XIII. TAXONOMIC STUDIES ON THE DROSOPHILIDAE

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INTRODUCTION

The publication, in 1942, of a series of three papers on the systematics of the Drosophilidae (Sturtevant; Spencer; Patterson and Wheeler) was an indication of the renewed interest and research in this field. This increased activity was due in part to the realization that many more species existed than had formerly been suspected, frequently differing but slightly from one another morphologically. From a practical point of view, cognizance of this situation led many workers to turn to the multitude of Drosophila species as experimental animals in studies of evolution, phylogeny and comparative cytology. It has been diffcult for the taxonomist to keep abreast of the flood of data which has subsequently appeared, and equally difficult for these workers to appreciate the taxonomic implications of their results. Many new species have been described, new species groups have been erected and the limits of others redefined; several subgeneric units have been revised.

To the members of this laboratory, where a large part of the taxonomic work has been carried on, it has seemed advisable to examine carefully the accepted systematic relationships within the genus and to make a serious attempt to redefine the limits of the various groups in the light of our new knowledge.

It is the purpose of the present paper, then, to bring into a single publication the various additions and changes in systematic relationships suggested by various workers in the field of Drosophila systematics in order to get a clearer picture of the evolution and phylogeny of the group as revealed by such studies. As a consequence, four papers of a taxonomic nature appear in this bulletin. One of these (Tan, Hsu and Sheng) is purely a descriptive work on the known Drosophila species of China. In the second Mr. Hsu presents a rather complete study of the external male genitalia. This was undertaken primarily because it was realized that, although these organs present many morphological characters of specific value, the field had scarcely been touched. In a third paper the writer presents a revision of the subgenus *Pholadoris* and describes two new species. Finally, in the present paper we will attempt to redefine, in more or less outline fashion, our present conception of the limits of the various taxonomic units, including where appropriate additional descriptions of new species. No attempt has been made to include all the genera within the family, but in those genera where new species are being described we have included a key whereby the new forms may be separated from those previously known from North America. This work is in no sense to be considered a monograph on the subject, but it is hoped that it may serve to stimulate other workers in the field to combine their efforts in this

direction for a future publication summarizing all the available data on the family Drosophilidae from around the world.

The type specimens of all the species described as new in this article have been deposited in the Drosophila Type and Reference Collection of the Texas Natural History Collection of The University of Texas, Austin, Texas. We have also indicated, by placing (T) after the name of the describers, those previously described species whose types are maintained in this collection. Specific names preceded by (?) represent forms whose inclusion in a particular species group is questionable and should not be interpreted as questioning the identification of the included species.

THE GENUS GITONA MEIGEN

A third North American member of this genus was collected by the writer in lower Arizona. This new species is quite similar to *G. americana* Patterson, from which it differs largely in the abdominal pattern, wing indices and external male genitalia. A description of these more important differences follows.

Gitona sonoita, sp. nov.

Abdomen shining yellow with the following pattern of black bands: on the first complete tergite are two dark brown splotches placed laterally at about the angle of the tergite, originating at the level of the outer basal corners of the scutellum and terminating at the angle, the splotches being widely separated from the narrow brown areas along the margin; on the following tergite is a large distinct band, narrowly but clearly broken in the mid-line, about half the width of the tergite and located centrally on it, the bands narrowing somewhat at the angle and then expanding widely to form narrow solid lateral areas; the band of the next tergite similar but the narrowing at the angle is much less pronounced, this area being almost as wide as the median portion, and the lateral expansion is larger and darker; on the fourth tergite the bands expand along the median interruption nearly to the previous segment, then narrow rapidly towards the angle where they are narrower and fainter than on the previous tergite, the lateral expansions here being about as large and as dark as on the preceding. On the last complete tergite the median extensions, the lateral expansions, as well as the narrowing tendency are more pronounced, giving the effect of two semi-circular bands on this segment. The genital arch is uniformly burnt brown in color.

The external male genitalia are described and figured by Hsu (this publication).

Wings clear; apex of first costal section with one prominent dorsal bristle, the ventral one being thin and not black. Third costal section with heavy bristles on its basal 2/5. Costal index about 3.1; 4th vein index about 3.0; 5x index about 1.8.

Length body (in preserved female): 4.3 mm.; wings: 3.5 mm.

In addition to the above characteristics, these flies appeared lighter in body color and eye color when compared with *G. americana* but this difference may have been only one of age since both specimens examined had expanded the ptilinum when preserved.

Distribution.—The only record is two flies, a male and a female, taken from banana-baited traps along the Sonoita River, near Patagonia, Arizona on 6-10-48 by the writer.

Types.—Holotype female (No. 1854.5), preserved in Barber's fluid*, and slide mounts of legs, wings and genitalia of the male.

Relationship.—On the basis of the external morphology and male genitalia this new species appears to be quite closely related to *G. americana,* and may be another example of "sibling species" as defined by Mayr (1942).

With the addition of this species to the genus, its seems worthwhile to include a key for the separation of the known North American species.

Key to the North American Species of Gitona

1. Legs silvery gray, with blackish bands at ends of femora and proximal ends of tibiae; lower portion of eyes iridescent yellowish-green, upper portion purplish-yellow; abdominal bands of about equal size from median interruption to margin; 4th vein index less than 3.0 ..... **bivisualis** Patterson
   Legs yellow to grayish yellow, without darker bands; eyes iridescent yellowish-green throughout; abdominal bands consisting of dark splotches connected in various patterns; 4th vein index 3.0 or over 2
2. Second complete tergite with 6 large splotches, the median two of each side united by a wide band; 4th vein index about 3.9 ..... **americana** Patterson
   Second complete tergite with a continuous band from median interruption to lateral margin, narrowed at the angle and expanded at the margin; 4th vein index about 3.0 ..... **sonoita** n.sp.

THE GENUS SINOPHTHALMUS COQUILLETT

The collection of a single male, described by Patterson and Mainland (1944) as *S. pictus gagei,* from central Chihuahua, Mexico by G. B. Mainland in October, 1942, was the first record of this species from outside of California. In view of the lack of information concerning the distribution of this species, it seems advisable to report here two additional localities where it has been captured. A total of 107 individuals were taken by W. K. Baker and the writer in Spring Canyon near Mogollon, New Mexico, in June, 1947, by sweeping collecting nets around our heads. These specimens did not fit the description of the subspecies *gagei.* In August of the same year the writer captured a single male near Zacatecas, Mexico. The coloration of this individual also differed from that of *gagei.*

THE GENUS AMIOTA LOEW

In this and the related genus, *Stegana,* specific distinctions are extremely obscure. Sturtevant (1921) stated the situation quite succinctly as

*This excellent preserving fluid is prepared by mixing in order the following: 95% alcohol, 53 pts.; ethyl acetate, 19 pts.; benzol, 7 pts.; dist. water, 49 pts.

follows: "Our knowledge of the Nearctic species is in a very unsatisfactory condition . . ." Malloch and McAtee (1924) also acknowledged the prevailing confusion, stating that "the specific distinctions are not well understood as yet." The group seems to have evolved quite rapidly into many species differing in remarkably few morphological characteristics. Neither color nor size differences seem to be competely reliable. We are, consequently, in agreement with Malloch and McAtee who believed that "a comparison of the male hypopygia" was essential. The genitalia studies presented by Mr. Hsu in this bulletin indicate that these structures can serve to differentiate the many species, in fact, they are the only morphological characters which seem to us to be reliable.

