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A New Species-Group of the Blackfly Genus *Simulium* from Western South America (Simuliidae, Diptera, Insecta)

BY PEDRO WYGODZINSKY¹ AND SIXTO COSCARÓN²

During field work carried out under the auspices of the American Museum of Natural History and the National Science Foundation on the arid west coast of Peru and Chile, the authors obtained two peculiar species of *Simulium*. These insects differ from other Neotropical *Simulium* at a first glance in the combination of the almost uniformly silver-gray color of the scutum in adults of both sexes, and the four slender filaments of the respiratory organ of the pupa.

A species collected by Mr. Luis Peña, of the University of Chile, Santiago, in the Atacama Highlands, in Chile also proved to belong to this group. We wish to thank Mr. Peña and Dr. Fortunato Blancas, of the Natural History Museum "Javier Prado," Lima, Peru; Dr. Raúl Cortés, Universidad del Norte, Arica, Chile; and our wives, Betty Wygodzinsky and Carmen Coscarón, for their help in the field. Dr. Alan Stone, of the United States National Museum, Smithsonian Institution, lent us paratypes for comparison, and Dr. Evert I. Schlinger, of the University of California, sent us material collected by him; we are much obliged to both colleagues. National Science Foundation Grants GB-5852 and GB-8783 supported part of our work.

¹ Curator, Department of Entomology, the American Museum of Natural History.

² Research Fellow, Department of Entomology, the American Museum of Natural History.

All drawings are by the authors and by Mr. Matthew Cormons.

The species described or redescribed in the present paper do not fit any named New World segregate of *Simulium* as defined by the respective type species. The South American subgenera of *Simulium* have not yet been carefully analyzed, nor have their precise limits been suggested. We therefore prefer to treat the species mentioned by us as forming a species-group rather than a new subgenus, leaving their ultimate rank to be decided in the future.

THE *blancasi* SPECIES-GROUP

DIAGNOSIS: Species of *Simulium* characterized mainly by the uniformly silver-gray scutum in adults of both sexes, lack of denticles of the cibarium, simple claw and glabrous gonopophyses of the female, general structure of the male genitalia, and the four long branches of the respiratory organ of the pupa.

DESCRIPTION: ADULT: Medium-sized (wing length, 2.2–3.2 mm.). Color of scutum in both sexes uniformly gray, except small area near anterior border; abdomen with conspicuous dark and light pattern elements. Eighth and ninth tergites of female polished. Female with fronto-ocular triangle well developed; cibarium glabrous between cornuae; mandibles and maxillae serrated on both edges. Setae of scutum of uniform type, irregularly arranged, not forming lines or groups. Pleural membrane and katapisternum bare. Basal section of R bare in both sexes; R₁ with setae and spines. Fore tarsi narrow, approximately eight times as long as wide. Calcipala and pedisulcus present. Hairs on legs simple, not scalelike. Male genitalia with distimere about as long as basimere, elongate, subconical, without projection at base, and with single apical spinule. Ventral plate subtriangular, membranous, lacking median keel. Median sclerite about as long as wide, with apical incision. Endoparameres with several large hooks. Female with seventh sternite not specialized. Gonapophyses small, glabrous. Paraproct short, simple. Spermatheca globular, not reticulate, its surface minutely punctate; internal spicules present.

PUPA: Cocoon inverted slipper-shaped, lateral margins of anterior opening receding from dorsal to ventral surface; lateral apertures absent. Respiratory organs with four long, slender filaments arising from two short bases or from a common trunk. Trichomes of head and thorax simple, very short. Tergites II–V with 4 + 4 simple hooks, VII and VIII with spine combs; sternites V–VII each with 2 + 2 simple, bifid or trifid hooks. Apex of abdomen lacking specialized setae, and with 1 + 1 apical tubercles.

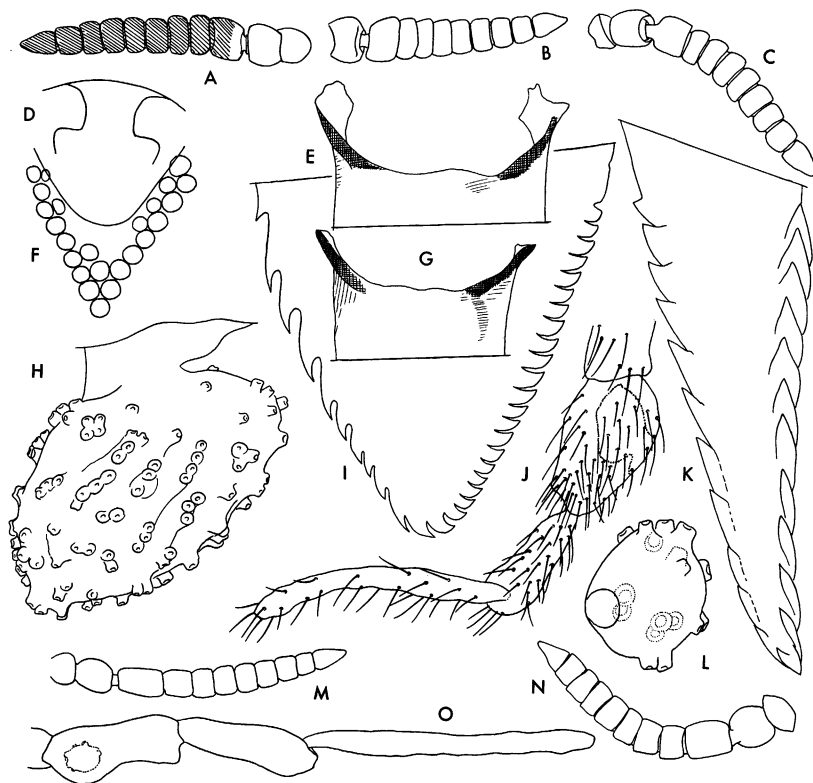


FIG. 1. *Simulium blancasi*. A-K. Female. A-C. Antennae, pigment pattern shown in A only. D. Frons. E. Detail of cibarium. F. Fronto-ocular triangle. G. Detail of cibarium. H. Sensory organ of maxillary palp. I. Apex of mandible with teeth. J. Maxillary palp. K. Apex of maxilla, with teeth. L-O. Male. L. Sensory organ of maxillary palp. M, N. Antennae. O. Maxillary palp.

LARVA: Abdomen gradually widening toward behind, apex not truncate; ventral papillae absent. Head and cephalic fans normal. Head pattern positive. Antennae as long as stem of cephalic fan; second antennal segment with one or two constrictions. Apical tooth of mandible much larger than outer teeth. Preapical teeth decreasing in size from first to third; two marginal serrations present. Hypostomium with median and lateral teeth about equally prominent, intermediate teeth much smaller. Hypostomial setae arranged in 1 + 1 single rows, these rows slightly diverging posteriorly from lateral margins of hypostomium. Gular cleft either large or almost absent. Cervical sclerites very small, isolated in neck membrane. Lateral sclerites of proleg well developed, elongate sub-

pentagonal; setae arranged in one row, clustered in groups in most cases formed of three or four long and short setae; over-all size of setae increasing from upper to lower border of sclerite. Cuticle of body bare; perianal setae present. Anal gills composed of three simple lobes.

