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ABSTRACT

A key to the species of *Machilanus* Silvestri and the description of the new species *hebraeus*, *insensilis*, *lapidicola*, *schmidi*, and *swani* are presented. The last four species are from the Himalayas, some collected from as high as 19,000 feet; the first is from Israel, a considerable extension westward of the range of the genus, known formerly only from central Asia. The close relationship of *Machilanus* to the genus *Stachilis* Janetschek from the Balkans is shown. Characters of the first males reported for the genus *Praetrigoniophthalmus* Janetschek and for *Silvestrichilis trispina* (Wygodzinsky) are briefly described.

Bristletails of the order Microcoryphia are among the few insects that have successfully colonized very high altitudes in various parts of the world. Swan (1961) gave a short report on the ecology of a species of *Machilanus* Silvestri found by him between 17,500 and 19,000 feet in the Nepal Himalayas. Mani (1968) mentioned Swan's findings but misspelled the insects' name as *Machilinus*, which happens to be the name of a genus of the microcoryphian family Meinertellidae. The genus *Machilinus* Silvestri has not been reported from the Himalayas but Wygodzinsky (1967) reported a species occurring in the Pre-cordillera of western Argentina above 14,700 feet.

The present paper contains the description of the material collected in the Himalayas by L. W. Swan and F. Schmid, together with notes and descriptions of other species of *Machilanus* and of a few additional machilid genera.

Material was received from Dr. M. S. Ghilarov, Academy of Sciences of the USSR, Moscow; Dr. F. Schmid, Biosystematics Research Institute, Canada Agriculture, Ottawa; Dr. L. W. Swan, San Francisco State College; and from the authorities of the Department of Zoology, Hebrew University, Jerusalem. I am grateful to all of them.

Material of most of the species is deposited in the American Museum of Natural History. All drawings were made by the author.

Abbreviations of institutions:

AMNH, the American Museum of Natural History
CAS, California Academy of Sciences

MACHILANUS SILVESTRI

Redescription. Machilidae. Body length from 7.5 to 15 mm. Body and appendages with varied amounts of hypodermal pigment. Frons only slightly convex, not protruding. Eyes subcircular, slightly shorter than wide, line of contact in all cases much shorter than length. Ocelli oval, not more than twice as wide as long, situated sublaterally to eyes. Antennae stouter in male than in female, not distinctly longer than body, in some cases shorter; scapus, pedicellus, and flagellum with scales. Mandibles normal, with four teeth. Maxillary palps of male in most cases with long, slender hairs and setulae on undersurface of some segments. Terminal segment of labial palp widened to varied degree; terminal and subterminal segments in males with long, slender setae and, in most cases, setulae.

Legs with stylet on second and third pairs. Tarsi three-segmented; praetarsus without scopula; spinelike setae on various leg segments. Femur and tibiae of foreleg of males thickened; femur with a more or less conspicuous posteroventral bulge beset with conspicuous group of stout setae that may extend to rest of undersurface of femur. Disc of fore femur in most species with field of ramose sensillae.

Sternites II-VII well developed, from right to obtuse angled. Coxites I, VI, and VII with 1+1, II-V with either also 1+1 or with 2+2 eversible vesicles. Disc of sternites and coxites with a varied number of setae, in some cases quite numerous; posterolateral lobes of coxites with strong and in many cases spinelike setae.

Ovipositor of primary or secondary type, in latter case with strongly sclerotized fossorial spines. Parameres present only on ninth abdominal segment, with very long basal and very long apical article; intermediate articles subequal, shorter than wide, each with field of short hairs in addition to ordinary setae and marginal comb-like row of spinelike setae. Parameres about as long as penis. Penis with apical portion as long as, or slightly longer than, basal portion. Penis opening subapical, subcircular or narrowly elongate, surrounded by field of short specialized setae.

Cerci with single apical spur.

Type Species. Machilanus hummeli Silvestri.

Discussion. The area of greatest species density of *Machilanus* extends in an arc from Szechuan (China) over Mongolia and Tuva (USSR) through northern India and Pakistan to Afghanistan. A species of *Machilanus* from Israel, described in the present paper, although seemingly isolated geographically from the main body of the genus, is not isolated morphologically. The geographical isolation may be more apparent than real, because of the extremely spotty knowledge of these insects; for instance, no machilids have ever been reported from Iran, but there is no reason to assume they do not occur there.

A short discussion of the genus *Stachilis* Janetschek, 1957 (= *Admesomachilis* Stach, 1958) is necessary here. *Stachilis* agrees in all morphological features, including the highly apomorphic structure of the penis and parameres with *Machilanus* (fig. 8C-J), except that its coxal stylets are restricted to the third pair of legs. As in *Machilanus*, the abdominal sterna II-V of *Stachilis* have either 1+1 or 2+2 eversible vesicles. *Stachilis* is found only on the Balkan peninsula.

It has been shown recently by various authors that indubitably congeneric species of machilids can differ by the number of eversible vesicles on some abdominal sterna, or by the absence or presence of parameres on the eighth abdominal segment of the male, but the number of coxal stylets has been considered as diagnostic for a given genus. The coincidence of most of the apomorphic characters of *Machilanus* and *Stachilis* strongly suggests close cladistic relationship. It is not possible, at this time, to make a statement regarding the type of relationship between *Machilanus* and *Stachilis*, viz., if *Machilanus* and *Stachilis* are sister groups, or if *Stachilis* is more closely related to a component of *Machilanus* than to the genus as a whole.

KEY TO THE SPECIES OF *MACHILANUS*

1. Abdominal sterna with only 1+1 eversible vesicles 2
- Some abdominal sterna with 2+2 eversible vesicles 8
2. Males 3
- Females 6
3. Setulae present on undersurface of segments

- II-VII of maxillary palp; line of contact of eyes less than one-third of length of eye (Mongolia)
- *intergerivus* Wygodzinsky, 1970
- Setulae restricted to undersurface of segments V-VII of maxillary palp; line of contact of eyes distinctly longer than one-third of length of eyes 4
4. Labial palp without setulae; stylets of ninth abdominal segment with numerous conspicuous ciliate setae (Mongolia; USSR [Tuva]) *ciliatus* Wygodzinsky, 1970
- Labial palp with setulae at least on apical segment; stylets of ninth abdominal segment lacking conspicuous ciliate setae. . 5
5. Large number of setulae present on entire undersurface of segments V-VII of maxillary palp; only apical segment of labial palp with setulae (Mongolia; USSR [Tuva]) *bifarius* Wygodzinsky, 1970
- Setulae of undersurface of segments I-VII very sparse, except dense group at base of segment V; apical and penultimate segments of labial palp with setulae (Mongolia) *confaratus* Wygodzinsky, 1970
6. Apical spine of distal article of gonapophyses transformed into heavily sclerotized, stout fossorial process (Mongolia)
- *confaratus* Wygodzinsky, 1970
- Apical spine of distal article of gonapophyses bristle-like, not heavily sclerotized. . 7
7. Hypodermal pigment distinct in many specimens; line of contact of eyes less than one-third of length of eyes (Mongolia).
- *intergerivus* Wygodzinsky, 1970
- Hypodermal pigment absent; line of contact of eyes distinctly longer than one-third of length of eyes (Mongolia; USSR [Tuva])
- *bifarius* Wygodzinsky, 1970
8. Males 9
- Females 19
9. Line of contact of eyes not longer than half the length of eyes 10
- Line of contact of eyes distinctly longer than half the length of eyes 17
10. Some segments of maxillary palp with numerous setulae on undersurface; penis opening surrounded by simple hairs, rarely some very short. 11
- Setulae on undersurface of segments of maxillary palp absent; penis opening surrounded laterally and anteriorly by numerous minute spines (Afghanistan)
- *povolnyi* Bitsch, 1968
11. Fore femora with sensory field; labial palp

- with setulae present either only on apical, or on apical and subapical segments . . . 12
- Fore femora lacking sensory field (fig. 2L); only apical segment of labial palp with setulae (fig. 2E) (N. India) *insensilis*, new species 12
12. Sensory field of fore femur approximately two units wide (fig. 1H); only apical segment of labial palp with setulae on undersurface (fig. 1G); apical sensory spines of distal segment not reduced in size (fig. 1E) (Israel) *hebraeus*, new species
- Sensory field of fore femur much wider (figs. 4M, 7A, 9L); apical as well as subapical segments of labial palp with setulae on undersurface (fig. 6G); apical sensory spines of distal segment of maxillary palp much reduced in size (figs. 4L; 6L; 9H) 13
13. Line of contact of eyes half the length of eyes (fig. 9E); setulae of undersurface of segments of maxillary palp very short (fig. 9H, K); most of hyaline sensory spines of apical segment of maxillary palp extremely short, length less than one-seventh of diameter of segment (fig. 9H); apical opening of penis more or less circular (similar to fig. 8C) (Nepal) *swani*, new species
- Line of contact of eyes distinctly shorter than half the length of eyes (figs. 4C; 6A); setulae of undersurface of segments of maxillary palp somewhat longer (figs. 4J, L; 6D, H); only distal hyaline sensory spines of apical segment of maxillary palp very short, most of remaining comparatively long, about one-fourth of diameter of segment (figs. 4L; 6L); apical opening of penis more or less slitlike (figs. 5C; 8G, H) 14
14. Distal segment of maxillary palp elongate, subcylindrical, about six times as long as wide; second tarsal segment of hind legs with more than 20 spinelike setae (Afghanistan) *oubahi* Bitsch, 1968
- Distal segment of maxillary palp not as above, less than six times as long as wide; second tarsal segment of hind legs with fewer than 20 spinelike setae 15
15. Eyes not quite touching along midline (fig. 6F); setulae present on undersurface of segments III-VII of maxillary palp (fig. 6D); sensory field of fore femur with approximately 80 sensilla (fig. 7A) (N. India) *schmidi*, new species
- Eyes touching along midline (fig. 4C); setulae present on undersurface of segments II-VII of maxillary palp (fig. 4I); sensory field of fore femur with 20-30 sensilla (fig. 4M) 16
16. Apical segment of maxillary palp subconical, somewhat pointed apically; abdominal sterna with few setae; labial palp with only basal half of second segment beset with setulae (Afghanistan) *wygodzinskyi* Bitsch, 1968
- Apical segment of maxillary palp subcylindrical, broadly rounded apically (fig. 4I, L); abdominal sterna with numerous, scattered hairs (fig. 5D); labial palp with almost entire surface of second segment covered with setulae (fig. 4K) (N. India, N. Pakistan) *lapidicola*, new species
17. Ocelli small, subcircular; fore tibia with small cluster of spines subapically below (Afghanistan). *bitschi* Wygodzinsky, 1962
- Ocelli distinctly wider than long; spine cluster of fore tibia absent 18
18. Sternites rectangular posteriorly; maxillary palp lacking setulae at least on segments II and III (Afghanistan) *tuxeni* Wygodzinsky, 1950
- Sternites obtuse-angled posteriorly; maxillary palp with setulae on segments II-VIII (China [Szechuan]) *hummeli* Silvestri, 1934
19. Ovipositor of primary type (fig. 10A, F, I) 20
- Ovipositor of secondary type (fig. 5E, G, H-K) 25
20. Line of contact of eyes half the length of eyes, or longer 21
- Line of contact of eyes distinctly shorter than half the length of eyes 22
21. Ovipositor surpassing stylets IX by more than length of stylets; gonapophyses with approximately 80 articles (Nepal) *swani*, new species
- Ovipositor only slightly extending beyond apex of stylets IX; gonapophyses with 55-60 articles (Afghanistan) *tuxeni* Wygodzinsky, 1950
22. Apical seta of gonapophyses extremely elongate, as long as five distal articles combined (Afghanistan) *wygodzinskyi* Bitsch, 1968
- Apical seta of gonapophyses shorter, at most as long as four distal articles combined 23
23. Ovipositor not quite attaining apex of stylets

