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II. The Nearctic and Neotropical Species of *Scaptomyza* Hardy (Diptera; Drosophilidae).¹

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The genus *Scaptomyza* was established by Hardy (1849, Proceedings of the Berwickshire Naturalists Club, 2:361) for the two nominal species, *Drosophila graminum* Fallén and *Scaptomyza apicalis* Hardy. The first of these, *graminum* Fallén, was chosen as the type species by Coquillett (1910). The current literature now lists 82 species of *Scaptomyza* for the world but this figure does not include the mass of new species being described from the Hawaiian Islands by Prof. D. E. Hardy (personal communication). Dr. Walter Hackman (1959), summarizing the species of the world, reported on 65 species; 17 other species were known to him only from the literature. His very excellent account has been the stimulus for this study, providing the necessary background for a comprehensive systematic study of the American species.

During the last century the taxonomic treatment of the group has been quite varied. *Scaptomyza* has sometimes been considered a subgenus of *Drosophila*; it has also been divided into several subgenera, new related genera have been added, and it has been treated as an entity consisting of several species groups or complexes. In his most recent account, Hackman (1959) reorganized the genus into nine subgenera; four of these occur in the Neotropical and Nearctic areas: *Scaptomyza s.s.*, *Parascaptomyza*, *Mesoscaptomyza*, and *Hemiscaptomyza*. We are rearranging somewhat the species to be included in *Parascaptomyza* and *Mesoscaptomyza*, and we are including a fifth subgenus, *Dentiscaptomyza*, which contains four South American species.

The apparent absence of the subgenus *Trogloscaptomyza* in the Americas is surprising; there are numerous species of this subgenus in Hawaii (Prof. Hardy, personal communication), although the type species came from the island of Tristan de Cunha in the South Atlantic. Hence, a connection across South America would seem logical. We have checked the male genitalia of a number of species from Central and South America which grossly resemble species of *Trogloscaptomyza* (of an appropriate size, and lacking ventral branches on the arista). Without exception, so far, these have turned out to be co-generic with *Cladochaeta nebulosa* (but which run through the available keys to *Clastoptomyia* Malloch = *Diathoneura* Duda) and do not seem to be closely related to *Scaptomyza*. However, there are still several hundred undescribed drosophilids from the Neotropical region and the possibility remains that among them some species referable to *Trogloscaptomyza* will be found.

Much of the past taxonomic work on the genus has been more confusing than helpful, due in large part to the color variability found in many of the species.

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Thus, the thorough studies of Hackman (1955, 1959), utilizing male genitalial features, represent a most important landmark in *Scaptomyza* taxonomy. We are now convinced that accurate identification of the species of this genus can only be accomplished with the use of such genitalial characteristics; in the present account, therefore, we are figuring the male genitalia for 54 American species (including 18 new species and 3 unnamed forms). Several of these species had been illustrated earlier by Hackman (1955, 1959) or by Brncic (1955, 1957a), but we believe that it is more practical to redraw them at this time so that all figures of American species would be directly comparable. For two named species, which we have not seen, we have copied the original author's figures. The genitalia dissections and original figures were made by the junior author; Mrs. Linda Kuich assisted in preparing them for publication.

Although this study is based primarily on material collected by members of the Genetics Foundation of the University of Texas¹ much additional useful material was loaned to us from the following collections: U.S. National Museum (loan arranged by Dr. Willis Wirth); California Academy of Sciences (arranged by Dr. Paul Arnaud); Centro Nacional de Investigaciones Agrícolas, Tibaitata, Bogota, Colombia (arranged by Miss Isabel Sanabria); the Instituto Oswaldo Cruz, Brazil (collection of Prof. Hugo Souza Lopes, arranged by Dr. O. Frota-Pessoa); collection of Dr. Danko Brncic, Universidad de Chile, Santiago. In all, about 1400 specimens have been available for this study.

Holotypes of the new species are being placed in the *Drosophila* Type and Reference Collection, Genetics Foundation, University of Texas, Austin, Texas; some paratypes of each species are being deposited in the U.S. National Museum. Variations from this general plan are stated under the individual descriptions.

TYPES OF MALE GENITALIA IN SCAPTOMYZA

In Figures 1-5 we have illustrated diagrammatically the major features of male genitalia in the genus. The apparent complexity seen in a number of species is due primarily to the development of one or more "extra" lobes bearing either bristles or stout teeth. Our interpretation of the origin of the more common types of extra lobes is shown in Figure 1, which is arranged in a logical sequence which may represent the evolutionary pattern. The simplest form, Type A, is represented by a single species, *nigricosta*; the *primary clasper* is plain, and there are no specializations of either the anal plates or the lower genital arch. Although there are a few other species which are nearly this simple, most members of the genus possess some modification of the anal plate. Types B-H of Figure 1 show the varying degrees of development of *secondary claspers* (*paralobes* of Frey and others) through specialization of the lower part of the anal plates. In the subgenus *Scaptomyza* (Type B) the differentiation is slight; in Type C (*Hemiscaptomyza* and some species of *Mesoscaptomyza*) the specialization is quite obvious; while in Type D (many species of *Mesoscaptomyza*) and Type E (*Parascaptomyza*) we find the most extreme development, with one to several prominent spines adorning the tip.

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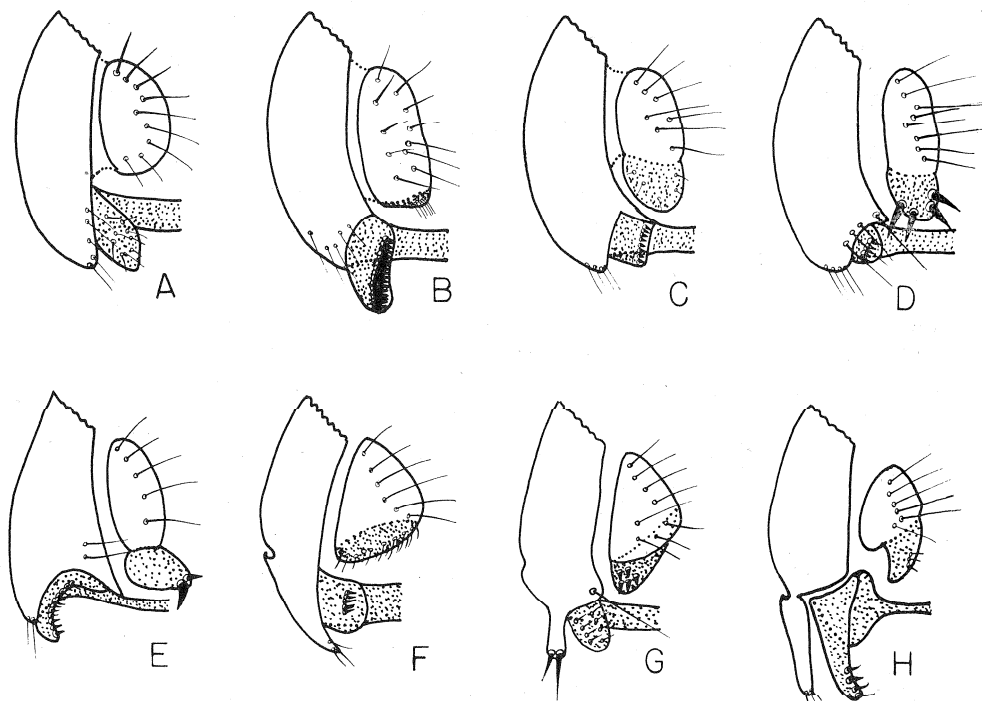


FIG. 1. Types of external male genitalia in *Scaptomyza*. A:—*nigricosta*-type; B:—*montana*-type; C:—*terminalis*-type; D:—*vittata*-type; E:—*pallida*-type; F:—*paradusta*-type; G:—*wheeleri*-type; H:—*denticauda*-type.

Three different appearances of the secondary clasper are also shown in Types F-H, but in these there is also shown the development of a specialized portion of the lower part ("toe") of the genital arch. In Type F (*paradusta* type) and Type G (some species of *Mesoscaptoomyza*) this specialization is only moderate, but in species of the subgenus *Dentiscaptoomyza* (Type H) the lower part of the arch becomes a *tertiary clasper*, forming a large and often spectacular part of the external genital apparatus. Still other lobes, with bristles and/or differentiated teeth, may occur in particular species, for example *S. Parascaptoomyza clavifera*.

Figure 2 illustrates the three basic hypandrium types in the genus; the arrows indicate that *lateral processes* of the hypandrium may develop at these points in varying degree. The major types of such processes are shown in Figure 3, the arrows indicating the four major types (B-D) which seem to have been derived from the basic Type A.

The anterior gonopophyses exhibit different relationships to the hypandrium; our interpretation of the major types is illustrated in Figure 4, from a front view and in a hypothetical sectional view.

One can represent, symbolically, the general features of the male genitalia for any species of *Scaptomyza* by referring to the specific "types" from each of these first five figures; for example, *paradusta* can be represented as "FBBDG", while *intermedia* is "HCDCD." Certain combinations occur in several species, and some species are difficult to assign precisely. However, we had hoped that certain

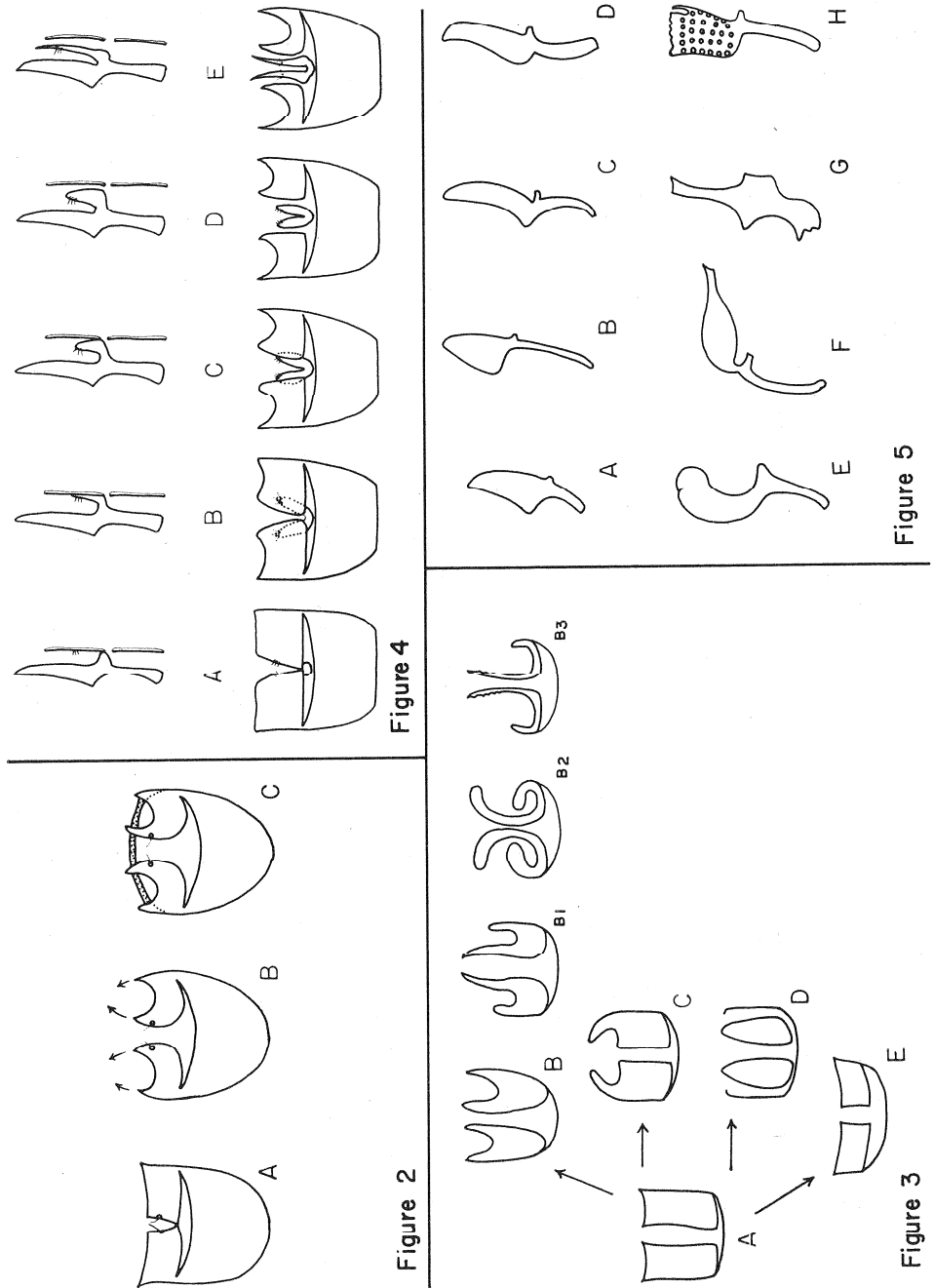


FIG. 2. Types of hypandrium in *Scaptomyza*. A:—*nigricosta*-type; B:—*terminalis*-type; C:—*parandina*-type.

FIG. 3. Types of lateral processes of the hypandrium in *Scaptomyza*. A:—*montana*-type; B:—*paravittata*-type; B₁—*nigricosta*-type; B₂:—*pallida*-type; B₃:—*clavifera*-type; C:—*teinoptera*-type; D:—*denticauda*-type; E:—*macroptera*-type.

(Continued on next page)

TABLE 1

The morphological types of male genitalia in the subgenera of *Scaptomyza*, based upon the traits shown in Figures 1-5

	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5
sg. <i>Scaptomyza</i>	B	ABC	ABB ₁ C	CD	CDEF
sg. <i>Mesoscaptomyza</i>					
nigricosta-type	A	A	B ₁	B	C
paravittata-type	C	B	BB ₁	CD	ABC
vittata-type	D	B	BB ₁	CD	ABC
wheeleri-type	G	B	BB ₁	A	A
sg. <i>Hemiscaptomyza</i>	C	B	B ₁	DE	C
sg. <i>Parascaptomyza</i>					
pallida-type	E	B	B ₁ B ₂ B ₃	D	CDH
paradusta-type	F	B	DE	DE	AG
sg. <i>Dentiscaptomyza</i>	H	BC	ABD	CDE	D

clusters of characters would serve to differentiate between the various subgenera; Table I shows that this is not true, although this ideal is nearly reached by the assignment of species on the basis of the type of external genital apparatus (Figure 1).

Key to American Subgenera of *Scaptomyza*

- (1) Acrostichal hairs distinctly 2-rowed, both between the dorsocentral rows and anteriorly 2
 Acrostichal hair 4-rowed anteriorly, with 2 or more irregular rows posteriorly between dorsocentrals 4
- (2) Palpi dark brown; posterior scutellar bristles rather short, and turned upright; presutural dorsocentral bristles often more or less evident *Mesoscaptomyza*
 Palpi pale; apical scutellars normally long and directed posteriorly; presutural bristles not common 3
- (3) Two strong humeral bristles; usually dark species; male genitalia of type B (Fig. 1); ♀ ovipositor plates stout and bearing coarse teeth *Scaptomyza* (part)
 One strong humeral; genitalia of Type E; ♀ ovipositor weak, inconspicuous *Parascaptomyza* (part)
- (4) One strong humeral; genitalia of Type D or F; ♀ ovipositor weakly sclerotized, inconspicuous *Parascaptomyza*
 Two humerals evident; ovipositor better developed 5
- (5) Usually with an apical wing spot in males, sometimes in females; male

FIG. 4. Types of anterior gonopophyses in *Scaptomyza*. A:—*wheeleri*-type; B:—*nigricosta*-type; C:—*vittata*-type; D:—*montana*-type; E:—*terminalis*-type.

FIG. 5. Types of penis shape in *Scaptomyza*. A:—*vittata*-type; B:—*setosa*-type; C:—*terminalis*-type; D:—*graminum*-type; E:—*nigrita*-type; F:—*atahualpa*-type; G:—*paradusta*-type; H:—*pallida*-type.