From the existing keys we have been able to identify among our material only three known species: *A. minor* Malloch, *A. humeralis* Loew, and *A. leucostoma* Loew. In addition, we believe we have examples of at least six new forms. Most of these are represented, however, by too few specimens to make their description as new species advisable. For the benefit of any future worker on the group we are giving a few details of these various forms, however, and are hoping that such treatment will aid in their future recognition and identification pending actual formal description.

The nine forms which we have had available for comparison seem to fall into three groups: (1) those without the milk-white spots; (2) small black forms with such spots; and (3) the larger brown forms, also with white spots. In group (1) we would place *A. minor,* "acadia," "big-eye," and "carolina." We have collected the "acadia" form in Acadia National Park, Mt. Desert Island, Maine and also in the northern tip of Maine, in western New York State, and in upper Michigan. It is generally larger than *minor,* is medium brown in color, and does not appear to fly around one's head and eyes as do certain other members of the genus. The "big-eye" form is similar in appearance to the "acadia" form but is western in its distribution, having been taken by us on several different occasions along Tonto Creek in north-central New Mexico. Only a single individual of the "carolina" form was captured by us in a swampy woodland in North Carolina. It is smaller than the other forms and somewhat lighter in color.

The typical member of group (2) is *A. humeralis.* In addition, we have taken a form which looks much like *humeralis* from several localities in Arizona and New Mexico. This form, which is undoubtedly a different species, has been referred to by us as "arizonensis" although "western humeralis" might be more appropriate.

We would place *A. leucostoma* as the type of group (3) and have taken this form in Virginia, Maine and Michigan. A second species, which we have called "gigantea" is quite similar but is generally larger. We have collected it in northern Maine only. Although we have not been able to separate the females of these two forms with any assurance, the males can generally be recognized superficially on the character of the "central processes" of the genitalia as figured by Malloch and McAtee. The two

most prominent processes of *leucostoma,* which are seldom visible externally, are light brown, long and slender, and bifid at or near the tip. In "gigantea" males four processes are evident externally and are short, semi-curled rods, quite black in color. A third form, related to the above, has been called "kingstoni" by us since we first captured it in Kingston Canyon, Nevada. We have also recorded it from Arizona. It is similar to *leucostoma* in appearance but tends to be darker in color.

Amiota albavictoria Patterson and Mainland (T) does not appear to be closely related to any of the above species. Prof. Sturtevant, in a letter to Dr. Patterson of this laboratory, once remarked that he believed it might be close to *Phortica variegata* of Europe, and would consider *Phortica* as a subgenus of *Amiota.*

THE GENUS CHYMOMYZA CZERNY

Taxonomists have suspected for many years that there were several undescribed species of *Chymomyza* in North America. Sturtevant (1921) remarked that the male genitalia were evidently of importance as taxonomic characters in the group and stated further: "I am certain that a study of these organs would show that what passes as *C. procnemis* is really a mixture of several species." The genitalia studies of Hsu (this bulletin) support this conclusion and, accordingly, we are here describing several new procnemis-like forms. A key to the known North American species is included.

Chymomyza leucopoda, sp. nov.

External characters of imagines.

♀. Arista with about 8 long branches, two below in addition to the terminal fork. Antennae light tan, third joint grayish tan, small. Front velvety black, orbits, ocellar triangle and a broad posterior connection between them iridescent in bright light. Palpi and proboscis black. A small reclinate orbital placed before larger proclinate, slightly less than half its length; proclinate bristle about ½ length posterior (reclinate), the latter directed outward rather than backward. Face shining black; carina a very narrow, high ridge above, larger and bulbous below, ending in a pronounced bulbous protuberance between the vibrissae. One prominent oral, the next one thin and less than half length first. Cheeks shining black, their width about 1/6 greatest diameter of eyes. Eyes dull red. Postvertical bristles enlarged, about equal in length to proclinate orbitals.

Acrostichals in about 8 irregular rows. No prescutellars. Scutellars, dorsocentrals and other thoracic bristles quite thin. Anterior scutellars divergent. One prominent humeral. Halteres pale yellow. Anterior sternopleural about ¾ length posterior, both thin. Mesonotum shining black, slightly pollinose. Scutellum shining black, grayish yellow at tip between bases of distal scutellars.

Middle and hind legs uniformly pale yellow. Coxae, trochanters and distal four tarsal segments of fore legs pure white, femora, tibiae and basal tarsal joints deep black. Abdomen shining black; sternites pale.

Wings clear, costal cell not darkened. Costal index about 1.8; 4th vein index about 3.3; 5x index about 2.3. Apex of first costal section with two equal bristles. Third costal section with heavy bristles on its basal ⅔.

Length body (in pinned specimen) : 2.5 mm.; wings: 2.2 mm. Description prepared from pinned specimen.

Other characteristics, relationship, and distribution.

Distribution.—The only record is a single female captured near Morelia, Michoacan, Mexico on 8-30-47 by Mr. F. A. Cowan and the writer.

Types.—Holotype female (No. 1796.21) placed in the collection of The University of Texas.

Relationship.—The darkened fore legs would seem to indicate affinity with *C. procnemis* and its relatives, the clear-winged condition also being present in *C. caudatula* of that group. However, the noticeably enlarged postverticals have not been previously noted in the genus, and, so far as known, divergent anterior scutellars are also unusual.

The pure white fore tarsi suggest affinities with *Zygodrosophila albatarsis* Hendel from Paraguay. As Duda (1925:65 & 69–70) points out, the separation of the monospecific genus from *Chymomyza* is scarcely tenable since it is said to differ only in that the postverticals and anal vein are lacking, whereas, as Duda mentions, even in typical *Chymomyza* these are quite small and undeveloped, although visible. There can, however, be no doubt but that *C. leucopoda* differs noticeably from *Z. albatarsis* in characters other than the postverticals, the latter species being largely yellow, with only the clypeal margin black, and having the costal cell brown.

Chymomyza mexicana, sp. nov.

External characters of imagines.

♂. Arista with about 7 branches, two below in addition to the terminal fork. Antennae pale yellow, third joint slightly darker. Front shining black with iridescent pollinosity except for a spot just posterior to the posterior orbitals and lateral to the ocellar triangle. This dark pollinose area ceases abruptly before the antennal bases along a semicircular line extending from the anterior orbits on each side. Anterior to this line the area is burnt orange in color and is not pollinose. Anterior and middle orbitals about equal in length and about ¾ length posterior. Palpi pale straw yellow. One prominent oral, the 2nd about ⅓ its length. Face pale yellow; carina exceedingly narrow, not prominent. Cheeks grayish yellow, darker posteriorly, their width about ⅙ greatest diameter of eyes.

Acrostichals in 6 irregular rows. No prescutellars. Anterior scutellars straight. One prominent humeral. Halteres pale yellow. Mesonotum and scutellum shining black with iridescent pollinosity. Humeral callus exceptionally pronounced. Anterior sternopleural quite thin, little more than ½ length posterior. Legs pale yellow except for fore femora, tibiae and two basal tarsal joints which are brown.

Abdomen shining brownish black. The external male genitalia are figured by Hsu (this bulletin).

Wings clear, costal vein and costal cell dark brown. Costal index about 1.7–1.8; 4th vein index about 3.2; 5x index about 3.0. Apex of first costal section with two equal bristles. Third costal section with heavy bristles on its basal ¾. Described from a pinned specimen.

Other characteristics, relationship, and distribution.

Distribution.—The only record is a single male collected at Peña de Gato, Puebla, Mexico on 9-4-47 by Mr. F. A. Cowan and the writer.

Types.—The single specimen was dissected and permanent slide mounts of the wings, legs, antennae and external genitalia were made, these slides constituting the only type material (No. 1800.17).

Relationship.—Belongs to the procnemis-like section of the genus and can be separated from all other known species by the possession of two dark segments on the fore tarsi.

