplus*: Female: Coxae I-IV

Coxae (Fig. 16): *Coxa I* triangular, ending anteriorly in a long narrow projection, posteriorly with long pointed internal and somewhat broader external spur, overlapping the posterior margin. *Coxa II* rectangular, with two broadly rounded spurs, overlapping posterior margin. *Coxa III* similar to *coxa II*, with spurs broader. *Coxa IV* rectangular, without spurs.

Spiracular plate: nearly circular.

Female

Dorsal surface of the body: Engorged specimens green-bluish, up to 12 mm in length and 7 mm in width.

Scutum (Fig. 17): Widest at eye-level, from 0.900 mm to 1.06 mm. The length, measured from the middle of the emargination to the posterior margin, ranges from 1.18 mm to 1.24 mm [larger than Australian specimens (Roberts, 1964)]. The antero-lateral margins are slightly convergent or almost parallel, the postero-lateral margins are sinuous, the posterior margin narrowly rounded. The cervical grooves are broad, shallow and long, convergent anteriorly and divergent posteriorly, reaching the postero-lateral margins. The emargination is well defined, broad, ending in strong scapulae, which are almost straight laterally and broadly concave mesially. *Eyes* are oval and slightly bulging.

The *alloscutum* is finely striated, without punctations, bearing numerous white hairs. Postero-median groove and postero-lateral grooves long, reaching anterior third of *alloscutum*.

Rostrum (Fig. 18a, b, c): *Subcollare* wide and narrow, not well developed.

The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.180 mm to 0.200 mm long and from 0.6 mm to 0.8 mm. Dorsal surface hexagonal, antero-lateral margin shorter than postero-lateral margin. The *areae porosae* are ovate or piriform and of moderate size, widely separated and divergent. The posterior margin is almost straight with small cornua.

Palpi: Short, from 0.240 mm to 0.260 mm. *Article II* from 0.110 mm to 0.120 mm in length and from 0.120 mm to 0.140 mm in width, measured at level of mid-length. *Article III* from 0.080 mm to 0.1 mm in length and from 0.105 mm to 0.115 mm in width, measured at posterior margin. *Article III* overlaps *article II* and *article II* overlaps *article I*. Ventrally in segments I to III the posterior internal angle is thickened. The inner margin of *article I* is concave.

Hypostome from 0.210 mm to 0.230 mm in length, *dentition* 4/4 with seven to nine teeth per file.

Legs (Fig. 19): Beaded, not as stout as in the male.

Tarsus I short, from 0.500 mm to 0.520 mm in length, tapering fairly rapidly towards rounded apex, with ventral subapical spur. Insertion of pulvillus apical. *Tarsus IV* short, from 0.490 mm to 0.510 mm, tapering fairly gradually towards rounded apex, with two ventral retrograde subapical spurs. Insertion of pulvillus apical.

Ventral surface of the body: *Genital opening* situated at level of *coxa II*, from whence the genital grooves run subparallel beyond *coxa IV*, then diverge but do not reach the posterior margin. *Anal groove* obsolete.

Coxae (Fig. 20): *Coxa I* triangular, with two nearly equal rounded spurs, separated by a narrow deep inverted V-shaped cleft. *Coxa II* rectangular, with two broadly rounded spurs, definitely less separated than in *coxa I*, setae as figured. *Coxa III* much as *coxa II*. *Coxa IV* rectangular, with external spur as a marginal salience.

Spiracular plate nearly circular.

Nymph (description based on 8 specimens)

Dorsal surface of the body: Engorged specimens blue, pear-shaped, longer than wide, up to 3.0 mm in length; widest up to 1.8 mm at level of scapulae, tapering to a broadly rounded posterior margin.

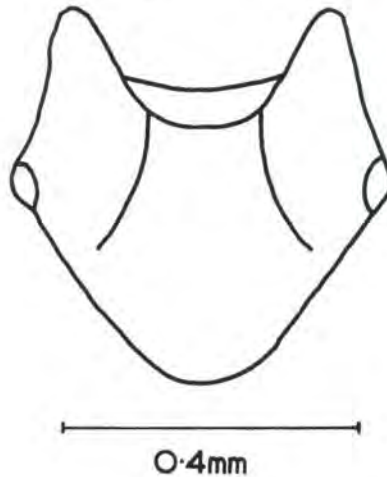


Fig. 21

FIG. 21.—*B. microplus*: Nymph: Scutum

Scutum (Fig. 21): Widest at eye-level, from 0.418 mm to 0.4375 mm. The length, measured from the middle of the emargination to the posterior margin ranges from 0.370 mm to 0.380 mm [larger than Australian specimens (Roberts, 1964)]. The antero-lateral margins are convergent and slightly concave, the postero-lateral margins straight, the posterior margin narrowly rounded. The cervical grooves are shallow and divergent posteriorly, reaching half way down the scutum. *Eyes* oval, slightly bulging beyond the margin of the scutum.

Rostrum (Fig. 22a, b): The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.136 mm to 0.144 mm long and from 0.351 mm to 0.370 mm wide. Dorsal surface hexagonal and bulging. Posterior margin salient and convex, cornua weak.