- genitalia of Type C; upper humeral twice length
 lower one *Hemiscaptomyza*
 Not entirely as above; upper and lower humerals usually equally strong;
 wing spots absent or of multiple spots 6
 (6) Secondary clasper poorly developed, and lacking tertiary clasper
 (Type B) *Scaptomyza**
 Secondary clasper evident, tertiary clasper strongly developed
 (Type H) *Dentiscaptomyza*

* Not keyed: the "*andina complex*", *q.v.*

Distributional List of American *Scaptomyza*

Subgenus *Scaptomyza*

1. *andina* n. sp. Colombia; Ecuador
2. *atahualpa* Hack. Peru
3. *flaviventris* Hack. Calif. to Wash.
4. *graminum* Fallén Holarctic; Calif. to Wash.; Mich.;
 Maine and Newfld. to Va.
5. *heedi* n. sp. El Salvador
6. *montana* Whlr. Alaska to Calif. and Mont., E. to
 New England
7. *neoandina* n. sp. Colombia
8. *nigrita* Whlr. Alaska to Calif., Ida. and Wyo.
9. *nigrocella* Whlr. N.Y.; ? other eastern states
10. *noei* Brncic Chile
11. *parandina* n. sp. Colombia
12. *subandina* n. sp. Colombia
13. *teinoptera* Hack. Alaska; Europe; U.S.S.R.
14. species A Alaska

Subgenus *Dentiscaptomyza*

15. *denticauda* Mall. Chile and Argentina
16. *intermedia* Duda Chile and Argentina
17. *melancholica* Duda Chile, Argentina and Bolivia
18. *multispinosa* Mall. Chile and Argentina

Subgenus *Hemiscaptomyza*

19. *apicata* Thomson Wash. to Mexico (Baja Calif.); Ariz.
20. *apicipuncta* Mall. Argentina
21. *bipunctipennis* Whlr. Calif. to Wash.
22. *hennigi* Hack. Mexico; Guatemala; Costa Rica
23. *hirsuta* Whlr. Mexico; Ariz.
24. *hsui* Hack. Wash. to Calif.; Ida.; Nev.
25. *maculifera* Becker Tex. to Ariz.; Mexico; Colombia to Peru
26. *malada* n. sp. Idaho
27. *terminalis* Loew Alaska
28. *trochanterata* Collin Holarctic; Alaska to Newfld.; Europe
29. *unipunctum* Zett. Holarctic; Alaska; Europe

Subgenus *Mesoscaptomyza*

- | | |
|---------------------------------|---|
| 30. <i>bogotae</i> n. sp. | Colombia |
| 31. <i>coquilletti</i> n. sp. | Greater Antilles; Mexico; Costa Rica |
| 32. <i>dankoi</i> n. sp. | Peru |
| 33. <i>fuscinervis</i> Mall. | Brazil; Bolivia |
| 34. <i>nigricosta</i> n. sp. | Colombia |
| 35. <i>nigripalpis</i> Mall. | Colombia to Peru, Bolivia and Brazil |
| 36. <i>paravittata</i> Whlr. | Calif; El Salvador; Haiti; Jamaica |
| 37. <i>personata</i> n. sp. | El Salvador; Honduras |
| 38. <i>pleurolineata</i> n. sp. | Colombia; ? Brazil |
| 39. <i>pseudovittata</i> Brncic | Chile |
| 40. <i>salvadorae</i> n. sp. | El Salvador; Panama |
| 41. <i>samurai</i> n. sp. | Colombia |
| 42. <i>setosa</i> n. sp. | Ecuador |
| 43. <i>striaticeps</i> n. sp. | Colombia; Argentina |
| 44. <i>subvittata</i> Hack. | Costa Rica |
| 45. <i>vittata</i> Coq. | La. to Fla.; Cuba to Jamaica and P. Rico;
Mexico to Panama to Peru and Bolivia |
| 46. <i>wheeleri</i> Hack. | Tenn. and Va. S. to Mexico, Colombia and
Ecuador; ? Peru and Bolivia |
| 47. species B | Costa Rica |
| 48. species C | Mexico |

Subgenus *Parascaptomyza*

- | | |
|-------------------------------|---|
| 49. <i>adusta</i> Loew | New England to Ariz.; Mexico to Argentina |
| 50. <i>clavifera</i> n. sp. | Peru |
| 51. <i>macroptera</i> n. sp. | Costa Rica |
| 52. <i>pallida</i> Zett. | Worldwide |
| 53. <i>paradusta</i> Whlr. | Calif. to Wash.; Ariz. |
| 54. <i>picefemorata</i> Hack. | Costa Rica; Colombia; Ecuador; Peru;
Venezuela |
| 55. <i>spinipalpis</i> Seguy | Argentina; Colombia; Bolivia |

Subgenus *SCAPTOMYZA*, s.s.

Type species: *Scaptomyza graminum* Fallén.

1. S. (*Scaptomyza*) *andina*, new species

This new species is typical of the *andina* species complex—a group of species which are characteristic of the highlands and paramos of the Andean Mountains in Colombia and Ecuador. The species known so far are extremely similar in external features, but differ significantly in male genitalia. Identification of females is still uncertain. We are naming four new species of the complex; a fifth species is represented by a single female, and is briefly described near the end of this report.

♂, ♀. Front dull, heavily pollinose, gray to black in the middle, paler on the orbits, especially anteriorly. Antennae tan to light brown; arista branches 3/1. Male face pale, tan to yellowish; that of female darkened in middle, paler at

sides. One strong oral bristle; palpi of both sexes unusually slender, pale basally, definitely dark brown at apex. Mesonotum dull dark brown with grayish stripes, the pattern usually moderately well defined. Acrostichal hairs in two distinct rows; haltere knob white. Pleura dark brown; legs pale; one stout humeral bristle. Abdomen dark brown, the basal tergites quite dull, the apical ones shiny. Wings clear.

Male genitalia: Fig. 10.1-5, drawn from the holotype, and checked with a second male from the same general area.

Types and Distribution: Holotype male (genitalia mounted on slide No. 146), allotype female and one paratype female, collected by W. B. Heed and H. L. Carson, Aug. 1960, "at Klm. 11, E. of Bogota, Colombia, in paramos on road to Choachi." One paratype male, genitalia in microvial, from S.E. of Bogota, Colombia, July, 1960, W. B. Heed and H. L. Carson. In addition there are two females which appear to belong to this species: Mt. Cotopaxi, Ecuador, 3583-3700 m., March 1958, M. R. Wheeler.

The three other new species of the complex are described in the following pages very briefly since they agree in most respects to the foregoing. The following brief key works reasonably well for the specimens in our collection:

- | | |
|--|------------------|
| 1. Fore coxae and all femora dark brown | unnamed species |
| Legs pale | 2 |
| 2. Palpi very slender, dark brown apically; male with pale face and pale 3rd antennal segment; female with dark midfacial stripe and brownish 3rd antennal segment | <i>andina</i> |
| Palpi entirely pale | 3 |
| 3. Male face pale | <i>parandina</i> |
| Male face darkened in midline | 4 |
| 4. Male face with a rather distinct, narrow midline stripe; 3rd antennal segment pale; apical tarsal joints rather dark | <i>neoandina</i> |
| Male face diffusely darkened in middle; 3rd antennal segment somewhat brownish | <i>subandina</i> |

We have located these species in the subgenus *Scaptomyza* although they are clearly aberrant there, with only two acrostichal rows and a single strong humeral bristle. We suspect that when more species have been studied, a new subgenus will be required for this complex.

2. *S. (Scaptomyza) atahualpa* Hackman

Scaptomyza atahualpa Hackman 1959:59. Holotype from Lima, Peru.

Male genitalia: Fig. 11.1-5, drawn from a paratype loaned by the U. S. National Museum.

Distribution: Eight specimens, from Lima and Pisco, Peru, were mentioned in the description; we know of no other records.

3. *S. (Scaptomyza) flaviventris* Hackman

Scaptomyza flaviventris Hackman 1959:63. Type locality: Mt. Constitution, Washington.

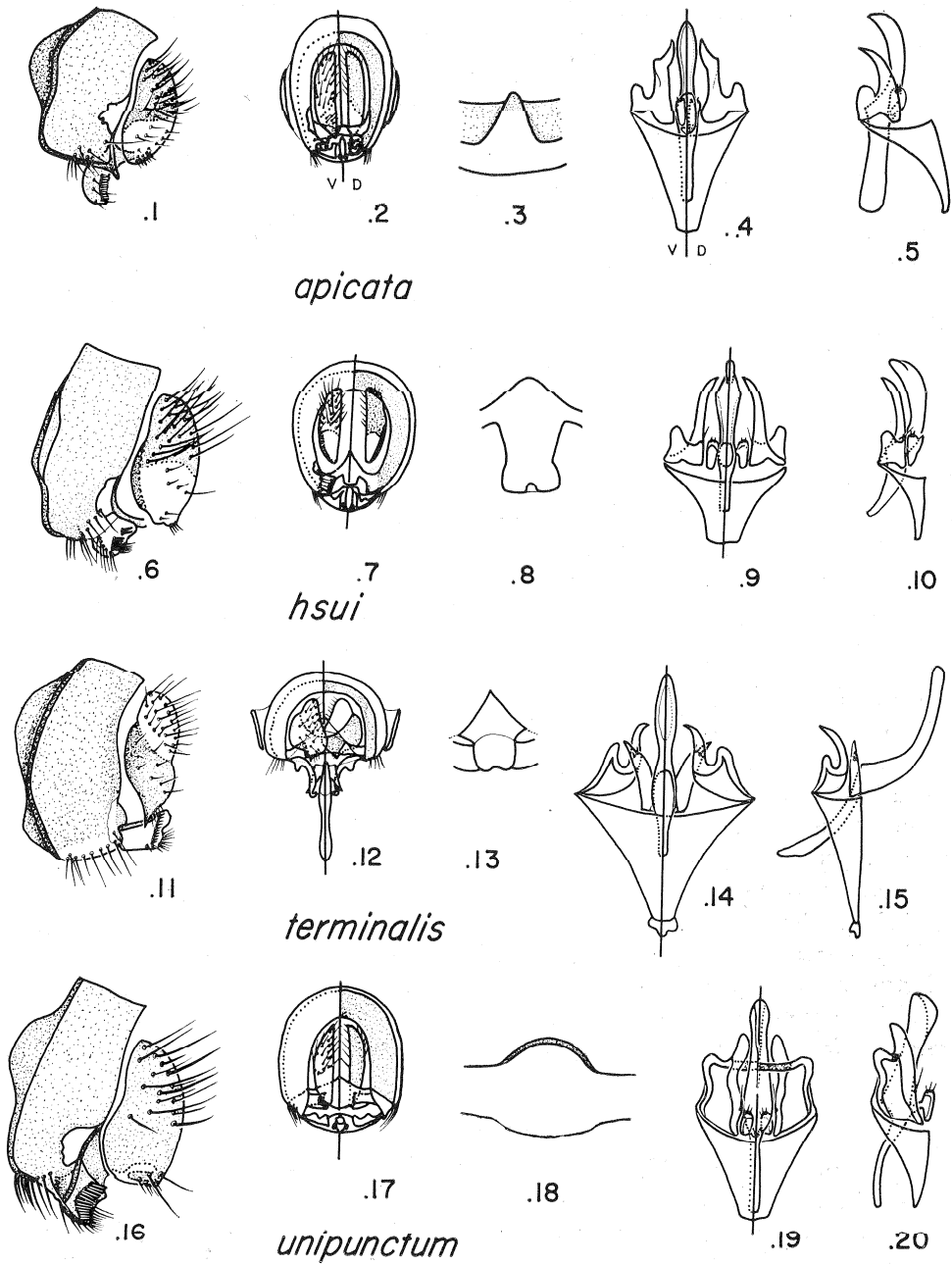


FIG. 6. Male genitalia of four species of the subgenus *Hemiscaptomyza*, showing the genital arch, anal plates and clasper, the gross genitalia in ventral (V) and dorsal (D) views, the bridge between the claspers, and the copulatory apparatus in ventral (V), dorsal (D), and lateral views.

Male genitalia: Fig. 9.11–15, drawn from the male paratype from the type locality.

Distribution: There are no new records of this species; earlier records are: type locality; Castle Rock, Wash.; Sequoia Park, Calif.; Muir Woods, Marin Co., Calif.

4. *S. (Scaptomyza) graminum* (Fallén)

Drosophila graminum Fallén 1823: 8. Type locality: Sweden.

Male genitalia: Fig. 8.11–15, drawn from a specimen from Scotland (donated by Mr. E. B. Basden) and checked with a male from New Hampshire (holotype of *borealis* Wheeler).

The synonymy of *borealis* Wheeler with *graminum* is now confirmed.

Distribution: Hackman (1959) states that *graminum* is found in most parts of Europe, in Transcaspia, to Siberia. In western America the species is found from California to Washington; to the east it occurs in Michigan, and from Newfoundland and Maine south to Virginia.

5. *S. (Scaptomyza) heedi*, new species

♂, ♀. Frontal orbits and large ocellar triangle shiny brown, rest of front dull tan becoming orange near lunule; occipital areas rather whitish pollinose when seen from certain angles, as in species of *Neotanygastrella*. Face of male whitish, that of female yellowish tan with a prominent black median stripe. One strong oral bristle; cheeks and palpi pale; arista 4/1. Mesonotum and pleura uniformly dark brown, subshining; acrostichal hairs clearly 2-rowed and with a few scattered hairs representing the outer rows of the presumed 4-rowed condition; one strong humeral. Legs pale tan, but with the front tibiae and tarsi contrastingly black, suggesting species of *Chymomyza* or *Neotanygastrella*. Abdomen brown, subshining. Wings clear; C3 bristles on the basal 2/5.

Male genitalia: Fig. 11.11–15, drawn from a paratype.

Types and Distribution: Holotype male, allotype and paratype male, Cerro Monte Cristo, Republic of El Salvador, 7000 feet, Feb. 1954, W. B. Heed.

This species does not fit well in any subgenus, and may ultimately need to be removed from the subgenus *Scaptomyza*.

6. *S. (Scaptomyza) montana* Wheeler

Scaptomyza montana Wheeler 1949:166. Holotype, Dutch Creek, Glacier National Park, Montana.

Male genitalia: Fig. 9.1–5, drawn from a specimen from Pasadena, California.

There is still some indecision as to the appropriate specific name for this species, and until much better evidence has been found, we prefer to continue to use the name *montana* for the American form of this (presumably) Holarctic species or species complex. The name *montana* has been considered to be a synonym of *flaveola* Meigen, but there is still considerable doubt as to what species that name applies to. Collin (1953: 151) recognized *flaveola* as valid, stating that "... as there is nothing contradictory in Meigen's description of *flaveola* (even

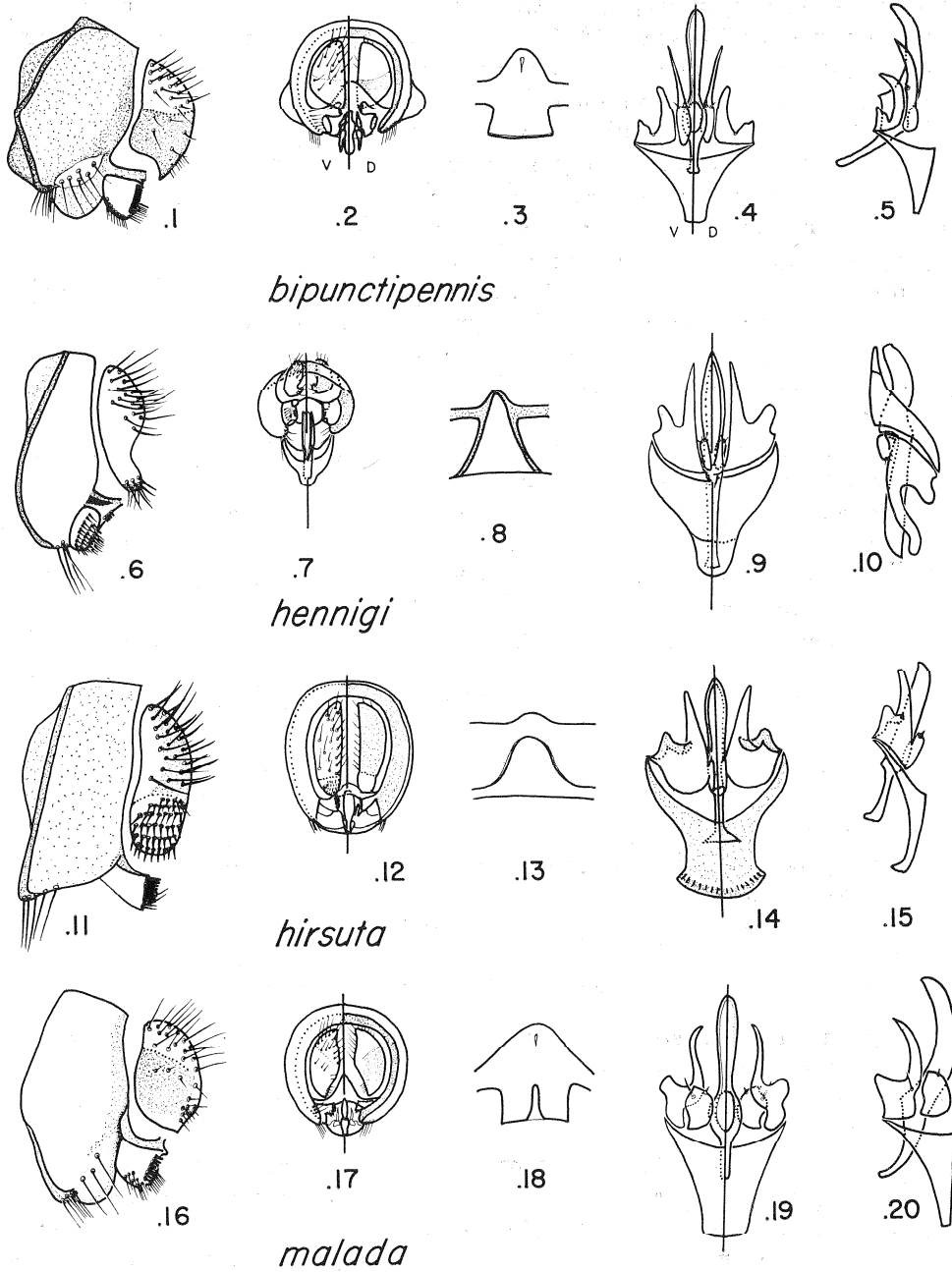


FIG. 7. Male genitalia of four species of the subgenus *Hemiscaptomyza*.

though he placed it in his genus *Notiphila* I see no reason for refusing to accept this identification." Basden (1961: 207) has taken the opposite view, preferring to use instead the name *apicalis* Hardy for what he believed to be the same species, since "... the identity of this is certainly known, whereas that of *flaveola* Mg. (1830), which most authors (except Duda 1934: 60) use instead of *apicalis*, is not certainly known, it being described as a *Notiphila*." Hackman (1959) adopted the combination *flaveola* subsp. *montana* for our form, but this still implies that the identity of *flaveola* is known. In fact, its identity may never be known; Duda (1921), for example, reported on his examination of the entire palaeartic drosophilid collection from the Wiener Staatsmuseum, including, he says, the existing Meigen and Schiner types; he stated clearly that at that time the Meigen type(s) of *flaveola* were missing. Further evidence on this point may come from the studies of E. B. Basden on the older European collections, but ultimately the determination of the biological relationships between *montana* and European species will require the thorough use of laboratory cultures.

