# On Hawaiian Scaptomyza species (Dipt., Drosophilidae).

Walter Hackman

When my monograph on the genus *Scaptomyza* Hardy (HACKMAN 1959) was already in the press, I received from Prof. ELMO HARDY (Hawaii) an additional Hawaiian collection of these flies for study. This collection contained numerous new species but it also shed more light on the taxonomy of the species already described by me.

Among the Hawaiian *Scaptomyza* species there is a distinct group of closely related species previously inserted by me in the subgenus *Trogloscaptomyza* Frey. This group of species is characterized by a flattened head and a pair of strong presutural dorso-central bristles. The male genitalia of the species are of a rather uniform type. In external characters, namely the shape of the head and the chaetotaxy of the head and thorax, the species group agrees well with the genus *Rosenwaldia* Malloch, based on a single species *R. kaavae* Mall. from the Marquesas Islands. MALLOCH (1935) described *R. kaavae* from a female and the male of the species is still unknown. The question of the possible synonymy of *Rosenwaldia* and *Trogloscaptomyza* was left open in my paper of 1959. Later, after discussing this matter with Prof. HARDY, I have found it suitable to place *Rosenwaldia kaavae* and the above-mentioned group of *Scaptomyza* species in a separate subgenus. The name of this subgenus will then be *Rosenwaldia* Mall., now used in a subgeneric sense.

There is a further group of Hawaiian species which deserves a subgenus of its own. In some characters the species are similar to some *Parascaptomyza* species but the male genitalia lack the secondary clasper characteristic of *Parascaptomyza*. The group takes an intermediate position between *Trogloscaptomyza* and *Parascaptomyza* but does not fit in well with either of these subgenera and I have therefore created a new subgenus *Alloscaptomyza* for this group.

*Rosenwaldia* and *Alloscaptomyza* can be inserted into my key to the *Scaptomyza* subgenera (HACKMAN 1959) by altering point 4. as follows:

(Characters from point 1. to 3.): Two postsutural dorsocentrals (a presutural one present or lacking). One humeral bristle. Ovipositor guides weakly sclerotized, never dentate. Male genitalia without a secondary clasper (paralobes *sensu* Frey 1954).

4. Dorsocentrals 1 + 2. Head flattened and eyes strongly oblique ..... sg. *Rosenwaldia* Mall.
— Dorsocentrals 0 + 2. Head usually not flattened ..... 4b
4b. Head short and high, broader than the thorax and about double as broad as long. Longest diameter of the eye nearly vertical. Arista with a ventral

branch basally of the end fork.[1] Vertical bristles very prominent, the inner vertical usually as long as the vertical diameter of the eye ..... sg. *Alloscaptomyza* n.sg.

— Head not very short, rarely flattened (*Trogloscaptomyza brevilamellata* Frey) and at most 1 1/2 times as broad as long. Longest diameter of the eye distinctly oblique. Arista usually without a ventral branch basally of the end fork ..... 4c

4c. End fork of arista very deep and stem of arista thus shorter than the branches of the end fork. Small species with medially white scutellum ..... sg. *Tantalia* Mall.

— End fork of arista not very deep (sometimes strongly reduced) and the branches of the end fork never longer than the stem. Without ventral branches on arista or at most with a very small ventral hair basally of the end fork ..... sg. *Trogloscaptomyza* Frey

Subgenus *Rosenwaldia* Malloch.

Subgenus type: *Rosenwaldia kaavae* Malloch 1935.

Characteristics: Small species with flattened head and oblique eyes. Arista with one or two dorsal branches basally of end fork, the latter not very deep. At most one short ventral branch (lacking in Hawaiian species). One strong humeral bristle. Dc 1+2, the presutural one slightly before the suture. Acrostichal hairs in two or four rows (in the latter case the external rows consist of rather few hairs). Mesonotum usually with dark stripes along the dorsocentrals. Male genitalia (not known in the type species) of the same simple type as in *Trogloscaptomyza*, an accessory clasper always lacking. Cerci small and simple.