Chymomyza tetonensis, sp. nov.

External characters of imagines.

♂. Arista with about 7 branches, including the terminal fork. Antennae pale tan. Front dull pollinose black, ocellar triangle and orbits somewhat less pollinose and slightly shining. Large proclinate orbital about ⅚ length other two and much thinner. Palpi pale yellow. Face pale yellow; carina practically absent. Second oral thin, about ⅔ length first. Cheeks creamy yellow above the bristle row, brownish below; their width about ¼ greatest diameter of eyes.

Acrostichals in about 6 very irregular rows. No prescutellars. Anterior scutellars convergent. Halteres pale. One prominent humeral. Anterior dorsocentral bristles about ½ length posterior. Basal scutellar pair about ½ length apical pair. Mesonotum and scutellum uniformly dull black, lightly pollinose. One prominent sterno-pleural, the anterior one quite thin, scarcely ⅔ length posterior. Legs pale tannish yellow except for the fore femora, tibiae and all tarsal joints of fore legs which are uniformily dark brown.

Abdomen shining black. External male genitalia as described and figured by Hsu (this bulletin).

Wings clear, costal vein and costal cell light brown. Costal index about 2.4; 4th vein index about 2.6; 5x index about 2.6. Apex of first costal section with two bristles of equal length. Third costal section with heavy bristles on its basal ⅔. Described from pinned specimen.

Other characteristics, relationship, and distribution.

Distribution.—The only record is a single male collected in Grand Teton National Park, Wyo., on 8–3–47 by the writer.

Types.—The single specimen was dissected and permanent slide mounts of the legs, wings, antennae and external male genitalia were made, these slides constituting the type material (No. 1769.2).

Relationship.—Probably belongs to the procnemis-like section of the genus, but differs from all previously known forms in having all the fore tarsal segments brown.

Key to the North American species of Chymomyza

1. Wings with a pattern of two large dark bands nearly crossing the blade; legs uniformly pale yellow ..... **amoena** Loew
   Wings clear or with the costal cell darkened, tip of wing sometimes white; at least femora, tibiae and basal tarsal segments of fore legs dark brown or black 2
2. Wings clear, costal cell not brown 3
   Wings with the costal cell brown 4
3. Front tannish brown, face whitish yellow, cheeks pale yellow; at least two humeral bristles present; four distal segments of fore tarsi pale yellow ..... **caudatula** Oldenberg
   Front velvety black, face and cheeks shining black; a single prominent humeral bristle; four distal segments of fore tarsi distinctly white ..... **leucopoda** n.sp.
4. Wings with a white tip ..... **procnemis** Williston
   Wings without a white tip 5
5. All segments of fore tarsi brown ..... **tetonensis** n.sp.
   At least three segments of fore tarsi pale yellow 6
6. Basal segment only of fore tarsi dark brown ..... **aldrichii** Sturtevant
   Two basal segments of fore tarsi brown ..... **mexicana** n.sp.

THE GENUS PARAMYCODROSOPHILA DUDA

The new species described below is apparently the first recorded species of the genus from continental North America, the three species described by Duda being from Costa Rica. Of these, *P. poeciloptera* and *punctipennis* have some degree of pictured wings, while *costaricana* has colorless, unmarked wings as does *P. mexicana* here described as new.

Paramycodrosophila mexicana, sp. nov.

External characters of imagines.

♂. Arista with about 8 long branches, one or two below in addition to the terminal fork. Antennae light tannish brown, third joint darker, long and flat with numerous fine hairs. Front tan, ocellar triangle darker, orbits somewhat lighter. Middle orbital quite thin, about ¼ length other two. One prominent oral, the 2nd thin, less than ½ length first. Palpi pale brown with one prominent bristle. Face pale grayish yellow. Carina prominent, high and narrow, rounded, ceasing abruptly below. Cheeks pale whitish yellow, their width about ⅕ greatest diameter of eyes. Eyes dark red, with short black pile. Clypeal margin grayish yellow, brownish in region of vibrissae.

Acrostichals in 6 irregular rows. No prescutellars. Two pairs of dorsocentrals, the anterior pair about ½ length posterior. Bases of halteres pale yellow, grayish yellow distally. Two humerals. Mesonotum light chestnut brown, with two indistinct darker stripes running longitudinally just within dorscentral rows. Thorax slightly shining. Scutellum burnt brown. Anterior sternopleural thin, a little less than ½ length posterior. Basal scutellar pair about ⅔ length apical pair. Pleurae light brown as far down as a line drawn from lower edge of first spiracle to base of halteres; below this line the pleurae, ventral sclerites and legs are all pale

whitish yellow. A prominent apical bristle on 2nd tibiae, prominent preapical on 3rd.

Abdomen shining brown, with a tendency for yellowish areas basally at angle of tergites, most noticeable on 3rd or 4th tergite. Hypopygium pale yellow. External male genitalia as described and figured by Hsu (this bulletin).

Wings clear with a faint brown cast; veins brown. Costal index about 1.3; 4th vein index about 2.6; 5x index about 2.6. Apex of first costal section with one prominent dorsal bristle, the ventral one distinctly thinner and shorter. Third costal section with heavy bristles on its basal $\frac{3}{5}$.

Length body (in pinned specimen): 3.0 mm.; wings: 2.8 mm. Described from pinned specimen.

Other characteristics, relationship, and distribution.

Distribution.—The only record is seven specimens taken from a bracket fungus on a willow tree near Jacona, Michoacan, Mexico on 8–2–42 by G. B. Mainland.

Types.—Holotype male and paratype male (No. 1349.2) as well as slide preparations of legs, wings and external male genitalia.

Relationship.—The inclusion of this new species in the genus *Paramycodrosophila* is based primarily on the presence of two distinct pairs of dorsocentrals, additional support being given by the partially developed second bristle at the costal break and the light colored mesonotum marked with a pair of darker stripes, characters cited by Duda (1925) as characteristic of the genus.

THE GENUS SCAPTOMYZA HARDY

The probable existence of several undescribed species of the genus in North America has been remarked upon by several workers. Sturtevant (1916), for example, stated, concerning *S. terminalis:* "It is extremely variable in several characters (size, color, wing-markings) and there may well be several species involved." Later (1921) he repeated this viewpoint and further illustrated the confusion in the group by stating, in a key separating *terminalis* and *adusta* from the other forms: *"usually* with a dark spot at tip of third vein" (italics mine). Malloch and McAtee (1924), concerning the same two species, also mention the apparent variability, stating: "wing *usually* with a blackish apical spot" (italics mine).

During the past several years we have accumulated a number of pinned specimens referable to *terminalis* or *adusta,* lacking, however, the apical spot typical of those species. Examination of the male genitalia (cf. Hsu, this bulletin) has revealed that these are separate and distinct forms and are accordingly being described. In addition, a redescription of *S. terminalis* is included for completeness.

Scaptomyza montana, sp. nov.

External characters of imagines.

♂. Arista with about 5 major branches and a series of shorter ones extending inwards at right angles to the former. Antennae pale tan, third joint not noticeably darker. Front brownish orange, velvety; orbits, ocellar triangle and rear surface of head pollinose steel gray. Middle orbital (anterior reclinate) about ⅔ length proclinate, and about ½ posterior reclinate. Palpi pale yellow, with several very stout bristles. Face pale yellow; carina a weak ridge above, quite flat below, not nose-like. Second oral slightly more than ½ length first. Cheeks pale yellow, changing to gray posteriorly; their width about ½ greatest diameter of eyes.