In this complex there is the further complication of finding very pale yellow individuals and dark gray ones, usually as populations. Male genitalia of a gray specimen from Pasadena, California agrees quite well with that of a yellow male from Wenatchee, Washington; on the otherhand, a study of the genitalia of the holotype male of *nigrocella* Wheeler (from New York state; generally thought to be a synonym of *flaveola* also) shows that this is another species (see Fig. 9.6-10). This may mean that yellow individuals from the eastern United States belong to *nigrocella*, while western populations are *montana*, and this possibility needs to be carefully studied.

Distribution: The dark form occurs in Alaska (Sitka, Fairbanks), Montana, Idaho, Washington, Oregon and California; Hackman (1959) reports a single gray specimen from Rosslyn, Virginia. In the west, the yellow form is known from Washington and California, but is probably more widespread. Eastern records for the pale form are: Nova Scotia, Connecticut, New York, District of Columbia, Maryland, Tennessee, Indiana, and Illinois.

7. *S. (Scaptomyza) neoandina*, new species

Very similar in appearance to *andina*; the face of the male has a narrow dark stripe in the midline and the palpi are quite pale, and more nearly of the usual shape (as compared to *andina*). Females have more extensive mid-facial darkening.

Male genitalia: Fig. 10.6-10, drawn from the holotype.

Types and Distribution: Holotype male (genitalia mounted on slide No. 147), 3 paratype males and 3 paratype females, from near "Klm. 11 E. of Bogota, Colombia, in paramos on road to Choachi," W. B. Heed and H. L. Carson, Aug. 1960.

8. *S. (Scaptomyza) nigrita* Wheeler

Scaptomyza nigrita Wheeler 1952: 205. Type locality: Pasadena, California.

Male genitalia: Fig. 9.16-20, drawn from a paratype.

Distribution: Originally reported from California, Idaho and Wyoming. New

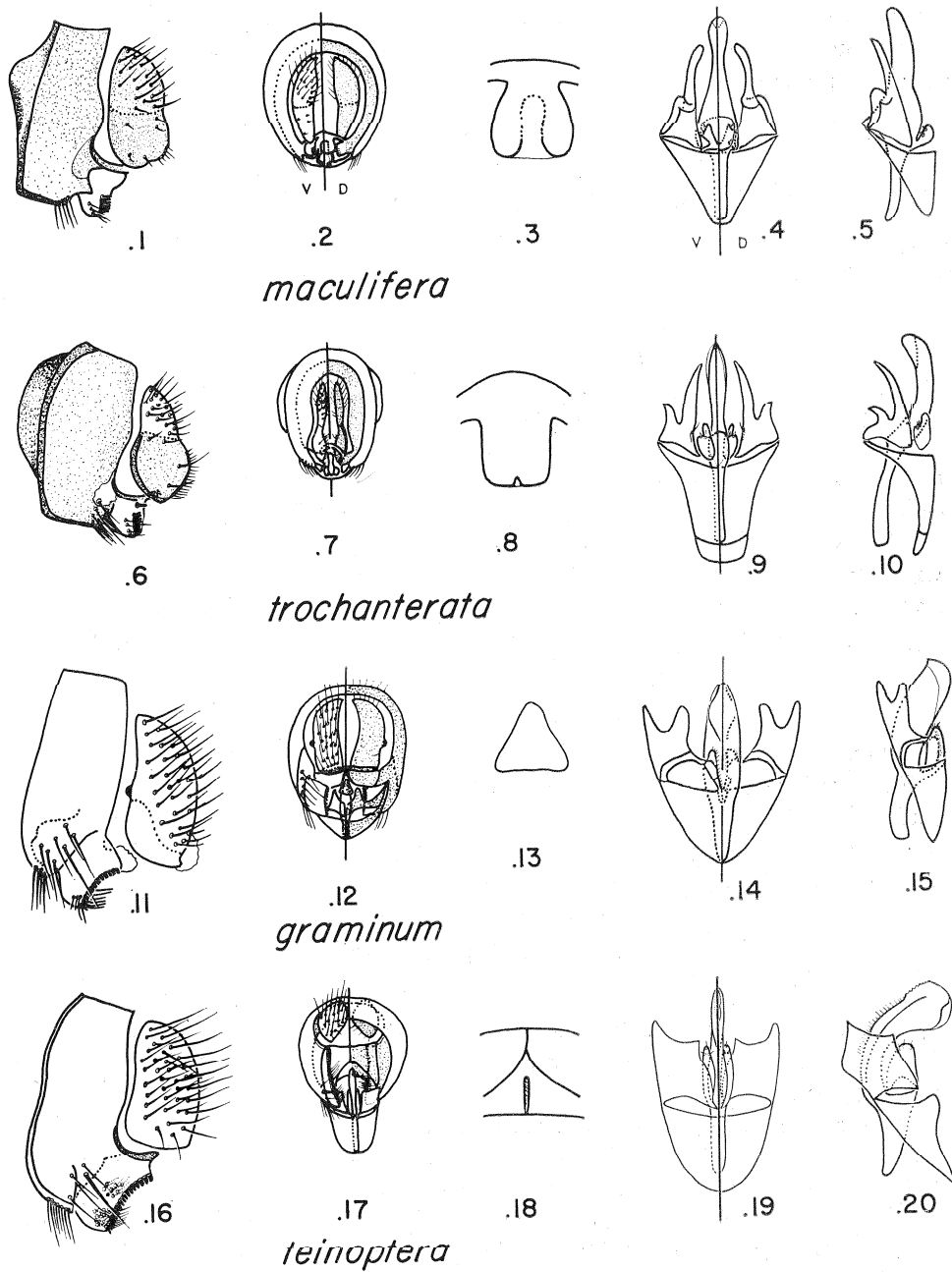


FIG. 8. Male genitalia of two species of the subgenus *Hemiscaptomyza*, .1-10, and two species of the subgenus *Scaptomyza*, .11-20.

extensions of the known distribution are: Fairbanks, Alaska (Wheeler and Throckmorton, 1960), and Vermillion Lake, Banff, Alta., Canada (one male, California Academy collection).

9. *S. (Scaptomyza) nigrocella* Wheeler

Scaptomyza nigrocella Wheeler 1949: 167. Type locality: Jasper, Steuben Co., New York.

Male genitalia: Fig. 9.6–10, drawn from the holotype.

This species has been considered by Hackman (1959) and others to be a synonym of *flaveola* Meigen, pale form (see remarks under *montana*). By an examination of the genitalia of the holotype male, we had thought that we could verify the synonymy, but as is shown in the figures, there are a number of differences between this species and *montana*, and we are now convinced that this is a valid species. It may yet be shown that it is the same as some European form, but until a comprehensive study has been made, it seems best to recognize *nigrocella* as a distinctive American species.

Distribution: Known certainly only from the type locality, Jasper, New York, where the two original males were taken by sweeping in a field of commercially-grown garden peas. As was stated elsewhere (see *montana* discussion), records of pale yellow "*flaveola*" from the eastern states may apply to *nigrocella*.

10. *S. (Scaptomyza) noei* Brcic

Scaptomyza noei Brcic 1955: 245. Type locality: Lluta (Yuta; Arica), Chile.

Male genitalia: Fig. 11.6–10, drawn from a specimen from Azapa (Arica), Chile.

Distribution: All published records are from the Department of Arica, Chile. We have seen five specimens from this area, donated by Dr. Brcic.

11. *S. (Scaptomyza) parandina*, new species

Very similar in appearance to *andina*; the face of the male is pale yellow, the 3rd antennal segment is also pale, and the palpi are pale and rather slender; the fore tarsi tend to be a little darkened. The female (one seen) has the middle of the face darkened.

Male genitalia: Fig. 10.16–20, drawn from the holotype.

Types and Distribution: Holotype male (genitalia mounted on slide No. 149), Bogota area, Colombia, Nov. 1955, W. B. Heed; 3 male and 2 female paratypes, about 10,000 feet near Bogota, Colombia, July 1960, W. B. Heed and H. L. Carson; one male paratype, 17 Klm. S. of Usme, Bogota area, Colombia, 11,000 feet, "on flowers," W. B. Heed, Dec. 1955.

12. *S. (Scaptomyza) subandina*, new species

Very similar in appearance to *andina*; the face of the male is more or less darkened in the midline, the 3rd antennal segment is more brownish, but the palpi are pale. The female (one seen) has the middle of the face darkened.

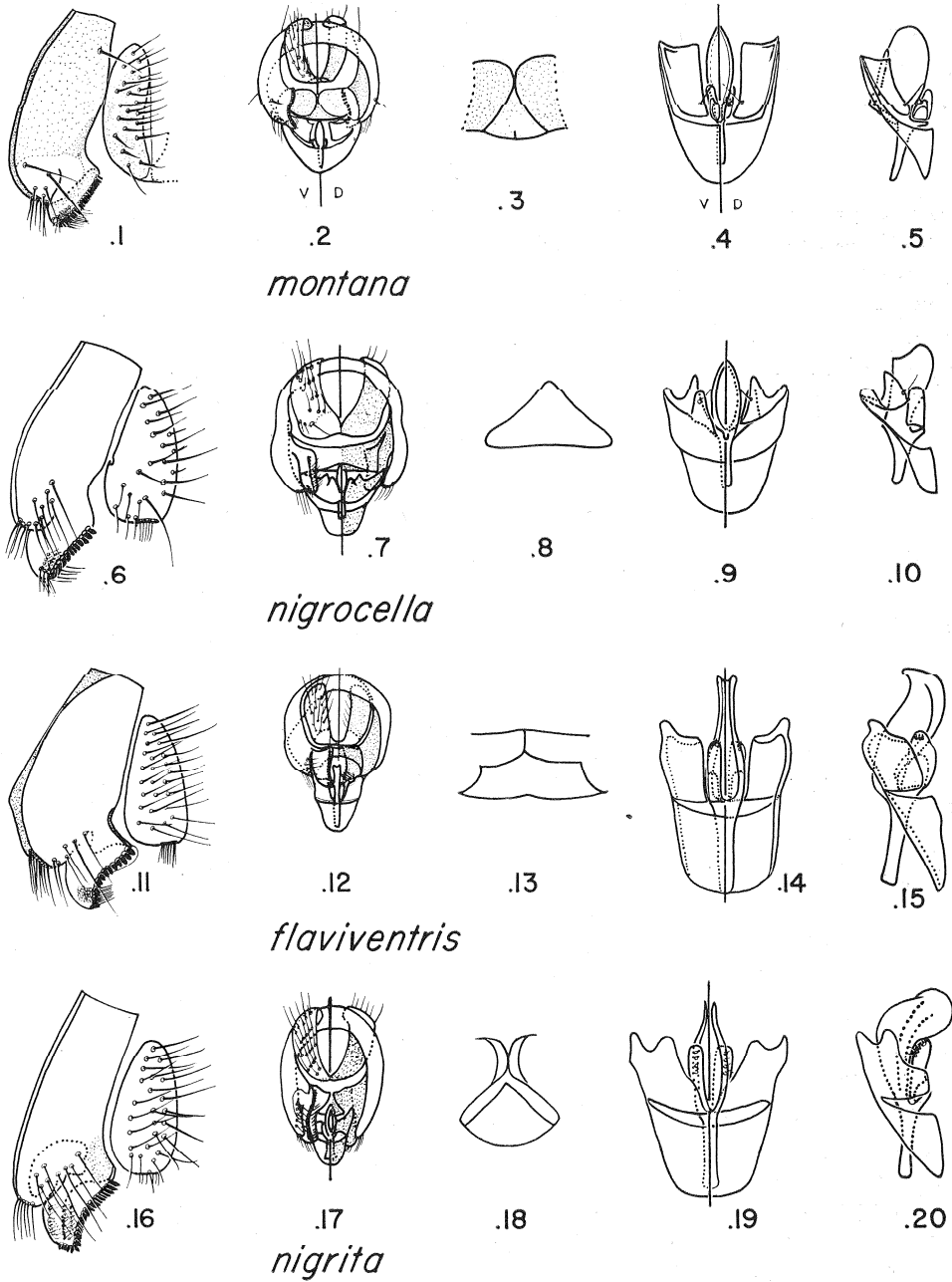


FIG. 9. Male genitalia of four species of the subgenus *Scaptomyza*.

Male genitalia: Fig. 10.11–15, drawn from the holotype.

Types and Distribution: Holotype male (genitalia mounted on slide No. 148), two male and one female paratypes, 17 Klm. S. of Usme, Bogota area, Colombia, 11,000 feet, "on flowers," W. B. Heed, Dec. 1955.

13. *S. (Scaptomyza) teinoptera* Hackman

Scaptomyza teinoptera Hackman 1955: 82. Type from Finland.

Male genitalia: Fig. 8.16–20, drawn from a paratype loaned by the U.S. National Museum.

Distribution: Hackman (1955) reported the species from various places in Finland, and a single male from Sitka, Alaska; Hackman (1959) also mentions the Leningrad area of U.S.S.R.

14. *S. (Scaptomyza) species a*

Male genitalia: Fig. 11.16–20.

Wheeler and Throckmorton (1960) referred to a single male from Cape Thompson, Alaska (Lat. 68° 10' N) but did not identify it. We are illustrating the male genitalia of this specimen which seems to represent an undescribed species.

Subgenus DENTISCAPTOMYZA Takada¹

Type species: *Scaptomyza denticauda* Malloch.

We are including in this subgenus four characteristic species of southern South America. They are generally dull and heavily pollinose; the acrostichal hairs are 4-rowed; the abdominal tergites are mostly dull and dark; and the ventral part of the genital arch is modified to form a "tertiary clasper" (see Fig. 12.1–20).