- IX (fig. 7H) (N. India)
 *schmidi*, new species
 Ovipositor surpassing apex of stylets IX (fig. 3C) 24
24. Ovipositor surpassing apex of stylets IX by distance equal to at least three fourths of length of stylet (Afghanistan)
 *oubehi* Bitsch, 1968
 Ovipositor surpassing apex of stylets IX only very slightly (fig. 3C) (N. India)
 *insensilis*, new species
25. Ovipositor completely hidden by coxites IX; posterior submedian lobes of coxites VII conspicuously projecting, as long as wide at base (Mongolia)
 *ciliatus* Wygodzinsky, 1970
 Ovipositor distinctly surpassing apex of coxites IX, thus apical portion of ovipositor free (fig. 5G); posterior submedian lobes of coxites VII not conspicuously projecting, much shorter than wide at base (fig. 5B) 26
26. Distal articles of gonapophyses each with more than three fossorial spines; sternites II-VI right-angled posteriorly (N. India)
 *hutchinsoni* Silvestri, 1936
 Distal articles of gonapophyses, except in some cases apical one, each with three or fewer fossorial spines (fig. 5H, J, K); posterior angle of sternites II-VI obtuse (fig. 5D) 27
27. Ocelli almost circular; apical articles of anterior gonapophyses with curved fossorial spines on both margins (Afghanistan)
 *bitschi* Wygodzinsky, 1962
 Ocelli distinctly transverse (fig. 4B, C); apical articles of anterior gonapophyses with curved fossorial spines only on outer margin (fig. 5H, J, K) 28
28. Line of contact of eyes slightly more than half as long as length of eyes; ovipositor almost attaining apex of styli IX; gonapophyses with approximately 40 articles (China [Szechuan])
 *hummei* Silvestri, 1934
 Line of contact of eyes slightly shorter than half the length of eyes; ovipositor not surpassing level of center of styli IX; gonapophyses with 30 articles or less (fig. 5E) 29
29. Pigment on frons in shape of small V or Y; ovipositor with 20 articles; abdominal sterna with scarce setae (Afghanistan)
 *povolnyi* Bitsch, 1968
 Ovipositor with 30 articles; frons almost en-

tirely pigmented (fig. 4A); abdominal sterna with numerous scattered setae (fig. 5D) (N. Pakistan, N. India)
 *lapidicola*, new species

The literature cited at the end of this paper covers the primary literature for *Machilanus* and its species.

Machilanus bifarius Wygodzinsky
 Figure 1C, I, J

Material Examined. USSR: Tuva: South of Tannu-Ola, June 14, 1962, four females; Chaa-Khol, July 13, 1962, three males, two females.

All specimens are in the collection of the Academy of Sciences of the USSR, Leningrad.

This species was described from Mongolia (Wygodzinsky, 1970).

Machilanus ciliatus Wygodzinsky

Material Examined. USSR: Tuva: Tuva intermountain valley, N slope, Aug. 12, 1962, one male, one female; Ubsanoor intermountain valley, near Lake Tere-Khol, July 23, 1962, one female; Tuva Valley, Chaa-Khol River, July 11, 1962, seven males, two females; Chaa-Khol River, July 14, 1962, two males, three females; Ubsanoor Valley, near Shevelik-Khol River, Aug. 3, 1962, one male, one female; bank of Yenissei River, Aug. 15, 1962, one male; Tuva Valley, bank of Yenissei River, Aug. 15, 1962, one male, one female.

The above specimens occurred mostly in areas of steppe vegetation. The material is in the collections of the Academy of Sciences of the USSR, Moscow; two males are in the collections of the American Museum of Natural History.

This species has previously only been reported from Mongolia (Wygodzinsky, 1970).

Machilanus hebraeus, new species
 Figure 1

Diagnosis. A *Machilanus* differing from all other species by the combination of characters shown in the key.

Description. Male. Body length 9 mm. General body color yellowish brown, as if more heavily sclerotized than usual in machilids. Hypo-

dermal pigment absent on thorax and abdomen. Pattern formed by scales unknown.

Frons, clypeus, and labrum with extensive but faint hypodermal pigment. Shape of eyes and ocelli as shown in figure 1A, B. Ratio $L/1=0.9$; $c/L=0.41$. Ocelli as shown in figure 1A, B, twice as wide as long. Antennae stout, preserved por-

tion 5.3 mm. long. Flagellum uniformly brown. Scapus not quite twice as long as wide (fig. 1C). Subarticles of middle of antennae with bristles and sensory setae arranged in from two to four transversal rows. Maxilla and first segment of maxillary palp with hypodermal pigment. Shape of maxillary palp as illustrated (fig. 1D). Apical

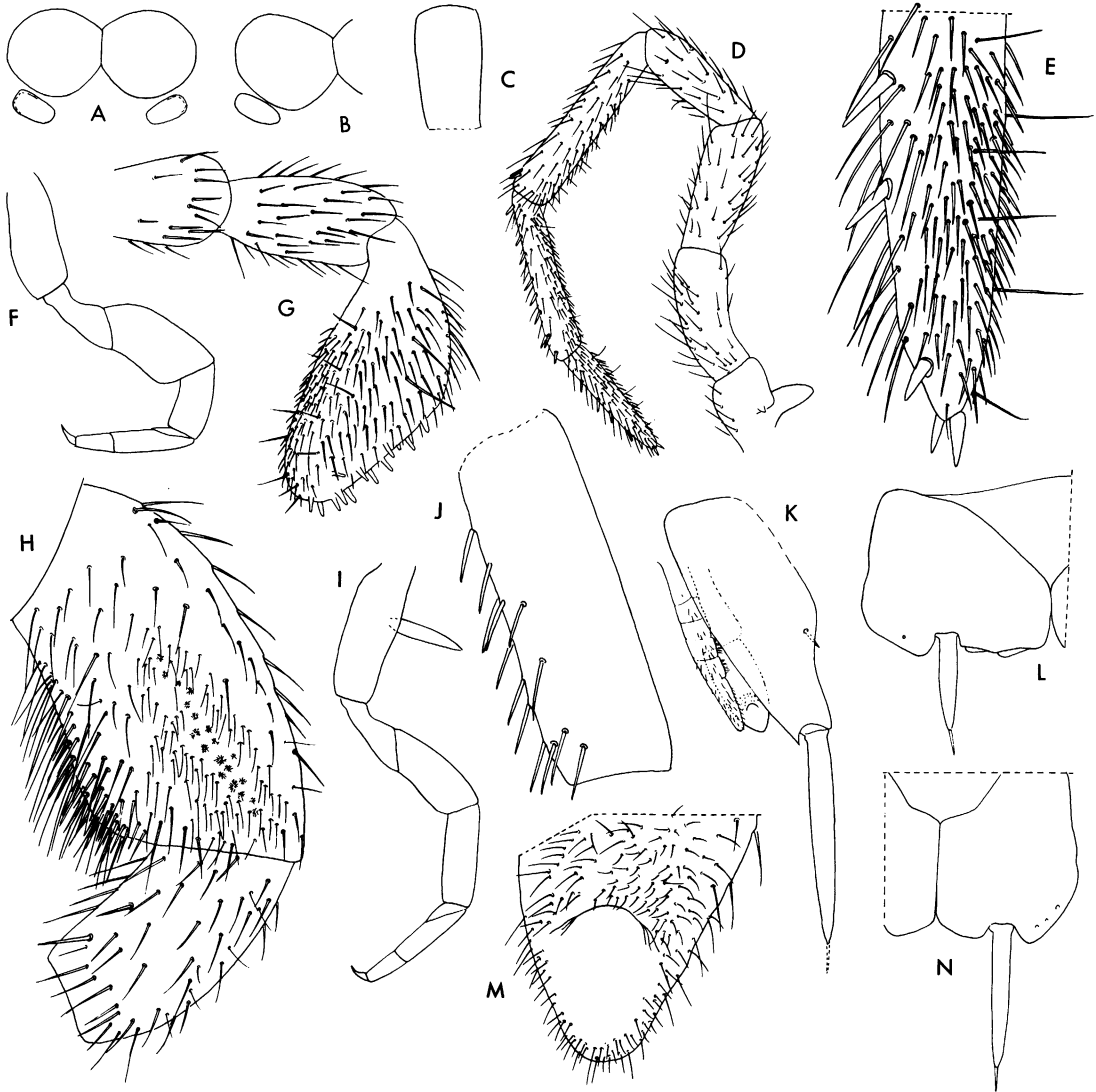


FIG. 1. *Machilanus hebraeus*, male. A. Eyes and ocelli, front view. B. Eye and ocellus, lateral view. C. Scapus, outline. D. Maxillary palp. E. Portion of apical segment of maxillary palp. F. Foreleg, outline. G. Labial palp. H. Femur and tibia of foreleg, external surface. I. Hind leg, outline. J. Hind tibia, with spinelike setae shown. K. Coxite and stylus IX, with penis and one paramere. L. Portion of abdominal sternum V. M. Apex of penis, high magnification. N. Portion of abdominal sternum VIII.