Acrostichals in 4 irregular rows. Anterior dorsocentrals about ½ length posterior. Two prominent humerals, the lower one about ⅔ length upper. Halteres pale yellow. Mesonotum and scutellum black, with a steel gray pollinosity; there is a tendency towards a less pollinose streak down midline. A semi-circular area far anterior on mesonotum, just behind head, without pollinosity, shining black. One prominent sternopleural, the other bristles being about ¼ its length. Legs light tannish brown, fore coxae yellowish.

Abdomen uniformily dark chestnut brown, shining. Sternites dark. The external male genitalia are figured and described by Hsu (this bulletin).

Wings clear, without clouding. Costal index about 3.0; 4th vein index about 1.5; 5x index about 1.6. Apex of first costal section with two prominent bristles about equal in length. Third costal section with heavy bristles on its basal ½.

Length body (in pinned specimen): 2.7 mm.; wings: 3.0 mm. Described from pinned specimen.

Other characteristics, relationship, and distribution.

Distribution.—The only record is a single male collected from banana-baited traps along Dutch Creek in Glacier National Park, Montana on 7–27–47 by Mr. F. A. Cowan and the writer.

Types.—This single male was dissected and slide mounts made of the legs, wings, antennae, palpi, and external male genitalia; these slides constitute the only type material (No. 1763.9).

Relationship.—Superficially this new species looks much like *S. terminalis* without the apical wing spot.

Scaptomyza hirsuta, sp. nov.

External characters of imagines.

♂, ♀. Arista with about 7 branches, two below in addition to the terminal fork. Antennae light tan, third joint slightly darker. Front light tannish brown, orbits and ocellar triangle with distinct grayish pollinosity. Middle orbital about ½ length of anterior (proclinate), about ⅓ length posterior (reclinate). Palpi pale with but one large bristle. Face pale yellow; carina quite narrow and ridge-like throughout its length.

One prominent oral, the 2nd thin and a little less than ½ length first. Cheeks pale yellow, their width about ¼ greatest diameter of eyes. Eyes light red with light colored pile.

Acrostichals in 2 regular rows between the dorsocentrals, in 4 rows just anterior to them. Anterior dorsocentrals about ⅔ length posterior. Anterior scutellars divergent, long and slender, posterior pair shorter, thicker, about ½ length anterior. One humeral bristle. Halteres gray. Mesonotum steel gray, strongly pollinose except for three faint longitudinal stripes as follows: one in midline between innermost acrostichal rows, and one on each side from humeral callus backwards just outside the dorsocentral rows. These stripes seem to be due only to differences in pollinosity and are not always obvious. Scutellum uniformily steel gray, pollinose. Anterior sternopleural thin, about ⅖ length posterior; middle bristle quite small. Legs dirty grayish yellow except for first femora and tibiae and all tarsi which are brownish, darkest distally. On the female the fore coxae only are quite light, the remainder of the legs being rather uniformly light brown.

Abdomen black, slightly shining. Sternites dark. The external male genitalia are figured by Hsu (this bulletin).

Wings clear, without clouding. Costal index about 3.2; 4th vein index about 1.4; 5x index about 1.4. Apex of first costal section with two prominent bristles of equal length. Third costal section with heavy bristles on its basal 2/5.

Length body (in pinned specimen): 2.5 mm.; wings: 2.7 mm. Described from pinned specimen.

Other characteristics, relationship, and distribution.

Distribution.—The only record is 6 specimens collected from banana-baited traps at Peña de Gato, Puebla, Mexico, on 9–4–47 by Mr. F. A. Cowan and the writer.

Types.—Holotype male and paratype female (No. 1800.15) as well as slide mounts of legs, wings and external male genitalia.

Relationship.—This new species looks somewhat like *S. adusta* without the apical wing spot. It has been named for the exceptionally numerous bristles present on the lower portion of the anal plate of the male.

Scaptomyza nigrocella, sp. nov.

External characters of imagines.

♂. Arista with 7–8 branches. Antennae pale yellow, third joint no darker. Front and face yellow with a slight orange cast, ocellar triangle quite black. One prominent oral bristle, the 2nd thin and about ½ length first. Middle orbital about ⅓ other two, placed as far forward as the proclinate one. Palpi pale with several prominent bristles. Eyes peach red with light colored pile. Cheeks pale yellow, their width about ¼ greatest diameter of eyes.

Acrostichals in 2 irregular rows between the dorsocentrals, in 4 rows just anterior to them. Anterior scutellars convergent. Apical and basal

scutellars about equal in length. Halteres pale. Mesonotum and scutellum pale yellowish tan, without markings. Two humerals. Anterior sternopleural little more than ⅓ length posterior, the middle one quite small. Abdomen uniformly pale yellow, the anal plates darker. Sternites pale. External male genitalia as figured by Hsu (this bulletin).

Wings clear, without clouding. Costal index about 2.8; 4th vein index about 1.5; 5x index about 1.7. Apex of first costal section with two bristles, equal in length. Third costal section with heavy bristles on its basal 2/5.

Length body (in preserved specimen): 2.8 mm.; wings: 2.8 mm. Described from specimens preserved in Barber's fluid.

Other characteristics, relationship, and distribution.

Distribution.—The only record is two males collected by sweeping in a field of garden peas near Jasper, New York, on 7–28–48 by Mr. T. C. Hsu and the writer. The total collection consisted of 136 flies of which the remainder were all *S. graminum.*

Types.—Holotype male (No. 1896.2) preserved in Barber's fluid, as well as slide mounts of legs, wings, and external male genitalia.

Relationship.—The external coloration is markedly different from all other known forms, but this species has many characters in common with *terminalis* and *montana,* the similarities to the genitalia of the latter form being rather striking.

Scaptomyza terminalis Loew (Redescribed).

Since the original description of this species in Latin by Loew, no further descriptive notes appear to have been published. With the discovery of other species more or less closely related to it, it seems advisable now to give a more complete description based on living material. The following description was prepared by the writer from two living females captured in a weed patch in Oakland, Calif., on 12–6–44, and is as follows:

A very neat-looking fly, slow of movement, with a bluish gray thorax, a dull brown abdomen, and prominent dark clouding at the apices of the third veins.

Arista with about 8 branches, two below in addition to the terminal fork. Antennae pale brownish yellow, third joint slightly darker. Orbits, ocellar triangle and occiput grayish pollinose, front, face, and orbital area anterior to the bristles pale yellow. Second antennal segment with about 3 large bristles. Third antennal segment rather short, its greatest width about ¾ its length. Proclinate orbital about ⅔ length posterior reclinate, middle orbital ⅓–¼ length of latter. One prominent oral, 2nd one much thinner and about ⅓ its length. Palpi pale yellow with two prominent bristles. Carina not distinctly separated from rest of face, evenly elevated throughout and evenly rounded below, not sulcate. Eyes deep red with short, light-colored pile.

Mesonotum and scutellum bluish gray, pollinose, with a prominent central brown stripe which is continued, less distinctly, to scutellar apex.

Acrostichals in 4 rows at the level of the anterior dorsocentrals, in two rows between them, these rows limiting exactly the central stripe. No prescutellars. Anterior scutellars divergent. Pleurae gray, pollinose. Two humerals. Anterior sternopleural about 0.6 length of posterior, middle one about ½ length of the latter. Halteres pale yellow. Legs pale brownish yellow, coxae of 2nd and 3rd legs darker. Preapicals on all tibiae, apicals evident only on second.

Abdominal tergites dark brown, slightly lighter along their apices. Ovipositor plates dark brownish black.

Wings clear except for prominent small clouds at apices of third veins.

Two enlarged bristles at apex of first costal section. Third costal section with heavy bristles on its basal ⅓. Costal index about 3.7; 4th vein index about 1.4; 5x index about 1.3.