DISCUSSION: Glabrous gonapophyses and a cibarium without denticles, as well as male genitalia similar to those of the *blancasi*-group are found in *Simulium exiguum* Roubaud (type species of *Notolepria* Enderlein), and *Simulium bicoloratum* Malloch (type species of *Ectemnaspis* Enderlein). In none of these species, however, is there a comparable color scheme in the adult, or a four-branched pupal respiratory organ. In both species the claw of the female has a distinct tooth, and the paraproct of the female is conspicuously projecting. There is no fronto-ocular area in *exiguum*, and the setae of the mesonotum are arranged in patches in this species. *Simulium bicoloratum* differs further by very striking pupal characteristics (palmate trichomes, and others).

This group is formed by three closely knit species, *blancasi*, new species, *tenuipes* Knab, and *penai*, new species. Although these three species are clearly different, we have been unable to find absolutely reliable characters to distinguish females of *blancasi* and *tenuipes* if not well preserved, and the larvae of *tenuipes* and *penai*.

KEYS TO SPECIES OF THE *blancasi*-GROUP

FEMALES

1. Abdominal tergites III-V velvet black, their center anteriorly (fig. 2N) with or without transverse dumbbell-shaped light-colored spots; setae of scutum sparse, not conspicuous under low magnification. *blancasi*
Abdominal tergites III-V brown or piceous, always without light-colored spots anteriorly (fig. 8A); setae of scutum very abundant, conspicuous under low magnification. 2
2. Abdominal tergites III-V entirely dark velvet brown (fig. 8A); calcipala comparatively large, broadly rounded apically (fig. 8H). *tenuipes*
Abdominal tergites III-V dark anteriorly, distinctly lighter posteriorly, entire posterior half light colored on V; calcipala much reduced, subtriangular (fig. 10B). *penai*

MALES

1. Abdominal tergites III-V velvet black, their anterior border at center with distinct light-colored spot (fig. 2M); setae of scutum sparse, not conspicuous under low magnification; genitalia with median sclerite not longer than wide (fig. 4F). *blancasi*
Abdominal tergites III-V dark, sometimes with lighter regions posteriorly but not on anterior border (fig. 8B); setae of scutum very abundant, conspicuous under low magnification; genitalia with median sclerite longer

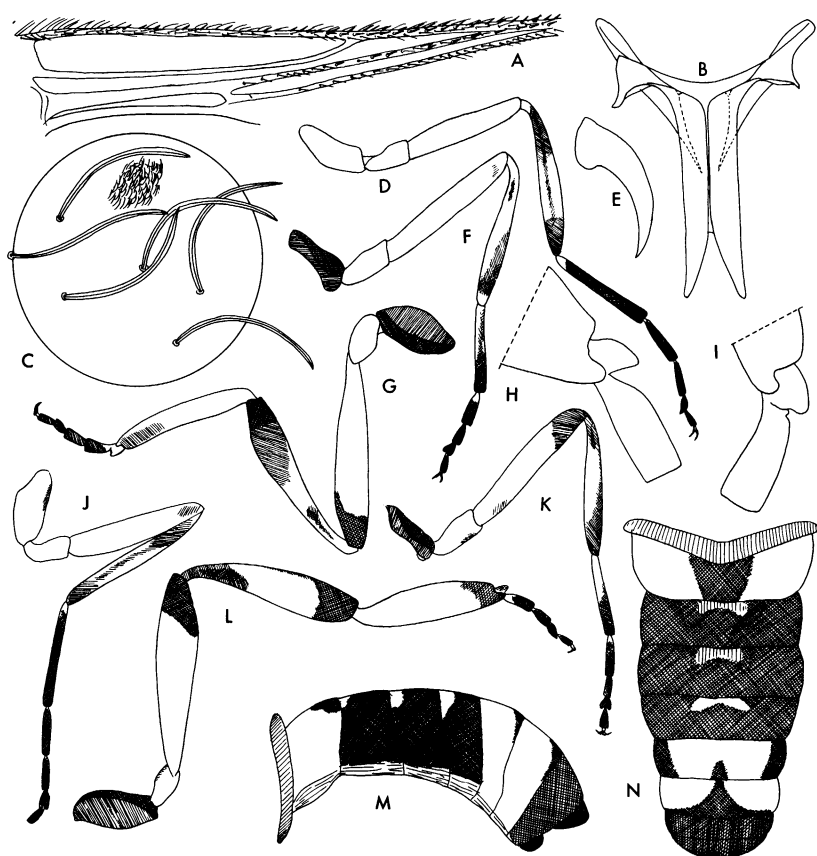


FIG. 2. *Simulium blancasi*. A-G. Female. A. Detail of wing. B. Furcasternum. C. Setae and microtrichia of scutum, high magnification. D. Foreleg. E. Claw. F. Midleg. G. Hind leg. H. Apex of basitarsus with second tarsal segment, hind leg, male. I. *Idem*, female. J-M. Male. J. Foreleg. K. Midleg. L. Hind leg. M. Color pattern of abdomen, lateral view. N. Color pattern of abdomen of female, dorsal view.

- than wide (figs. 8I, 10D). 2
2. Hind basitarsus more than four times as long as wide; calcipala much reduced, subtriangular (fig. 10C). *penai*
- Hind basitarsus less than four times as wide (fig. 8D); calcipala not so reduced, broadly rounded apically (fig. 8F). *tenuipes*

PUPAE

1. Respiratory organ with a short trunk followed by two distinct secondary

- branches bearing the 2 + 2 filaments (figs. 5G, H; 6G-K). *blancasi*
 Respiratory organs with all four filaments seemingly arising from a very short common trunk (figs. 9A, C; 10I, J). 2
2. Front and exposed portion of thorax with abundant platelets (as in figs. 5E; 6B, C, E); surface of cocoon rough, its color brown when examined in liquid. *tenuipes*
 Head and exposed portion of thorax without or with very sparse platelets (fig. 10I, G); surface of cocoon smooth, its color brown with a leaden sheen, parchment-like, when examined in liquid. *penai*

LARVAE

1. Gular cleft large (fig. 7E). *blancasi*
 Gular cleft obsolescent (fig. 10H). 2
2. Over-all color of body whitish *penai*
 Over-all color of body greenish *tenuipes*

Simulium blancasi, new species

Figures 1-7

DIAGNOSIS: See keys for diagnostic characters.

DESCRIPTION: FEMALE: Wing length, 2.7-2.8 mm.