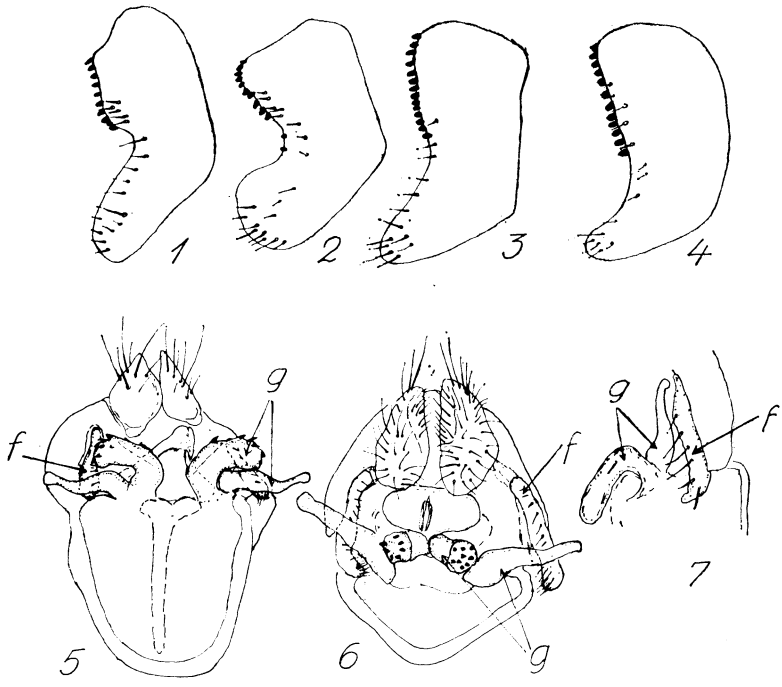
Ovipositor guides of the female weakly sclerotized.

The subgenus includes *R. kaavae* Mall. from the Marquesas and the following Hawaiian species: *R. mediopallens* Hackm., *striatifrons* Hackm., *abrupta* Hackm., *michelli* Hackm. and *aloha* Hackm.

The study of the new Hawaiian collection has shown that some key characters used by me in 1959 for separating the species are less satisfactory because of considerable variability in some of the species. A key to the *Rosenwaldia* species is given below:

1. Eyes long oval, about twice as long as wide. (Marquesas) .... *kaavae* Mall.
— Eyes not so long oval, the longest diameter about 1 1/2 times the width (Hawaiian species) ..... 2
2. Mesonotum with a broad pale greyish median stripe between the dorsocentrals continuing on the scutellum. Acrostichal hairs practically biseriate. (Hawaii Island) ..... *mediopallens* Hackm.
— Mesonotum with other pattern, sometimes pale greyish yellow with narrow indistinct brown stripes along the dorso-central rows. The stripes do not

[1] The end fork in *Alloscaptomyza* is probably the result of a secondary branching (see figs. 14—23).




Figs. 1—4. Forceps of male genitalia of *Scaptomyza (Rosenwaldia)* species. Fig. 1 *S. (R.) abrupta* Hackm., fig. 2 *S. (R.) mitchelli* Hackm., fig. 3 *S. (R.) aloha* Hackm. from Hawaii Island, fig. 4 *S. (R.) aloha* Hackm. from Molokai. Fig. 5. Male genitalia of *Scaptomyza (Alloscaptomyza) buccata* n.sp. (ventro-caudal view). Fig. 6. The same of *S. (A.) stramineifrons* n.sp. Fig. 7 Gonites and forceps of *S. (A.) fuscifrons* n.sp. (ventro-lateral view). g — gonites, f — forceps.

continue on the scutellum. Usually with varying indistinct brown patterns medially on the mesonotum. Acrostichal rows usually in four rows ..... 3

3. Frons with a distinct dark median stripe from the ocellar area of the frontal triangle to the front margin of frons (fig. 9). Lateral parts of the frontal triangle and the orbitae preyish, rather pale. Interorbital area yellow to brownish yellow. Mesonotum with a slightly darker median stripe between the internal rows of acrostichal hairs. (Kauai) ..... *striatifrons* Hackm.

— Not the above combination of frontal and mesonotal pattern. Sometimes with an indistinct brown median spot in front of the frontal triangle but not continued as a median stripe on the triangle itself. Mesonotum medially with indistinct patterns of various kinds, sometimes only with a slight suffusion in the prescutellar area ..... 4

4. Male forceps as in fig. 2. Interfrontal parts of frons yellow to reddish brown without any dark shadows along the borders of the frontal triangle. (Maui) ..... *mitchelli* Hackm.