segment more than half as long as penultimate, somewhat pointed distally (fig. 1E). Undersurface of segments II and III with a few setae somewhat longer than those of lateral or dorsal surface of these segments; segments V-VII on undersurface with numerous setulae not as short or dense as usual for the genus. Apical sensory spines of maxillary palp hyaline, only very slightly diminishing in size toward apex of seventh segment (fig. 1E). Labial palp as illustrated (fig. 1G); apical segment very strongly widened triangularly, its undersurface with setulae very similar to those of maxillary palp.

Femur of foreleg widened (fig. 1F, H), slightly projecting on undersurface apically. Numerous strong, distinctly pigmented setae on undersurface, very dense on inferoanterior angle. Ramose sensillae of fore femur forming very narrow sensory field about one-half as long and one-seventh as wide as femur. Fore tibia (fig. 1F, H) stout, slightly curved, with spinelike setae not conspicuous. Number of spinelike setae of tibia I, 2 or 3, tibia II, 5 or 6, tibia III, 8-10; these setae arranged on tibia III in three irregular rows (fig. 1J).

Abdominal segments I, VI, and VII with 1+1, II-V with 2+2 eversible vesicles. Posterior angle of sternite V approximately 90 degrees (fig. 1L). Shape of sternum VIII as shown in figure 1N. Sternites and coxites glabrous, posterolateral portion of posterior coxites with a few spines (fig. 1K, N). Ratio stylus/coxite, on segments II-VII=0.65, on segment VIII, 0.77, on segment IX, 0.88. Setae on styli forming irregular but distinct whorls.

Genital appendages (fig. 1K, M) not quite attaining level of apex of coxites IX; parameres attaining apex of penis. Genital opening subcircular, surrounded by simple short setae. Parameres with 1+6 articles, the apical one as long as the three foregoing combined.

Material Examined. Israel: Sataf (Friedlaender; AMNH), one male, holotype, on slide.

Etymology. From the Latin *hebraeus*, Hebrew; the species occurs in Israel.

Discussion. *Machilanus hebraeus* is the most westerly of all species of the genus.

***Machilanus insensilis*, new species**

Figures 2, 3

Diagnosis. A *Machilanus* differing from re-

lated species by the combination of characters shown in the key.

Description. Body length and general color not recorded; intense hypodermal pigment on first segment of maxillary palp. Pattern formed by scales unknown.

Shape of eyes and ocelli as shown in figure 2C, D. Ratio $L/1=1.0$, $c/1=0.3$. Ocelli two and one-half times as wide as long, their distance slightly longer than their width. Maximum observed length of antennae 9 mm., shorter than body; antennae of male slightly thicker than those of female. Scapus of male not quite twice as long as wide. Flagellum brown, concolorous. Subarticles of middle of antennae in both sexes with setae arranged in one or two transversal rows. Apical preserved portion of antennae with articles divided into 9-12 subarticles. Shape of maxillary palp of male as shown in figure 2A, of female as shown in figure 2B; last segment more than half as long as penultimate, in both sexes. Apical segment of maxillary palp of male subcylindrical, not swollen, narrowly rounded apically. Long hairs of undersurface of segments of maxillary palp absent, but segment V-VII with minute spinelike setulae (fig. 2A, F, K). Sensory spines of maxillary palp of male hyaline, elongate except on apical portion of segment VII (fig. 2K). Apical segment of labial palp of male with setulae similar to those of maxillary palp.

Outline of legs as shown in figure 2H, I, L, M. Fore femur of male widened, with numerous strong, elongate setae on undersurface (fig. 2L). Field of ramose sensillae not developed. Fore tibia of male short, with only a few long spinelike setae. Femora of all legs of female, and of legs II and III of male without spinelike setae. Number of spinelike setae on tibiae; tibia I, 0; tibia II, male, 3-5, female, 7 or 8; tibia III, male, 6-8, female, 10-12; spinelike setae on tibia III arranged in three irregular series (fig. 2J).

Abdominal segments I, II, and III with 1+1, II-V with 2+2 eversible vesicles. Posterior angle of sternite V approximately 105 degrees. Shape of sternum VIII of male as shown in figure 2P. Apices of lobes of coxites VII of female forming a short projection with almost straight posterior borders (fig. 2R). Coxites with a few spinelike setae on posterolateral lobes, otherwise glabrous. Ratio stylus/coxite, on segments II-VII, 0.5; seg-



FIG. 2. *Machilanus insensilis*. A. Maxillary palp of male, schematic, area occupied by setulae hatched. B. Maxillary palp of female, outline. C. Eye and ocellus, front view. D. Eye and ocellus, lateral aspect. E. Labial palp of male. F. Setulae of maxillary palp of male, high magnification. G. Labial palp of female, outline. H. Foreleg of male, outline. I. *Idem*, female. J. Hind tibia of male, with spinelike setae. K. Portion of apical segment of maxillary palp of male. L. Foreleg of male, external surface. M. Hind leg of female, outline. N. Apex of cercus. O. Genital segment of male. P. Portion of sternum VIII of male. Q. Portion of sternum V of male. R. Portion of sternum VII of female.

ment VIII, male, ?, female, 0.73; segment IX, male, 0.75, female, 0.62. Setae on apical half of styli slightly darker than on basal half. Styli IX of male without conspicuous ciliate setae.

Genital appendages of male reaching level of apex of coxites IX, parameres attaining level of apex of penis (fig. 2 O). Genital opening narrow, elongate, surrounded by field of short hairs. Para-

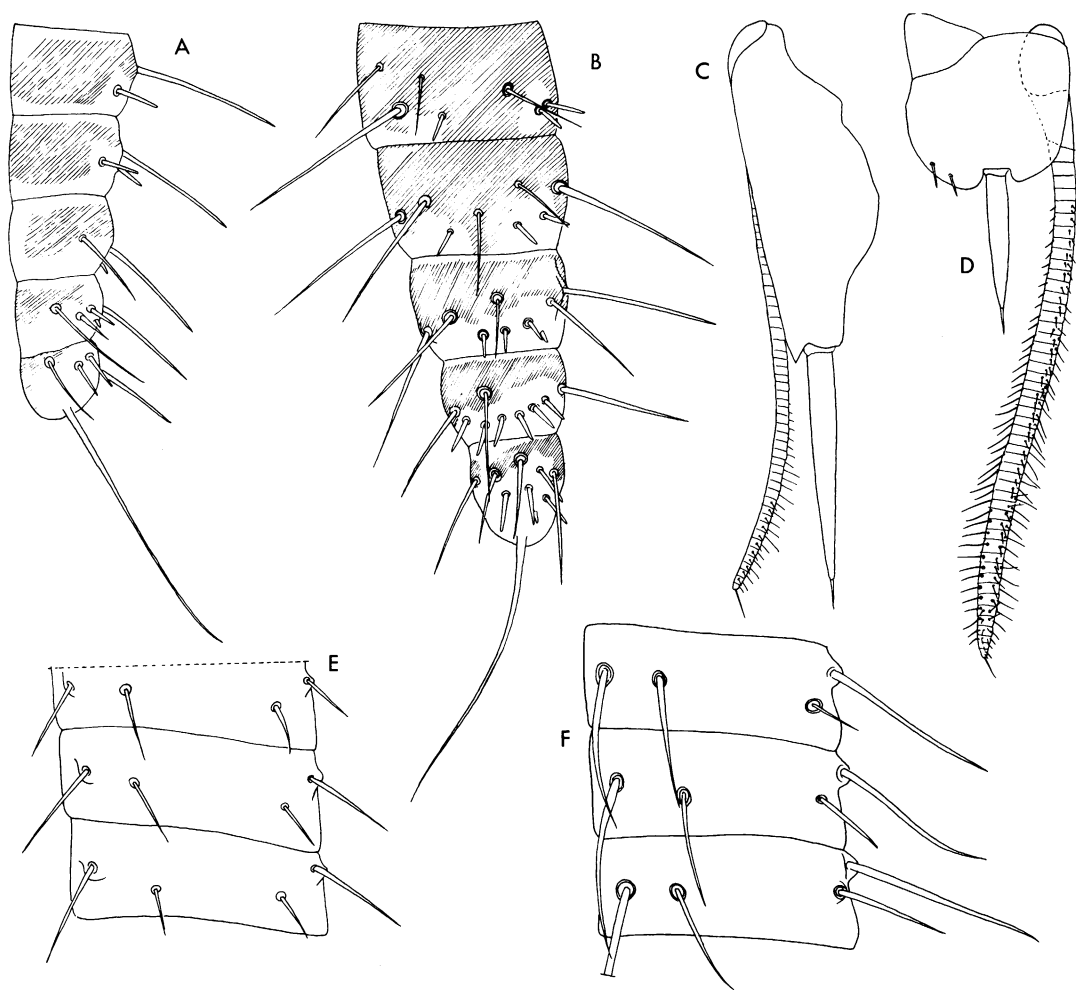


FIG. 3. *Machilanus insensilis*, female. A. Apical portion of posterior gonapophysis. B. *Idem*, anterior gonapophysis. C. Coxite IX with posterior gonapophysis. D. Coxite VIII, with anterior gonapophysis. E. Tenth to twelfth articles of anterior gonapophysis. F. Twenty-fifth to twenty-seventh articles of anterior gonapophysis.

meres with 1+4 or 1+5 articles, the apical about as long as the basal one. Ovipositor of primary type (fig. 3C, D), slender, elongate, attaining level of apex of terminal spine of stylus IX. Anterior gonapophyses with 50 or 51 articles, their chaetotaxy as illustrated (fig. 3B, D-F); basal five segment bare. Basal portion of gonapophyses lightly, apical half more heavily pigmented, distal articles with irregular unpigmented areas (fig. 3B). Terminal spine about as long as the three apical articles combined. Posterior gonapophyses with

approximately 55 articles, the basal 15 bare, the remaining with similar but fewer setae (fig. 3A, C) than anterior gonapophyses.