Frons and clypeus dull gray, with a few scattered yellowish hairs. Mouth parts piceous; maxillary palps grayish. Antennae black, grayish pruinose; first, second, and base of third segment light orange colored (fig. 1A). Scutum dull gray. Anterolateral angles and 1 + 1 anterior submedian spots silver-white. Pleura and sterna with grayish pruinosity, faintly nacreous. Pleural membrane dark brown. Hairs of scutum short, scattered, yellowish. Scutellum yellowish brown, narrowly gray pruinose along margins. Hairs of scutellum from yellowish to black. Metanotum glabrous, black, heavily gray pruinose. General color of legs yellowish white, dark pigment from piceous to black; pattern as shown in fig. 2D, F, G. Fore coxae light colored, mid and hind coxae dark. White reflections on leg segments absent. Setae of legs colored as respective background. Anterior wing veins light grayish brown; setae at base of wing black. Stem of halteres yellowish, knob silver-white. Color pattern of abdomen as shown in figure 2N. First abdominal segment yellowish white, its fringe silver-white. Second tergite blackish at center, sides with 1 + 1 very large silvery spots. Third to fifth tergites velvet black, their center at anterior half with a transverse dumbbell-shaped light-colored spot, pinkish or yellowish on third and fourth, silver-white on fifth segment; these spots imperceptible in some specimens. Sixth and seventh tergites silver-white, dark only at extreme sides and in some cases also along posterior margin behind large silvery area, the latter occasionally

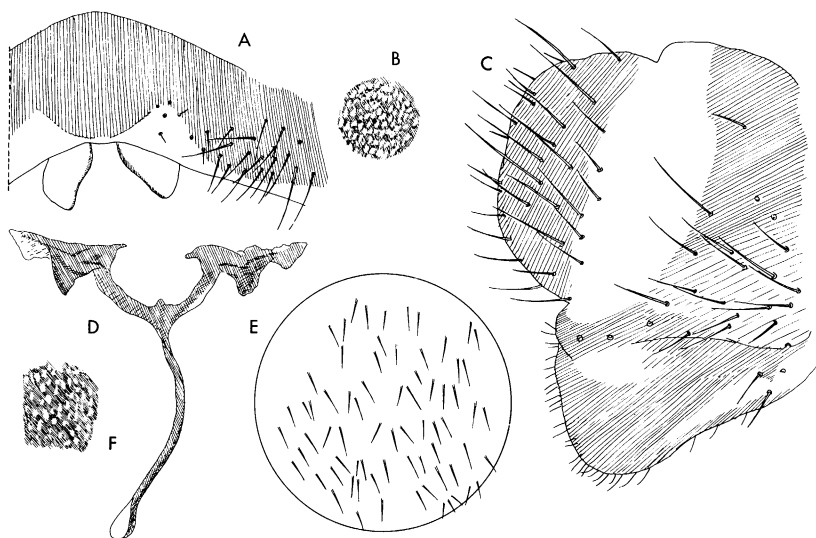


FIG. 3. *Simulium blancasi*, female genitalia. A. Detail of sternite VIII, with gonapophyses. B. Portion of spermatheca, high magnification. C. Cercus and paraproct. D. Genital fork. E. Spicules of portion of inner surface of spermatheca. F. Portion of spermatheca, high magnification.

indentate posteriorly at middle. Eighth and ninth tergites piceous or black, not conspicuously lighter than anterior tergites. Under surface of abdomen grayish.

Fronto-ocular triangle (fig. 1F) small, wider than deep. Antennae 11-segmented, shape and proportions of segments as shown in figure 1A-C. Frons as shown in figure 1D. Cibarium as shown in figure 1E, G. Maxillary palp as shown in figure 1J; apical segment as long as the two preceding combined. Third segment rather strongly widened. Sensory vesicle (fig. 1H) large, its diameter slightly larger than half the width of third segment, its mouth wide; tubercles numerous. Maxillae and mandibles serrate on both edges. Maxillae (fig. 1K) with 20-23, mandibles (fig. 1I) with 33-35 teeth.

Scutum lacking scales, setae randomly distributed, not forming rows or groups, all of identical structure (fig. 2C), viz., with one single central ray. Microtrichia relatively long, of feltlike appearance.

S_c and basal section of R glabrous. R_1 with setae and spines arranged in one row. R_s with setae arranged in one row beginning slightly beyond base of vein; details of chaetotaxy as shown in figure 2A.

Shape of legs and proportions of articles as shown in figure 2D, F, G.

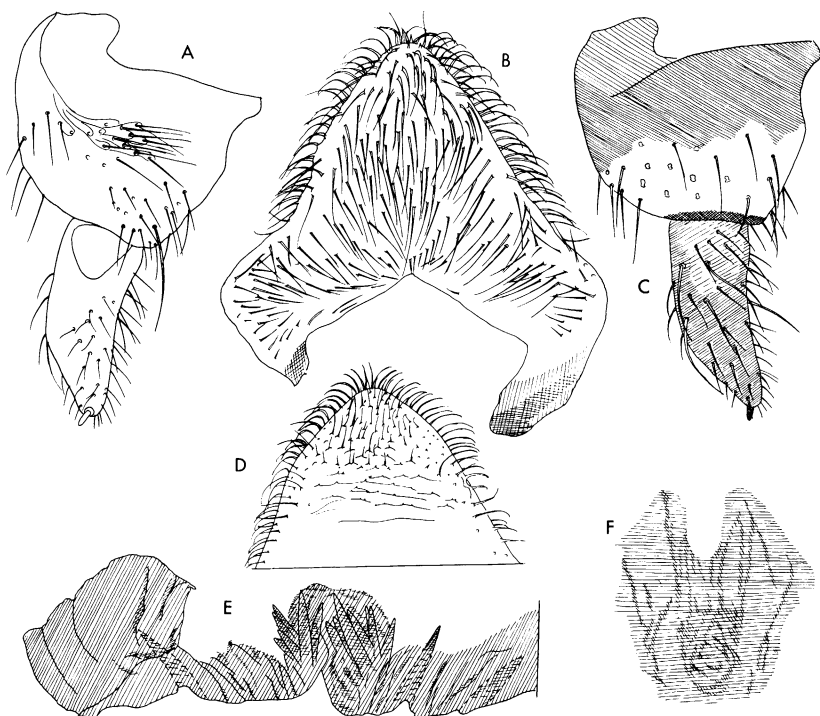


FIG. 4. *Simulium blancasi*, male genitalia. A. Paramere, upper surface, pigment not shown. B. Ventral plate. C. Paramere, under surface, pigment pattern shown. D. Apex of ventral plate, under surface. E. Portion of endoparameres. F. Median sclerite.

First segment of fore tarsus narrow, approximately eight times as long as wide. Calcipala well developed, but not quite attaining level of pedisulcus (fig. 2I). Claws as in figure 2E. Setae of legs simple.