Palpi: Short, from 0.120 mm to 0.128 mm in length. *Article I* apparently fused with article II. *Article II* from 0.072 mm to 0.076 mm in length and from 0.056 mm to 0.064 mm in width, measured at level of the feathered bristle (ventromesial). *Article III* from 0.048 mm to 0.052 mm in length and from 0.040 mm to 0.044 mm in width, measured at posterior margin, smaller than article II, somewhat triangular in shape. Article III overlaps article II slightly externally, internally article II extends beyond base of article III. *Article IV* with several setae. In the other articles there are eight setae dorsally and five setae ventrally.

Hypostome from 0.150 mm to 0.154 mm in length. *Dentition* 3/3 with eight denticles per file, one pair posthypostomal setae and one pair postpalpal setae.

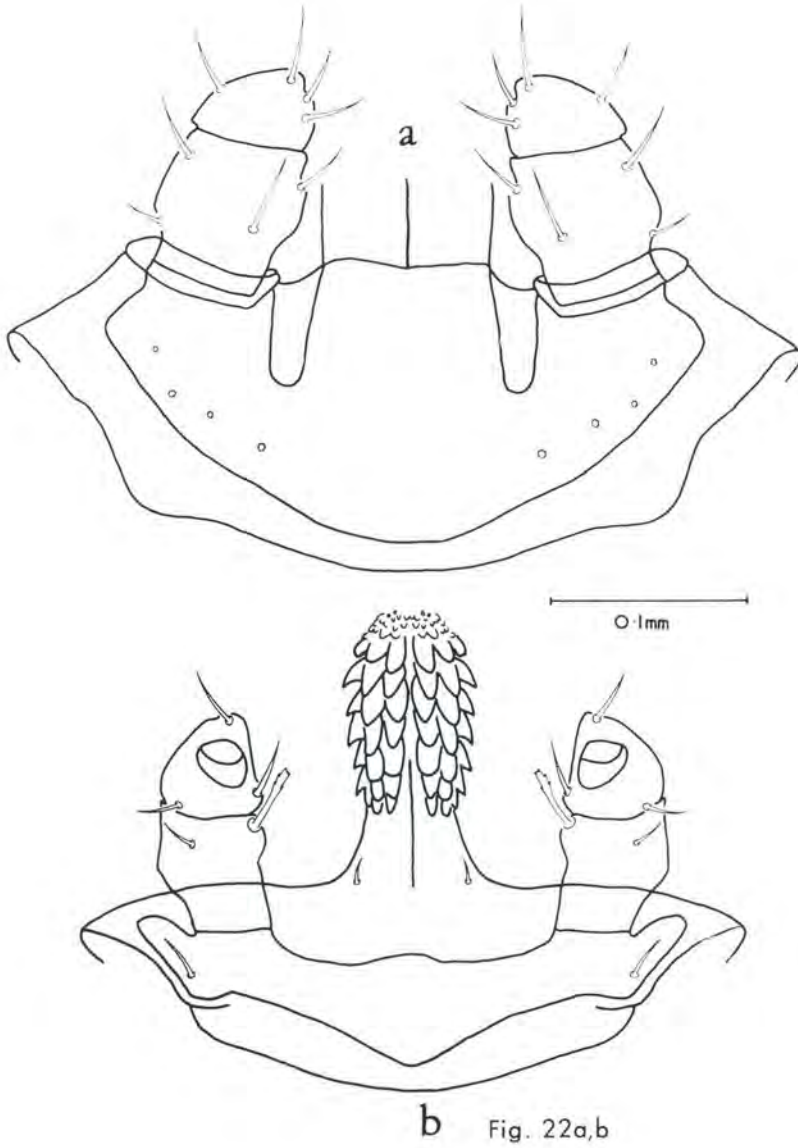


FIG. 22a.—*B. microplus*: Nymph: Rostrum, dorsal surface
FIG. 22b.—*B. microplus*: Nymph: Rostrum, ventral surface

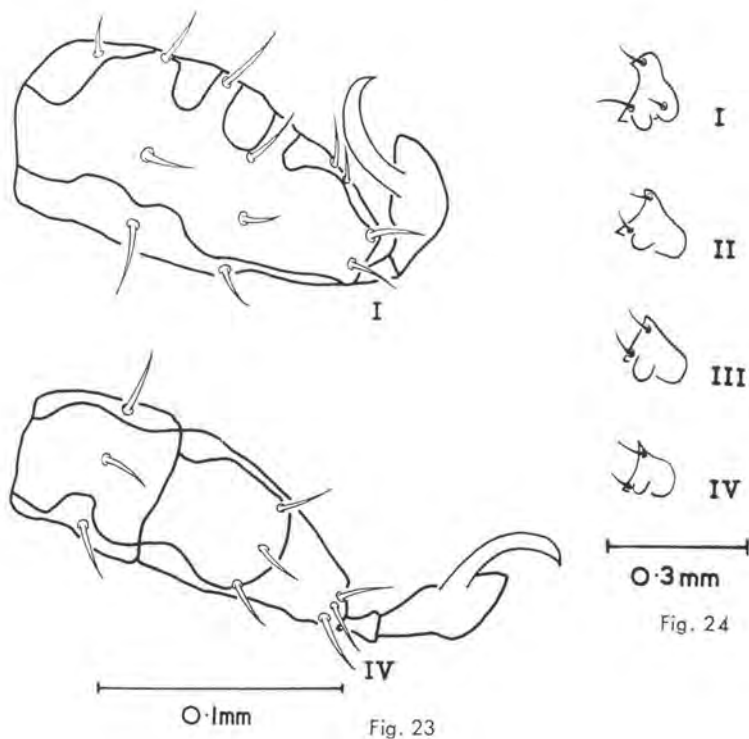


FIG. 23.—*B. microplus*: Nymph: Tarsus I and IV

FIG. 24.—*B. microplus*: Nymph: Coxae I-IV

Legs (Fig. 23): *Tarsus I* short and stumpy, from 0·140 mm to 0·148 mm, tapering fairly rapidly toward distal end. *Tarsus IV* short, from 0·148 mm to 0·152 mm, tapering gradually toward distal end.