— Male forceps as in figs. 1, 3, 4. Interfrontal parts of frons with dark greyish shadows along the borders of the greyish frontal triangle or at least in the female with a dark brown spot in front of the frontal triangle ..... 5

5. Male forceps as in fig. 1. Frons comparatively dark with dark shadows in the interfrontal area. (Maui) ..... *abrupta* Hackm.

— Male forceps as in figs. 3—4. Frons rather pale (as in *mitchelli*), interfrontalia reddish yellow to reddish brown without any dark grey shadows along the borders of the frontal triangle but at least in the female with a brownish spot in front of the frontal triangle. (Molokai, Hawaii Island) ..... ..... *aloha* Hackm.

*Scaptomyza (Rosenwaldia) abrupta* Hackm. and *mitchelli* Hackm.

These two very similar species, occurring on the same Hawaii Island, Maui, are sometimes very difficult to separate in the female sex. The frontal pattern (figs. 10—13) is as a rule darker in *abrupta* than in *mitchelli* but there are

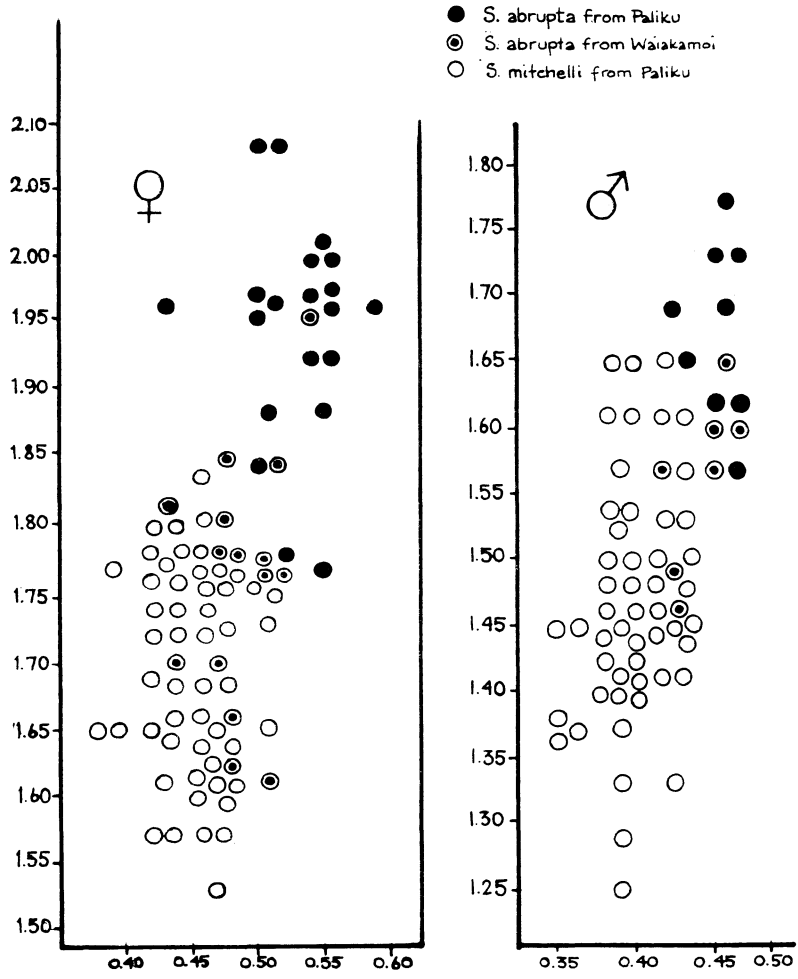



Fig. 8. Length of costal portion $mg_2$ plotted against $mg_3$ (abscissa) in *Scaptomyza (Rosenwaldia) abrupta* Hackm. and *S. (A.) mitchelli*. (Measurements in mm.).