Abdomen without scales, only with scattered setae, except basal fringe. Tergal plates well developed. Seventh sternite lacking specialized setae. Eighth sternite as shown in figure 3A, with about 25 + 25 setae. Gonapophyses glabrous, their inner border faintly sclerotized; setae and microtrichia absent. Paraprocts and cerci as shown in figure 3C, both slightly pigmented. Cercus much wider than long, apex rounded. Apex of paraproct subrectangular. Genital fork as shown in figure 3D; stem slender; branches as illustrated. Spermatheca globular, spicules of inner surface (fig. 3E) simple, not arranged in groups; surface of spermatheca with minute, puncture-like structures (fig. 3B, F).

MALE: Wing length, 2.5–2.6 mm.

Frons and clypeus dull silver-gray; mouth parts dark. Antennae black, faintly grayish pruinose; first, second, and basal third of third segment orange colored. Eyes purple. Scutum dull gray, faintly tinged with olivaceous; 1 + 1 submedian spots at anterior margin of mesonotum faintly silvery white. Pleura and sterna gray, the less-sclerotized areas testaceous. Scutellum, metanotum and setae of thorax as in female. General color of legs yellowish white, dark pigment from piceous to blackish; pattern as shown in figure 2J, K, L. Fore coxae light colored, mid and hind coxae dark. White reflections on leg segments absent. Color of wings and halteres as in female. Color of abdomen as in female, but all spots silver colored, and tergites VI and VII almost completely white (fig. 2M).

Holoptic. Antennae 11-segmented; shape and proportions of segments as shown in figure 1M, N. Maxillary palp as shown in figure 1O; last segment slightly longer than the two preceding combined. Sensory vesicle globular, its diameter equal to half the width of third segment; structure of vesicle as shown in figure 1L.

Chaetotaxy of thorax as in female.

Wing venation and chaetotaxy as in female.

Shape of legs and proportions of articles as shown in figure 2J, K, L. Fore basitarsus approximately eight times as long as wide, hind basitarsus 4.6 times as long as wide. Calcipala as shown in figure 2H. Setae of legs somewhat longer and more numerous than in female.

Parameres as shown in figure 4A, C. Basimere wider than long; distimere approximately as long as basimere, elongate conical, slightly over twice as long as wide, with one apical spine; basal process not developed. Ventral plate (fig. 4B, D) subtriangular, membranous, only its short basal arms faintly sclerotized. Keel absent. Endoparameres and endoparameral hooks as shown in figure 4E. Median sclerite (fig. 4F) broad, as long as wide, its apical incision occupying approximately one-third of length of sclerite.

PUPA: Cocoon (fig. 5A, G, H) subconical, inverted slipper-shaped, viz., anteroventral collar absent, dorsal wall salient at middle, projecting somewhat beyond level of ventral border of anterior opening. Ventral wall of cocoon delicate but complete. Cocoon translucent, shining, threads perceptible but not coarse; borders of anterior opening not reinforced. Color of cocoon light brown. Length of cocoon along dorsal surface, 3.0–3.5 mm., along ventral surface, 2.5 mm. Length of pupa, 2.8–3.0 mm., of respiratory organ up to 4.5 mm., viz., up to one and one-half times as long as body of pupa.

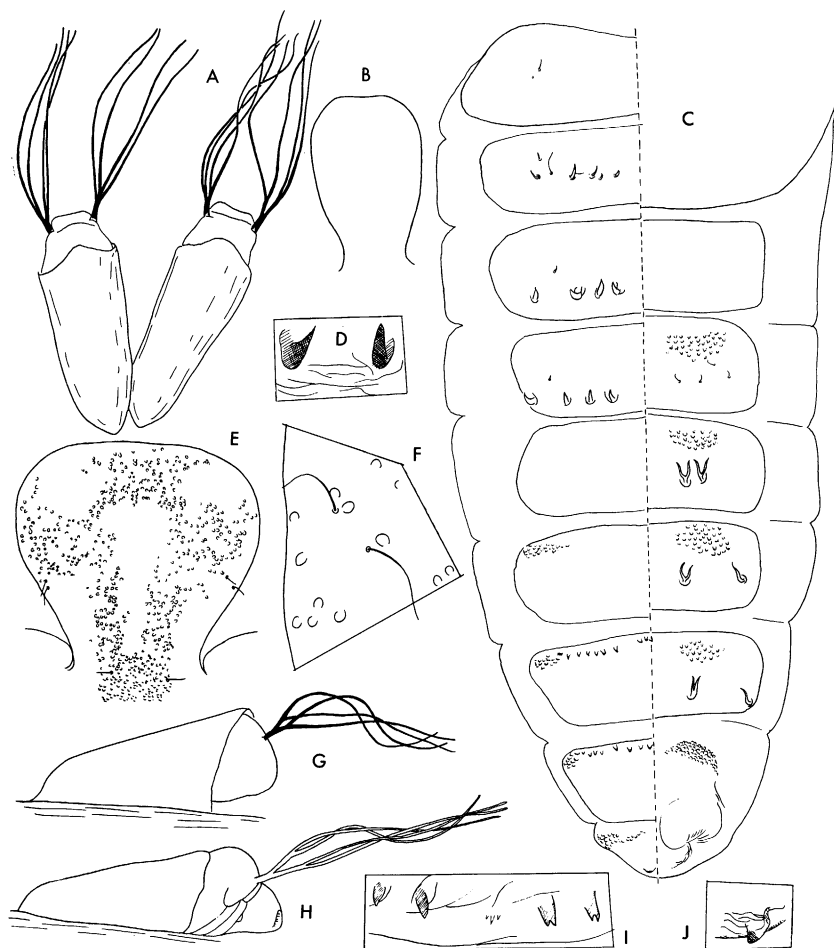


FIG. 5. *Simulium blancasi*, pupa. A. Pupae with cocoons, dorsal view. B. Outlines of frons of male. C. Abdomen of pupa, dorsal surface on left, ventral surface on right. D. Hooks of tergite IV. E. Frons of female, with platelets and trichomes. F. Area of frontal trichomes, high magnification. G, H. Pupa with cocoon, lateral aspect. I. Denticles of tergite VIII. J. Apical tubercle.