Ventral surface of the body: *Coxae* (Fig. 24): *Coxa I* triangular, with internal and external spur overlapping the posterior margin. *Coxa II* elongate rectangular, with external spur overlapping posterior margin. *Coxa III and IV* similar to coxa II, but coxa IV not so elongate.

Larva (description based on 12 specimens, reared from two females)

Dorsal surface of the body (Fig. 25): Unengorged specimens approximately as wide as long, widest at level of the posterior end of the scutum, ranging from 0·408 mm to 0·427 mm and from 0·456 mm to 0·475 mm in length, measured from the middle of the emargination to the posterior margin. There is one pair of sensilla sagittiformia on the dorso-lateral body surface. On the dorsal surface there are two pairs of central dorsal setae, eight pairs of marginal dorsal setae, five pairs of which are anterior to the dorso-lateral sensilla sagittiformia.

Scutum: Widest at eye-level, from 0.37 mm to 0.389 mm. The length, measured from the middle of the emargination to the posterior margin ranges from 0.256 mm to 0.275 mm. The posterior margin is an even wide curve. The cervical grooves are shallow, convergent and short. One pair of setae external to the anterior end of the cervical grooves, one pair in front of the eyes near the margin and one pair in the central field about halfway back. *Eyes* oval, bulging beyond the margin of the scutum.

Rostrum (Fig. 26a, b, c): The *basis capituli*, measured from the base of the hypostome to the posterior margin is 0.084 mm to 0.092 mm long and from 0.168 mm to 0.176 mm wide. Dorsal surface quadrangular and bulging, with lateral margins broadly rounded. Posterior margin nearly straight.

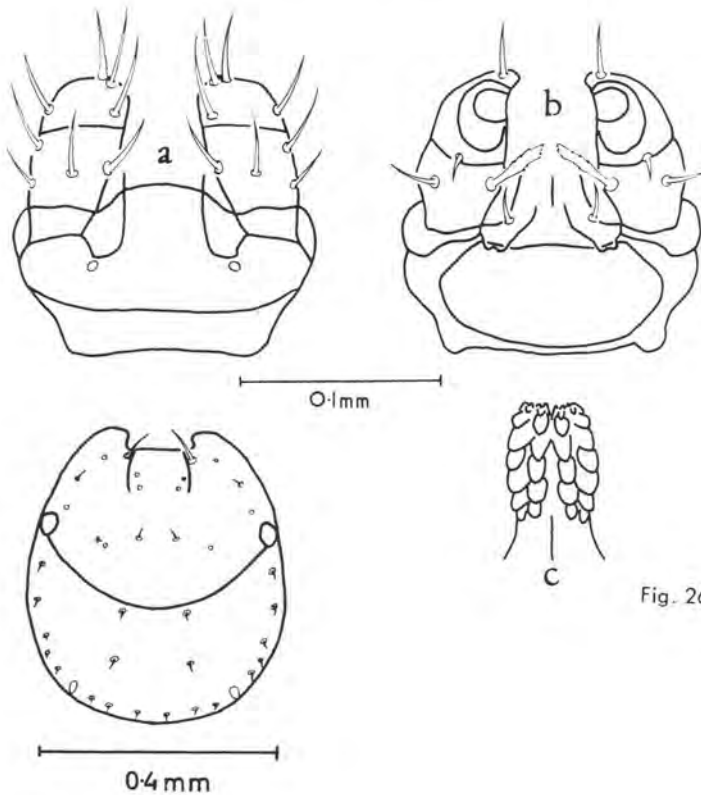


Fig. 26a,b,c

Fig. 25

FIG. 25.—*B. microplus*: Larva: Body, dorsal surface

FIG. 26a.—*B. microplus*: Larva: Rostrum, dorsal surface

FIG. 26b.—*B. microplus*: Larva: Rostrum, ventral surface

FIG. 26c.—*B. microplus*: Larva: Hypostome

TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION

Palpi short, from 0·084 mm to 0·092 mm in length. *Article I* apparently fused with article II. *Article II* from 0·046 mm to 0·050 mm in length and from 0·038 mm to 0·042 mm in width, measured at level of the feathered bristle (ventromesial). *Article III* from 0·038 mm to 0·042 mm in length and from 0·042 mm to 0·046 mm in width, measured at posterior margin. *Article IV* with several setae. In the other articles there are eight setae dorsally and four ventrally.

Hypostome from 0·08 mm to 0·088 mm in length, dentition 2/2, with six denticles per file; one pair of posthypostomal setae.