Material Examined. India: Uttar Pradesh: Kumaon Hills, Pauri Charwal, Barasu, 5000-6000 ft., May 5, 1958 (F. Schmid; AMNH), one male, holotype, one female, allotype, mounted on slides.

Etymology. From the Latin *insensilis*, insensible, an allusion to the absence of sensory sensillae on the fore femur of the male.

***Machilanus lapidicola*, new species**

Figures 4, 5

Diagnosis. A *Machilanus* distinguished from its congeners by the combination of characters shown in the key.

Description. Maximum body length of male 12 mm., of female 14 mm. General body color whitish. Hypodermal pigment on body and appendages, in some places very intense on head as shown in figure 4A. Pattern formed by scales unknown.

Shape of eyes and ocelli as shown in figure 4A-C. Ratio $L/l=1.0$, $c/L=0.31-0.41$. Ocelli about twice as wide as long, their distance equal to, or slightly longer than, their width.

Maximum observed length of antennae 11 mm.; antennae of male thicker than those of female. Scapus of male not quite twice as long as wide. Scapus and pedicellus with heavy hypodermal pigment. Flagellum brown, with distal chains alternately slightly darker and slightly lighter. Articles of middle of antennae of male and female with setae arranged in one or two transversal rows. Apical preserved articles divided into up to 12 subarticles. Pigment pattern of mandibles as shown in figure 4D. Shape and pigment pattern of maxillary palp of male as shown in figure 4E, of female as shown in figure 4F; last segment more than half as long as penultimate, in both sexes. Apical segment of maxillary palp of male subcylindrical, not swollen, broadly rounded distally (fig. 4I, L). Undersurface of segments I and II with long hairs; segments II-VII with abundant setulae. Sensory spines of maxillary palp of male hyaline, becoming very short toward apex of seventh segment (fig. 4L). Apical segment of labial palp only moderately widened in both sexes (fig. 4G, H, K). Second and third segment of labial palp of male with setulae similar to those of maxillary palp, occupying almost entire disc of segments (fig. 4K).

Outline of legs as shown in figure 4N-Q; pigmentation of legs more extensive in male (fig. N, Q) than in female (fig. O, P). Fore femur of male widened; strong setae forming compact group of projecting portion of undersurface. Ramose sensilla forming a field one-half as long and about one-fourth as wide as femur (fig. 4M). Fore tibiae of male stout, somewhat curved, with a few

spinellike setae. Femora of all pairs of legs of female and of pairs II and III of male without distinct spinellike setae. Number of spinellike setae on tibiae: tibia I, male, 1 or 2, female, 1 or 2; tibia II, male, 3-5, female, 2 or 3; tibia III, male, 10-12, female, 8-10; spinellike setae of hind tibia arranged in two or three irregular series (fig. 4R).

Abdominal sterna I, VI, and VII with 1+1, II-V with 2+2 eversible vesicles. Posterior angle of sternite V approximately 120 degrees. Shape of sternum VIII of male as shown in figure 5A. Apices of lobes of coxites VII of female forming a projection with a conspicuous apical incision (fig. 5B). Disc of sternites and coxites with numerous long setae (fig. 5D). Ratio stylus/coxite, on segments II-VII, 0.50-0.54; segment VIII, male, 0.76, female, 0.70-0.80; segment IX, male, 0.91, female, 0.62-0.70. Setae of apical portion of styli darker than those of basal portion. Styli IX of male without conspicuous ciliate setae.

Genital appendages of male (fig. 5F) attaining level of apex of coxites IX, parameres attaining level of apex of penis. Genital opening elongate oval, surrounded by field of fine hairs (fig. 5C). Parameres with 1+5 articles, apical one slightly longer than the four preceding combined. Ovipositor of secondary type, stout, only attaining level of middle of styli IX. Anterior gonapophyses with 26-31 articles, their chaetotaxy as illustrated in figure 5E, H-K. Terminal articles each with two or three closely grouped fossorial spines, the distalmost articles with small groups of sensory rods. Posterior gonapophyses (fig. 5G) with about 30 articles; disc of about the first 10 basal articles glabrous, the others with similar but fewer setae than on anterior gonapophyses.

Material Examined. Pakistan: North-West Frontier Province: Kagan Valley, Kagan, 6680 ft., July 27, 1953, on rocks, very abundant (F. Schmid; AMNH), one male, holotype, one female, allotype, both mounted on slides; four males, seven females, paratypes; *ibid.*, Naran, 8000 ft., July 27, 1953 (F. Schmid; AMNH); one female. India: Kashmir: Jammu, Chittakatha Sar, 15,000 ft., Aug. 24, 1954 (F. Schmid; AMNH), one female.

Etymology. From the Latin *lapis*, -idis, stone, and -cola, inhabitant, dweller; allusion to the habitat where the types were collected.

Observation. The female from Kashmir was

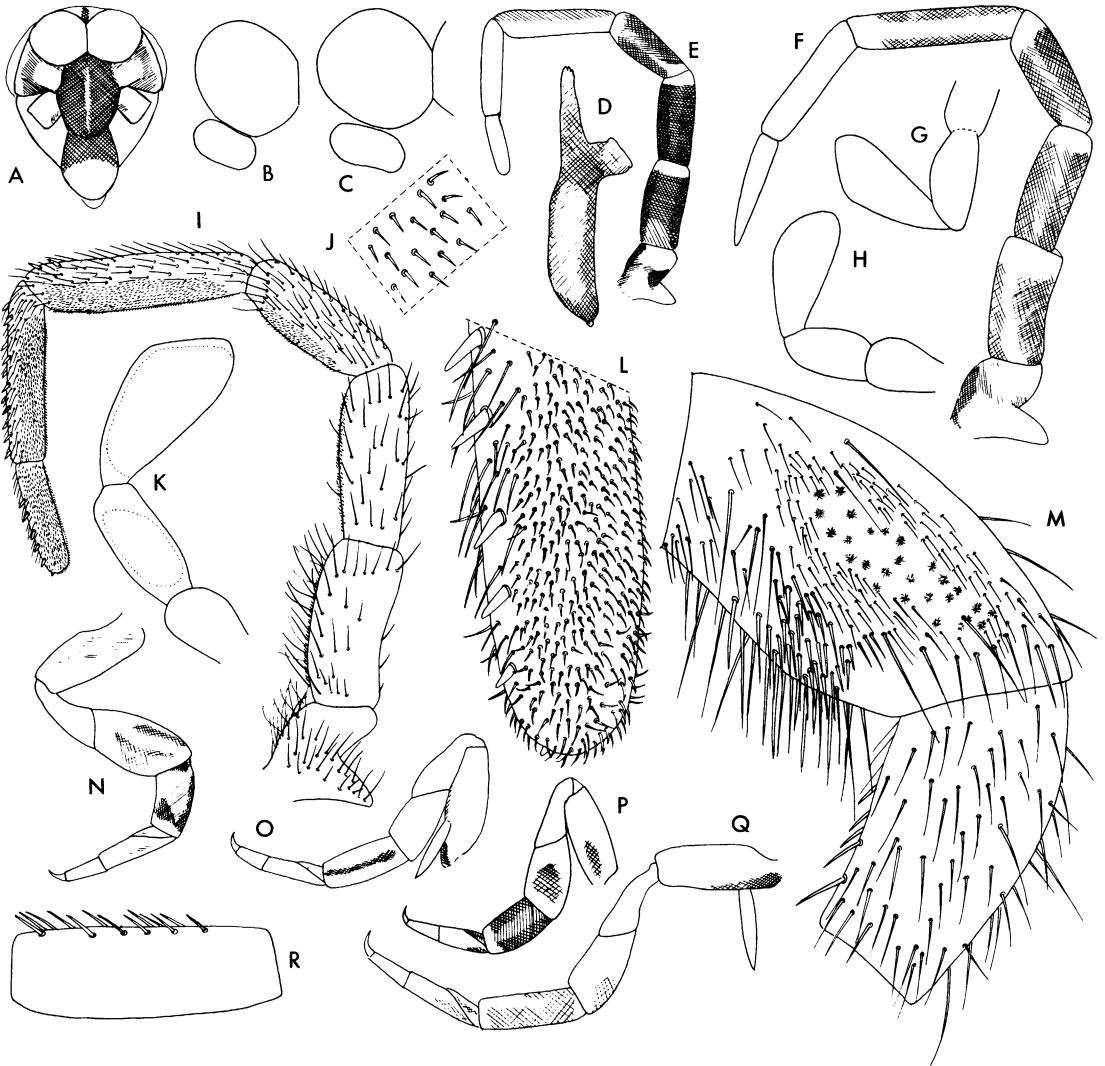


FIG. 4. *Machilanus lapidicola*. A. Head, front view. B. Eye and ocellus, front view. C. Eye and ocellus, lateral view. D. Mandible. E. Maxillary palp of male, pigment pattern. F. Maxillary palp of female, pigment pattern. G. Labial palp of female from Naran. H. Labial palp of female from Kagan. I. Maxillary palp of male. J. Setulae of maxillary palp of male, high magnification. K. Labial palp of male, outline; limits of area occupied by setulae indicated by dotted line. L. Portion of apical segment of maxillary palp of male. M. Femur and tibia of foreleg of male, external surface. N. Foreleg of male, with pigment pattern. O. Hind leg of female, with pigment pattern. P. Foreleg of female, with pigment pattern. Q. Hind leg of male, with pigment pattern. R. Hind tibia of male, with spinelike setae. All drawings are from specimens from Kagan, except 4G which is from Naran.