Respiratory organs composed of four forwardly directed slender filaments (figs. 5A, G, H; 6G-K). Two primary branches arising from a short common trunk. Ventral primary branch slightly shorter than dorsal one, widened from its base to place of origin of filaments. Filaments gradually tapering toward their lightly pointed tips. Ventral filament of

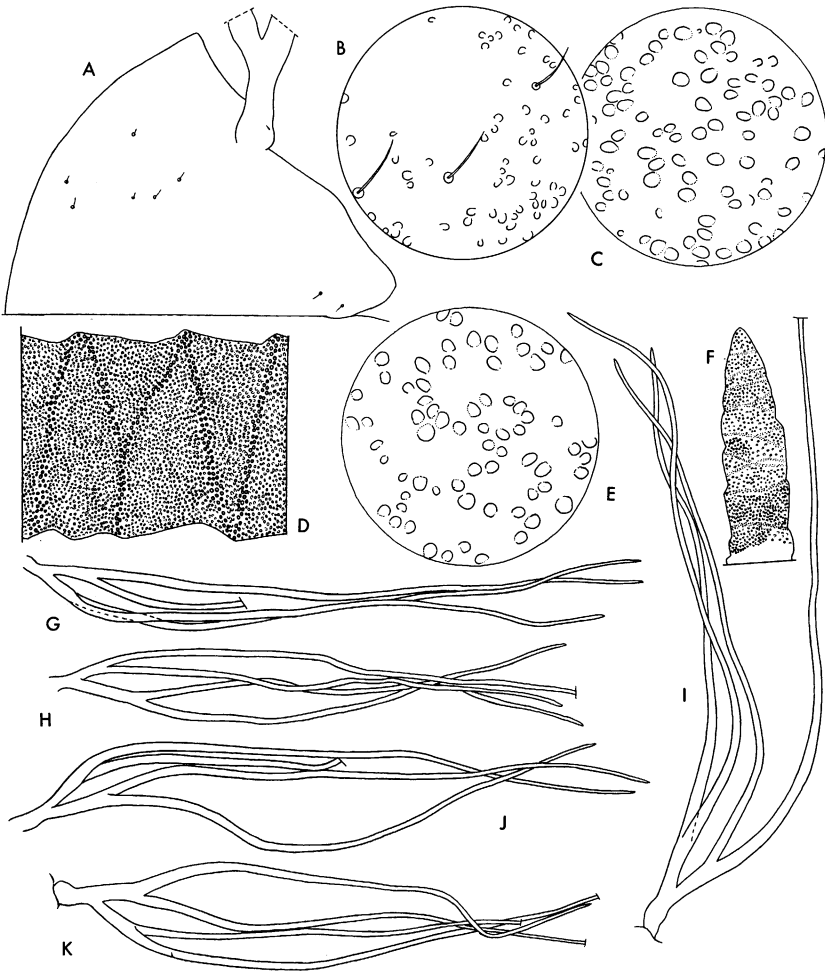


FIG. 6. *Simulium blancasi*, pupa. A. Portion of thorax, with trichomes and base of respiratory organ. B. Area of trichomes, high magnification. C. Platelets of thorax, high magnification. D. Basal portion of respiratory filament, high magnification. E. Platelets of frons, high magnification. F. Apex of respiratory filament, high magnification. G-K. Various respiratory organs.

ventral branch and dorsal filament of dorsal branch distinctly thicker at base than the other two filaments. Surface of filaments with minute tubercles arranged in a spiral pattern (fig. 6D, F).

Head and thorax of pupa with numerous small platelets, arranged in irregular groups as shown in figures 5E, 6B, C, E. Trichomes small, hairlike,

not branched (figs. 5F, 6B). Head with 2 + 2 frontal and 1 + 1 facial trichomes, occasionally only one frontal trichome on one side. Platelets on frons arranged as in figure 5E. Dorsal surface of thorax on each side with five to six simple, very short, hairlike trichomes (fig. 6A, B).

Abdomen as illustrated in figure 5C. Tergite I with a few small setae. Tergite II with 3 + 3 small, slender, simple spines accompanied laterally by a characteristic group of two small spines and one long hair. Tergites III and IV each with 4 + 4 simple hooks (fig. 5D) and a few very short hairs. Tergite V glabrous. Anterior border of tergites VII and VIII with a transverse row of 20–22 spiniform tubercles (fig. 5I), these rows connecting laterally with areas of very small scalelike cuticular processes, the latter areas also present on tergites VI and IX. Apex of abdomen with 1 + 1 distinct, slightly sclerotized tubercles (fig. 5J). Sternite IV with 1 + 1 groups composed of two to four simple short hairs. Sternites V–VII with 2 + 2 hooks, closely approximated on V, more distant on VI and VII. Most hooks bifid, occasionally trifid, the outer ones frequently simple, especially on tergites VI and VII. Sternites IV–VIII each with 1 + 1 groups of minute scalelike cuticular processes.

LARVA: Length of mature larva, 6.0–6.5 mm.; width of head capsule, 0.7 mm. General body color whitish, greenish pigment dorsally and on ventral surface of anterior half of body. Head yellowish white; pattern of cephalic apotome as shown in figure 7B. Body integument glabrous, a few short setae in caudal area.

General body shape as shown in figure 7A, C; abdomen gradually widened toward behind, not abruptly truncate at tip. Ventral papillae absent.

Antennae as shown in figure 7F, G, faintly but distinctly pigmented throughout, second segment lightest in color. Second segment with a very deep constriction accompanied by unpigmented area. Ratio of length of segments I–III = 1/1.1/1.25, viz., third segment distinctly longer than first. Fourth segment relatively elongate and slender (fig. 7I). Large fan of mouth brush with 40–45 rays. Primary teeth (fig. 7L) relatively stout, secondary teeth conspicuously decreasing in size from one primary tooth to the next, from over half as long to less than half as long as primary teeth. Toothing of mandible as shown in figure 7H, J, K; two outer teeth and one large apical tooth, all strongly sclerotized; three subapical teeth, conspicuously decreasing in size from first to third; marginal teeth as illustrated. Maxillary palp as shown in figure 7N, about 3.7 times as long as wide. Hypostomium as shown in figure 7D; anterior border heavily pigmented; median and lateral teeth prominent, intermediate teeth much smaller. Sublateral teeth and lateral serrations