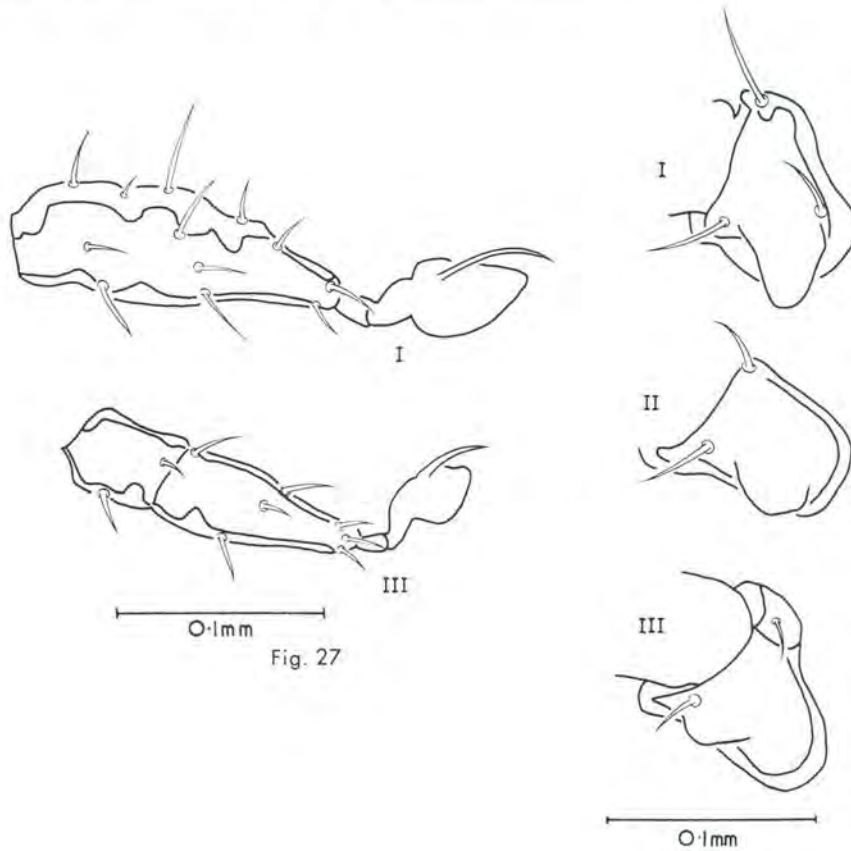


FIG. 27.—*B. microplus*: Larva: Tarsus I and III
 FIG. 28.—*B. microplus*: Larva: Coxae I-III

Legs (Fig. 27): *Tarsus I* long, from 0·172 mm to 0·180 mm, tapering gradually distally. Laterally there are dorsally one pair non-parallel prehalleral setae, one seta of the halleral pair, and three setae each of the three posthalleral pairs; ventrally there are two each of the terminal, median and basal group. *Tarsus III* long, from 0·140 mm to 0·148 mm, tapering gradually toward distal end, with three dorsal, three lateral and three ventral setae.

Ventral surface of the body: There are three pairs of sensilla sagittiformia, one pair posterior to each coxa. There are three pairs of sternal setae, two pairs of preanal setae, four pairs of premarginal setae and five pairs of marginal ventral setae. The anal opening is circular, with one seta on each anal valve.

Coxae (Fig. 28): *Coxa I* triangular, with rounded spur, widely overlapping posterior margin, one anterior lateral seta, one median mesial seta and one posterior lateral seta. *Coxa II* almost rectangular, with a broadly rounded spur near the inner edge of the posterior margin, overlapping it, with one anterior lateral seta and one posterior lateral seta. *Coxa III* almost rectangular, with broadly rounded spur near the outer edge of the posterior margin slightly overlapping it, with one anterior lateral seta and one posterior lateral seta.

MARGAROPUS WINTHEMI

Male

Dorsal surface of the body: Small, reddish brown, roughly pear-shaped, averaging 4.0 mm by 2.4 mm, with numerous hairs, edging the scutum laterally.

Conscutum: Widest about midlength, from 1.64 mm to 1.94 mm. The length, measured from the middle of the emargination to the posterior margin, ranges from 2.6 mm to 2.8 mm, reddish brown, strongly convergent anteriorly, with a slightly convex outline and a bluntly rounded posterior margin, does not extend to the posterior extremity of the body. The cervical grooves are shallow, convergent anteriorly and divergent posteriorly, reaching one third of the scutal length. A row of hairs outlines the position of the female scutum. Posterior median groove is distinct, shallow, narrow and elongate, the postero-lateral grooves similar, but somewhat shorter. Grooves without hairs. The emargination is deep, well defined, ending in strong subtriangular scapulae. The *eyes* are indistinct, small and flat, situated at level of the anterior margin of coxa II. Posterior to the spiracular plates the row of hairs edging the body forms six groups, each of five to ten longer hairs. Body ends in a short appendage, with finely striated surface.

Rostrum: *Subcollare* prominent, globular.

The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.210 mm to 0.230 mm long; and from 0.520 mm to 0.540 mm wide. Dorsal surface rectangular with a transverse row of hairs about midlength. Posterior margin slightly concave with small cornua.

Palpi: Short and broad, from 0.200 mm to 0.220 mm in length. *Article II* from 0.095 mm to 0.105 mm in length, and from 0.1 mm to 0.11 mm in width, measured about midlength. Postero-internal angle thickened to form a short sharp projection. *Article III* from 0.08 mm to 0.09 mm in length, and from 0.08 mm to 0.09 mm in width, measured at posterior margin. *Article III* is short, broadly rounded, ventrally with a prominent tapering triangular spur.