dorberline cases. The palpi of both species are yellow in the male and apically dark in the female. (The female allotype of *mitchelli* happened to be abnormal in this respect). The mesonotal pattern shows an overlapping variability in these species (see figs. 10—13). In the study of closely related *Scaptomyza* species an analysis of the length variation of the costal portions $mg_2$ and $mg_3$ has proved useful (HACKMAN 1955 p. 85 and 1959 p. 57). The additional material from Hawaii contained 16 ♂♂ and 35 ♀♀ of *abrupta* and 50 ♂♂ and 62 ♀♀ of *mitchelli*. The results of the measurements are given in the diagram, fig. 8. The specimens of *abrupta* are from two localities, Paliku (Haleakala crater area, altitude about 2,000 m) and Waikamoi (northwestern slope of Mt. Haleakala, rain forest at 1,200—1,500 m). The specimens of *mitchelli* are all from Paliku. The diagram indicates an interesting feature both in males and females. When *abrupta* from Waikamoi is compared with *mitchelli* from Paliku we find a strong overlapping of the mg values but when we compare specimens of the two species from the same locality, Paliku, there is much less overlapping. $mg_2$ and $mg_3$ tend clearly to be longer in *abrupta* than in *mitchelli*. The above case of costal length variation is reminiscent of a well known phenomenon of geographical variation in vertebrates (for example birds in the genus *Sitta* studied by VAURIER): Two very close species showing more difference in the area where their distribution overlaps than in the areas where they are geographically separated. In the case of the birds the phenomenon is explained as a result of natural selection and thus on a genetic basis. In the case of the two sibling species of *Scaptomyza* one must be cautious in drawing conclusions but the parallelism seems striking.

*Scaptomyza (Rosenwaldia) aloha* Hackm.

There are 3 ♂♂ and 11 ♀♀ from Hawaii Island extremely similar to *aloha* Hackm. described from Molokai. The genitalia of the males from Hawaii Island are slightly different from those of the single known male specimen of *aloha* from Molokai. It is possible that the specimens from Hawaii Island represent separate subspecies of *aloha* or even a separate species but for solving this problem series of males from Molokai and Hawaii Island are needed. The specimens from Hawaii Island are from the following localities:

Humula, 9.VIII.1946 (1 ♂, 5 ♀♀ leg. W. C. Mitchell); Kaiholena, Kohala Mt. VIII.1952 (1 ♂ at 1,200 m leg. W. C. Mitchell), Kaiholena Ridge, VIII.1952 (1 ♂ at 700 m leg. W. C. Mitchell); Kahuku Ranch, VII.1953 (1 ♀ at 900 m leg. E. Hardy); Kilauea, Nahau Trail, 18.VII.1934 (1 ♀ leg. O. H. Swezey); Mauna Loa, Truck Trail, VIII.1952 (1 ♀ at 1,200 m leg. W. C. Mitchell); Upper Olaa Forest, VII.1956 (1 ♀ at 1,200 m leg. E. Hardy).

Subg. *Alloscaptomyza* n.sg.

Subgenus type: *Scaptomyza (Alloscaptomyza) buccata* n.sp.