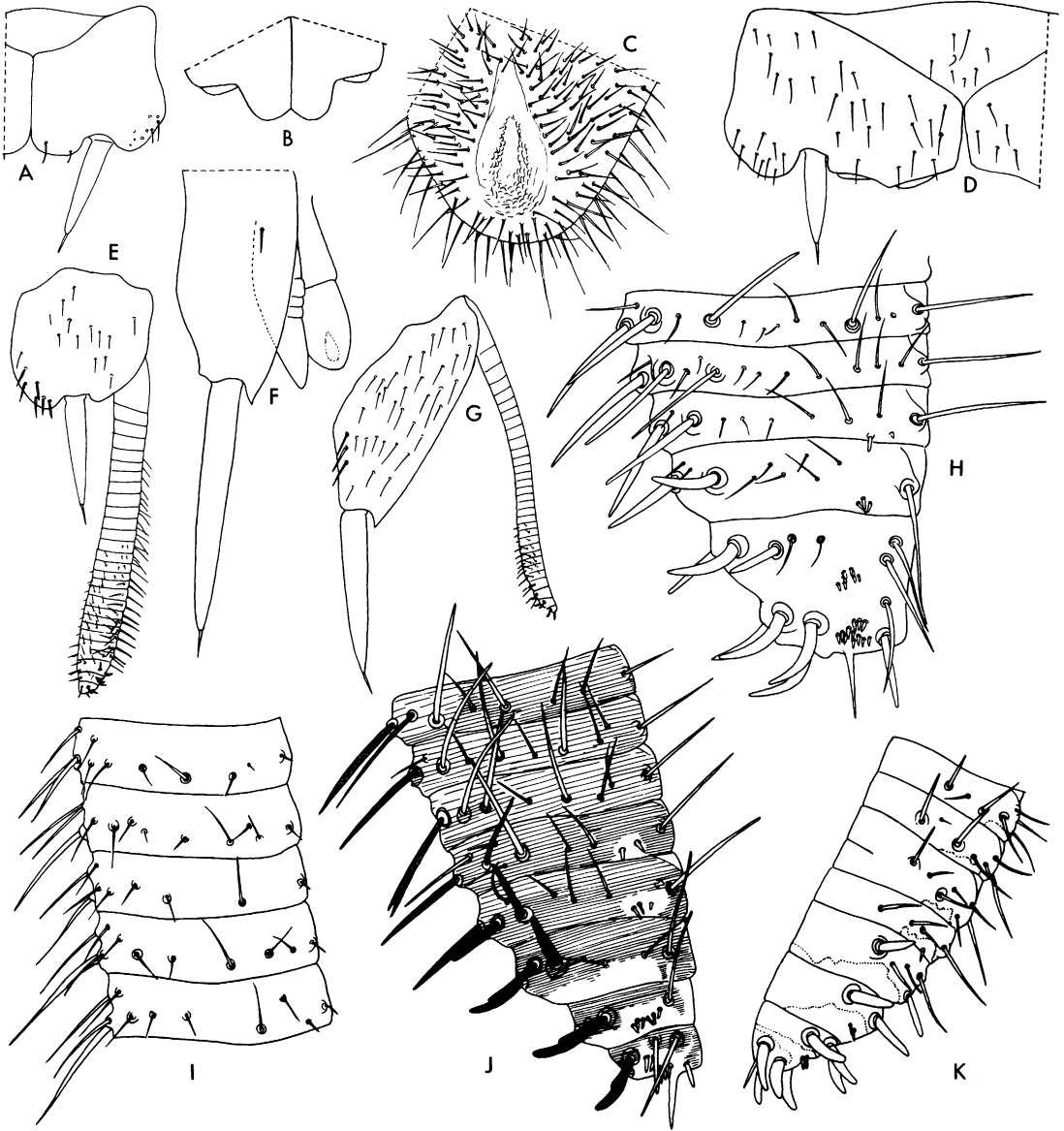


FIG. 5. *Machilanus lapidicola*. A. Portion of sternum VIII of male. B. Portion of sternum VII of female. C. Apex of penis, high magnification. D. Sternum V of female. E. Coxite VIII of female, with anterior gonapophysis. F. Portion of genital region of male. G. Coxite IX of female, with posterior gonapophysis. H. Apex of anterior gonapophysis, female from Naran. I. Ninth to thirteenth article of anterior gonapophysis of female. J. Apex of anterior gonapophysis of female. K. Apex of posterior gonapophysis of female. All drawings are from specimens from Kagan, except 5H which is from Naran.

obtained at a much higher altitude than the remaining specimens, but I was unable to find any significant differences between the female from Kashmir and those from the type series.

***Machilanus schmidi*, new species**

Figures 6, 7, 8 A, B, D-H

Diagnosis. A *Machilanus* distinguished from its congeners by a combination of characters indicated in the key.

Description. Maximum body length of male 13 mm., of female 14.5 mm. General body color yellowish. Hypodermal pigment faint, only perceptible on head. Pattern formed by scales unknown.

Shape of eyes and ocelli as shown in figure 6A, B, F. Ratio $L/l=1.2$, $c/L=0.32$. Ocelli approximately twice as wide as long, their distance equal to twice their width. Setae of frons of male and female as illustrated (fig. 6B, C). Maximum preserved portion of antennae 14 mm.

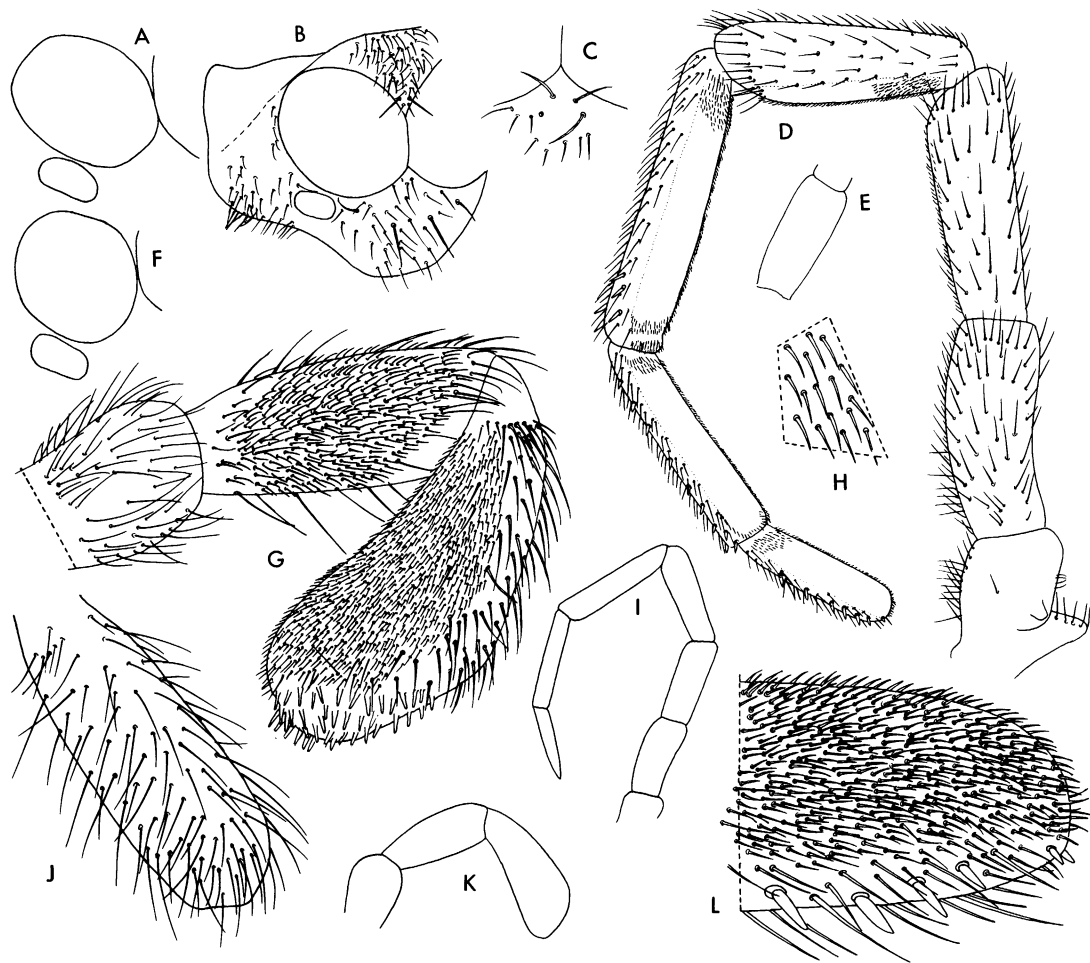


FIG. 6. *Machilanus schmidi*. A. Eye and ocellus, lateral aspect. B. Portion of head of male, sub-lateral view. C. Setae on frons of female. D. Maxillary palp of male. E. Scapus of male, outline. F. Eye and ocellus, frontal view. G. Labial palp of male. H. Setulae of maxillary palp of male, high magnification. I. Maxillary palp of female, outline. J. Anterior surface of second segment of labial palp of male. K. Labial palp of female, outline. L. Portion of apical segment of maxillary palp of male.

long. Flagellum uniformly light brown. Subarticles of middle of antennae with setae arranged in from two to four transversal rows. Apical preserved articles divided into up to 16 subarticles. Scapus of male distinctly more than twice as long as wide (fig. 6E). Shape of maxillary palp of male (fig. 6D) and female (fig. 6I) as illustrated. Last segment of palp more than one-half as long as penultimate, in both sexes. Apical segment of maxillary palp of male subcylindrical, very slightly thicker on apical than on basal half, its apex broadly rounded. Undersurface of segments III-VII with setulae, becoming gradually more numerous toward distal portion of palp, shape as shown in figure 6H. Sensory spines of maxillary palp hyaline, becoming very short on distal end of segment VII (fig. 6L). Apical segment of labial

palp more strongly widened in male (fig. 6G) than in female (fig. 6K). Second and third segments of labial palp of male with setulae similar to those of maxillary palp.