The characters of the external male genitalia are illustrated by Hsu (this bulletin).

The two females used in the description were kept on banana culture media for nearly two months during which they laid many eggs. These had four short filaments, rather thick, much like those of *S. adusta*. Eggs were laid flat on the food surface. Larvae were produced which appeared to do well until about the third instar when they invariably died.

Key to the North American species of Scaptomyza

1.	Palpi black; three pairs of dorsocentral bristles	**vittata** Coquillett
	Palpi yellow; two pairs of dorsocentral bristles	2
2.	Two humeral bristles present	3
	One prominent humeral bristle present	5
3.	Wings with a black spot at apex of third vein	**terminalis** Loew
	Wings clear, without such a spot	4
4.	Mesonotum, scutellum and abdomen largely yellow, only the ocellar triangle black	**nigrocella** n.sp.
	Mesonotum, scutellum and abdomen pollinose black	**montana** n.sp.
5.	Wings with a black spot at apex of third vein	**adusta** Loew
	Wings clear, without such a spot	6
6.	Anterior scutellars convergent; apical and basal scutellars about equal in length; acrostichals in 2 distinct rows	**graminum** Fallén
	Anterior scutellars divergent; apical scutellar pair about ½ length basal pair; acrostichals in 4 rows just anterior to dorsocentrals	**hirsuta** n.sp.

THE GENUS DROSOPHILA FALLEN

This large and complex genus was divided by Sturtevant (1939; 1942) into six subgenera, as follows: **Hirtodrosophila** Duda, **Pholadoris** Sturtevant, **Dorsilopha** Sturtevant, **Phloridosa** Sturtevant, **Sophophora** Sturtevant, and **Drosophila** Fallén. The subgenus **Siphlodora** was erected by Patterson and Mainland (1944). To this list we are now adding **Sordophila,** *subg. nov.,* for the reception of *D. acanthoptera,* n. sp.

Subgenus **Hirtodrosophila** Duda.

The excellent summary of this subgenus by Frota-Pessoa (1945) lists 26 species as members of the group. Although but five of these species were available for study, Hsu (this bulletin), on the basis of the external

genitalia, believes that they may be separated into the following three species groups, the remainder, of necessity, being unclassified at present:

1. *duncani species group*

D. duncani Sturtevant

2. *longala species group*

D. longala Patterson and Wheeler.

D. grisea Patterson and Wheeler (T).

3. *cinerea species group*

D. cinerea Patterson and Wheeler.

D. orbospiracula Patterson and Wheeler.

Unclassified species

D. jordanensis Frota-Pessoa.
D. narinosa Frota-Pessoa.
D. nigrohalterata Duda.
D. prognatha Sturtevant.
D. alabamensis Sturtevant.
D. chagrinensis Stalker and Spencer.
D. glabrifrons Duda.
D. ochracella Hendel.
D. dentata Duda.
D. hirticornis de Meijere.
D. innocua Malloch.
D. latifrontata Frota-Pessoa.
D. longecrinita Duda.
D. lundstroemi Duda.
D. oldenbergi Duda.
D. seminigra (Duda) Malloch.
D. flavohalterata Duda.
D. fuscohalterata Duda.
D. astioidea Duda.
D. trapezina Duda.
D. unicolor Malloch.

Also included in the list of members of the subgenus given by Frota-Pessoa (1945) are *D. lugens* Duda, *D. pilicrus* Duda and *D. sumatrensis* Duda. Mr. Frota-Pessoa has informed me, however, that their inclusion was based on the citation in the Zoological Record which listed these species from Duda's 1926 paper as *Hirtodrosophila*, but that when the original of Duda's paper was obtained it was noted that he had actually included them in his *Paradrosophila*.

Subgenus **Pholadoris** Sturtevant.

A revision of this subgenus presented by the writer elsewhere in this bulletin divides the members of the subgenus into two species groups as follows:

1. *victoria species group.*

This newly-erected group contains the following species:

D. victoria Sturtevant.
D. coracina Kikkawa and Peng.
D. nitens Buzzati-Traverso.
D. lebanonensis Wheeler.
? *D. anuda* Curran.
? *D. excepta* Malloch.
? *D. bryani* Malloch.

2. *mirim species group.*

We would consider this group to contain the following:

D. mirim Dobzhansky and Pavan.
D. baeomyia Wheeler.

Subgenus **Dorsilopha** Sturtevant.

In establishing this subgenus, Sturtevant (1942) indicated that it contained but one species: *D. busckii* Coquillett.

Subgenus **Phloridosa** Sturtevant.

This subgenus was stated by Sturtevant (1942) to contain the following species:

D. floricola Sturtevant.
D. alfari Sturtevant.
D. lutzii Sturtevant.
D. tristani Sturtevant.
? *D. mauiensis* Grimshaw.

Subgenus **Siphlodora** Patterson and Mainland.

As established, this subgenus contains the following species:

D. sigmoides Loew.
D. subsigmoides Patterson and Mainland (T).
D. flexa Loew.

Subgenus **Sordophila,** *subg. nov.* Type, *D. acanthoptera, sp. nov.*

Eggs with two filaments, expanded at the tip; ventral receptacle long and tightly coiled; spermathecae thin-walled, without chitinized centers; testis composed of moderate number of coils; anterior Malpighian tubes with enlarged tips, posterior pair forming a loop around the gut, their ends merely apposed and lacking a continuous lumen; bands on abdomen not narrowed or interrupted in midline; costa pectinate; eyes small, cheeks wide (about ½ eye diameter in type species); anterior reclinate orbital about as far forward as proclinate; no prescutellar bristles.

Drosophila acanthoptera, sp. nov.

External characters of imagines.

♂. Arista with 8 rather long branches, two below in addition to the terminal fork. Antennae pale tannish yellow, third joint slightly darker. Face and front, including orbits, pale tannish yellow, ocellar triangle slightly darker. One prominent oral bristle followed by about two smaller hairs, directed upward, and the usual series of bristles directed as the vibrissa, the first of this series about ½ or less length of first oral. Anterior reclinate orbital about as far forward as proclinate, about ½ length of the latter and ⅓ length of posterior reclinate. Carina exceptionally broad, rounded, not sulcate. Palpi pale with several enlarged hairs. Cheeks pale tannish yellow, broad, almost half the greatest diameter of eyes. Eyes small, deep Burgundy in color (Pl. 56–E 8; Maerz and Paul, 1930) with light colored pile. In young specimens the eyes are lighter, deepening to a dark brown in old individuals.

Acrostichals in 6 rows, outer rows irregular. No prescutellars. Anterior scutellars convergent. Halteres pale. Anterior sternopleural thin, about ½ length posterior; no median bristle. Pleurae tannish yellow. Mesonotum and scutellum light chestnut brown, without markings. Legs pale tannish yellow. Tarsal joints progressively thinner distally. A series of

short recurved hairs on fore tarsi (in both sexes), a few on other legs. A well-defined apical bristle on 2nd tibiae only, preapicals on all three.

Abdominal tergites pale yellow with exceedingly indistinct bands which are but slightly darker. The bands are not interrupted and sometimes appear to be somewhat wider in the midline. The bands continue to the margin, becoming rather narrowed in this region. Sternites pale. External male genitalia as figured and described by Hsu (this bulletin).