The following key will separate most pinned specimens:

1. Wings with a prominent series of dark spots apically *intermedia*
 Wings lacking dark spots 2
2. Two oral bristles of each side nearly equal in size; palpi, face and antennae of males bright yellow, often darker on females; upper humeral distinctly longer than lower one; mesonotum usually with 1–3 brown stripes, although they may be indistinct *multispinosa*
 Second oral bristle much weaker than the first; face usually dull tan to brownish, pollinose; two nearly equal humerals 3
3. Mesonotum heavily grayish pollinose, without an evident median brown stripe; carina rather large, usually noselike and widened below; proclinate orbital and anterior reclinate with their bases almost at the same level *melancholica*

¹ Takada (1965:43) inadvertently used the name of this subgenus, thereby establishing an unintended priority. The critical sentences are as follows (free translation): "**Scaptomyza denticauda** Malloch (Fig. 5–6) resembles at first glance *4C* (Fig. 1 and 2); however, the genital arch of this species is divided into two parts and there are two different types of teeth on the primary clasper. In addition, formation of the secondary clasper (which is related to the tenth abdominal tergite) is discernible. These characteristic features have been observed among many **Scaptomyza (Dentiscaptomyza) species.**"

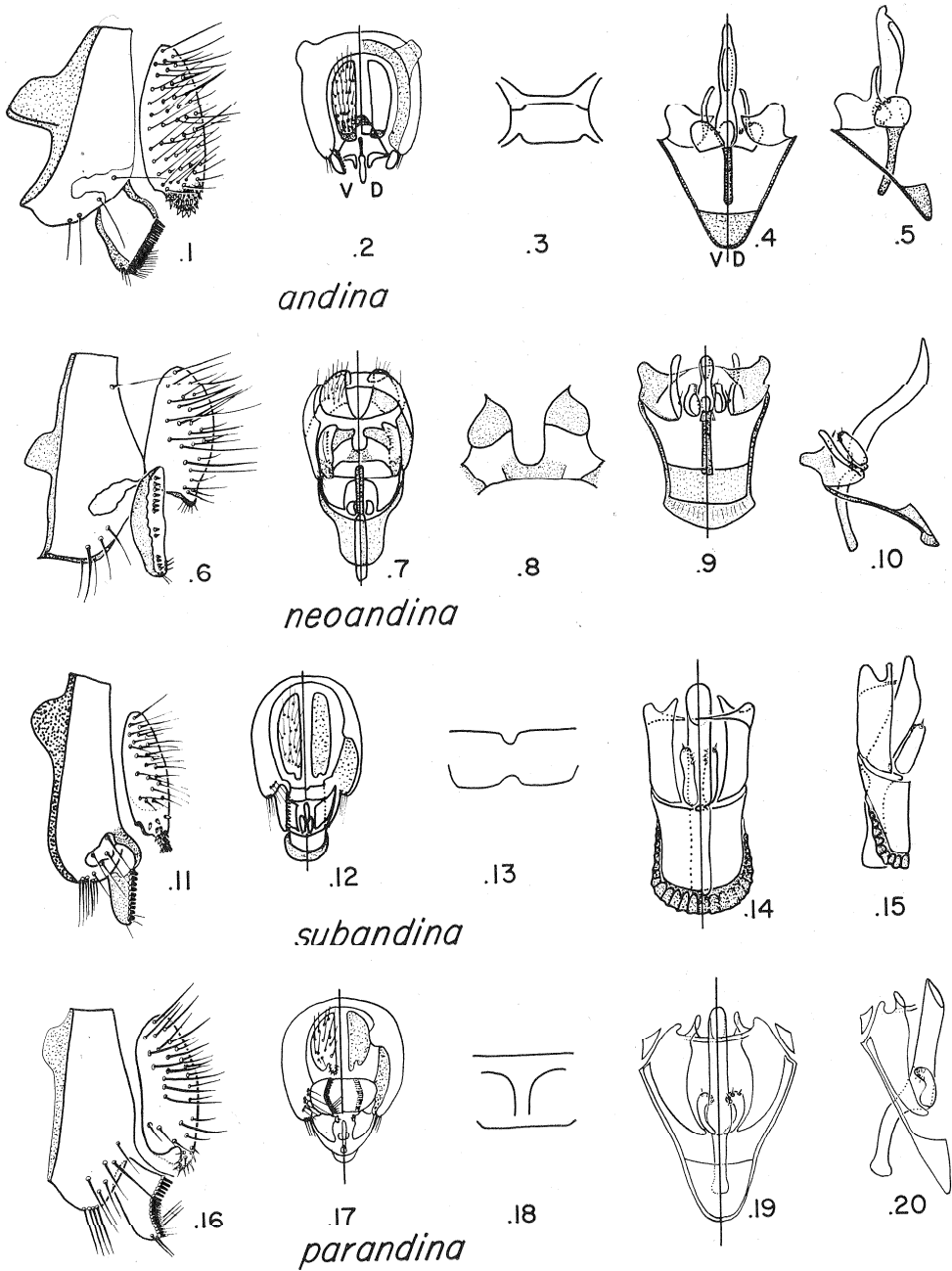


FIG. 10. Male genitalia of four species of the subgenus *Scaptomyza*.

Mesonotum pollinose, usually with a faint brownish median stripe; legs yellow but hind femora sometimes darker, at least basally, and hind coxa and trochanter usually darkened also; carina rather narrow, low, ♂♂ face usually strongly pollinose, silvery gray to whitish; base of anterior reclinate orbital a bit behind that of proclinate *denticauda*

15. *S. (Dentiscaptomyza) denticauda* Malloch

Scaptomyza denticauda Malloch 1934: 449. Holotype ♂, Peulla (Llanquihue), Chile.

Male genitalia: Fig. 12.1–.5, drawn from specimen from Balmaceda (Aisén), Chile.

Brncic (1955) stated that this is the dominant species in most areas of southern Chile, and shows some color variation (Brncic 1957a: 50), with specimens from the regions of Aisén and Magallanes being much darker than those from the more central parts of the country.

Distribution: Widely distributed in Chile (see Brncic 1957a); also reported from the Juan Fernandez Islands, 400 miles west of Chile (Brncic, 1957b), and from three places in Argentina (Malloch *op. cit.* and Brncic, 1957a). We have seen 87 Chilean specimens, partly from Dr. Brncic, and the remainder from the California Academy collection (collectors: Ross and Michelbacher).

16. *S. (Dentiscaptomyza) intermedia* (Duda)

Drosophila (Scaptomyza) adusta var. *intermedia* Duda 1927: 151. Type ♀, Quillota, Chile.

= *Scaptomyza dissimilis* Malloch 1934: 452. Types, Angol, Chile.

Male genitalia: Fig. 12.6–.10, drawn from specimen from Angol, Chile, part of type series, loaned by the U.S. National Museum.

Hackman (1959) compared the type material of Duda and of Malloch and published the synonymy, and placed it in the subgenus *Hemiscaptomyza*. On the basis of male genitalial characters we are including it in *Dentiscaptomyza*, although it is rather atypical here.

The wing pattern is distinctive, and has been figured by Malloch (1934, ♂ Fig. 7, ♀ Fig. 8, of Pl. VIII) and by Brncic (1955: 245, ♂ Pl. 3) (1957a: 103, ♂ Fig. 13.9). Some variation occurs; a ♀ from El Abanico (Bio Bio), Chile, has a distinct spot on each side of the third vein, rather than a single one below.

Distribution: Malloch reported specimens from Angol, Chile, and Lago Correntoso, Argentina. Brncic (1957a) reported three specimens from Chile (Santiago, and Los Alpes). Hackman (1959) saw only the Duda and Malloch specimens. We have seen two more specimens (California Academy collection): 18 km. E. of San Carlos, Nuble, Chile, XII–24–50; and Bio Bio, El Abanico, Chile, XII–31–50; both collected by Ross and Michelbacher.

17. *S. (Dentiscaptomyza) melancholica* (Duda)

Drosophila (Scaptomyza) melancholica Duda 1927: 153. Types, Chile (Santiago, Quillota) and Bolivia (Sorata, Yungasweg).

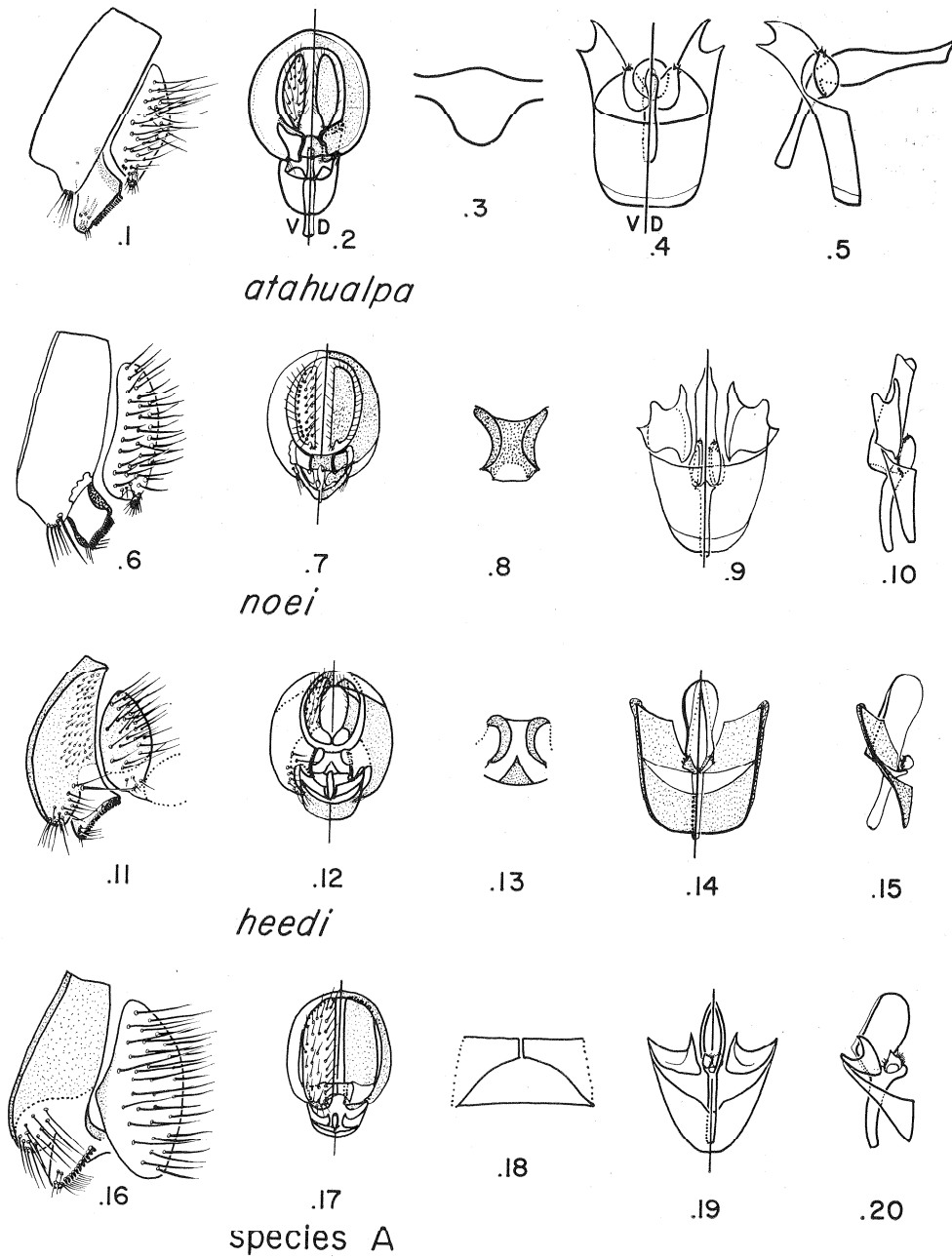


FIG. 11. Male genitalia of four species of the subgenus *Scaptomyza*.

Male genitalia: Fig. 12.11–15, drawn from specimens from Punta Arenas, Chile.

Distribution: Widespread and common in Chile; also known from Argentina and Bolivia. Brncic (1957b) reports it to be the most abundant species in the collections from the Juan Fernandez Islands. The prevalence of this species, and several other *Scaptomyza*, is well described by Brncic and Dobzhansky (1957). We have seen about 50 specimens from various Chilean localities, sent by Dr. Brncic, and about 25 from still other Chilean localities, from the California Academy collection (Ross and Michelbacher colls.).

18. *S. (Dentiscaptomyza) multispinosa* Malloch

Scaptomyza multispinosa Malloch 1934: 450. Type locality, Bariloche, Argentina.

Male genitalia: Fig. 12.16–20, drawn from specimens from Santiago (Arrayan), Chile.

Distribution: This species is reported from numerous localities in Chile and four in Argentina; we have seen 9 specimens from Chile, part from Dr. Brncic and part from the California Academy collection.

Subgenus HEMISCAPTOMYZA Hackman

Type species: *Scaptomyza unipunctum* (Zetterstedt)

19. *S. (Hemiscaptomyza) apicata* (Thomson)

Drosophila apicata Thomson 1869: 597. Type locality: San Francisco, California.

Male genitalia: Fig. 6.1–5, drawn from specimens from San Francisco, California.

This species and *hsui* are extremely similar in appearance and have extensive overlap in distribution. Males of *apicata* are often identifiable by the sharply pointed "toe" of the genital arch, since this is frequently visible without dissection.

Distribution: Washington to California to Baja California (Mexico); also occurs in Arizona (male genitalia of a specimen from Flagstaff checked).

20. *S. (?Hemiscaptomyza) apicipuncta* Malloch

Scaptomyza apicipuncta Malloch 1934: 451. Holotype male from Lago Correntoso, Argentina.

We have not seen this species and it has not been reported since its description. Malloch described it as being about 3 mm. long, black, the mesonotum shining and evenly dusted, the abdomen glossy black, and the legs yellow except that the hind femora were largely blackened. The antennae and palpi are yellow, the acrostichal hairs are 4-rowed anteriorly from about the middle of the mesonotum, and the humeral bristles are said to be two and unequal in size. He figures the wing (his Fig. 9 of Pl. VIII) as having a large subquadrate dark brown spot

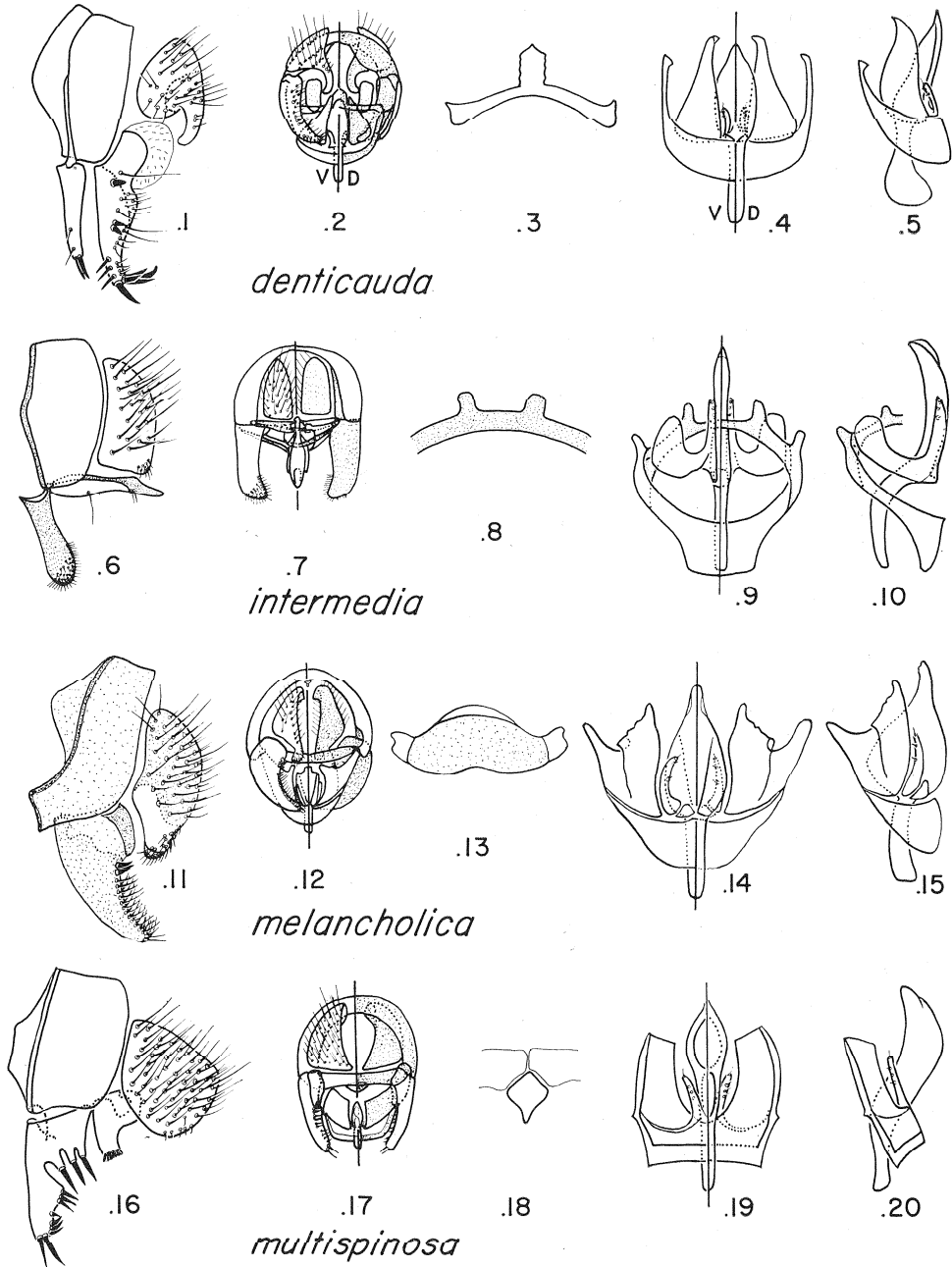


FIG. 12. Male genitalia of four species of the subgenus *Dentiscaptomyza*.

apically between the third and fourth veins. Its location, *between* the veins rather than *on* them, is unusual; we have copied this part of his figure as Fig. 19.10.