Outline of legs as shown in figure 7A-D. Fore femur of male widened, subapically below with pigmented strong setae aggregated in brushlike group. Ramose sensillae forming field (fig. 7A) about half as long and one third as wide as femur. Fore tibia of male (fig. 7A) not as much shortened as in other species of genus; its spinelike setae short. Femora of all legs of female and legs of pairs II and III of male without spinelike setae. Number of spinelike setae of tibiae: tibia I, male, 10, female, 2; tibia II, male, 18, female, 6-8; tibia III, male, 17-19, female, ?.

Abdominal sterna I, VI, and VII with 1+1,

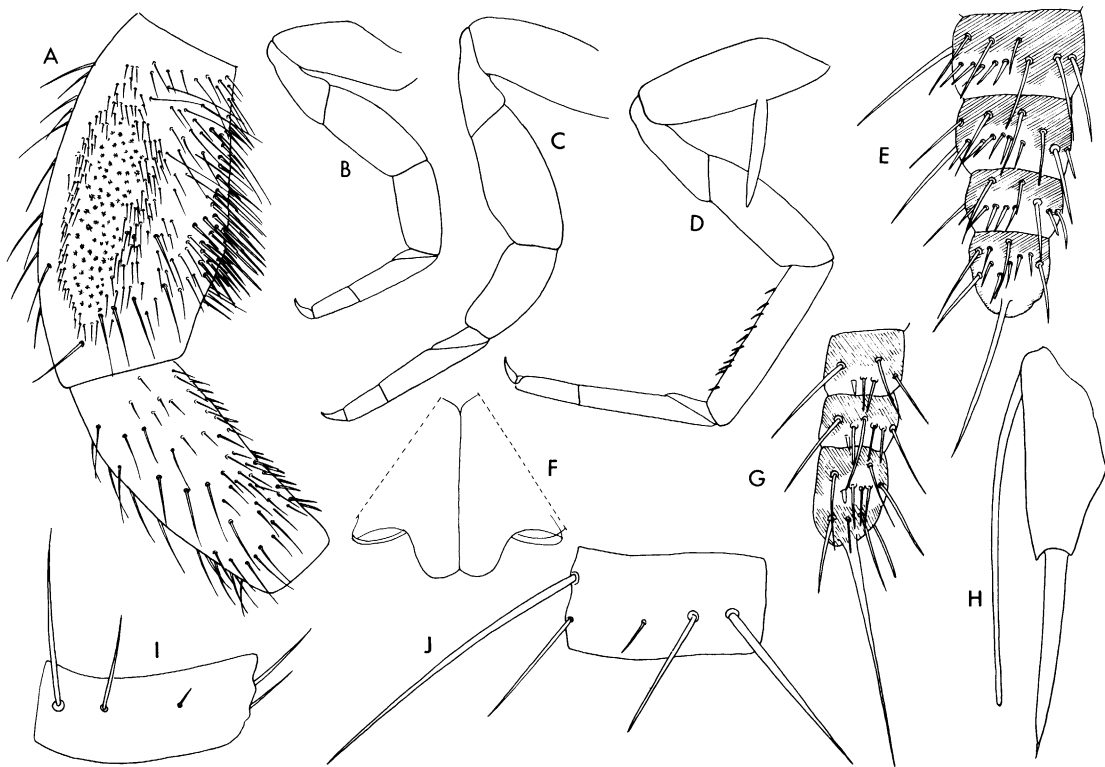


FIG. 7. *Machilanus schmidi*. A. Femur and tibia of foreleg of male, external surface. B. Foreleg of female, outline. C. Foreleg of male, outline. D. Hind leg of male, outline, with spinelike setae of tibia shown. E. Apical articles of anterior gonapophysis of female. F. Portion of sternum VII of female. G. Apical articles of posterior gonapophysis of female. H. Coxite IX of female, with posterior gonapophysis, outline. I. Thirteenth article of anterior gonapophysis of female. J. Fiftieth article of anterior gonapophysis of female.

II-V with 2+2 eversible vesicles. Posterior angle of sternite V approximately 100 degrees (fig. 8A). Shape of sternum VIII of male as shown in figure 8B. Apices of lobes of coxites VII of female forming projection with distinct apical incision (fig. 7F). Sternites glabrous, posterolateral portions of posterior coxites with a few scattered spinelike setae. Ratio stylus/coxite, on segments II-VII, male, 0.73, female, 0.63; VIII, male, 0.81, female, 0.82; IX, male, 1.26, female, 0.86. Setae

on basal half of styli weakly pigmented, becoming darker on apical portion of stylus. Styli IX of male without conspicuous ciliate setae.

Genital appendages of male reaching level of apex of coxites IX; parameres surpassing apex of penis (fig. 8F). Genital opening narrow, elongate, surrounded by field of short hairs (fig. 8G, H). Parameres with 1+5 articles, the apical one as long as the four preceding combined (fig. 8D, E). Ovipositor of primary type, slender, elongate,

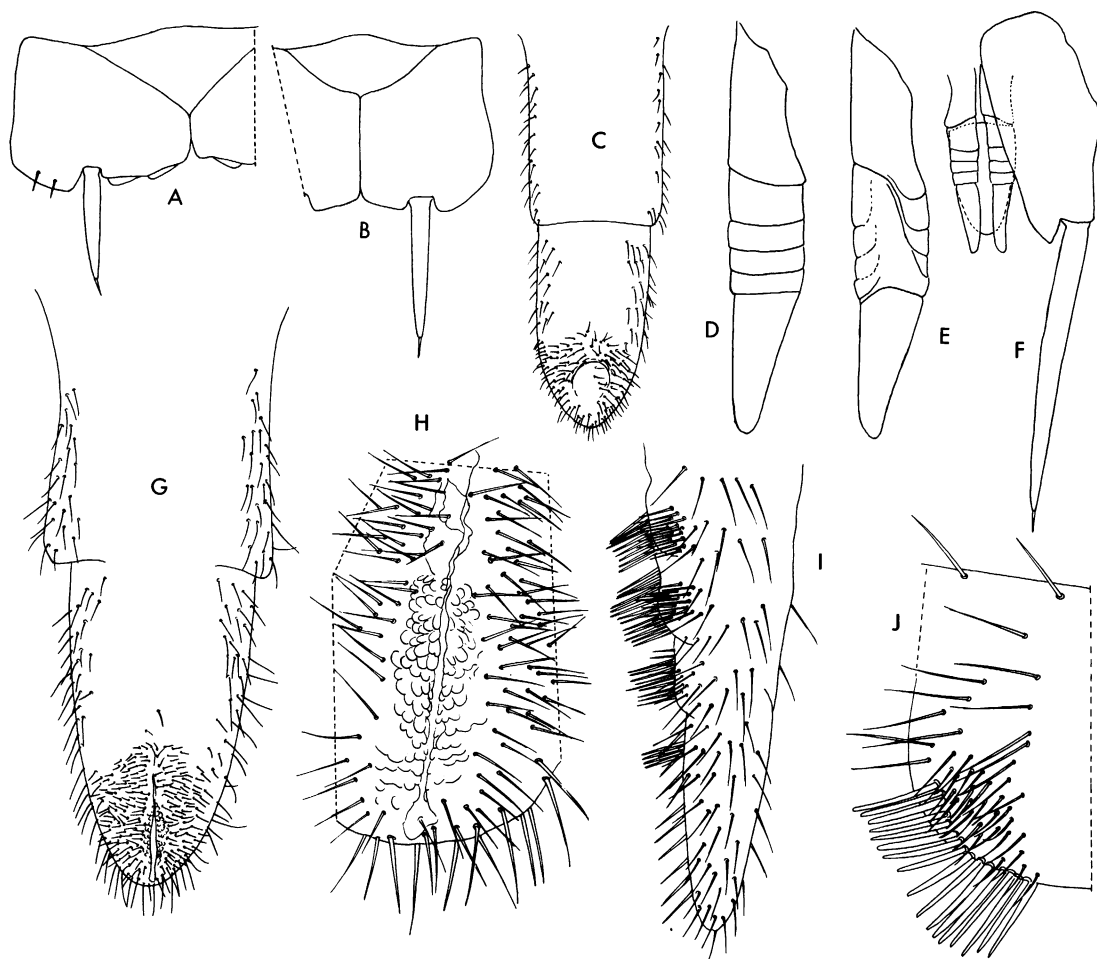


FIG. 8. A, B. *Machilanus schmidi*. A. Sternum V of male. B. Portion of sternum VIII of male. C. *Machilanus bifarius*, penis. D-H. *Machilanus schmidi*. D. Paramere, ventral view, setae not shown. E. Idem, dorsal view. F. Genital region of male, setae not shown. G. Penis. H. Apical portion of penis, high magnification. I, J. *Machilanus bifarius*. I. Apical half of paramere, with setae shown. J. Portion of article of paramere, high magnification.

falling slightly short of apex of styli IX (fig. 7H). Anterior gonapophyses with 58-60 articles, their chaetotaxy as illustrated (fig. 7E, I, J); basal three or four articles glabrous. Pigmentation of gonapophyses uniformly light brown except light colored areas on distal articles (fig. 7E). Terminal spine about as long as three apical articles combined. Posterior gonapophyses with 58-60 articles, the basal 8-10 articles bare, the remaining with similar but fewer setae (fig. 7G) than on anterior gonapophyses.