Wings clear, without clouding. Apex of first costal section with two quite large bristles. Distal costal incision rather deep. The heavy bristles of the costal margin considerably enlarged over the usual condition in the genus, and, in addition, every 4th or 5th bristle is still more enlarged, being about half the length of those at the costal break. Third costal section with this series of heavy bristles on its basal ⅓. Costal index about 2.6. Other wing indices more variable than normal due to the variable position of the posterior crossvein which frequently runs obliquely between L 4 and L 5, making an angle of around 80° with the latter instead of the more customary 90°. The point of origin of the crossvein from L 4 affects the remaining indices as follows: 4th vein index from 1.4 to 1.8; 5x index from 1.18 to 1.42, there being a negative correlation between these two indices, i.e., when the crossvein arises nearer the base of the wing the 4th vein index increases while the 5x index decreases since the length of the crossvein is itself increased. The 4c index varies from about 0.9 to slightly more than 1.0, increasing as the origin of the crossvein moves basally. These rather striking wing characteristics can be seen in Fig. 1.

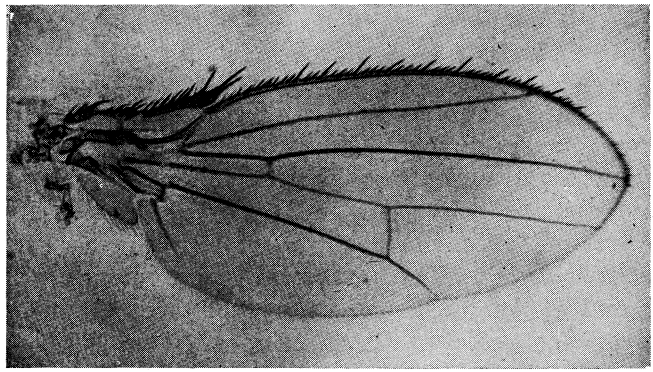

FIG. 1. Wing of *D. acanthoptera*, n. sp.

♀. Thorax chestnut brown, distinctly darker than in the male. Banding on abdominal tergites similarly darker, appearing quite brown when contrasted with the male. The bands continue completely to the margin. Sternites darker than in male.

Length body, male: 2.5 mm. (in living specimen); wings: 2.5 mm.

Female: 3.5 mm.; wings 2.8 mm.

Internal characters of imagines.

Each testis consists of two large, loose, colorless outer coils and about four smaller outer coils, pale orange in color; the inner series consists of about four very small, tight coils and two larger loose coils in which the mature sperm collect. The paragonia are J-shaped with their ducts arising from the end of the longer arm of the J. The ejaculatory sac has two broad, blunt diverticula, strongly bent toward one another so that they almost meet below.

Spermathecae are two thin-walled sacs, without chitinized centers, their stalks opening near the base into a large central cavity. The walls appear to be sufficiently distensible to allow considerable increase in size as they fill with sperm. Ventral receptacle an extremely long structure, tightly coiled along its entire length, having the appearance of a 2-strand rope. The distal ⅓ of the receptacle is secondarily coiled on itself, this region being somewhat twisted. In the living specimen the terminal portion of the receptacle lies near the bases of the ovaries and seems to be attached to this region by tissue and tracheae.

Anterior pair of Malpighian tubes with noticeably enlarged tips. Posterior pair fused to form a loop around the gut, their ends, however, merely apposed and lacking a continuous lumen.

Other characteristics, relationship, and distribution.

Eggs.—Two filaments, widely expanded along their terminal halves into thin blades in which a central midrib is visible.

Puparia.—Golden yellow. Anterior spiracles with about 18 branches. Length of anterior horn or stalk rather variable; in some instances the branches arise directly from the puparium, while in other the stalks are of different lengths on the two sides. Measurements made on specimens with the longest horns observed, equal on both sides, show their length (plus the branches) to be about ¼ the length of the puparium itself. Masses of puparia are formed along the sides of the laboratory vials a short distance above the surface of the food.

Chromosomes.—Metaphase plate shows one pair of small V's, one pair of small J's, 2 pairs of rods of which one pair shows terminal satellites, and 2 large V-shaped X-chromosomes; the Y is a large J (det. by C. Ward).

Distribution.—The only record is three specimens, one male and two females, collected about 60 miles south of Oaxaca, Oax., Mexico, near the valley of the Rio Tehuantepec, on 9–7–47 by Mr. F. A. Cowan and the writer. From these individuals a laboratory stock was secured, this species going quite well on the usual culture medium.

Types.—Holotype male, 4 paratype males and 5 paratype females (No. 1808.21), all descendants of the original flies.

Relationship.—The presence of a pectinate costa does not seem sufficient to the writer to bar this new form from the genus *Drosophila,* since all other characters fit this genus rather well (the position of the anterior

reclinate orbital being a possible exception). Within the genus it seems nearest to the subgenus *Sophophora.*

Subgenus **Sophophora** Sturtevant.

Sturtevant (1942) separated the various members of this subgenus into four species groups. To this we are here adding one new group, the nannoptera species group, and are removing the alagitans species group from the subgenus Drosophila and placing it in this subgenus. The reasons for such a change are given in the section dealing with the group.

1. *saltans species group*

On the basis of certain color and bristle characteristics, Sturtevant (1942) arranged the members of this group in two sub-groups as follows:

Sub-group a.

D. saltans Sturtevant.
D. sturtevanti Duda.
D. rectangularis Sturtevant.
D. earlei Sturtevant.
D. prosaltans Duda.

Probably belonging to this sub-group is *D. pilifacies* Malloch which seems to resemble *D. rectangularis* in many characteristics.

Sub-group b.

D. cordata Sturtevant.
D. elliptica Sturtevant.
D. emarginata Sturtevant.

2. *willistoni species group*

Dobzhansky (1946) lists all but the last of the following species as belonging to this group:

D. willistoni Sturtevant.
D. equinoxialis Dobzhansky.
D. paulista Dobzhansky and Pavan.
D. sucinea Patterson and Mainland.
D. nebulosa Sturtevant.
D. fumipennis Duda.
D. capricorni Dobzhansky and Pavan.
D. bocainensis Pavan and da Cunha.

Spieth (1947) believes that the first four species listed above form a compact sub-group, while *fumipennis* and *nebulosa* are "quite distinct from each other and also from the other four." *D. capricorni,* he states, is intermediate between *willistoni* and *fumipennis.* Pavan and da Cunha (1947), in describing *bocainensis* from Brazil, state that it is related to *fumipennis* and *nebulosa.*

3. *melanogaster species group*

The studies of Hsu (this bulletin) indicate that this large group may be subdivided as follows:

Sub-group a.

D. melanogaster Meigen.
D. simulans Sturtevant.

Sub-group b.

D. takahashii Sturtevant.
D. lutea Kikkawa and Peng.

Sub-group c.

D. montium de Meijere.
D. rufa Kikkawa and Peng.
D. auraria Peng.
D. ficusphila Kikkawa and Peng.
D. nipponica Kikkawa and Peng.

Sub-group d.

D. ananassae Doleschall.
D. bipectinata Duda.

Sub-group e.

D. suzukii (Matsumura) Kamizawa.
D. pulchrella Tan, Hsu, and Sheng.

Unclassified species

D. illata Walker.
D. unipectinata Duda.
D. miki Duda.
D. serrata Malloch.
D. biarmipes Malloch.

4. *obscura species group*

As established by Sturtevant (1942), this group contains two large sub-groups, the first consisting of the obscura-like forms, the second of the affinis-like forms. The following list of species is a composite of those given by Sturtevant (1942), Pomini (1940), Burla (1948) and records from our laboratory:

Sub-group a.

D. obscura Fallén.
D. subobscura Collin.
D. obscuroides Pomini.
D. pseudoobscura Frolova.
D. persimilis Dobzhansky and Epling.
D. miranda Dobzhansky.
D. tristis Fallén.
D. alpina Burla.
D. bifasciata Pomini.
D. ambigua Pomini.
D. segúyi Smart.
D. frolovae n. sp.