21. *S. (Hemiscaptomyza) bipunctipennis* Wheeler

Scaptomyza bipunctipennis Wheeler 1952: 206. Type locality: Prairie Creek Redwood State Park, California.

Male genitalia: Fig. 7.1–.5, drawn from a paratype.

Distribution: California (type locality; Redwood City); Washington (Kalaloch; Bogachiel).

22. *S. (Hemiscaptomyza) hennigi* Hackman

Scaptomyza hennigi Hackman 1959: 60. Holotype male, San José, Costa Rica.

Male genitalia: Fig. 7.6–.10, drawn from a specimen from San Cristobal, Chiapas, Mexico.

Distribution: Originally described from two localities in Costa Rica and one in Guatemala; we have 6 specimens from San Cristobal, Chiapas, Mexico (May 1959, M. Wasserman).

23. *S. (Hemiscaptomyza) hirsuta* Wheeler

Scaptomyza hirsuta Wheeler 1949: 166. Types from Peña de Gato, Puebla, Mexico.

Male genitalia: Fig. 7.11–.15, drawn from a specimen from Arizona, and compared with that of a paratype male.

Distribution: Mexico (type locality); Arizona (Rustler Park); New Mexico (Penasco River, reported by Hackman 1959).

24. *S. (Hemiscaptomyza) hsui* Hackman

Scaptomyza hsui Hackman 1955: 88. Holotype male from Mt. San Jacinto, southern California.

Male genitalia: Fig. 6.6–.10, drawn from a specimen from Dark Canyon, Mt. San Jacinto, California.

Distribution: Widespread in California, Oregon, Washington, Idaho and Nevada.

25. *S. (Hemiscaptomyza) maculifera* Becker

Scaptomyza maculifera Becker 1919: 210. Type locality: Ecuador.

= *Scaptomyza parapicata* Hackman 1959: 54: NEW SYNONYM.

Male genitalia: Fig. 8.1–.5, drawn from a male from New Mexico, and checked with specimens from various parts of the distribution.

Scaptomyza maculifera has apparently not been recognized since its description. The evidence on which we base our recognition of it is as follows:

Becker (1919) reported 59 specimens of *Scaptomyza* from Ecuador; of these, 8 were listed for his new species, *maculifera*, and 26 were listed as *apicata* Thomson. He separated the two primarily on two characters: a smaller wing spot in

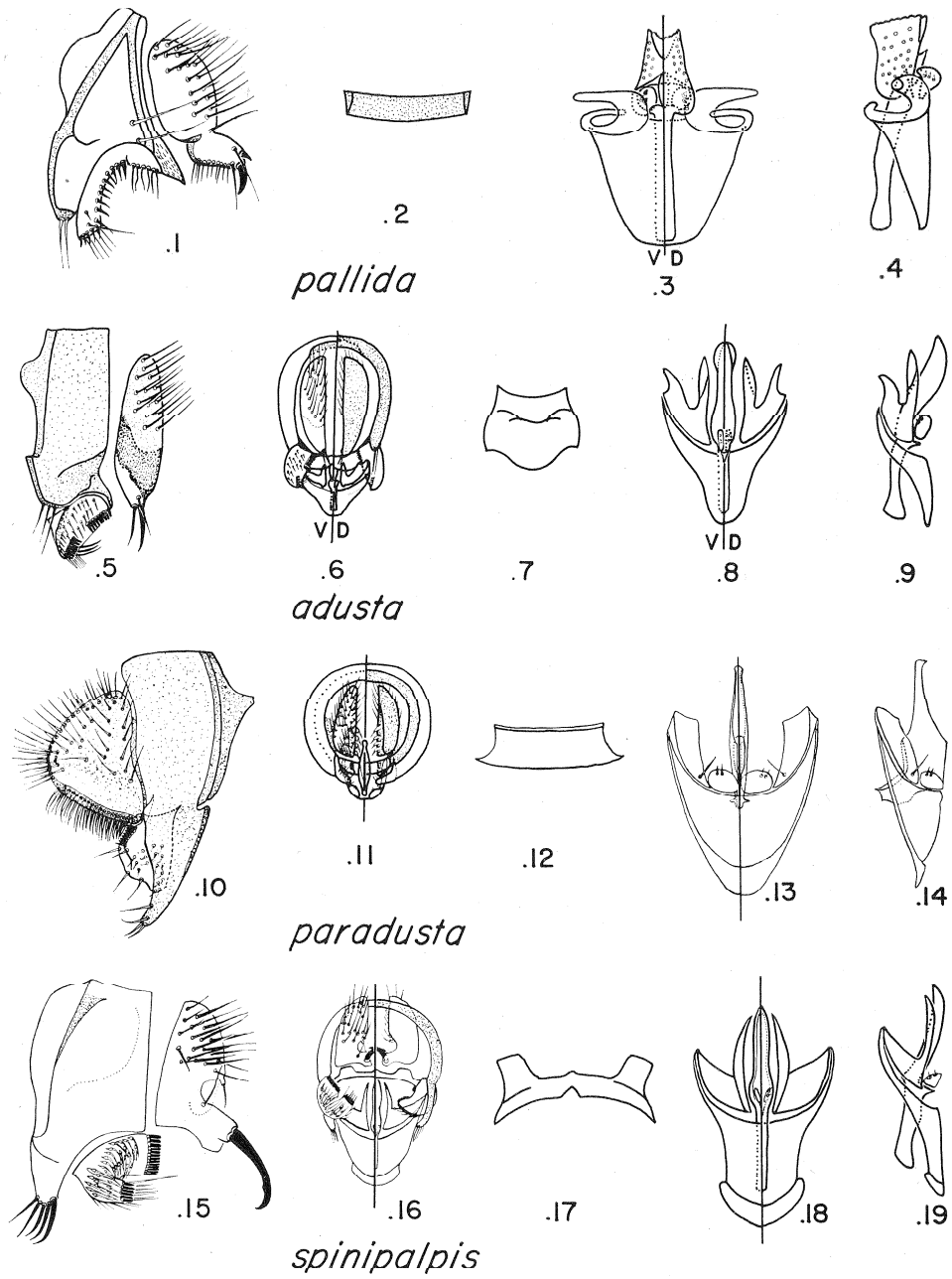


FIG. 13. Male genitalia of four species of the subgenus *Parascaptomyza*.

apicata, and with only the last abdominal tergite shiny, while on *maculifera* the last two tergites were said to be shiny. This appears to us to be a sex difference; on 53 South American specimens identified by us as *maculifera* (from Colombia, Bolivia, Peru), females have a smaller wing spot than males, and females have only the last tergite shiny while the last two are shiny on males. Becker did record both sexes present for both *maculifera* and *apicata*—for which we have no explanation.

Secondly, we have seen what appear to be four specimens from the collection studied by Becker. These four, from the Instituto Oswaldo Cruz, Brazil, all bear pale greenish labels reading "Museum Paris; Equateur; Alausi (2350 M D'Alt) [on two specimens; the other two have Danas (3792 M D'Alt)]; P. Rivet 1904." Three of the four specimens bear also name labels handwritten in pencil; one has "*Scatomyza maculifera* Beck" (sic); one has "*Scatomyza terminalis* L.w." (sic); and the third has "*Scatomyza graminum* Fl." Only the one labelled *maculifera* is male; we have dissected the male genitalia of this specimen and it agrees completely with males of *parapicata* from all parts of its range (Arizona and New Mexico, to Colombia, Bolivia and Peru). The three females all appear to us to belong to *maculifera* (the one labelled *graminum* shows only the barest sign of the apical wing spot).

It also seems worth noting that from the several hundred specimens of *Scatomyza* which we have seen from the highlands of the Andes, we know of no other species which is similar enough to be involved. With regard to the synonymy of *parapicata*, it is interesting that the types of this species also came from Ecuador (Pomasqui, Latacunga) and from Bolivia (Sorata).

In addition to the sexual dimorphism in the size of the apical wing spot, there is considerable variation geographically; the spot tends to be less intense in the north, darker and larger to the south, so that many individuals from Colombia and Bolivia have extremely dark and prominent wing spots and may, in the darkest individuals, even show a second spot apically on the fourth vein.

Distribution: This is one of the most widespread American species, extending from the southwestern United States to Bolivia and Peru. However, we have no specimens from Central America (except for Mexico) and, in view of the number of specimens seen, this seems significant. Actual records are: Texas (Hackman, 1959, who was uncertain of the identification); New Mexico (Cherry Creek Camp, Gila National Forest); Arizona (Rustler Park; Southwest Research Station, Portal); Mexico (40–50 miles NW C. del Maiz, S.L.P., Nov. 20, 1948, H. B. Leech; California Academy collection); Colombia (Bogota area, 10,000 to 11,000 feet; Funza, Cund.; Bello, Ant.; Colegio; Rio Negro; 35 specimens, U.S.N.M. collection, from Sonson, Ant., are labelled "*Solanum andigenum*"; Bolivia (Cocha Bamba); Peru (Cuzco); and Ecuador (types of *maculifera* and of *parapicata*).

26. *S. (Hemiscaptomyza) malada*, new species

A pale tannish yellow species with small blackish spot apically on third vein. This species was included earlier by Wheeler (1952) in *bipunctipennis*, but a comparison of the male genitalia shows that this was an error.

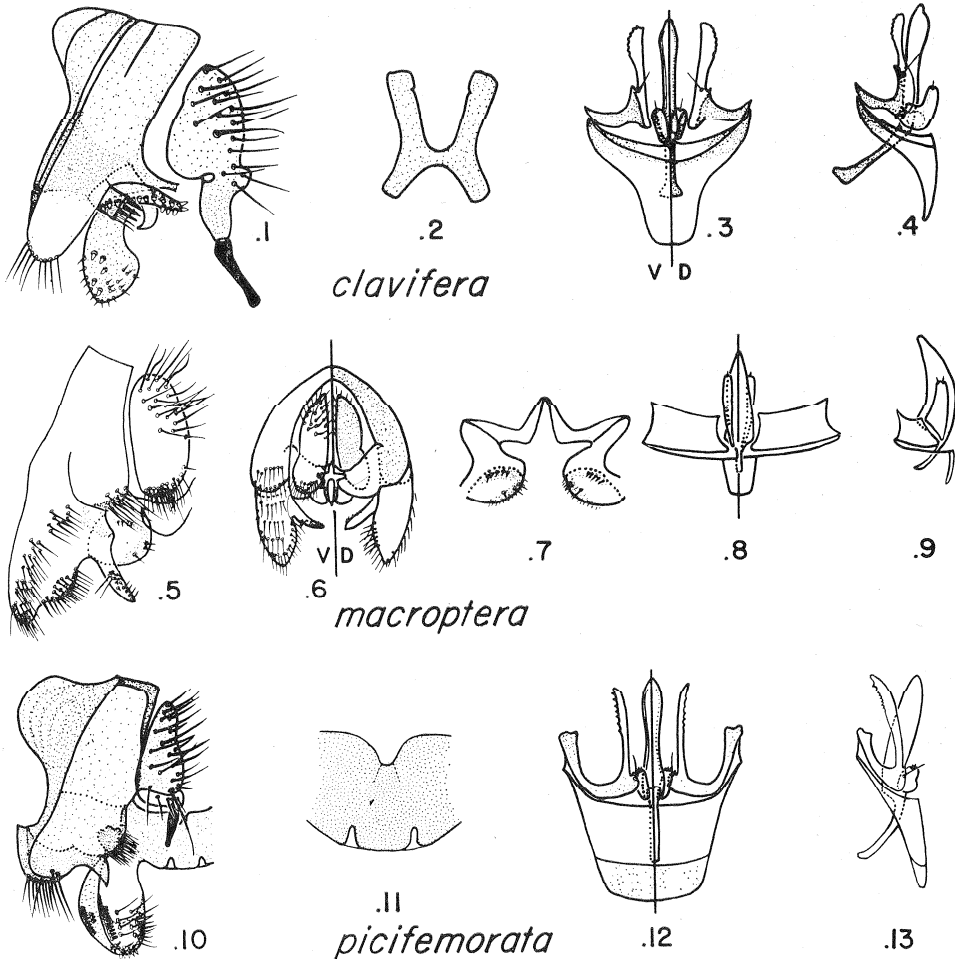


FIG. 14. Male genitalia of three species of the subgenus *Parascaptomyza*; 14.7 shows the intimate relationship between the primary claspers and the bridge.

Front yellow, orbits lighter and granulose; ocellar triangle indistinct; head bristles rather large; antennae tan; arista $5/2$; face whitish yellow, carina low; oral vibrissae stout, 2nd orals weaker but about half as long; palpi pale with two stout bristles; mesonotum and scutellum pale tan, overlaid with dense whitish pollen, and with a slightly darker stripe between median acrostichal rows. Legs uniformly pale yellowish. Four basal abdominal segments pale yellowish, 5th tergite with a lateral brownish spot on each side, 6th tergite entirely brownish. Wings with a slight blackish cloud over apex of third vein; costal index about 3.3. Body length about 2.7 mm.; wing length, about 3.0 mm.

Male genitalia: Fig. 7.16–.20, drawn from the holotype.

Types: Holotype male, and allotype, Malad, Idaho (15 miles NW, at Summit Forest Camp, Caribou National Forest), Aug. 12, 1951, M. R. Wheeler.

27. *S. (Hemiscaptomyza) terminalis* (Loew)

Drosophila terminalis Loew 1863: 32. Type locality: Alaska.

Male genitalia: Fig. 6.11–15, drawn from a specimen from Anchorage, Alaska.

Distribution: Known only from Alaska: Sitka (Loew, *op. cit.*; Hackman 1959); Anchorage and Kodiak (Wheeler and Throckmorton, 1960); Falls Creek, Wrangell Narrows, Mitkof Isl., 1.IX.1951, B. Malkin (California Academy collection).

28. *S. (Hemiscaptomyza) trochanterata* Collin

Scaptomyza trochanterata Collin 1953: 150. Types from Great Britain.

Male genitalia: Fig. 8.6–10, drawn from specimens from Fairbanks, Alaska.

Collin and Hackman seem agreed that an apical wing spot is lacking in this species. However, of 12 specimens from Fairbanks, Alaska, two males had distinct, though narrow, dark apical wing clouds; the male genitalia of these individuals agrees completely with the more usual non-spotted males.

Distribution: This species has a very broad holarctic distribution: Alaska; Manitoba; Alberta; Northwest Territory; Newfoundland; Europe.

Hackman (1959: 57) points out that “. . . the records of “*S. terminalis*” from New England (Wheeler’s hypothetical species “E”) refer most probably to *trochanterata*.” An example is the report of *S. apicata* Thomson from Mt. Washington, New Hampshire, in Slosson (1902: 8).

29. *S. (Hemiscaptomyza) unipunctum* (Zetterstedt)

Geomyza unipunctum Zetterstedt 1847: 2533. Type locality: Sweden.

Male genitalia: Fig. 6.16–20, drawn from a specimen from Bethel, Alaska.

Distribution: Holarctic. Hackman (1955) lists it from Sweden and Finland, European Russia and Siberia (Kamchatka); he later (Hackman, 1959: 58) described *S. okadai* for the Kamchatka specimens, along with material from Japan. Wheeler and Throckmorton (1960) record *unipunctum* from Bethel and Fairbanks, Alaska.

Subgenus **MESOSCAPTOMYZA** Hackman

Type species: *Scaptomyza wheeleri* Hackman.

This is strictly an American subgenus, with most of the species occurring in the Neotropical realm. We are including in it 19 species of which 10 are new. We have altered somewhat the limits of the subgenus as it was defined by Hackman (1959); we are including only those species which, like *wheeleri*, have two rows of acrostichal hairs, a single strong humeral bristle, blackish palpi, short apical scutellar bristles carried usually in an upright position, and more or less tan body with rather prominent mesonotal stripes. We are then transferring the other American species which were treated as *Mesoscaptomyza* by Hackman (1959) into the subgenus *Parascaptomyza*.