Characteristics: head short, broader than thorax and about double as

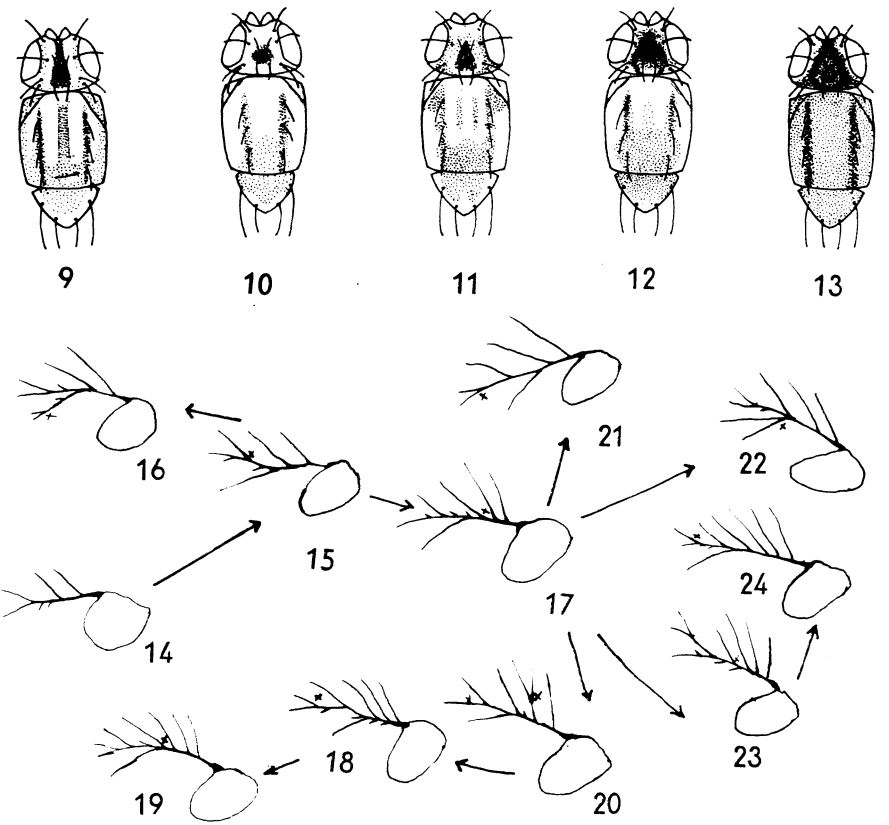



Fig. 9—13. Pattern of head and thorax in *Scaptomyza (Rosenwaldia)* species. Fig. 9. *S. (R.) striatifrons* Hackm., fig. 10—11. *S. (R.) mitchelli* Hackm. (pattern in fig. 11 also occurring in *abrupta* Hackm.), fig. 12—13. *S. (R.) abrupta* Hackm. (Figs. 9—13 schematized, most bristles omitted). Figs. 14—24. Arista in *Scaptomyza* species. Fig. 14. *S. (Trogloscaptomyza) hawaiensis* Hackm., fig. 15. *S. (Alloscaptomyza)* sp.z, fig. 16. *S. (A.)* sp. y, fig. 17—20. *S. (A.) buccata* n.sp., fig. 21—22. *S. (A.)* sp. x, fig. 23—24. *S. (A.)* sp. (♀♀ possibly belonging to *buccata*). The arrows indicate possible trends of evolution of the arista branches, the crosses indicate the site of additional branches.

broad as long. Longest diameter of the eye nearly vertical. Vertical bristles very strong. Arista with 2—4 dorsal branches and one ventral branch basally of end fork. The latter not very deep, sometimes very small. One prominent humeral bristle. Dorsocentrals 0 + 2. Acrostichal hairs in 4 often not very regular rows, rarely in six irregular rows. Apical scutellars long. Male genitalia (known in 3 species) with weakly developed forceps and without a secondary clasper. Hypandrium with 2 pairs of gonites, the median pair conspicuously large. Ovipositor guides very weakly sclerotized.

The subgenus contains several new, probably endemic, Hawaiian species, but because of insufficient material only 3 are described and named here.

Further I have inserted here the species *longisetosa* Hackm. described by me in 1959 as a *Parascaptomyza*. The latter subgenus is obviously very closely related to *Alloscaptomyza*. In some *Parascaptomyza* species from islands in the Pacific the head is short and broad and the arista similarly branched as in *Alloscaptomyza* but the male genitalia are of a different type (a secondary clasper present). The branching of the arista in some of the species indicates that the »ventral branch basally of the end fork» can be interpreted as the Ventral branch of an original end fork, the dorsal branch of which has branched again. In some of the species other branches of the arista also show secondary dichotomy on the right or left arista, thus showing the instability of aristal branching in this subgenus (see fig. 16—23).

Key to the *Alloscaptomyza* species.