Drosophila frolovae, sp. nov.

External characters of imagines.

♂. Arista with about 8 branches, the first dorsal one originating near the base. Antennae dark brown, third joint still darker. Face and front black, pollinose, ocellar triangle and orbits less pollinose and with a slightly rusty brown color. One prominent oral, the next large one about ⅓ its length. Middle orbital about ½ length anterior proclinate, ⅓ posterior reclinate. Palpi with a single prominent bristle. Carina narrow above, gradually widening below, somewhat rounded, not sulcate. Cheeks grayish black, pollinose, quite wide, their width almost ⅓ greatest diameter of eyes. Eyes dark red with dark pile.

Acrostichal hairs in 8 rows; slightly enlarged hairs in prescutellar position. Anterior scutellars convergent. Mesonotum and scutellum dark,

dull black, rather pollinose throughout. Pleurae dark pollinose black. Anterior sternopleural about ½ length posterior; middle one undeveloped. Legs pale grayish yellow. Basal tarsal segment of fore legs with a large row of long, black teeth, 14–16 in number, the row placed slightly obliquely on the segment. Second tarsal joint also with a large prominent sex-comb, consisting of a row of equally long teeth, 10–11 in number, placed less obliquely, almost parallel to the axis. The position and size of these combs is shown in Fig. 2.

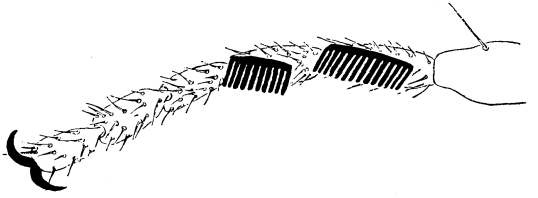

FIG. 2. Tarsal joints of male of *D. frolovae*, n. sp.

Abdomen solid brownish black, slightly shining.

Wings clear. Two prominent bristles at distal costal break. Third costal section with heavy bristles on its basal 2/5. Costal index about 2.5; 4th vein index about 1.8; 5x index about 1.6.

Length of body (in pinned specimen): 2.0 mm.; wings: 2.5 mm. Described from pinned specimens.

Other characteristics, relationship, and distribution.

Distribution.—The only record is two males and an unknown number of females collected by Mr. F. A. Cowan and the writer in a forest high in the mountains about 19 miles east of Morelia, Mich., Mexico, on 8–30–47.

Types.—Holotype male (No. 1796.1) and slide preparations of legs and wings.

Relationship.—Belongs to sub-group a of the obscura species group of the subgenus Sophophora. The presence of two large sex-combs readily separates the males of this form from all other known species in North America. This new species has been named in honor of S. L. Frolova, a pioneer worker in the taxonomy of the obscura group.

Notes.—The original collection in which this species was detected consisted of 28 flies recorded as "*azteca* and n.sp." Among these specimens two males with this unusual series of sex-combs were observed. A number of live females were isolated in an attempt to raise a stock of this new form, but none of the females suspected of belonging to this species laid fertile eggs. These females were indistinguishable from those of *azteca* except for the acrostichal rows.

Sub-group b.

D. affinis Sturtevant.
D. algonquin Sturtevant and Dobzhansky.
D. athabasca Sturtevant and Dobzhansky.
D. azteca Sturtevant and Dobzhansky.
D. tolteca Patterson and Mainland.
D. narragansett Sturtevant and Dobzhansky.
D. seminole Sturtevant and Dobzhansky.
D. dobzhanskii Patterson (T).
D. helvetica Burla.

The last-named form differs from Sturtevant's diagnosis of the subgroup in having two teeth in the distal sex-comb, according to Burla (1948).

5. *alagitans species group*

This group, as established by Patterson and Mainland (1944), contains the following two species:

D. alagitans Patterson and Mainland.
D. capnoptera Patterson and Mainland (T).

Our transfer of this group from the subgenus *Drosophila* to *Sophophora* is admittedly a radical change. It is unfortunate that many of the more important characters are unknown for these two species, but on the basis of the external male genitalia (which are remarkably similar to those of the willistoni group) and other morphological characters (e.g.: low sterno-index, abdominal pattern, narrow cheek, low number of coils in testes) there seems to be little doubt but that the group is more logically placed in this subgenus. The high costal index (about 4.0 in the two forms listed above) is unusual. Other characteristics, such as the 6 acrostichal rows, divergent anterior scutellars, clouded wings, etc., are all present in one or more species commonly recognized as belonging to the *Sophophora*. As mentioned by the above-cited authors, the habit of waving the wings is strongly suggestive of many species of *Chymomyza*, but there do not appear to be any other similarities.

6. *nannoptera species group*

This new group is here being established for *D. nannoptera*, n. sp.

Drosophila nannoptera, sp. nov.

External characters of imagines.

♂, ♀. Arista with about 7 branches, two below in addition to the terminal fork. Antennae tannish brown, third joint black. One prominent oral bristle, the 2nd a little less than ½ length first; remaining orals arranged in an irregular series. Carina short, broadly rounded below, distinctly sulcate. Palpi pale, with several enlarged hairs. Front, including ocellar triangle, black, changing gradually to tannish brown toward anterior margin; orbits pollinose gray. Cheeks grayish black, their width about ⅓ greatest diameter of eyes. Eyes dark wine red, with light colored pile.

Acrostichals in 8 irregular rows; a pair of enlarged hairs in prescutellar position. Anterior scutellars convergent. Anterior sterno-pleural about ⅔ length posterior, middle one undeveloped. Mesonotum, pleurae and scutellum dull black with grayish pollinosity; two less pollinose stripes just within dorsocentral rows. Halteres pale yellow. Legs black, tibiae and tarsi somewhat lighter. A series of short recurved hairs on tarsi and tibiae of first legs, a few on other legs. Apical bristles on first and second tibiae, that of first small; preapicals on all three.

Abdominal tergites dull black; on newly emerged flies there is a wide apical dark band expanded in midline. Distal edges of tergites with distinct narrow yellow bands running completely across the segments. No opaque areas present. Sternites dark, lighter in female; last sternite of male much darker than rest, almost black. The external male genitalia are described and figured by Hsu (this bulletin).

Wings clear, without clouding. Costal index about 2.6–2.7; 4th vein index about 1.5; 5x index about 1.2; 4c index about 0.85. Apex of first costal section with two very prominent heavy bristles. Third costal section with heavy bristles on its basal ⅓.

Length male: 3.0 mm. (in live specimen); wings 2.0 mm.

Female: 3.5 mm.; wings: 2.5 mm.

Internal characters of imagines.

Testes bright orange in mature male, consisting of 6–8 large outer coils and about 6 very small, tight inner coils followed by 1½ larger coils. Ejaculatory sac with two, short, blunt diverticula.

Spermathecae of moderate size, with weakly chitinized, slender centers, their stalks quite long. Parovaria as large or slightly larger than the spermathecae, their stalks a little shorter than those of the latter. Ventral receptacle long, loosely coiled, tangled, with more than 50 coils.

Posterior Malpighian tubes fused to form a loop around the gut, their ends, however, merely apposed and lacking a continuous lumen.

Other characteristics, relationship, and distribution.

Eggs.—Two filaments, as long as the egg itself, their apical ⅔ broadly expanded into a thin blade.

Puparia.—Weakly chitinized and hence very pale, the anterior horns quite short, with about 11 branches. In this species the anterior spiracular horns are not attached to the anterior edge of the operculum but to the corresponding surface of the opposite side; consequently both the horns and last larval cephalopharyngeal skeleton are borne on this section, the operculum being bare. In the laboratory vials pupation is invariably at the surface of the food along the edges of the vial.