There are two reasons for this realignment of species. First, the group of species

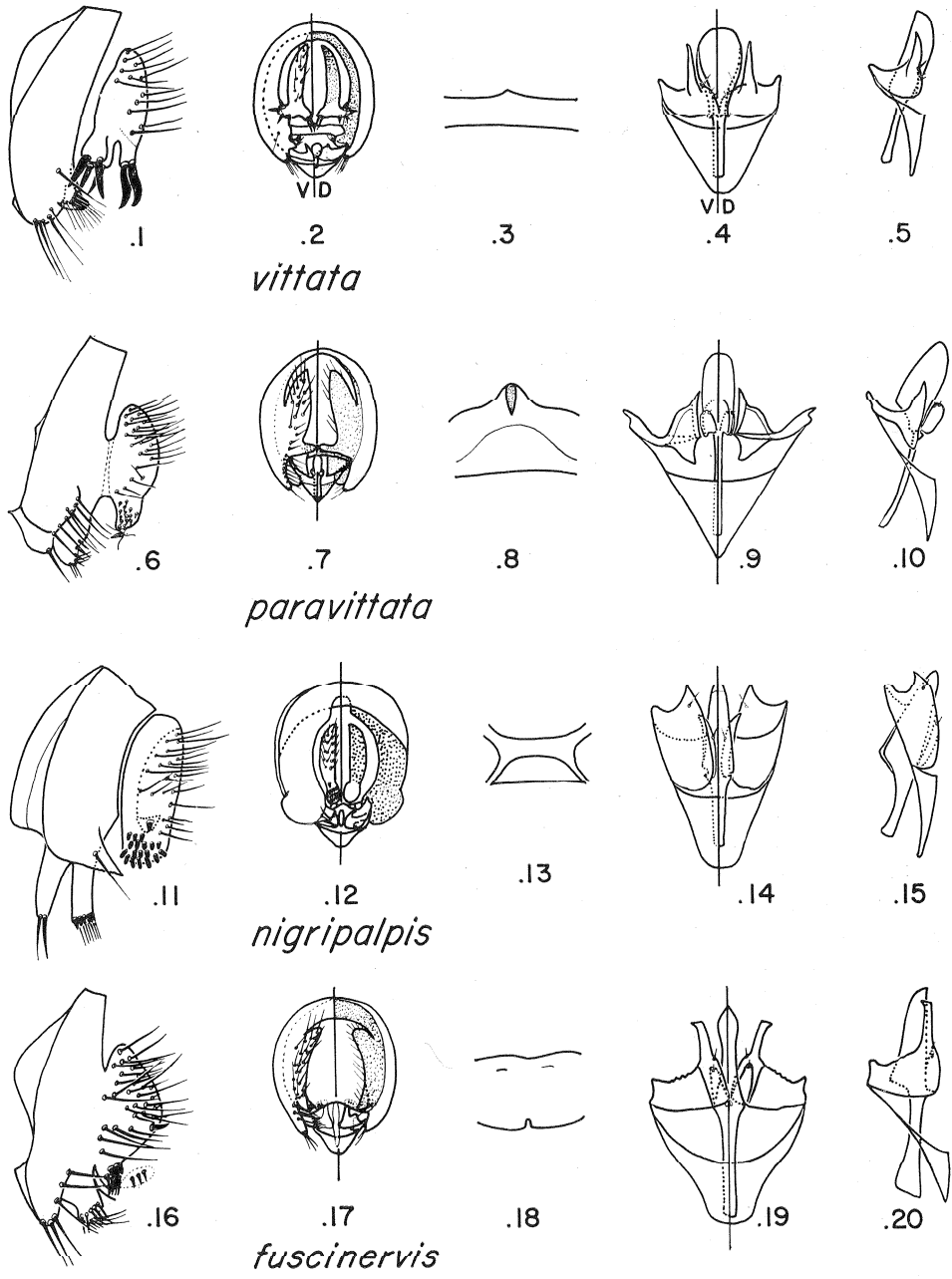


FIG. 15. Male genitalia of four species of the subgenus *Mesoscaptomyza*.

with the traits outlined above, represent the most uniform and most readily assigned species in the genus, and without doubt represent a distinctive evolutionary line. On the other hand, the taxonomic limits of *Parascaptomyza* are quite obscure, in part since the type species (*pallida*) is a rather aberrant species, and it is difficult to decide which of the other species in the subgenus should be thought of as "more typical." Judging from the range of species earlier included in *Parascaptomyza* by Hackman (1959), and by us in this report, the subgenus does not seem to be a well-defined systematic entity.

30. *S. (Mesoscaptomyza) bogotae*, new species

♂, ♀. Frontal orbits pale, mid-frontal area more tan; 2nd antennal joint brown, 3rd pale yellow; face pale with narrow but distinct dark stripe in midline; two nearly equally strong orals; arista usually $4/2$. Mesonotum tan with three fairly distinct brown longitudinal stripes, the middle one continued to scutellar apex; pleural stripe unusual—from its origin below the humeral callus it tends to bifurcate gradually and form two stripes posteriorly, one going to the wing base and the other, somewhat larger and darker, going to the haltere base and reaching the first abdominal segment. Knob of haltere brownish; lower pleura and legs pale; wings clear. Abdomen with pattern of pale and dark areas, almost wholly dark along extreme lateral margins.

Male genitalia: Fig. 17.1–5, drawn from a paratype.

Types and Distribution: Holotype male, allotype and ten paratypes, Bogota vicinity, Colombia, 8700 feet, Nov. 1955, W. B. Heed, collector.

31. *S. (Mesoscaptomyza) coquilletti*, new species

Extremely similar to *wheeleri* morphologically; the three mesonotal stripes are sometimes darker than on *wheeleri*, but there is no constancy for this character. The male and female genitalia, shown on Fig. 16, must be used to separate the two species.

Male genitalia: Fig. 16.11–15, drawn from specimens from Haiti. The two major bristles of the "toe" of the genital arch are nearly parallel, and the base from which they arise is distinctly narrowed near the middle. The teeth of the secondary clasper, arising from the lower part of the anal plate, are irregularly arranged into about three groups, the upper two with 1 or 2 teeth, and the lower one usually with 5–6 teeth.

The female ovipositor is shown in Fig. 16.16, and shows a few relatively consistent differences from *wheeleri* (Fig. 16.17). The major apical bristle is sub-terminal, and the apex has about two small bristles.

Distribution: Locality records which have been confirmed by a study of male genitalia are: Puerto Rico, Dominica, Haiti, Mexico (San Cristobal, Chiap.) and Costa Rica (San José). To date no specimens of *wheeleri* have been identified by us from islands of the Caribbean, but it has a much more extensive distribution on the mainland of North, Central, and South America.

Types: Holotype male, allotype, and 20 paratypes, Kenscoff, Haiti, 4000 ft., Feb. 1956, W. B. Heed collector.

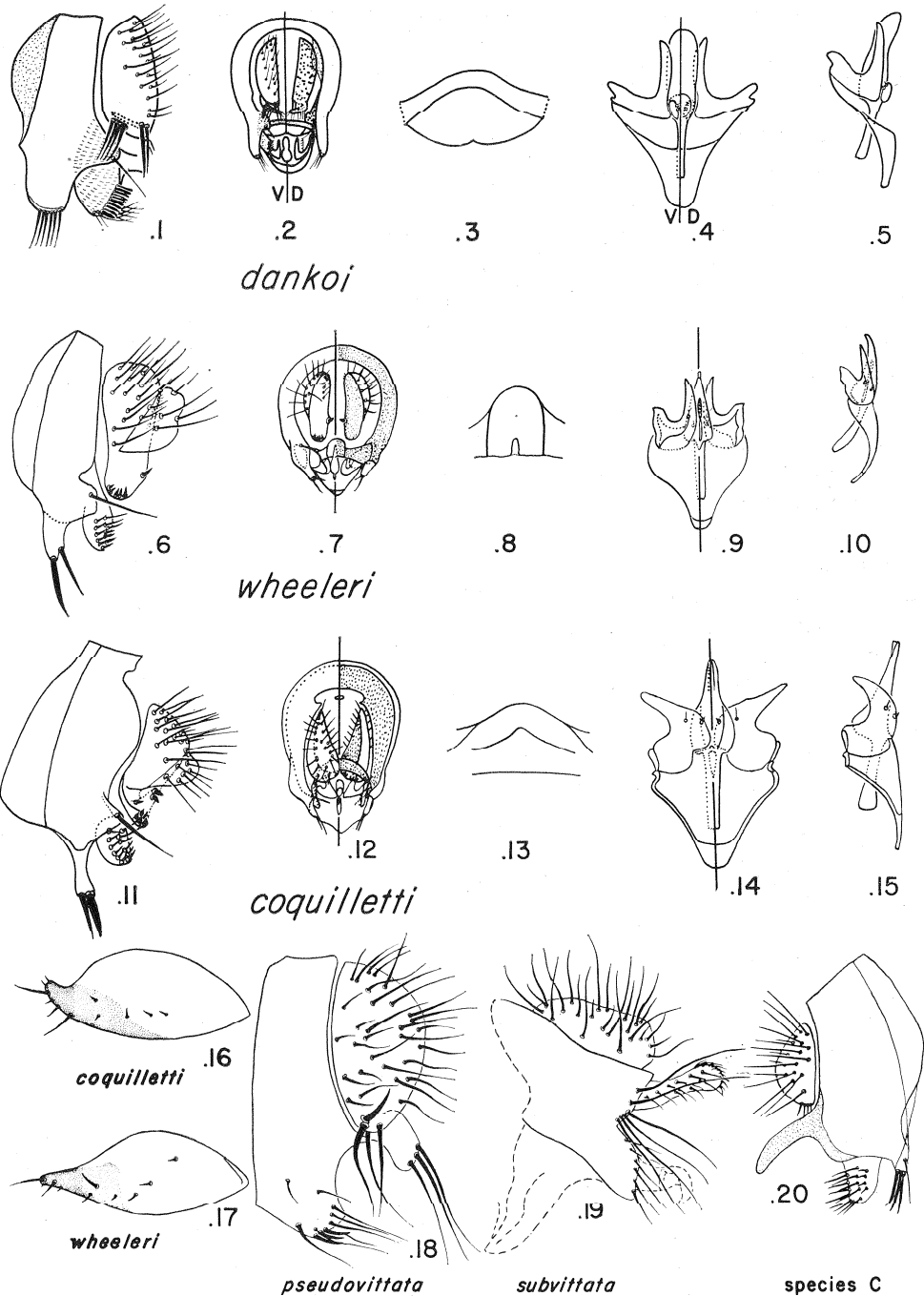


FIG. 16. Male genitalia of three species of the subgenus *Mesoscaptomyza*, ovipositor plates of *wheeleri* and *coquilletti*, and copies of published figures of three other species of *Mesoscaptomyza*.

32. S. (*Mesoscaptomyza*) *dankoi*, new species

♂, ♀. Frontal orbits pale, ocellar area dark, remainder of front deep tan, not especially darker at lunule; 2nd antennal joint dark brown, 3rd joint tan; face pale, only slightly darker medianly; cheeks pale; first oral stout, the 2nd about 2/3 its length but rather stout; arista 4/2 or 5/2. Mesonotum dark tan with three poorly differentiated longitudinal stripes, the median one broad and extended well onto scutellum. Pleural stripe large, broad and distinct; halteres, including the knob, rather dark. Legs pale, but fore tarsi a bit darkened on some individuals. Abdomen largely dull dark brown. Wings clear.

Male genitalia: Fig. 16.1-5, drawn from the holotype.

Types and Distribution: Holotype male, allotype and two paratypes, Cuzco, Peru, Feb.-Mar. 1956, Danko Brncic, collector.

33. S. (*Mesoscaptomyza*) *fuscinervis* Malloch

Scaptomyza fuscinervis Malloch 1924: 11. Types from Brazil.

Male genitalia: Fig. 15.16-20, drawn from a male from Nova Friburgo, E. do Rio, Brazil.

The species has not been reported since its description. Malloch based the species on a type and two paratypes from Alto Itatiaya, Serro do Itatiaya, southeastern Brazil, taken at 7150 feet, Feb. 21, 1922, E. G. Holt, collector.

We have studied one male from the collection of the Instituto Oswaldo Cruz, Brazil; this male is labelled Nova Friburgo, E. do Rio, Brasil, S. Lopes, 27-4-37. It compares very well with Malloch's description, and since it comes from Brazil also, we feel that the identification is fairly certain. We give the following brief notes on the specimen:

Palpi missing; front pale yellowish tan, orbits lighter, granulose; postverticals, ocellars, inner and outer verticals rather large; anterior reclinate and proclinate orbitals standing at almost the same level; ocellar darkening limited to ocelli; anterior reclinate a scant 1/3 length of other two; antennae pale, 3rd joint rather short but rather long-haired. Arista 4/2 plus the apical fork; a single stout pair of orals; carina very low, scarcely evident; face whitish; cheeks narrow; legs pale yellow; a single strong humeral; acrostichals 2-rowed, none visible behind the level of the posterior dorsocentral; a 3rd dorsocentral only slightly enlarged; scutellum and posterior third of mesonotum rather shiny. Apical scutellars turned up. Abdomen nearly uniformly shining reddish brown. Base of wing and costal cell moderately clouded, marginal cell slightly clouded, costal vein dark. Costal index about 3.5.

Distribution: Brazil (type locality; Nova Friburgo); Bolivia (Coroico, April 1958, M. Wasserman; ♀).

34. S. (*Mesoscaptomyza*) *nigricosta*, new species

♂, ♀. Frontal orbits broad, whitish, the large ocellar triangle dark tan; 2nd antennal joint light brown, 3rd pale yellowish; face pale; orals thin, 2nd about half length 1st; cheeks pale; arista usually 5/2. Mesonotum appearing mostly dark brown and subshining, the pattern of longitudinal stripes not prominent;

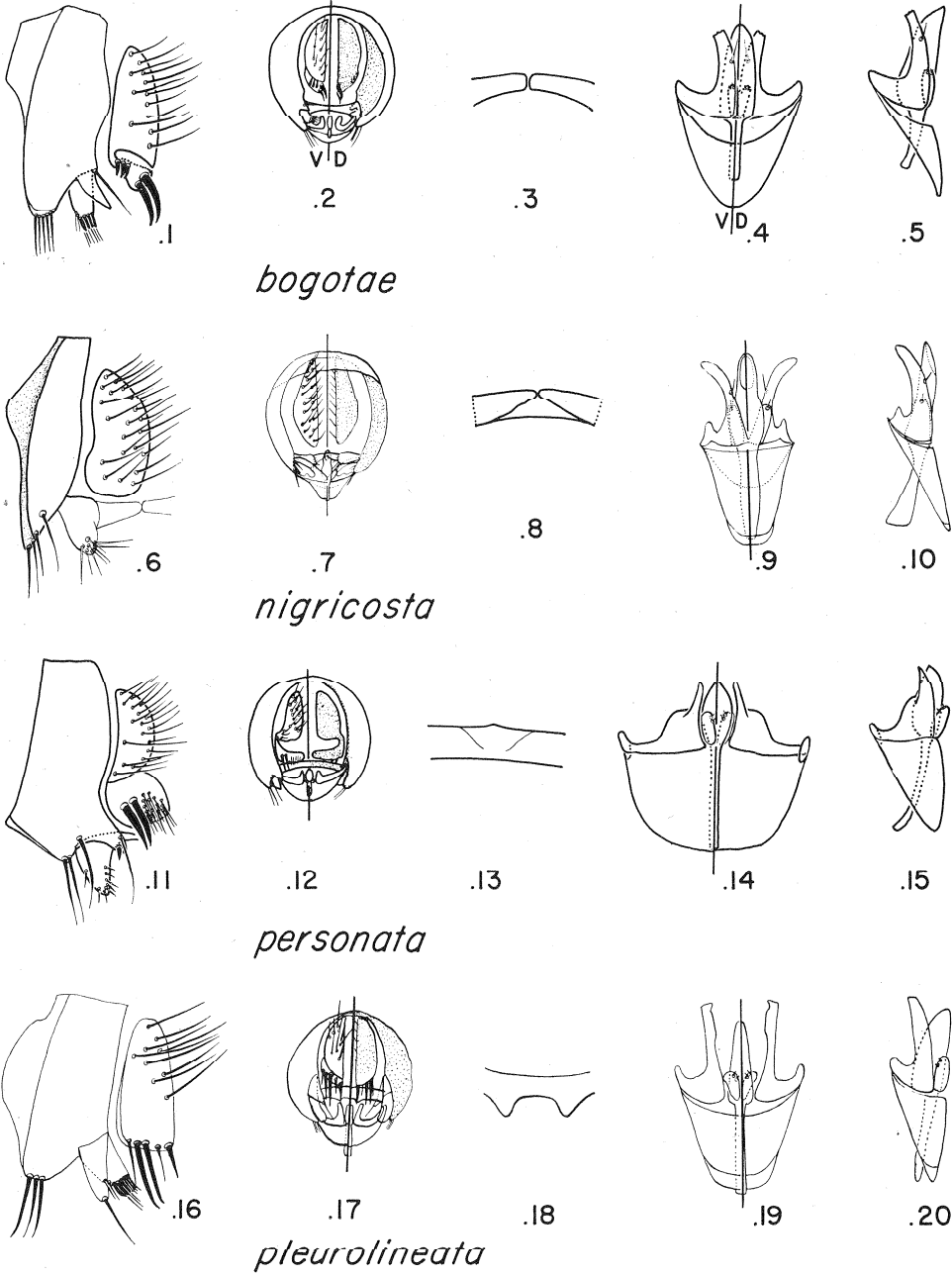


FIG. 17. Male genitalia of four species of the subgenus *Mesoscaptomyza*.

pleura dark, with the humeral callus pale on females; legs pale. Abdomen uniformly dark brown to black, moderately shining. Wings unusual, with the base darkened (except for the region around the humeral crossvein) and with the costal margin conspicuously darkened.