Hypostome from 0.200 mm to 0.220 mm in length, dentition 4/4 with usually five to seven teeth in the inner and nine to eleven teeth in the outer files.

Legs: Stout, markedly beaded, with distal brown annulations on each yellow-brown segment, increasing progressively in size from I to IV, bearing long, pale hairs, fringing the dorsal surface of each segment. There are a few lateral and ventral hairs.

TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION

Tarsi: Very small compared with the other segments of the legs. *Tarsus I* short, from 0·390 mm to 0·410 mm in length, strongly tapering, terminating claw-like, with subapical spur ventrally. Insertion of pulvillus dorsal and subapical. *Tarsus IV* somewhat shorter, from 0·360 mm to 0·380 mm, strongly tapering distally terminating in a claw-like structure, with subapical spur ventrally. Insertion of pulvillus dorsal and subapical.

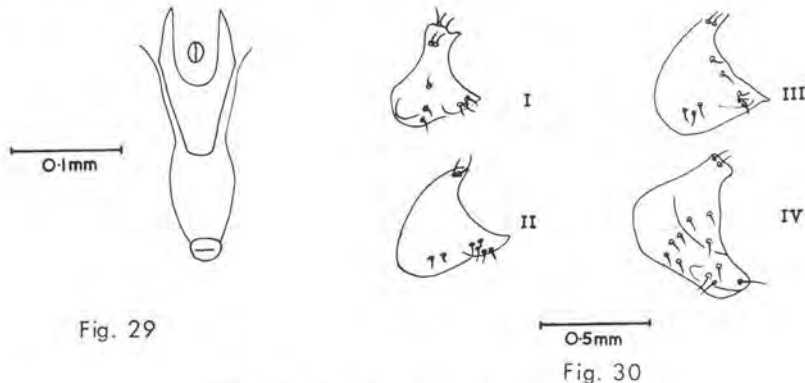


FIG. 29.—*M. winthemi*: Adanal plates
 FIG. 30.—*M. winthemi*: Male: Coxae I-IV

Ventral surface of the body (Fig. 29): *Genital opening* broadly rounded anteriorly, gradually converging laterally and bluntly angled posteriorly; situated at the level of the anterior half of coxa II. *Adanal plates* are fused together anteriorly, reaching to the posterior level of coxa III, projecting posteriorly beyond the anus as two tapering, narrowly pointed robust spurs. Posterior margin with *caudal appendage*. *Anal groove* obsolete.

Coxae (Fig. 30): *Coxa I* subtriangular, with blunt internal spur and short, sharp external spur. *Coxa II* subquadrate, slight thickening of cuticle in position of external spur. *Coxa III* similar to coxa II. *Coxa IV* subtriangular with indistinct blunt external spur.

Spiracular plate nearly circular.

Female

Dorsal surface of the body: Engorged specimens bluish-green, up to 14 mm in length and 9 mm in width.

Scutum (Fig. 31): Widest at eye-level, from 0·960 mm to 1·020 mm. The length, measured from the middle of the emargination to the posterior margin, ranges from 0·950 mm to 1·050 mm. The antero-lateral margins are convergent, the postero-lateral sinuous, posterior margin bluntly rounded. The cervical grooves broad, shallow and long, running at first divergent, then slightly convergent up to eye-level, continuing divergent again and reaching the postero-lateral margins below eye-level. The emargination is well defined, broad, ending in strong scapulae, which are almost straight laterally and broadly concave mesially. *Eyes oval*, distinct and convex. The *alloscutum* is finely striated, without punctations, bearing short white hairs. Postero-median groove and postero-lateral grooves long, reaching midlength.

Rostrum (Fig. 32a, b, c): *Subcollare* prominent and oval.

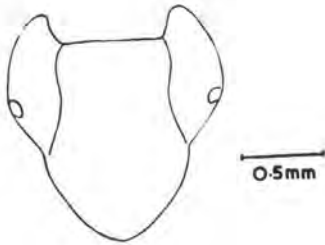
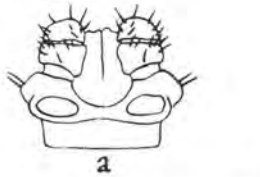
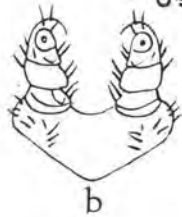


Fig. 31



a



b



c

Fig. 32a,b,c

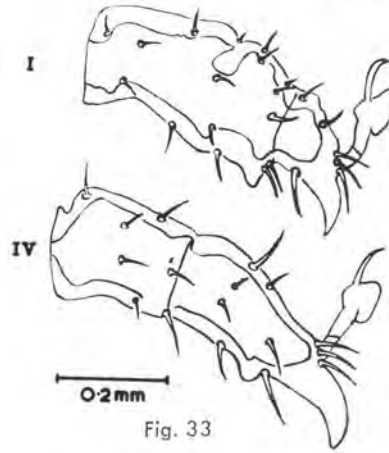


Fig. 33



I



II



III



IV



Fig. 34

- FIG. 31.—*M. winthemi*: Female: Scutum
 FIG. 32a.—*M. winthemi*: Female: Rostrum, dorsal surface
 FIG. 32b.—*M. winthemi*: Female: Rostrum, ventral surface
 FIG. 32c.—*M. winthemi*: Female: Hypostome
 FIG. 33.—*M. winthemi*: Female: Tarsus I and IV
 FIG. 34.—*M. winthemi*: Female: Coxae I-IV

TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION

The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.230 mm to 0.250 mm long and from 0.700 mm to 0.740 mm wide. Dorsal surface hexagonal, convex antero-lateral margins shorter than concave postero-lateral margins. The *areae porosae* are large, transversely oval, widely separated. The posterior margin rectilinear to slightly concave.