Material Examined. India: Uttar Pradesh:

Kumaon Hills, Pauri Charwal, Jagrao, 17,500 ft., June 26, 1958 (F. Schmid; AMNH), one male, holotype, one female, allotype, both mounted on slides; one female, paratype, one juvenile specimen.

Etymology. This species is gratefully named for Dr. F. Schmid in recognition of his valuable contribution to this study.

***Machilanus swani*, new species**

Figures 9, 10

Diagnosis. A *Machilanus* differing from con-

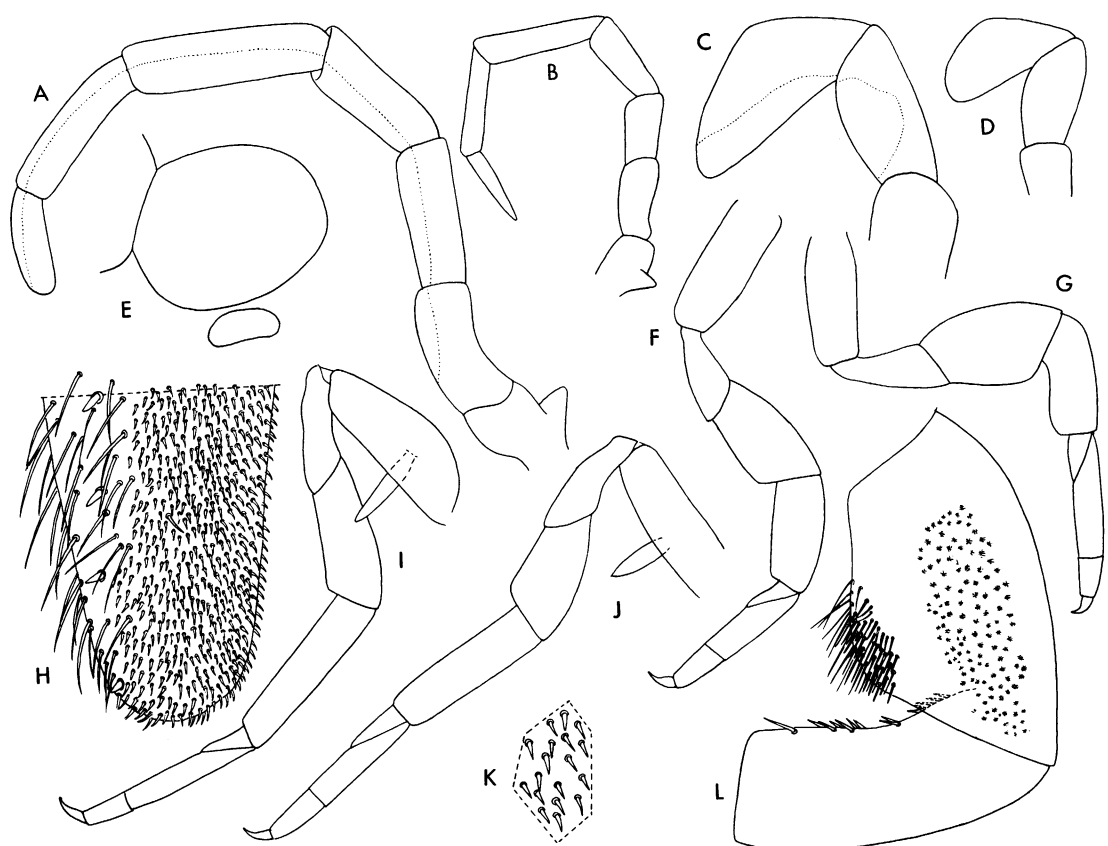


FIG. 9. *Machilanus swani*. A. Maxillary palp of male, outline; limits of area occupied by setulae indicated by dotted line. B. Maxillary palp of female, outline. C. Labial palp of female, outline, limits of area beset with setulae, indicated by stippled line. D. Labial palp of female, outline. E. Eye and ocellus, lateral view. F. Foreleg of female, outline. G. Foreleg of male, outline. H. Portion of apical segment of maxillary palp of male. I. Hind leg of male, outline. J. Hind leg of female, outline. K. Setulae of maxillary palp of male, high magnification. L. Femur and tibia of foreleg of male, external surface not all setae shown.

generic species by the combination of characters shown in the key.

Description. Maximum body length of male 14 mm., of female 15 mm. General body color yellowish. Hypodermal pigment on body and appendages present, but not well enough preserved for description. Pattern formed by scales unknown.

Shape of eyes and ocelli as shown in figure 9E. Ratio $L/l=1.05$, $c/L=0.5$. Ocelli one and one-half times as wide as long, their distance equal to slightly over one and one-half times their width.

Maximum present portion of antennae 9.5 mm. long; antennae of male thicker than those of female. Scapus of male not quite twice as long as wide. Flagellum brown, with distal chains of subarticles alternately with only a few or about one-half of the basal subarticles slightly more light colored. Subarticles of middle of antenna of male and female with setae arranged in one or two transversal rows. Apical preserved articles divided into approximately 12 subarticles. Shape of maxillary palp of male as shown in figure 9A, of female as in figure 9B; last segment more than

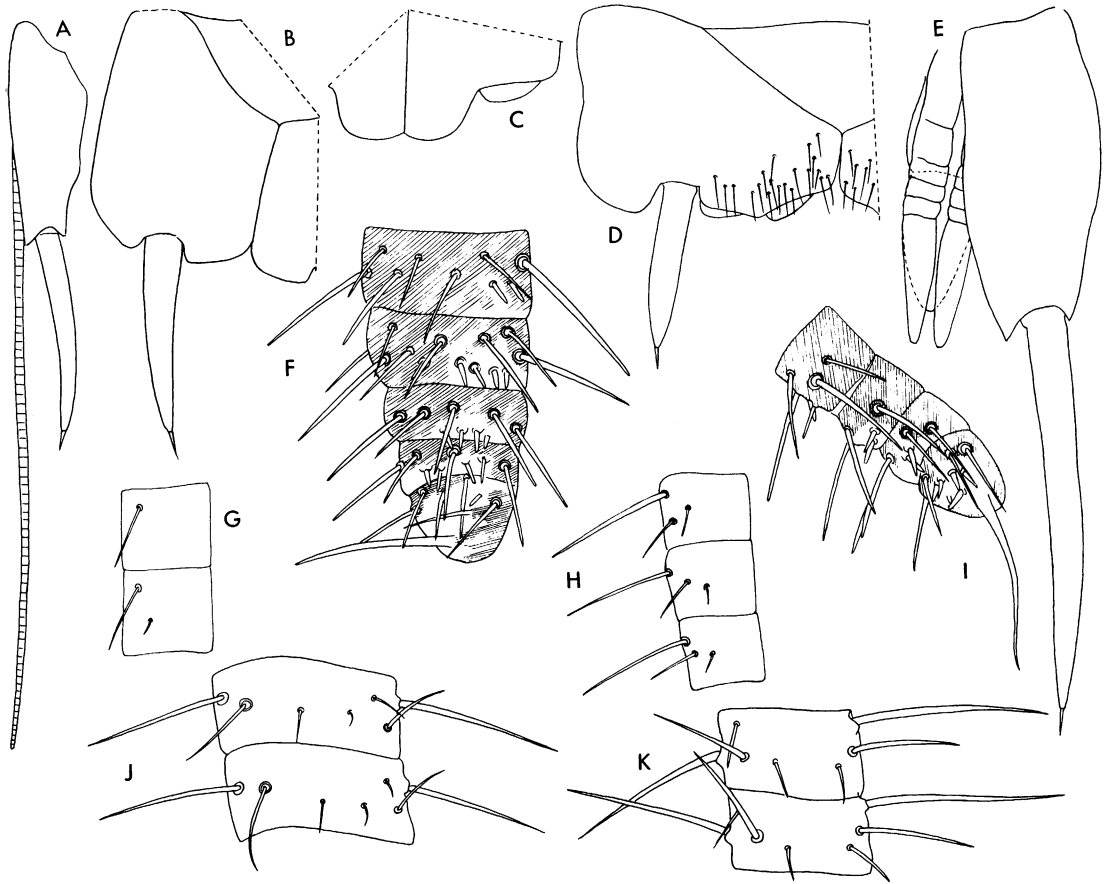


FIG. 10. *Machilanus swani*. A. Coxite IX of female, with anterior gonapophysis, setae not shown. B. Portion of sternum VIII of male. C. Portion of sternum VII of female. D. Portion of sternum V of male, setae on stylets not shown. E. Genital region of male, setae not shown. F. Apical articles of anterior gonapophysis of female. G. Fifty-first and fifty-second article of posterior gonapophysis. H. Seventy-fourth article of posterior gonapophysis. I. Apical portion of posterior gonapophysis. J. Fifteenth and sixteenth articles of anterior gonapophysis. K. Fifty-first and fifty-second articles of an anterior gonapophysis.

half as long as penultimate, in both sexes. Apical segment of palp of male subcylindrical, somewhat swollen, broadly rounded apically. Undersurface of segment I and base of segment II with a few inconspicuous long hairs; apical portion of undersurface of segment II and entire undersurface of segments III-VII with extremely abundant minute spinelike setulae (fig. 9H, K). Sensory spines of maxillary palp of male hyaline, comparatively short, the apical spine of seventh segment minute (fig. 9H). Apical segment of labial palp strongly widened in both sexes (fig. 9C, D). Second and third segments of labial palp of male on undersurface with setulae similar to those of maxillary palp.