Male genitalia: Fig. 17.6-10, drawn from a paratype from 25 km. W. of Bogota, Colombia.

Types and Distribution: Holotype male, allotype and 4 paratypes, Bogota area, Colombia, 8700 feet, Feb. 1958, M. R. Wheeler; 8 paratypes, 25 km. W. of Bogota, Colombia, July 1960, W. B. Heed and H. L. Carson; 3 paratypes, 30 km. N.W. of Medellin, Colombia, 8000 feet, Nov. 1955, W. B. Heed.

35. *S. (Mesoscaptomyza) nigripalpis* Malloch

Scaptomyza nigripalpis Malloch 1924:11. Types from Brazil.

Male genitalia: Fig. 15.11-15, drawn from a specimen from Tequendama Falls, Bogota, Colombia.

Hackman (1959:51) tentatively recognized a male specimen from Brazil as *nigripalpis*; we see no reason to doubt his identification. The type and three paratypes came from Serro do Itatiaya, 7150 feet, southeastern Brazil. We have seen 29 specimens ranging from Colombia to Peru, indicating that the species is probably quite widespread in South America.

Distribution: Colombia (Bogota vicinity; Pasto; Bucaramanga), Ecuador (Bubna); Bolivia (Coroico), Peru (Urubamba), and Brazil (type locality; Ouro Preto [in Hackman 1959]; Nova Friburo). Male genitalia were checked on specimens from Bogota, Colombia, Coroico, Bolivia, and Nova Friburo, Brazil.

36. *S. (Mesoscaptomyza) paravittata* Wheeler

Scaptomyza paravittata Wheeler 1952:200. Type locality: Rosemead, California.

Male genitalia: Fig. 15.6-10, drawn from a paratype from California.

Distribution: California; El Salvador (Volcan Santa Ana; Cerro Monte Cristo); Haiti (Kenscoff); Jamaica (Hardware Gap).

37. *S. (Mesoscaptomyza) personata*, new species

♂, ♀. Front pale on orbits, darker nearer center, dark brown in midline; 2nd antennal segment dark brown, 3rd segment tan; face pale yellowish with a prominent brownish black median stripe; cheeks pale; arista usually 5/2; 1st oral bristle stronger than 2nd but both are rather weak. Mesonotum with three brownish longitudinal stripes, more or less prominent; median stripe continued onto scutellum. A single dark brown pleural stripe; haltere base dark, the knob pale tan. Legs pale; wings clear; C3 bristles on the basal 2/5. Abdomen with shiny black areas, strongly contrasting with the pale pattern seen dorsally.

Male genitalia: Fig. 17.11-15, drawn from a specimen from Cerro Monte Cristo, El Salvador, and checked with a male from Monte Vyuca, Honduras.

Types and Distribution: Holotype male, allotype and 5 paratypes, Monte Vyuca, 10 km N.W. of Zamorano, Republic of Honduras, 5000 feet, March 1954,

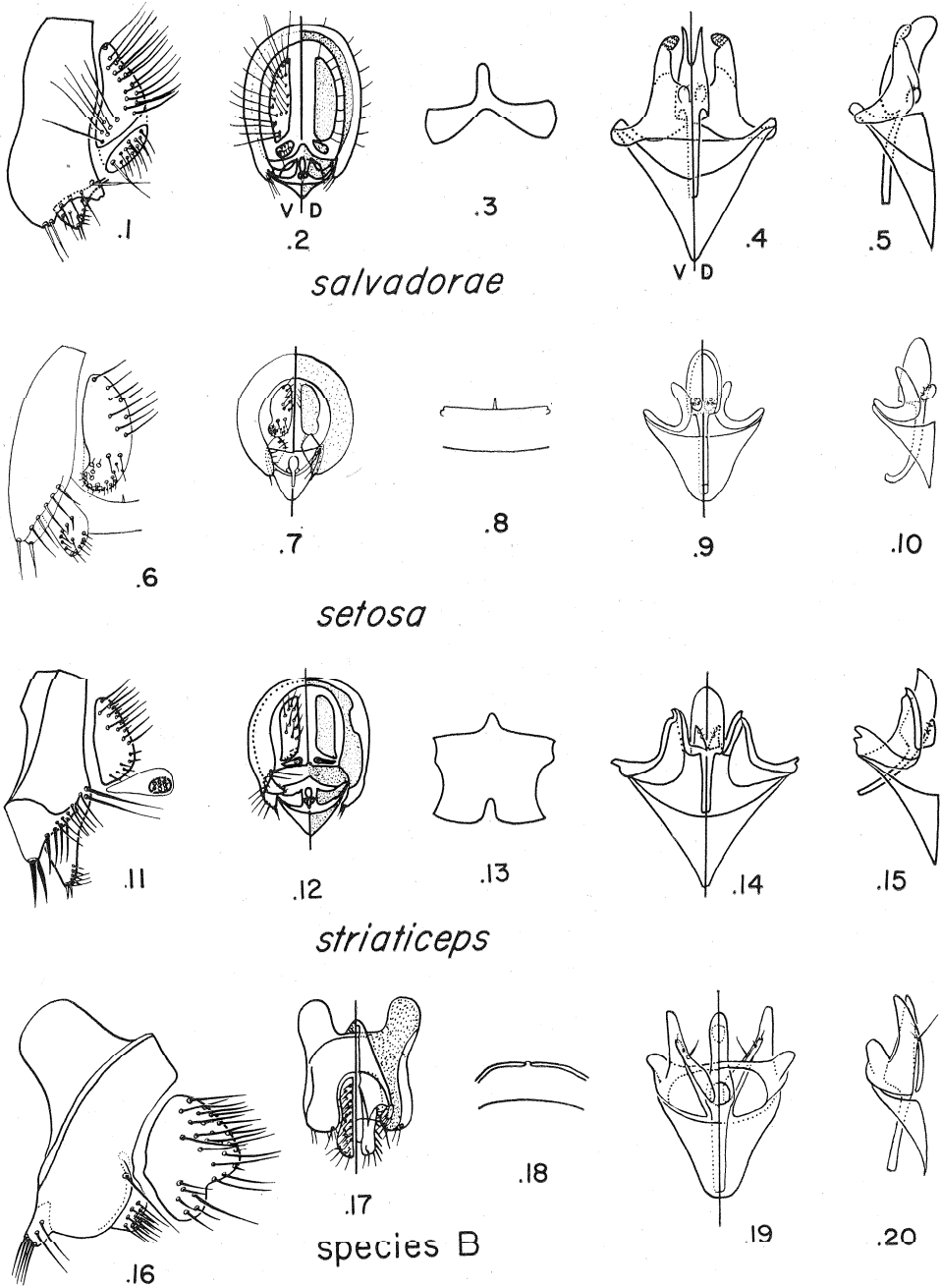


FIG. 18. Male genitalia of four species of the subgenus *Mesosaptomyza*.

W. B. Heed; ten paratypes, Cerro Monte Cristo, El Salvador, 7000 feet, Feb. 1954, W. B. Heed.

38. S. (*Mesoscaptomyza*) *pleurolineata*, new species

♂. Frontal orbits pale, center tan becoming more brown in midline; 2nd antennal joint brown, 3rd joint yellow; face and cheeks white (female uncertain); two nearly equal oral bristles on each side; arista 4/2. Mesonotum tan with three distinct dark brown longitudinal stripes, the middle one continued to scutellar apex. Pleura with two distinct dorsal brown stripes; the upper, thinner one reaches the wing base, and the lower, more prominent one passes from the fore coxal base to the haltere base and is continuous visually with the dark margins of the abdominal tergites. Rest of pleura pale; legs pale; wings clear but posterior crossvein darkened, in some individuals with a slight cloud. Abdominal tergites with a series of light and dark areas, these more or less aligned so as to form a series of light and dark longitudinal stripes; typically, the last (pregenital) tergite is dark and shiny except for the median interruption.

Male genitalia: Fig. 17.16–20, drawn from a paratype from Tequendama, Bogota, Colombia.

Types and Distribution: Holotype male and one male paratype, Popayan (30 km. N.), Colombia, March 1958, M. R. Wheeler; 6 male paratypes, Bogota and Tequendama Falls areas, Colombia, July 1960, W. B. Heed and H. L. Carson; 4 male paratypes, Bucaramanga, Colombia, Sept. 1956, H. L. Carson, M. Wasserman, and H. Hoenigsberg; 1 male paratype, Medellin, Colombia, Nov. 1955, W. B. Heed.

There is, in addition, a single damaged female which seems to belong to this species; it comes from Mogi das Cruzes, Brazil, April 1958, M. Wasserman.

39. S. (*Mesoscaptomyza*) *pseudovittata* Brcnic

Scaptomyza pseudovittata Brcnic 1955:246. Types from Azapa, Chile.

Male genitalia: Fig. 16.18, redrawn from Brcnic's original illustration of the genital arch and claspers.

We have not seen this species. Hackman (1959:49) considered it most likely a subspecies of *vittata*, but we feel that the differences in male genitalia are too great, and prefer to consider it a distinct species.

Distribution: Known only from Chile.

40. S. (*Mesoscaptomyza*) *salvadorae*, new species

♂, ♀. Frontal orbits whitish, middle with a poorly defined dark streak, face and cheeks pale; 2nd antennal joint brown, 3rd joint tan; one prominent oral; arista usually 5/2. Mesonotum dark tan with three well defined longitudinal stripes; median stripe continued to scutellar apex. Brown pleural stripe well defined. Legs pale. Abdomen largely pale, each segment with broadly interrupted dark shiny bands, the last tergite all dark. Wings clear.

Male genitalia: Fig. 18.1–5, drawn from a paratype from Cerro Monte Cristo, El Salvador.

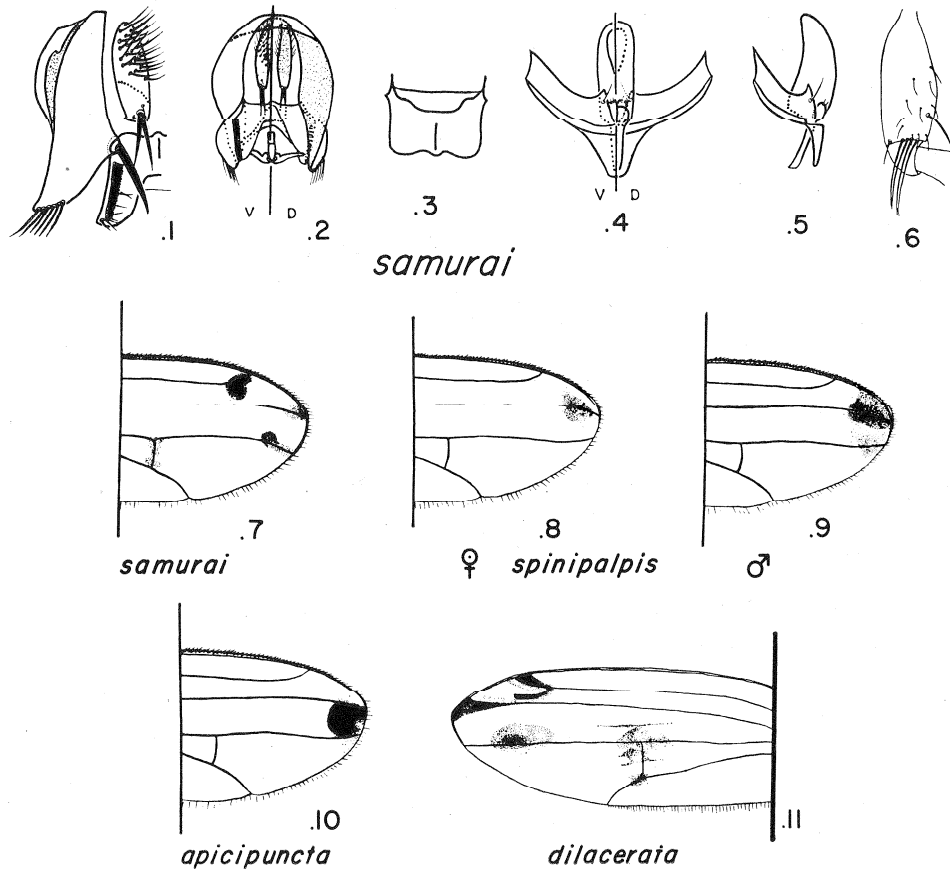


FIG. 19. Male genitalia (.1-5), fore coxa (.6) and wing apex (.7) of *S. Mesoscaptomyyza samurai*; wing apices of ♂ and ♀ of *S. Parascaptomyyza spinipalpis* (.8-9); wing apex of *S. Hemiscaptomyyza apicipuncta* (.10), redrawn from Malloch; wing pattern of *Drosophila dilacerata* Becker, redrawn from Becker (.11).

Types and Distribution: Holotype male, allotype and 9 paratypes, Cerro Monte Cristo, El Salvador, 7000 feet, Feb. 1954, W. B. Heed; 3 paratypes, Volcan Boqueron, El Salvador, 4500 feet, Feb. 1954, W. B. Heed; in addition there is one female which probably belongs with this species: Boquete, Chiriqui Prov., Panama, June-July 1959, W. B. Heed and H. L. Carson.

41. *S. (Mesoscaptomyyza) samurai*, new species

♂. Front tan, becoming pale on orbits; antennae light brown; face brownish, becoming pale near eyes; cheeks pale; 1st oral bristle stout, 2nd thin and weak; arista 4/2. Mesonotum with three brownish longitudinal stripes, not well defined; median stripe continued broadly onto scutellum; pleural stripe dark brown to black, very prominent; haltere base brown, the knob tan. Legs pale; fore coxae adorned with a series of stout bristles apically (Fig. 19.6). Abdomen almost uniformly dull brown. Wings (Fig. 19.7) with a striking pattern of dark areas; spur

veins occur in the large dark area near the apex of the 2nd longitudinal vein, and in the dark spot apically on the 4th vein. Female unknown.

Male genitalia: Fig. 19.1-5, drawn from a paratype.

Types and Distribution: Holotype male and two male paratypes, from S.E. of Bogota, Colombia, 10,000 feet, July 1960, W. B. Heed and H. L. Carson.

42. *S. (Mesoscaptomyza) setosa*, new species

♂, ♀. Front dull tan, the orbits dark brown and well differentiated; ocellar area dark; 2nd antennal joint dark tan to brown, 3rd joint lighter; face tan, often darker on carina; cheeks rather broad, pale; palpi dark; one prominent oral bristle; arista 3/2 or 4/2. Head and thoracic bristles longer and more conspicuous than usual. Mesonotum dark brown to black, subshining, some striping only faintly indicated on some individuals as paler stripes just inside dorsocentral lines; scutellum darker in midline, paler on sides. Upper part of pleura about as dark as mesonotum, becoming pale tan below; legs all pale; halteres pale; wings clear. Abdomen mostly dark brown to black, subshining, but with the series of broad pale median areas united to form a broad pale midline stripe.

Male genitalia: Fig. 18.6-10, drawn from a paratype.

Types and Distribution: Holotype male, allotype, and 13 paratypes, Chilicay, Chimborazo, Ecuador, July 1955, Levi Castillo, collector; all types are the property of the U. S. National Museum and are being returned to that collection.

43. *S. (Mesoscaptomyza) striaticeps*, new species

♂, ♀. Front pale yellow to tan, with a broad blackish stripe from ocelli to anterior margin; 2nd antennal joint dark brown, 3rd joint very pale; face and cheeks pale; arista 4/2 or 5/2; 2nd oral bristle weak. Mesonotum with three prominent dark longitudinal stripes; the central stripe extends to the end of the scutellum and the lateral stripes extend onto the sides of the scutellum. A single dark pleural stripe, large and prominent, continued to postscutellum. Base of haltere dark, the knob white. Legs pale; wings clear, the 3C black bristles on the basal 1/5 or 1/6. Abdominal tergites shiny black with a dorsal pattern of pale yellow areas except on the last segment.