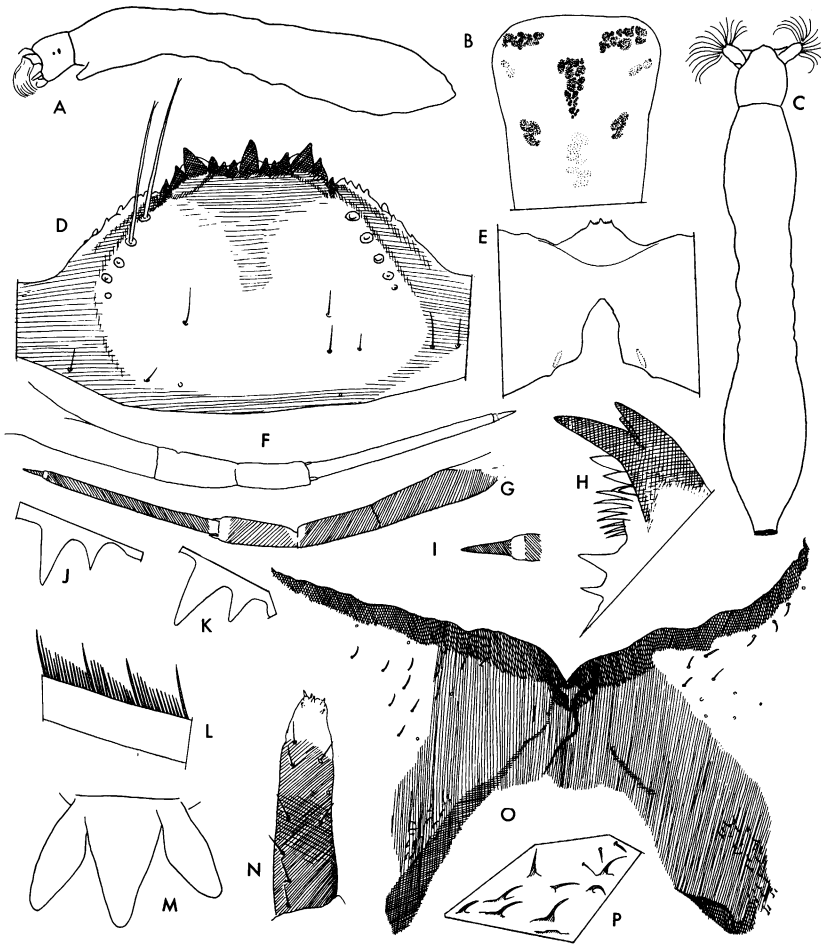


FIG. 7. *Simulium blancasi*, larva. A. General aspect, lateral. B. Pattern of cephalic apotome. C. General aspect, dorsal. D. Hypostomium. E. Under surface of head, as seen on slide preparation. F. Antenna. G. Antenna, with pigment shown. H. Apex of mandible. I. Antenna, apex of third with fourth antennal segment. J, K. Serrations of mandible. L. Detail of center of ray of large mouth fan. M. Anal gills. N. Maxillary palp. O. Anal sclerite. P. Cuticular processes of anterior arms of anal sclerite, high magnification.

very well developed. Hypostomial setae arranged in a single row, their number approximately five in each group. Disc of hypostomium with a few short, simple setae. Gular cleft deep, about as deep as postgenal bridge (fig. 7E).

Anal sclerite as shown in figure 7 O. Area between arms with simple sensory setae; area near apex of anterior arms with heavily pigmented, simple, spinelike cuticular processes (fig. 7 O, P). Posterior circlet with approximately 80 rows each composed of about 17 hooks. Anal gills simple, composed of three lobes (fig. 7M).

MATERIAL EXAMINED: Peru: Lima: 4 kilometers east of Surco, Rimac Valley, 2100 meters, August 17, 1965 (P. and B. Wygodzinsky and F. Blancas), one male holotype, one female allotype, seven male and four female paratypes, all reared, numerous pupae and larvae. All specimens are in the American Museum of Natural History.

ETYMOLOGY: This species is named for Dr. Fortunato Blancas, Museo de Historia Natural "Javier Prado," Lima, who has done much to further our field work in Peru.

BIOLOGICAL DATA: The larvae and pupae of this species occurred in a small crystal-clear stream on the bottom of the narrow Rimac Valley; the stream was about 1 meter wide and 30 cm. deep. Specimens were taken a few meters from the source of the stream at the bottom of a steep slope of the mountains bordering the valley; the water temperature was 15° C. Although some larvae and pupae were found on leaves of grass trailing in the current and on leaves of watercress, most specimens were located on the underside of large rocks on the bottom of the stream.

Simulium tenuipes Knab

Figures 8, 9

Simulium tenuipes KNAB, 1914, p. 21.

DIAGNOSIS: See key for diagnostic characters.

DESCRIPTION: FEMALE: Wing length, 2.2–2.9 mm.

Color of head and thorax and their appendages as in *blancasi*. Abdomen (fig. 8A) with tergites I and II as in *blancasi*, III–V dark velvet brown, VI and VII very light brown with 1 + 1 silvery white spots on VI; VIII and IX piceous. Under surface of abdomen grayish. Frons as shown in figure 8C. Fronto-ocular triangle, antennae, palpi, maxillae with sensory vesicle, mandible, and cibarium as in *blancasi*. Setae of scutum somewhat longer and more abundant than in *blancasi* (as in *penai*, figure 10A). Wings and legs with claws (fig. 8E) as in *blancasi*. Genitalia (fig. 8G, J) very similar to those of *blancasi*.

MALE: Wing length, 2.4–2.7 mm.

Color of head and thorax and their appendages very close to that of *blancasi*, but because of the greater number of hairs on mesonotum their golden color is more apparent. Legs with tibiae not distinctly darkened at base (fig. 8D). Abdomen with color pattern very similar to that of

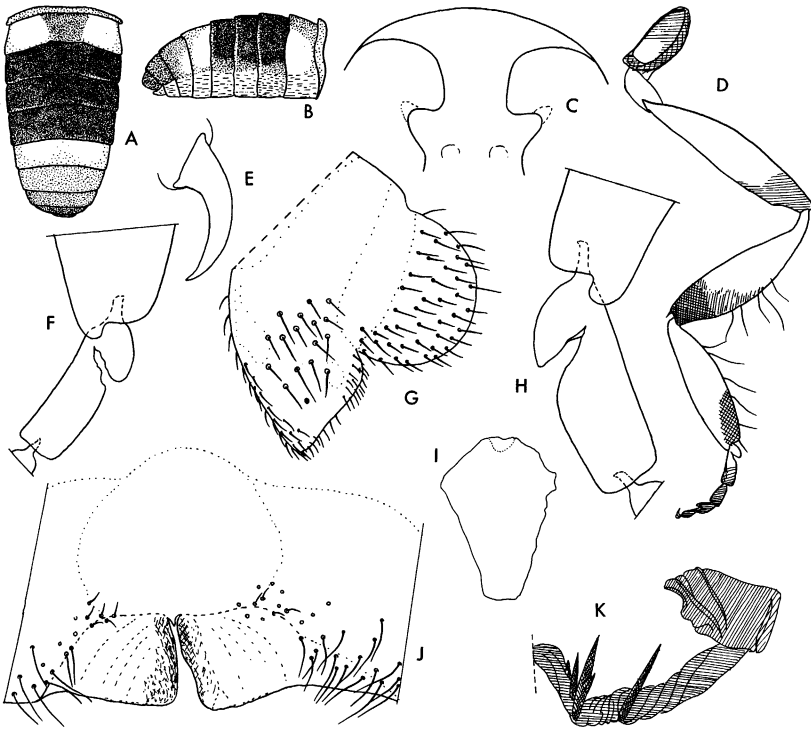


FIG. 8. *Simulium tenuipes*. A. Abdomen of female, dorsal view. B. Abdomen of male, lateral aspect. C. Frons, female. D. Hind leg, male. E. Claw, female. F. Apex of hind basitarsus with second tarsal segment, male. G. Cercus and paraproct, female. H. Apex of hind basitarsus with second tarsal segment, female. I. Median sclerite, male. J. Portion of eighth sternite of female, with gonapophyses. K. Endoparamere, male.

female, but tergites VI and VII with 1 + 1 small sublateral silvery spots (fig. 8B).