Palpi: Short, from 0.300 mm to 0.320 mm in length. *Article II* from 0.140 mm to 0.160 mm in length and from 0.180 mm to 0.200 mm in width, measured at level of midlength. *Article III* from 0.080 mm to 0.1 mm in length and from 0.170 mm to 0.190 mm in width, measured at posterior margin, broadly rounded anteriorly.

Hypostome from 0.290 mm to 0.310 mm in length, dentition 4/4 with seven to eight teeth in the inner and ten to eleven teeth in the outer files.

Legs (Fig. 33): Beaded, with distal brown annulations on each yellow-brown segment, lacking the dorsal fringing hairs so characteristic of the male.

Tarsus I elongate and narrow, from 0.540 mm to 0.560 mm in length, tapering gradually to claw-like apex. Insertion of pulvillus dorsal and subapical. *Tarsus IV* elongate and narrow from 0.520 mm to 0.540 mm in length, tapering fairly gradually toward claw-like apex. Insertion of pulvillus dorsal and subapical.

Ventral surface of the body: *Genital opening* situated at level of coxa II, from whence the genital grooves run subparallel beyond coxa IV, then diverge but do not reach the posterior margin. *Anal groove* obsolete.

Coxae (Fig. 34): *Coxa I* triangular, internal and external spur present, but not well developed. *Coxa II* and *III* subquadrate, with short, very broadly rounded external spur, not easily seen in all specimens. *Coxa IV* subtriangular.

Spiracular plate nearly circular.

Nymph (description based on 3 specimens)

Dorsal surface of the body: Engorged specimens pear-shaped, longer than wide, up to 3.2 mm in length, widest up to 2.8 mm at level of coxa IV, tapering to a broadly rounded posterior margin.

Scutum (Fig. 35): Widest at eye-level, from 0.446 mm to 0.465 mm. The length, measured from the middle of the emargination to the posterior margin, ranges from 0.380 mm to 0.399 mm. The antero-lateral margins convergent and almost straight, the postero-lateral margins slightly concave, the posterior margin narrowly rounded. The cervical grooves shallow and divergent posteriorly, reaching halfway down the scutum. *Eyes* oval, small, slightly bulging beyond the margin of the scutum.

Rostrum (Fig. 36a, b, c): The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.170 mm to 0.180 mm long and from 0.338 mm to 0.342 mm wide. Dorsal surface hexagonal and bulging, the longer postero-lateral margins meeting the short antero-lateral margins in a rounded angle. Posterior margin nearly straight.

Palpi: Short, from 0.156 mm to 0.164 mm in length. *Article I* apparently fused with article II. *Article II* from 0.084 mm to 0.092 mm in length and from 0.086 mm to 0.090 mm in width, measured at level of medial bristle. *Article III* from 0.068 mm to 0.072 mm in length and from 0.070 mm to 0.074 mm in width, measured at posterior margin. *Article IV* with several setae; other three articles, eight setae dorsally and six setae ventrally.

Hypostome from 0·156 to 0·164 mm in length, dentition 3/3 with seven to eight denticles per file; one pair of posthypostomal setae and one pair of postpalpal setae.

Legs (Fig. 37): Beaded, moderate in length.

Tarsus I short and stumpy, from 0·190 mm to 0·200 mm long, tapering rapidly to a blunt point. Setae as figured. *Tarsus IV* short, from 0·182 mm to 0·192 mm, tapering fairly gradually toward distal end. Setae as figured.