1. Genae broad, about $^1/_3$ as long as vertical diameter of eye ..... 2
— Genae much narrower, about $^1/_5$ as long as vertical diameter of eye ..... 3
2. Mesonotum grey. Arista with 3—5 usually 4 dorsal branches basally of end fork. Frons to varying extent yellow but at least upper parts of orbitae and the ocellar area grey. (Maui) ..... *buccata* n.sp.
— Mesonotum yellow. Arista with 3 dorsal branches. Frons yellow except for a small grey spot between the ocelli. Also most other parts of the head yellow. (Molokai) ..... sp.x.
3. Acrostichal hairs in 6 irregular rows in the area anterior of the dorsocentrals, between these in 4 rows. Arista with 3 dorsal branches and a large end fork. (Oahu) ..... *stramineifrons* n.sp.
— Acrostichal hairs in four sometimes irregular rows anterior of the dorsocentrals ..... 4
4. Antennae entirely dark brown to blackish. Frons dark greyish brown, interorbitalia only slightly yellowish. Pleura dark greybrown. (Kauai) ..... *fuscifrons* n.sp.
— At least second antennal joint yellow or yellowish brown. Pleura at least to a great extent yellowish ..... 5
5. Orbitae and frontal triangle grey, other parts of frons ochreous to brownish yellow ..... 6
— Frons grey with only the anterior margin yellowish. (Hawaii, Island) .. sp.y.
6. Arista with 4 dorsal branches before end fork. (Molokai and Maui) ..... *longisetosa* Hackm.
— Arista with 2 dorsal branches before end fork (Maui) ..... sp. z (possibly a form of *longisetosa*)

*Scaptomyza (Alloscaptomyza) buccata* n.sp.

Body length 1.8—2.9 mm, wing length 2.2—2.3 mm. Costal index 2.6—3.1.

♂ — Frons yellow, upper parts to varying extent grey. Genae broad and yellow. Vibrissa strong, one buccal bristle still stronger. Face pale greyish yellow. Second antennal joint yellow, third joint brown to blackish. Branching of arista somewhat variable, sometimes different on right and left sids of same specimen:

Specimen 1. right: 4 dorsal branches, end fork and ventral branch.
left: 4 » » » » » » »
Specimen 2. right: 4 » » » » » » »
left: 3 » » » » » » »
Specimen 3. right: 5 » » » » » » »
left: 4 » » » » » » »
Specimen 4. right: (lost)
left: 4 dorsal branches, (second from the base bifurcate), end fork and ventral branch.

Palpi yellow with two black bristles, one apical and one subapical. Mesonotum grey and pollinose without any distinct pattern. Acrostichal hairs in 4 irregular rows. Dorsocentrals strong, the anterior one slightly shorter than the posterior one. Pleura greyish pollinose, ventral parts more or less brown. Two sternopleural bristles, the posterior one stronger. Scutellum grey, pollinose, laterally yellowish. Scutellar index 1.2. Wings hyaline and of normal shape. Small dark spines on the costa reaching $^1/_3$ of $mg_3$. Halteres pale yellow. Legs dusky yellow. Abdomen black. Male genitalia as in fig. 5.

Holotype and 3 paratypes from Maui: Haleakala Crater, 2,000 m (holotype VI.1953, leg. C. P. Toyce, paratypes VIII. 1958, leg. D. E. Hardy).

Two female specimens from Maui: Waikamoi might possibly belong to this species, but they are darker in colour than the males described above. On the frons only the interfrontalia are yellowish. The genae are not quite as broad as in the males. Arista on both sides with 4 dorsal branches and a small end fork. Costal index 2.1. The row of extremely small costal spines reaching nearly $^1/_2$ of $mg_3$.

Maui: Waikamoi (Haleakala mountain area, 1,200 m) VIII.1958, 1 ♀ leg. E. Hardy. Puu Nianiau, 24.IX.1945, 1 ♀ leg. E. C. Zimmeman.

*S. (Alloscaptomyza) sp.* (»sp.x»).

A single female specimen from Molokai differs in colour characters from *buccata* and probably represents a separate n.sp. The instability of the branching of the arista, obviously a common feature in this subgenus, is also shown in this specimen: on the right antenna the ventral branch is bifurcate at the base.

Molokai: Puu Kolekole, VII 1953, 1 ♀ at 1,100 m.

*S. (Alloscaptomyza) stramineifrons* n.sp.