Outline of legs as shown in fig. 9F, G, I, J. Fore femur of male strongly widened. Short, strong setae forming tuft on projecting portion of undersurface (fig. 9L). Ramose sensillae forming large field (fig. 9L), two-thirds as long

and over one-third as wide as femur. Fore tibia of male stout, somewhat curved, with spinelike setae very short. Femora of all legs lacking short spinelike setae. Number of spinelike setae on tibiae: tibia I, male, 12, female, 2-4; tibiae II, male, 15-17, female, 8-10; tibia III, male, over 20, female, 15-18; spinelike setae on tibia III arranged in two or three irregular series.

Abdominal segments I, VI, and VII with 1+1, II-V with 2+2 eversible vesicles. Posterior angle of sternite V approximately 120 degrees. Shape of sternum VIII of male as shown in figure 10B. Apices of lobes of coxites VII of female forming a projection with an apical incision (fig. 10C). Coxites with numerous setae on their posterior portion, otherwise glabrous (fig. 10D) and without spinelike setae on posterolateral portions. Ratio stylus/coxite, on segments II-VII, 0.7; segment VIII, male, 0.75, female, 0.82; segment IX, male, 1.15, female, 0.85. Setae of basal half of styli weakly pigmented, those of apical half very dark. Styli of ninth segment of male only with normal setae.

Genital appendages of male (fig. 10E) reaching level of apex of coxites IX, parameres slightly surpassing apex of penis. Genital opening subcircular, surrounded by long, simple setae. Parameres with 1+6 articles, the apical one almost as long as all remaining combined. Ovipositor of primary type, slender, elongate, surpassing apex of styli IX by from slightly over one and one-half times to two times the length of these styli (fig. 10A). Anterior gonapophyses with 84-86 articles, their chaetotaxy as illustrated in figure 10F, J, K; basal three or four segments glabrous. Basal half of gonapophyses lightly, apical half heavily, pigmented. Distal spine about as long as apical three articles combined. Posterior gonapophyses with about 58 articles, the basal 10 to 15 articles bare, the others with fewer setae (fig. 10I, G, H) than anterior gonapophyses.

Material Examined. Nepal: Arun Valley, 17,000-19,000 ft., May 27, 1954 (L. W. Swan; CAS), one male, holotype, one female, allotype, both mounted on slides, one male, paratype; *idem* (L. W. Swan; AMNH), one male, paratype; Barun Valley, NW of Peak Makalu, 17,500 ft., May 25, 1954 (L. W. Swan; CAS), two females.

Etymology. The species is gratefully named for its collector, Dr. Lawrence W. Swan.

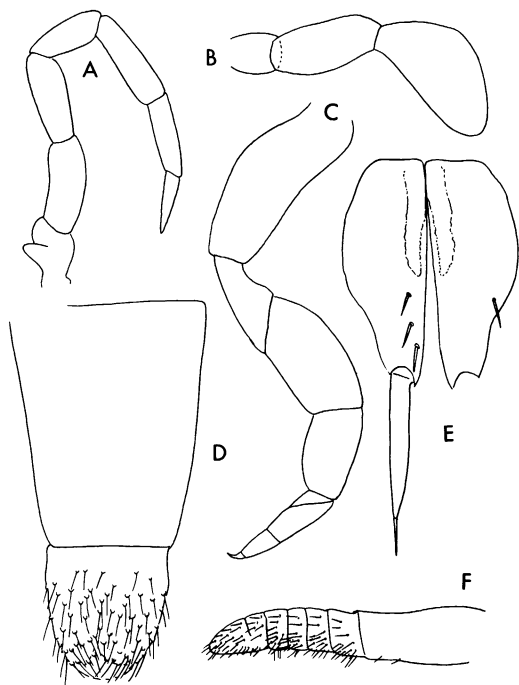


FIG. 11. *Praetrigoniophthalmus gigas*, male. A. Maxillary palp, outline. B. Labial palp, outline. C. Foreleg, outline. D. Penis. E. Genital region, penis removed. F. Paramere.

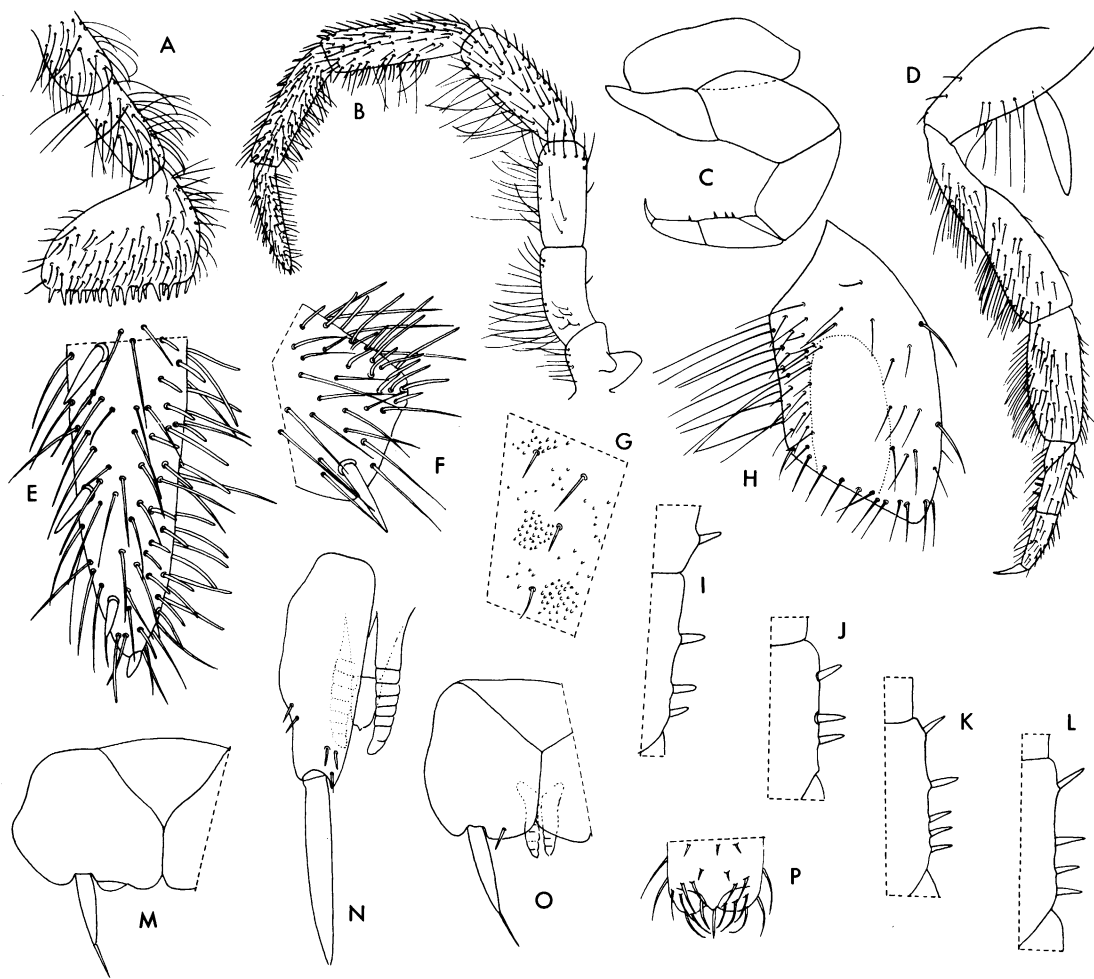


FIG. 12. *Silvestrichilis trispina*, male. A. Labial palp. B. Maxillary palp. C. Foreleg, schematic. D. Hind leg. E. Portion of apical segment of maxillary palp. F. Apex of penultimate segment of maxillary palp. G. Surface structure and setae of sensory field on fore tibia. H. Fore tibia, limits of sensory field indicated by dotted line. I. Spines of undersurface of fore tarsus. J. *Idem*, tarsus of second pair. K, L. *Idem*, tarsi of third pair. M. Portion of sternum V. N. Genital region. O. Sternum VIII with anterior parameres, schematic. P. Apex of penis.

PRAETRIGONIOPHTHALMUS JANETSCHKE

Praetrigoniophthalmus gigas (Burmeister)

Figure 11

Material Examined. Israel: Jerusalem, May 25, 1955 (J. Wahrman), one female; *ibid.*, Aug. 8, 1952 (J. Wahrman), one juvenile female; near Aqua Bella, March 6, 1954 (J. Wahrman), one

female; Sataf (Friedlander) one male, two females, all immature. All specimens in the American Museum of Natural History.

The male of this genus has never been described; thus a few notes and illustrations of the male examined are given here, even though it is immature. Its length is 7 mm. The forelegs and maxillary palps lack specialized setae; this may

be due to the immaturity of the specimen. The legs lack spinelike setae. The terminal segment of the labial palp is strongly widened (fig. 11B) and bears very numerous sensory pegs on its apical surface. Parameres exist only on the ninth segment (fig. 11F); they are of conventional type. The basal portion of the penis is much longer than the distal one; the gonopore seems to be subapical, and is not conspicuous; there are numerous long setae on the apical portion of the penis (fig. 11D).

SILVESTRICHILIS WYGODZINSKY

Silvestrichilis trispina (Wygodzinsky)

Figure 12

Material Examined. Israel: Ammi'ad, March 22, 1961 (Katznelson; AMNH), one male, one female.

Silvestrichilis trispina was known up to the present only from the female. The males now examined agree with the females in such specific characters as the proportional measurements of the eyes and the range of the number of tarsal spines. A few characters of the male are illustrated here; the figures are self-explanatory.

The armature of the maxillary palp (fig. 12B, E, F) is of special interest, and quite different from that of the known males of other species of the genus. There are numerous long ciliate hairs on the undersurface of segments I-IV, and some also on V, but most of the suberect setae of the undersurface of segments V-VII are peculiarly thickened and rodlike. There are long hairs also on the labial palp, but rodlike setae are not found.

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