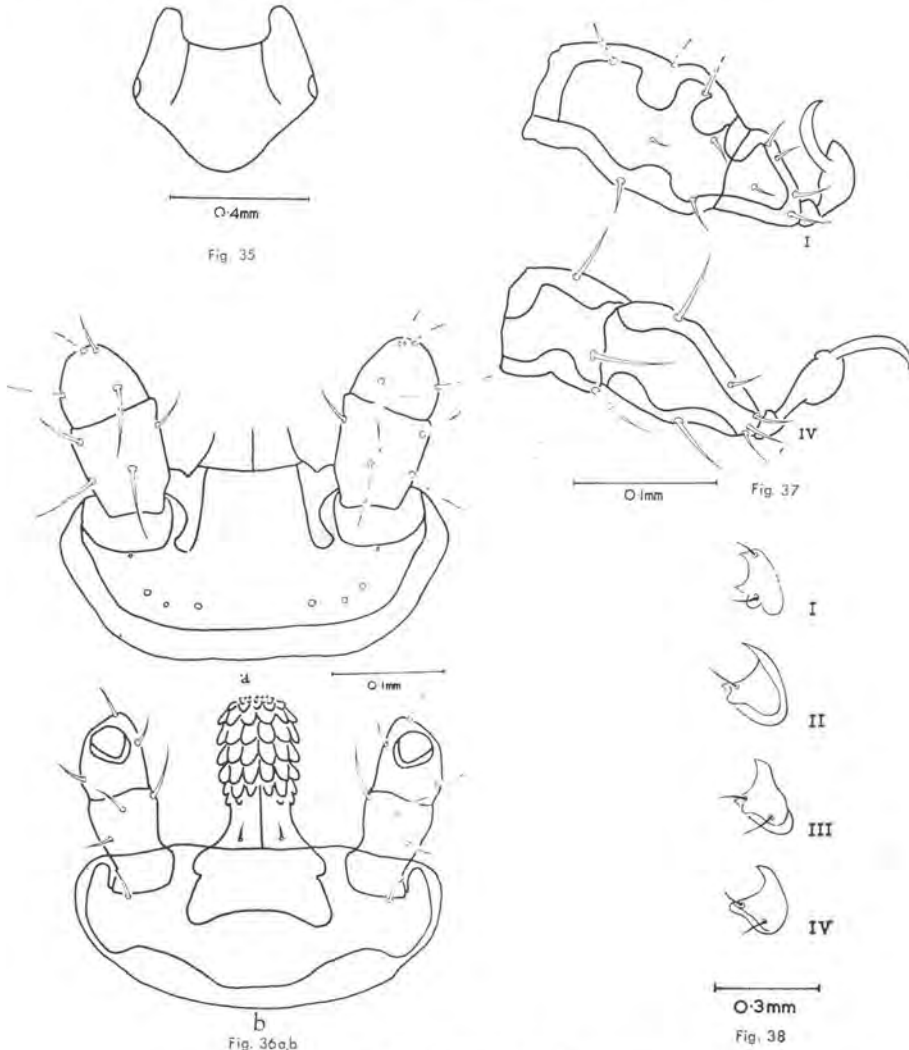


FIG. 35.—*M. winthemi*: Nymph: Scutum
 FIG. 36a.—*M. winthemi*: Nymph: Rostrum, dorsal surface
 FIG. 36b.—*M. winthemi*: Nymph: Rostrum, ventral surface
 FIG. 37.—*M. winthemi*: Nymph: Tarsus I and IV
 FIG. 38.—*M. winthemi*: Nymph: Coxae I-IV

TICKS IN THE SOUTH AFRICAN ZOOLOGICAL SURVEY COLLECTION

Ventral surface of the body Coxae (Fig. 38): *Coxa I* triangular, with internal and external spur, overlapping the posterior margin. *Coxa II* elongate, rectangular, with external spur overlapping the posterior margin. *Coxa III* similar to *Coxa II*. *Coxa IV* similar to *Coxa III*, but not so elongate and without spur.

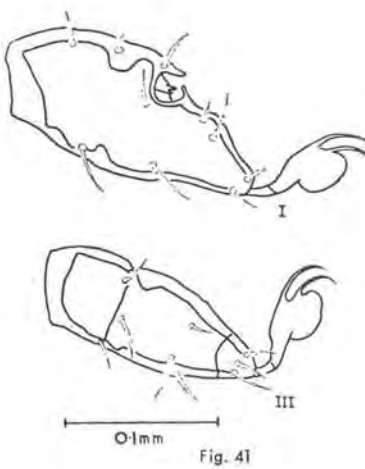
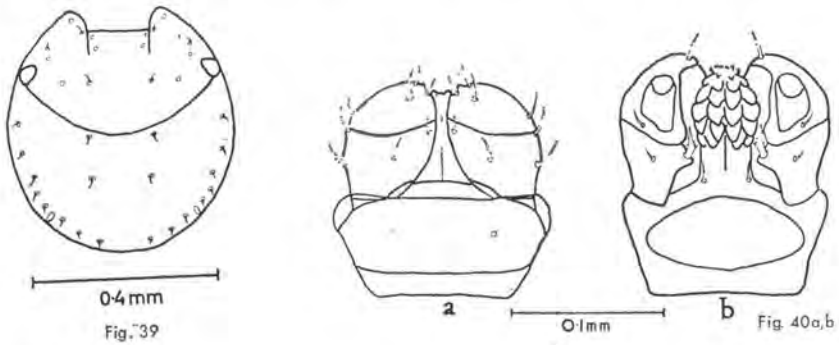


FIG. 39.—*M. winthemi*: Larva: Body, dorsal surface
 FIG. 40a.—*M. winthemi*: Larva: Rostrum, dorsal surface
 FIG. 40b.—*M. winthemi*: Larva: Rostrum, ventral surface
 FIG. 41.—*M. winthemi*: Larva: Tarsus I and III
 FIG. 42.—*M. winthemi*: Larva: Coxae I-III

Larva (description based on 12 specimens, reared from two females)

Dorsal surface of the body (Fig. 39): Unengorged specimens approximately as wide as long, widest at level of the posterior end of the scutum, ranging from 0.446 mm to 0.456 mm and from 0.446 mm to 0.465 mm in length, measured from the middle of the emargination to the posterior margin. There is one pair of sensilla sagittiformia on the dorso-lateral body surface. On the dorsal surface there are two pairs of central dorsal setae, eight pairs of marginal dorsal setae, five pairs of which are anterior to the dorso-lateral sensilla sagittiformia.