Body length 2.1—2.2 mm. Wing length 2.2. Costal index 1.9—2.0. ♂ — Frons greyish yellow, upper half grey. Antennae entirely yellow. (Arista damaged on both sides in the single ♂ but the fragments indicate a shape similar to that of the ♀) Face yellowish grey, carina low and indistinct. Genae narrow and yellow. Vibrissa moderately strong, two buccal bristles, the anterior one longer and of the same size as the vibrissa. Palpi yellow with two black bristles, apical and subapical in position. Mesonotum yellowish brown. Acro-

stichal hairs anteriorly in 6 irregular rows, between the dorsocentrals in four rows. Posterior pair of dorsocentrals, slichtly longer than the anterior pair. Pleura yellow-brown, pollinose. Scutellum yellow, apical scutellars longer than the basal ones. Wings yellowish tinged. Small costal spines reaching $^3/_5$ of $mg_3$. Halteres yellow. Legs yellow. Abdomen yellow-brown. Male genitalia as in fig. 6.

♀ — Frons yellow, orbitae above slightly greyish, only the area between the ocelli darker grey. Second antennal joint yellow, the third one dusky yellow. Arista with 3 dorsal branches basally of end fork. Head, thorax, wings and legs otherwise similar to the male. Abdominal tergites basally dark drown, apically yellowish.

Holotype, ♂, Oahu: Palehua, 20.XII.1952, leg. C. P. Hoyt. Allotype, ♀, Oahu: Waipio, 14.II.1953, leg. C. P. Hoyt.

*S. (Alloscaptomyza) fuscifrons* n.sp.

Body length 1.6 mm. Wing length 1.8 mm. Costal index 2.3 ♂ — Frons grey-brown with slightly yellowish interfrontal stripes. Antennae dark brown, third joint almost blackish. Arista with 4 dorsal branches basally of end fork. Face dark brown with low carina. Palpi dark brown, labellae yellow-brown. Genae narrow dark greyish brown. Vibrista strong, one buccal bristle also prominent but not as strong as the vibrissa. Mesonotum dark grey, pollinose. Acrostichal hairs in four irregular rows. Anterior pair of dorsocentrals shorter than the posterior ones. Pleura dark grey-brown. Scutellum grey-brown, scutellars subaequal in length. Wings hyaline. The row of small costal spines (extremely small) reaching ½ of $mg_3$ Halteres pale yellow. Legs dusky yellow. Abdomen blackish. Male genitalia: median pairs of gonites without dark denticles (fig. 7).

Holotype, ♂, Kauai: Nualolo Valley, VII. 1952, at about 1,000 m., leg. E. Hardy.

*S. (Alloscaptomyza) longisetosa* Hackm.

This species was placed by me in 1959 in the subgenus *Parascaptomyza* but it is now evident that this species belongs to *Alloscaptomyza*. The chaetotaxy of the head and especially the shape of the arista (HACKMAN 1959, fig. 18 p. 13) agrees well with other species of *Alloscaptomyza*. The species was described from two ♀♀ (from Molokai and Maui). The male is still unknown and I have not seen any additional specimens of this species.

*S. (Alloscaptomyza) sp.* (»sp.y»).

A small species (body length 1.6 mm) represented in the collection by a single ♀ from Hawaii Island. Frons grey with yellowish front margin. Meso-

notum greyish yellow. Here, too, the arista shows a tendency to dichotomy: on the right antenna the ventral branch of the arista is bifurcate (left antenna lost).

Hawaii Island: Waipio Valley, VII.1952, leg. E. Hardy.

*S. (Alloscaptomyza) sp.* (»sp.z»).

A single female specimen from Maui. Similar to *longisetosa* in colour characters but the arista is different. Might possibly only represent a form of *longisetosa*.

Maui: Iao Valley, 6.VI.1943, leg. N. L. H. Krauss.

The types of the species described as new are deposited in the B. P. Bishop Museum, Honolulu, Hawaii.

## References

HACKMAN, W., 1955. On the genera Scaptomyza Hardy and Parascaptomyza Duda (Dipt. Drosophilidae). Not. Ent. 35: 74-91. — 1959. On the genus Scaptomyza Hardy (Dipt., Drosophilidae) with descriptions of new species from various parts of the world. Acta Zool. Fennica, 97: 1-73. — MALLOCH, J. R., 1935. Additional new species and other records of acalyptrate Diptera (Sapromyzidae, Asteidae, Drosophilidae, Ephydridae and Trypetidae) from the Marquesas Islands. B. P. Bishop Mus. Bull., 114: 179-200.