Male genitalia: Fig. 18.11-15, drawn from a paratype from Bogota.

Types and Distribution: Holotype male, allotype and two paratypes, Tequendam Falls area near Bogota, Colombia, Feb. 1958, M. R. Wheeler; 7 paratypes from the same locality, July 1960, W. B. Heed and H. L. Carson; 2 paratypes, Bogota vicinity, 8700 feet, Nov. 1955, W. B. Heed; one paratype, Fusagasuga, S.W. of Bogota, Colombia, Nov. 1955, W. B. Heed. There is in addition one specimen, badly damaged, which may belong here; it is labelled "Argentina; Jose C. Paz; Ogloblin; 2-X-39" (from Inst. Oswaldo Cruz collection).

44. *S. (Mesoscaptomyza) subvittata* Hackman

Scaptomyza subvittata Hackman 1959: 50. Type from San José, Cost Rica.

Male genitalia: Fig. 16.19, redrawn from Hackman's original figure of the genital arch and clasper.

We have not seen this species; it is said to be very similar in appearance to *paravittata*.

Distribution: Costa Rica.

45. *S. (Mesoscaptomyza) vittata* (Coquillett)

Drosophila vittata Coquillett 1895: 318: Type locality: Charlotte Harbor, Florida.

Male genitalia: Fig. 15.1–.5, drawn from a specimen from Coroico, Bolivia, and checked with specimens from Colombia, Ecuador, and Louisiana.

Distribution: A widely distributed species; Florida to Louisiana; Cuba to Jamaica and Puerto Rico; Mexico to Panama to Colombia to Bolivia and Peru.

46. *S. (Mesoscaptomyza) wheeleri* Hackman

Scaptomyza wheeleri Hackman 1959: 49. Types from Falls Church, Virginia.

Male genitalia: Fig. 16.6–.10, drawn from a specimen from Medellin, Colombia, and checked with males from El Salvador, and from Great Smoky Mountain National Park, Tennessee. For comparison with the similar *coquilletti*, the female ovipositor is shown in Fig. 16.17.

As was stated under *coquilletti*, it and *wheeleri* are not readily separated except by the use of the male genitalia. There is also some overlap in the respective distributions but, in general, *wheeleri* ranges widely on the mainland (Virginia to perhaps Peru) while *coquilletti* is primarily found on the islands of the Caribbean and in some localities in Central America.

Distribution: Tennessee and Virginia south to Mexico to Colombia and Ecuador. Probably occurring also in Peru and Bolivia (Hackman 1959).

47. *S. (Mesoscaptomyza) species b*

This undescribed species is known to us by a single male from Cerro de la Muerte, Costa Rica. The male genitalia are illustrated in Fig. 18.16–.20. This specimen shows almost no midfrontal stripe, the face is whitish, the vibrissa is single and strong, the mesonotal striping is moderately pronounced, the pleural stripe is typical and well-developed, the haltere knob seems to be somewhat discolored, and the legs and wings are pale.

48. *S. (Mesoscaptomyza) species c*

This undescribed species is known from a single male from Peña de Gato, Puebla, Mexico. The genital arch was illustrated by Hsu (1949:90) under the misidentification, *vittata*. The species has not been recaptured, so we are redrawing Hsu's original figure as Fig. 16.20.

Key to species of *Mesoscaptomyza*

- | | |
|---|---|
| 1. Mesonotum with three rather prominent dark brown longitudinal stripes | 3 |
| Mesonotum dark brown to blackish, without stripes or with faintly indicated paler stripes | 2 |

2. Pleura all dark, or at least darker below than it is above; wing base and costal margin black; abdomen black *nigricosta*
 Pleura dark above, pale below; wings pale; abdomen with some light areas mid dorsally *setosa*
3. Wings without distinctive apical clouds 4
 Wings with a series of dark spots apically *samurai*
4. Abdominal tergites with a pattern of light and dark areas 6
 Abdomen uniformly dark or nearly so 5
5. Wings clear; abdomen dull dark brown *dankoi*
 Wing base and costal cell dark, marginal cell slightly darkened; abdomen semishining reddish brown *fuscinervis*
6. Vibrissa single and strong, the 2nd oral bristle thin and usually not half as long as 1st; pleura usually with a single dark brown stripe above 9
 Two relatively thin and weak oral bristles on each side; pleural stripe indistinct or tending to form two stripes 7
7. Male face pale, often whitish 8
 Male face with a dark median stripe; pleural stripe tending to bifurcate into two stripes posteriorly *bogotae*
8. Pleura of male with two distinct stripes *pleurolineata*
 Pleural stripes rather indistinct *vittata*; *pseudovittata*
9. Male face with a dark median stripe *personata*
 Male face uniformly pale, often whitish 10
10. Front pale tan to orange in middle *wheeleri*; *coquilletti*; *subvittata*
 Front usually dark brown medianly, sometimes conspicuously so
 *paravittata*; *salvadorae*; *striaticeps*; *nigripalpis*

Subgenus PARASCAPTOMYZA Duda

Type species: *Scaptomyza pallida* (Zetterstedt).

49. S. (*Parascaptomyza*) *adusta* (Loew)

Drosophila adusta Loew 1862:231. Type locality: Washington, D.C.

Male genitalia: Fig. 13.5-9, drawn from specimens from Austin, Texas, and compared with males from Mexico, Costa Rica, El Salvador, Colombia and Argentina.

Distribution: Very widely distributed in North America from British Columbia and Washington to Ontario and Maine, south to Florida and Arizona (Chiricahua Mts.); Mexico to Colombia to Argentina. Hackman (1959) reported specimens from Bermuda; this is the only authenticated record from the Caribbean islands since the earlier report of this species on Puerto Rico (Townsend and Wheeler 1955) cannot now be confirmed due to a lack of specimens.

50. S. (*Parascaptomyza*) *clavifera*, new species

♂, ♀. Frontal orbits and ocellar triangle dark brown, subshining; rest of front dull brown becoming tan to orange anteriorly; antennae yellow to tan; face pale, almost white, on males but with brownish carina on females; cheeks and palpi

pale; two nearly equal oral bristles on each side; arista usually 4/2. Mesonotum dark brown, evenly pollinose and usually with no visible evidence of longitudinal stripes; scutellum all dark. Pleura entirely dark brown, subshining; haltere base dark, the knob whitish; legs pale, wings clear. Abdomen dark brown, rather shining posteriorly.

Male genitalia: Fig. 14.1-4, drawn from a paratype.

Types and Distribution: Holotype male, allotype, and 5 paratypes, Cuzco, Peru, February-March 1956, Danko Brncic, collector.

51. *S. (Parascaptomyza) macroptera*, new species

This species seems to occur in a dark form and a light form; the holotype comes from the light form.

Dark form (♀♀ only). Front gray pollinose behind, tan anteriorly, the large ocellar triangle becoming black anteriorly; antennae pale; arista with two dorsal, no ventral, branches; face tan, brownish in midline; cheeks tan; clypeus dark; palpi pale; 1st oral stout, 2nd small. Mesonotum dull grayish brown with three poorly defined longitudinal stripes; pleura dark brown; legs pale, with the terminal two tarsal joints darker. Abdomen dull, dark brown, subshining on last segment. Wings slightly brownish, posterior crossvein darkened.

Light form (♂, ♀). Front tan, lightly browned in midline and in ocellar area; face entirely pale (♂♂) or with a narrow dark line in middle (♀); palpi, cheeks and clypeus pale; pleura mostly pale, a darker dorsal stripe only indicated; prosternum blackish near posterior edge, variable. Mesonotum tan, only a median longitudinal stripe evident, this continued onto scutellum. Wings clear. Other characteristics about as in the dark form.

Male genitalia: Fig. 14.5-9, drawn from the holotype.

Types and Distribution: All specimens but one have the same collection data: Cerro de la Muerte, Costa Rica, July-August, 1956, W. B. Heed, H. L. Carson, and M. Wasserman. Holotype male, allotype, and one paratype of the light form; 4 paratype females of the dark form.

One female paratype, dark form, Volcan Irazu, Costa Rica, 11,000 feet, "off mushroom," July 1956; collectors as above.

The arista, with two dorsal branches and none ventrally, is unique for American species, and suggests the subgenus *Trogloscaptomyza* (see Hackman 1959:10, Fig. 11 for *S. T. striatifrons* Hackman).

52. *S. (Parascaptomyza) pallida* (Zetterstedt)

Drosophila pallida Zetterstedt 1847:2571. Type from Europe.

Male genitalia: Fig. 13.1-4, drawn from specimens from Chichi Jima, Bonin Islands.

This is the common American species which has been referred to by most American authors as "*graminum* Fallén" or "*disticha* Duda."

Distribution: Worldwide and rather common except in the colder northern and southern extremes; not known from Alaska nor from the southern parts of South America.

53. S. (Parascaptomyza) paradusta Wheeler

Scaptomyza paradusta Wheeler 1952:198. Type locality: Mt. San Jacinto, California.

Male genitalia: Fig. 13.10-14, drawn from a male from Oregon, and compared with a paratype.

Distribution: California (numerous localities); Oregon (Saddleback Mt., Lincoln Co., J. C. Dirks-Edmunds coll.); Washington (Mt. Constitution); Arizona (Oak Creek Canyon).

54. S. (Parascaptomyza) picifemorata Hackman

Scaptomyza picifemorata Hackman 1959:45. Type from Ecuador.

Male genitalia: Fig. 14.10-13, drawn from specimens from Bogota, Colombia and checked with males from Volcan Irazu, Costa Rica, and Cuzco, Peru.

Distribution: Costa Rica (Volcan Irazu); Colombia (various localities, some up to 10,000 feet); Ecuador (in Hackman 1959); Venezuela (pass on Pacific-Atlantic divide, 8-9000 feet, Estado Trujillo); Peru (Cuzco). The dark femora, mentioned by Hackman, are not characteristic; of about 90 specimens which we have seen, only 14 show the trait.

55. S. (Parascaptomyza) spinipalpis Séguy

Scaptomyza spinipalpis Séguy 1934:11. Type, male, from La Plata, Argentina.

Male genitalia: Fig. 13.15-19, drawn from a specimen from Coroico, Bolivia and compared with a specimen from Ogloblin, Argentina.

This species has apparently not been reported since its description. We have seen two males from what appears to be the type locality, loaned by Dr. Blanchard of Buenos Aires; in addition we have three other specimens from Argentina, four from Bolivia and eight from Colombia.

The markings of the wings are distinctive, as is shown in Fig. 19.9 (male) and 19.8 (female). The unusually large apical wing spot of the male is produced by a fusion, more or less complete, of the large spot apically on the 3rd vein with the smaller one apically on the 4th vein. On one male from Bolivia, the spot of the 4th vein is lacking, and this is essentially so also on a male from Colombia. Females have only the spot on the 3rd vein. We have also noted that the specimens from Bolivia are decidedly darker than those from elsewhere, but a check of the male genitalia shows that the same species is involved.

Distribution: Argentina, Bolivia, Colombia. Our list of specimens examined is as follows: two, La Plata, Argentina, V-VI-1935, R. Costa (loaned by Dr. Blanchard); three, Argentina, Ogloblin, José C. Paz, 24-VIII-39 and 10-IX-39 (loaned by Dr. Souza Lopes, Inst. Oswaldo Cruz, Brazil); four, Coroico, Bolivia, April 1958, M. Wasserman; eight, Bello, Ant., Colombia, C. Rios, 27-VI-55, VI-16-55, and 21-VIII-56, all but one labelled "Frijol" indicating that they were reared from or captured on bean plants (collection of CNIA, Tibaitata, Bogota, the loan arranged by Miss Isabel Sanabria).

OTHER SPECIES

We have seen a single female of an undescribed species belonging to the "andina complex." The mesonotal pattern is strong, consisting of prominent brown and bluish-gray stripes; the mid-facial stripe is broad and very black; the palpi are black; and the fore coxae and all femora are black. This specimen, like others of the *andina* complex, came from near Bogota, Colombia, in the paramos above the city, and was collected by W. B. Heed and H. L. Carson.

Hackman (1959:66, Fig. 28) mentions an unidentified species, probably belonging to the subgenus *Scaptomyza*, from Cerra Punta, Panama, (U.S.N.M. collection). We have not recognized the species among our material. The two individuals studied by Hackman were said to be in very poor condition, and the external features could not be given with any certainty. The single character which sounds highly significant is an unusual one for this genus: dark fore tibiae.

Drosophila dilacerata Becker (1919), from Ecuador, has not been reported since its description. Duda (1927:217) expressed the opinion that it was most likely a *Scaptomyza*. In our opinion, this is most unlikely. Becker (*op. cit.*) made a point of commenting on the reality of separating *Scaptomyza* from *Drosophila* on the presence of only two or four acrostichal rows in the former; thus it seems safe to infer that *dilacerata* must have more than four rows of acrostichal hairs, and this is not true for any known species of American *Scaptomyza* (although it is common among Hawaiian species, for example). The wing pattern figured for *dilacerata* seems unique; we are reproducing it as Fig. 19.11.

REFERENCES

- Basden, E. B. 1961. Type collections of Drosophilidae (Diptera). 1. The Strobl collection. Beitr. z. Ent. 11: 160-224.
- Becker, T. 1919. Mission du serv. Geogr. de l'Armee pour la mesure d'un Arc de Meridien Equat. en Emerique du Sud. 10(2), Diptera, Brachyceres: 163-215; Pl. XVII.
- Bronic, D. 1955. The Chilean species of *Scaptomyza* Hardy (Diptera, Drosophilidae). Rev. Chilena de Ent. 4: 237-250.
- . 1957a. Las especies Chilenas de Drosophilidae. Monograf. Biol. 8, Univ. Chile, Santiago. pp. 136.
- . 1957b. Los insectos de las Islas Juan Fernandez. 31. Drosophilidae (Diptera). Rev. Chilena de Ent. 5: 391-397.
- and T. Dobzhansky. 1957. The southernmost Drosophilidae. Amer. Nat. 91(857): 127-128.
- Collin, J. E. 1953. On the British species of *Scaptomyza* Hardy and *Parascaptomyza* Duda (Dipt., Drosophilidae). The Entomologist 86: 148-151.
- Coquillett, D. W. 1910. The type-species of the North American genera of Diptera. Proc. U.S.N.M. 37(1719): 499-647.
- Duda, O. 1921. Kritische Bemerkungen zur Gattung *Scaptomyza* Hardy (Dipteren). Vereins für schlesische Insektenkunde, Breslau, 13: 57-69 (pp. 1-13 in reprint version).
- . 1924. Beitrag zur Systematik der Drosophiliden unter besonderer Berücksichtigung der paläarktischen u. orientalischen Arten (Dipteren). Arch. f. Naturg. 90A3: 172-234.
- . 1927. Die sudamerikanischen Drosophiliden unter Berücksichtigung auch der anderen neotropischen sowie der nearktischen Arten. Arch. f. Naturg. 91A11-12(1925): 1-228.

- Hackman, W. 1955. On the genera *Scaptomyza* Hardy and *Parascaptomyza* Duda (Dipt., Drosophilidae). Notul. Ent. 35: 74-91.
- . 1959. On the genus *Scaptomyza* Hardy (Dipt., Drosophilidae). Acta Zool. Fennica 97: 1-73.
- Hsu, T. C. 1949. The external genital apparatus of male Drosophilidae in relation to systematics. Univ. Texas Publ. 4920: 80-142.
- Malloch, J. R. 1924. Descriptions of neotropical two-winged flies of the family Drosophilidae. Proc. U.S.N.M. 66(3): 1-11.
- 1934.38
Segúy, E. 1934. Etude sur quelques Muscides de l'Amerique Latine. Rev. Soc. Ent. Argentina 6: 9-16.
- Slosson, A. T. 1902. Additional list of insects taken in alpine region of Mt. Washington. Ent. News 13: 4-8.
- Takada, H. 1965. Differentiation of the external male genitalia in the Drosophilidae. Kushiro Women's College Publ. 1: 39-50 (in Japanese; English summary pp. 131-132).
- Townsend, J. I., and M. R. Wheeler. 1955. Notes on Puerto Rican Drosophilidae including descriptions of two new species of *Drosophila*. Jour. Agr. Univ. P. Rico 39: 57-64.
- Wheeler, M. R. 1949. Taxonomic studies on the Drosophilidae. Univ. Texas Publ. 4920: 157-195.
- . 1952. The Drosophilidae of the nearctic region, exclusive of the genus *Drosophila*. Univ. Texas Publ. 5204: 162-218.
- , and L. H. Throckmorton. 1960. Notes on Alaskan Drosophilidae (Diptera), with the description of a new species. Bull. Brooklyn Ent. Soc. 55: 134-143.