Scutum: Widest at eye-level, from 0.3895 mm to 0.4085 mm. The length, measured from the middle of the emargination to the posterior margin, ranges from 0.209 mm to 0.266 mm. The posterior margin is an even wide curve. The cervical grooves are shallow, straight and short. One pair of setae external to the anterior end of the cervical grooves, one pair in front of the eyes near the margin and one pair in the central field about halfway back. *Eyes* oval, bulging beyond the margin of the scutum.

Rostrum (Fig. 40a, b): The *basis capituli*, measured from the base of the hypostome to the posterior margin, is 0.068 mm to 0.072 mm long, and from 0.144 mm to 0.156 mm wide. Dorsal surface quadrangular and bulging, with lateral margins broadly rounded, Posterior margin nearly straight.

Palpi: Short, from 0.078 mm to 0.086 mm in length. *Article I* apparently fused with article II. *Article II* from 0.042 mm to 0.046 mm in length and from 0.052 mm to 0.056 mm in width, measured at level of the feathered bristle (ventromesial). *Article III* from 0.036 mm to 0.040 mm in length and from 0.044 mm to 0.048 mm in width, measured at posterior margin of article III. *Article IV* with several setae. In the other articles there are eight setae dorsally and four ventrally.

Hypostome from 0.064 mm to 0.068 mm in length; dentition 2/2 with five denticles per file, one pair of posthypostomal setae.

Legs (Fig. 41): *Tarsus I* short and stumpy, from 0.164 mm to 0.168 mm long, tapering fairly rapidly to a blunt point. Laterally there are dorsally one pair non-parallel prehalleral setae, one seta of the halleral pair, and three setae each of the three posthalleral pairs; ventrally there are two each of the terminal, median and basal group. *Tarsus III* short and stumpy, from 0.124 mm to 0.132 mm, tapering fairly rapidly toward distal end, with three dorsal, three lateral and three ventral setae.

Ventral surface of the body: Three pairs of sensilla sagittiformia, one pair posterior to each coxa. There are three pairs of sternal setae, two pairs of preanal setae, four pairs of premarginal setae and five pairs of marginal ventral setae. The anal opening is circular, with one seta on each valve.

Coxae (Fig. 42): *Coxa I* broadly triangular, with rounded spur, not overlapping the posterior margin, one anterior lateral seta, one median mesial seta and one posterior lateral seta. *Coxa II* an elongate rectangle, with one anterior lateral seta and one posterior lateral seta. *Coxa III* similar to coxa II, but not so elongate.

KEY

Males

1. Accessory anal plates absent, adanal plates fused anteriorly, six pairs of hair tufts on posterior body margin; legs with massive, beady segments; insertion of pulvillus dorsal and subapical: dorsal surface of basis capituli rectangular..... *M. winthemi*
 Accessory anal plates present, adanal plates not fused anteriorly; posterior body margin without conspicuous, fringing hair tufts; legs beaded, but not massive; insertion of pulvillus apical; dorsal surface of basis capituli hexagonal..... 2 *emi*
2. Dentition of hypostome 3/3. Palpal article I with bristle bearing protuberance mesio-ventrally. Adanal plates with long narrow internal spur usually extending beyond posterior body margin.... *B. decoloratus*
 Dentition of hypostome 4/4. Palpal article I without bristle-bearing protuberance mesio-ventrally. Adanal plates with short internal spur, not reaching posterior body margin..... *B. microplus*

Females

1. Insertion of pulvillus dorsal and subapical, legs with distal brown annulations on each yellow-brown segment, coxa I not showing a deep elongate "inverted V" shaped cleft dividing the spurs... *M. winthemi*
 Insertion of pulvillus apical; legs unicolored yellowish; coxa I with deep elongate "inverted V" shaped cleft dividing the spurs 2 *emi*
2. Dentition of hypostome 3/3. Palpal article I with bristle-bearing protuberance mesio-ventrally..... *B. decoloratus*
 Dentition of hypostome 4/4. Palpal article I without bristle-bearing protuberance mesio-ventrally..... *B. microplus*

*Nymphs**

1. Lateral margins of basis capituli broadly angled, ventro-mesial bristle on article II not feathered..... *M. winthemi*
 Lateral margins of basis capituli sharply angled, ventro-mesial bristle on article II feathered..... 2 *emi*
2. External spur on coxa IV absent, on coxa II and III weakly developed, not easily seen; basis capituli without cornua..... *B. decoloratus*
 External spur on coxa IV present, seen more readily on coxa II and III; basis capituli with small cornua..... *B. microplus*

* This key is provisional, only three specimens of *M. winthemi* were available for study, hence some of the features can not be guaranteed. The differences between the three species are very slight, thus it is difficult to pick out distinctive features.

Larvae

1. Coxa I broadly triangular, spur not overlapping posterior margin; tarsus I and III short and stumpy, tapering fairly rapidly to a blunt point; palpal article II broader than long..... *M. winthemi*
 Coxa I triangular, with spur reaching or widely overlapping posterior margin; tarsus I and III long and gradually tapering to a pointed distal end, palpal article II longer than broad... 2
2. Coxa I with a spur, just reaching posterior margin; coxa II and III without spur, scutum with postero-lateral margins almost straight, meeting in a broadly rounded posterior point..... *B. decoloratus*
 Coxa I with spur, widely overlapping posterior margin, coxa II and III with spur overlapping posterior margin; scutum with posterior margin as an even curve..... *B. microplus*

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