Shape of antennae, maxillary palp, and sensory vesicle as in *blancasi*. Setae of mesonotum as in female. Shape and proportions of articles of legs very similar to those of *blancasi*, but hind legs somewhat wider (fig. 8D); fore basitarsus approximately 8.8 times as long as wide, hind basitarsus 3.7 times as long as wide. Genitalia similar to those of *blancasi*, but endoparameres (fig. 8K) with some spines comparatively longer, and median sclerite (fig. 8I) more elongate, longer than wide.

PUPA: Color and shape of cocoon (fig. 9B, D) as in *blancasi*. Threads under high magnification as shown in figure 9F. Length of cocoon along

dorsal surface, 2.3–2.9 mm., along ventral surface, 1.8–2.0 mm. Length of pupa proper, 2.5–2.9 mm., of respiratory organs, 2.1–2.5 mm., viz., not longer than body of pupa. Respiratory organ composed of four forwardly and downwardly bent filaments (fig. 9A) arising from a short common trunk. Shape and structure of filaments as shown in *blancasi*. Trichomes and platelets of head and thorax of pupa as in *blancasi*. Abdominal onchotaxy as in *blancasi*.

LARVA: Length of mature larva, 6.0–6.8 mm.; width of head capsule, 0.65–0.7 mm. General body color whitish, with greenish pigment dorsally and on ventral surface of anterior half of body. Antennae much as in *blancasi*; ratio of length of segments I–III = 1/1.1/1.2. Large fan of mouth brush with approximately 35 rays. Primary teeth (fig. 9J) slender, spaced closely, secondary teeth more than half as long as primary ones. Mandible much as in *blancasi*, with two, or occasionally three, serrations (fig. 9G, H). Palpi and hypostomium as in *blancasi*; six or seven hypostomial setae in each row. Gular cleft extremely reduced, almost imperceptible. Respiratory histoblast as shown in figure 9I; lateral sclerites of proleg as illustrated (fig. 9E). Anal sclerite as in *blancasi*. Posterior circlet with about 80 rows each composed of 15–18 hooks.

MATERIAL EXAMINED: Chile: Tarapaca: Valle de Lluta, 15 kilometers northeast of Arica, upper limit of area under cultivation, 200 meters, in ditches and in the Lluta River, October 12, 1967 (S. and C. Coscarón), three reared males, two reared females, a few pupae, and many larvae; all are in the American Museum of Natural History.

DISCUSSION: This species can be most easily separated from *blancasi* in the larva, with its obsolete gular cleft, and in the pupa, with the secondary respiratory filaments that seemingly arise from a common trunk. The females of *tenuipes*, especially if poorly preserved, may not always be distinguishable from those of *blancasi*, but the characters indicated in the key will help to separate well-preserved material. The males of *tenuipes* differ from those of *blancasi* by the more numerous hairs on the scutum, the wider hind basitarsus, and, in the genitalia, the median sclerite which is longer than wide, and the longer spines of the endoparameres.

Our material has been compared with two paratypes of this species, also from the Valle de Lluta. The paratypes agree with the original description, although their wings are slightly longer (2.2 mm. versus 2.0 mm.). The darker color of the mesonotum and scutellum of the types is in disagreement with our specimens, but we believe it may have been caused by the poor state of preservation of the paratypes.

BIOLOGICAL DATA: The larvae and pupae collected in the ditches were found on leaves of *Scirpus* (Cyperaceae) and leaves of aquatic plants

trailing in the current; the water was slightly turbid, and its temperature 16° C. Larvae and pupae in the Lluta River were found on branches of trees and on rocks; the water temperature was 18° C. Numerous pupal exuviae on rocks suggested a great abundance of specimens some time before our material was collected.

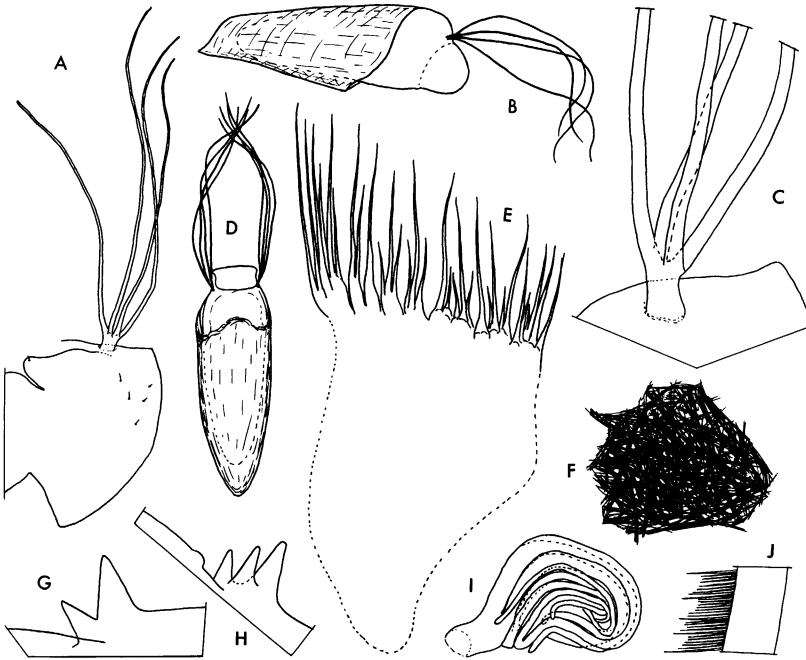


FIG. 9. *Simulium tenuipes*. A. Portion of thorax of pupa, with respiratory organ. B. Pupa with cocoon, lateral view. C. Basal portion of respiratory organ of pupa. D. Pupa with cocoon, dorsal aspect. E. Lateral sclerite of proleg of larva. F. Detail of cocoon. G, H. Serrations of larval mandible. I. Respiratory histoblast. J. Detail of center of ray of large mouth fan.

Although a search was made for aquatic instars of simuliids beginning at the mouth of the Lluta River, they were found only from the locality mentioned upstream. The lower portion of the river had shortly before been treated with insecticides (organophosphates) because of the bothersome bites of blackflies along the stream. Silva Figueroa (1917) explained that *Simulium tenuipes* attacks man, mules, and horses, but *Simulium escomeli* Roubaud, a decidedly anthropophilous species, also occurs in the Lluta Valley, and either species, or both, could be involved.

Simulium penai, new species

Figure 10

DIAGNOSIS: See key for diagnostic characters.

DESCRIPTION: FEMALE: Wing length, 2.8–3.2 mm.

Color of head and thorax and their appendages as in *blancasi*, except scutum and metanotum which are darker, contrasting more with the pale yellow scutellum. Pattern of abdomen similar to that of *tenuipes* but with posterior border of tergites III–V light colored, the light-colored portion on V occupying entire posterior half. Frons as in *tenuipes*. General structure of fronto-ocular triangle, antennae, maxillary palp with sensory vesicle, and cibarium as in *blancasi*; maxillae with approximately 20, mandibles with 35, teeth. Setae and microtrichia of scutum as shown in figure 10A, similar to those of *tenuipes* but longer than those of *blancasi*. Shape and pigmentation of articles of legs much as in *blancasi*, but calcipala much reduced, subtriangular (fig. 10B). Wings as in *blancasi*.

MALE: Wing length, 2.8 mm.

Color of head and thorax with their appendages as in *blancasi*, but scutum and metanotum darker. Color pattern of abdomen not examined in detail, apparently rather similar to that of female. Structure of head and appendages and of wings as in *blancasi*. Shape and proportions of articles of legs much as in *tenuipes*, but hind basitarsus 4–4.5 times as long as wide. Calcipala (fig. 10C) similar to that of female. Genitalia similar to those of *blancasi*, viz., endoparameres with comparatively short spines, but median sclerite (fig. 10D) longer than wide, as in *tenuipes*, and distimere (fig. 10E) of slightly different shape.

PUPA: Color and shape of cocoon much as in *blancasi*, but more closely woven and, when observed in liquid, somewhat parchment-like, viz., with a leadlike sheen.¹ Length of cocoon along dorsal surface 2.8–3.5 mm., along ventral surface 2.6–3.0 mm. Length of pupa proper, 3.4–3.7 mm., of respiratory organs, 3.8–4.0 mm., viz., slightly longer than body of pupa. Respiratory organs either straight or downwardly curved. Arrangement of branches of respiratory organs as in *tenuipes*; microscopical structure of filaments as illustrated for *blancasi*. Head and thorax without or with only a few scattered platelets (fig. 10F, G, I). Arrangement of trichomes as in *blancasi*, although trichomes slightly longer (fig. 10F). Abdominal onchotaxy as in *blancasi*.

LARVA: Length of mature larva, 6.5–7.0 mm.; width of head capsule,

¹ Cocoons with the same aspects are found in certain unnamed species of *Simulium* (*Pternaspatha*) found in the highlands of the Chilean and Argentinian *puna*.

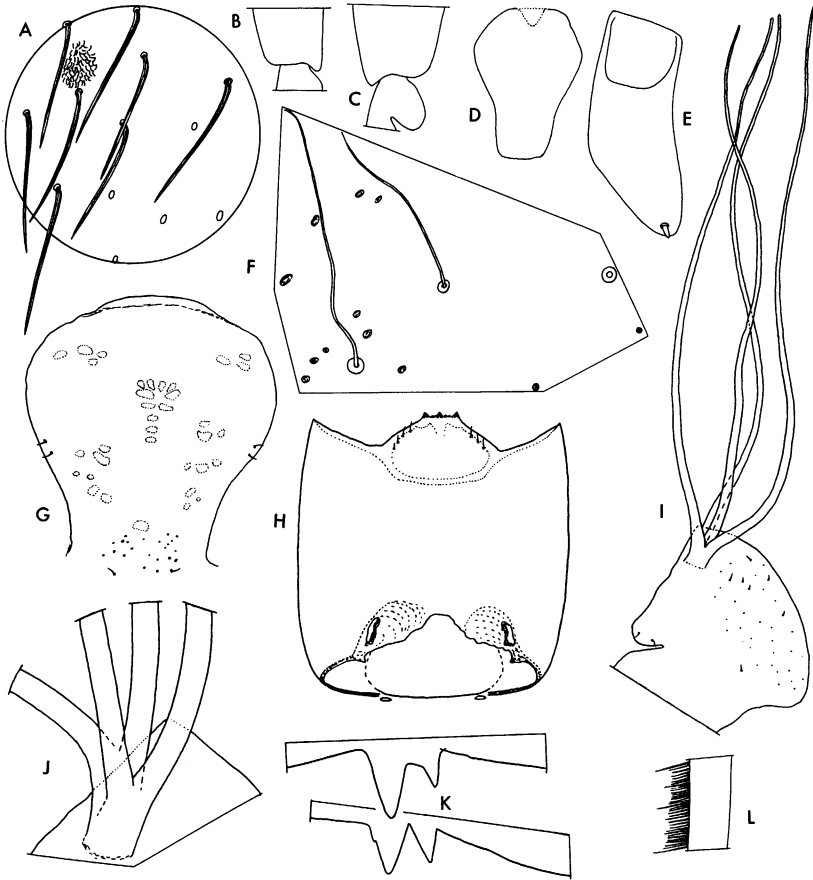


FIG. 10. *Simulium penai*. A. Setae and microtrichia of scutum, female, high magnification. B. Apex of hind basitarsus and base of second tarsal segment, female. C. *Idem*, male. D. Median sclerite, male. E. Distimere, male. F. Detail of surface of thorax of pupa, with two trichomes. G. Frons of pupa, female. H. Under surface of head of larva. I. Portion of thorax of pupa, with respiratory organ. J. Base of respiratory organ. K. Mandibular serrations of larva. L. Detail of center of ray of large mouth fan.

0.65–0.7 mm. Over-all color of body whitish; pattern of cephalic apotome as in *blancasi*. Antennae similar to those of *blancasi*; ratios of lengths of segments I–III = 1/1.1/1.2. Large fan of mouth brush with 38–42 rays. Primary teeth (fig. 10L) slender, not spaced closely, secondary teeth somewhat over half as long as primary ones. Mandible, palpi, and hypostomium much as in *blancasi*; from five to seven hypostomial setae in each

row. Gular cleft extremely reduced (fig. 10H). Anal sclerite as in *blancasi*. Posterior circlet with 76–80 rows, each composed of 13–17 hooks.

MATERIAL EXAMINED: Chile: Antofagasta: Aguas Blancas, east of Salar de Atacama, Cordillera de Antofagasta, 2500 meters, November 12, 1968 (L. Peña), one male, holotype, one female, allotype, one female, paratype, all reared; two males, one female, dissected from pupae, several pupae and larvae. Holotype and allotype in the Museo Nacional de Historia Natural, Santiago, Chile; remaining material in the American Museum of Natural History. Antofagasta: Río Loa, 25 kilometers south of Quillaga, August 20, 1966 (E. I. Schlinger and M. E. Irwin), 12 males, seven females, in the California Insect Survey and the American Museum of Natural History.

ETYMOLOGY: This species is named for its collector, Luis Peña, in recognition of the assistance received.

DISCUSSION: *Simulium penai* seems to be closer to *S. tenuipes* than to *S. blancasi*. It agrees with the former in the structure of the respiratory appendages and virtual disappearance of the gular cleft, a specialized character in this group. The larvae of *tenuipes* and *penai* are very similar; the color character suggested in our key for their distinction may not hold up when more specimens become available. The pupae of the two species are easy to distinguish, as shown in the key, and the adults of *penai* can be distinguished from those of *tenuipes* by the much reduced calcipala.

BIOLOGICAL DATA: The collector informed us that the aquatic instars were collected on aquatic plants in a small, slightly brackish stream.

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