Chromosomes.—Metaphase plate shows one pair of large V's, one pair of medium-sized V's, one pair of large J's, one pair of small J's, and one pair of V-shaped X-chromosomes of medium size; the Y is a long rod. (det. by C. Ward).

Distribution.—The only record is 297 specimens collected in the evening of 9-6-47 by Mr. F. A. Cowan and the writer about 60 miles south of Oaxaca, Oax., Mexico, near the valley of the Rio Tehuantepec, from traps placed along a stream.

Types.—Holotype male, 4 paratype males and 5 paratype females (No. 1808.1).

Relationship.—This new species apparently belongs to the subgenus *Sophophora,* wherein it superficially resembles the saltans group. However, the convergent scutellars and lack of opaque areas on the abdominal tergites argue against its inclusion in this group. The name is derived from terms meaning "short wings" and refers to the rather exceptionally short wings when compared to the body length.

Notes.—This form does not go well on the usual culture media. Many eggs do not hatch and many larvae which emerge fail to survive to pupation, indicating possible nutritional deficiency. When the soft centers of ripe fruits of the common prickly pear cactus, *Opuntia lindheimeri,* are added to the food, many more eggs are laid and the larvae do much better.

Subgenus **Drosophila** Fallén.

Sturtevant (1942) separated the members of this subgenus into 14 species groups, leaving a number of forms unclassified. Eighteen such groups are mentioned by Patterson and Mainland (1944). In the present paper a total of 20 groups are recognized by adding three new groups and removing one (alagitans group).

1. *quinaria species group.*

The following list has been assembled from various sources:

D. quinaria Loew.
D. subquinaria Spencer.
D. palustris Spencer.
D. subpalustris Spencer.
D. occidentalis Spencer.
D. suboccidentalis Spencer.
D. transversa Fallén.
D. munda Spencer.
D. suffusca Spencer.
D. tenebrosa Spencer.
D. innubila Spencer.
D. phalerata Meigen.
D. limbata von Roser.
D. mutandis Tan, Hsu and Sheng.
? *D. nigromaculata* Kikkawa and Peng.
D. deflecta Malloch.

It might also be pointed out that studies of the male genitalia of strains of *transversa* from Switzerland, China and the United States indicate that at least three species are concerned, in which case the name *transversa* should be limited to the European form, the other two needing substitute names. Specimens of *phalerata* from Switzerland and Beirut, Lebanon are apparently identical.

2. *guttifera species group.*

This group, established by Sturtevant (1942), includes but one species: *D. guttifera* Walker.

3. *pinicola species group.*

Sturtevant (1942) states that this group contains only the single species: *D. pinicola* Sturtevant.

4. *virilis species group.*

The known members of this group are as follows:

D. virilis Sturtevant.
D. americana Spencer.
D. novamexicana Patterson.
D. montana Patterson and Wheeler.
D. lacicola Patterson.

5. *testacea species group.*

Sturtevant (1942) includes the following two species in the group:

D. testacea von Roser.
D. putrida Sturtevant.

A comparison of specimens of *testacea* from Switzerland and eastern North America indicates that they are without doubt identical.

6. *tripunctata species group.*

The members of this group are as follows:

D. tripunctata Loew.
D. unipunctata Patterson and Mainland (T)
D. crocina Patterson and Mainland (T).

Careful morphological comparisons of *D. histrio* Meigen from China and Switzerland show that they are identical but do not belong to this species group.

7. *funebris species group.*

The following species are included in this group:

D. funebris (Fabricius).
D. subfunebris Stalker and Spencer.
D. macrospina Stalker and Spencer.
D. trispina n. sp.

Drosophila trispina, sp. nov.

External characters of imagines.

♂. Arista with about 10 branches, 3 below in addition to the terminal fork. Antennae light tan, third joint darker, clothed with numerous, fine, pale hairs. Front light tannish brown, orbits and ocellar triangle slightly lighter. Middle orbital small, about ⅓ length anterior, ¼ length posterior. Second oral about as long as first. Palpi pale, with several prominent bristles. Carina broad, evenly rounded throughout its length, not sulcate. Face light yellowish tan. Cheeks grayish yellow, their width about ¼ greatest diameter of eyes. Eyes bright red with dark pile.

Acrostichals in 8 regular rows; no prescutellars. Anterior scutellars convergent. Halteres pale yellow. Mesonotum and scutellum light burnt brown, somewhat shining, without markings. Pleurae pale yellowish tan. Anterior and middle sternopleurals thin, the anterior one about 0.6 length

posterior, middle one slightly less than ½ posterior. Legs uniformly pale yellow. Apical bristles on 1st and 2nd tibiae, preapicals on all three. Recurved hairs on all tarsi, more numerous on those of fore legs.

Abdomen uniformly dark shining brown, first two tergites lighter in midline. Genital arch and posterior edge of previous tergite yellow. Sternites pale tan. External male genitalia as figured by Hsu (this bulletin).

Wings clear. Costal index about 2.3–2.4; 4th vein index about 1.4; 5x index about 1.2. Apex of 1st costal section with two equal bristles. Third costal section with heavy bristles on its basal ⅗.

Length body (in live specimen) : 2.0 mm.; wings: 2.0 mm.

♀. Similar to male. Ovipositor plates tannish brown.

Length body: 3.0 mm.; wings: 2.4 mm.

Internal characters of imagines.

Testes lemon yellow with about 5 thick inner coils, rather whitish in color, and 8–9 thinner outer coils, more deeply colored. Ejaculatory sac with two thick diverticula, shaped as in *D. macrospina limpiensis,* figured by Patterson (1943:115). Point of union of vasa deferentia to form a common passage quite high, being on a level with the upper edges of the bends of the paragonia.

Spermathecae with large pear-shaped, lightly chitinized centers. Ventral receptacle loosely coiled at base, tightly and intricately coiled near tip.

Malpighian tubes yellow, anterior pair with whitish tips. Both anterior and posterior pairs with very short common stalks.

Other characteristics, relationship, and distribution.

Eggs.—Four filaments of medium thickness, anterior pair slightly shorter than posterior pair, which are about as long as the egg itself.

Puparia.—Orange brown; anterior spiracles with 11–12 branches, their stalks about 1/10 length of puparium. Posterior spiracles mostly divergent.

Chromosomes.—Metaphase plate shows 4 pairs of rather short rods, one pair of very large dots, one pair of very small dots, and one pair of long rod-shaped X-chromosomes; the Y is a shorter rod with a satellite (determined by C. Ward).

Distribution.—The only record to date is one female and three males captured by the writer on 6-14-48 in a small wooded grove along the Colorado River about 4 miles northwest of Earp, Calif. A laboratory stock was secured from these individuals.

Types.—Holotype male, 4 paratype males and 5 paratype females (No. 1858.5), all descendants of the original specimens.

Relationship.—Belongs to the funebris group of the subgenus Drosophila. Preliminary genetic tests reveal that this new form can be hybridized with *D. macrospina limpiensis* producing fertile female and sterile male offspring. When *trispina* is used as the female parent the cross goes

very slowly or not at all; the reciprocal cross goes very well. Hybrids with *D. subfunebris* have not been obtained.

Notes.—Males of this new form are easily distinguished from those of the other members of the group by the presence of three prominent black spines on the genitalia which are visible when viewed from the side (although, in fact, the innermost spine is a pair of close-set spines). The light color of the ovipositor serves to distinguish the females from those of *D. macrospina.*

8. *repleta species group.*

This is the largest and most complex group in the subgenus. As was pointed out by Patterson (1943), we have made several attempts to subdivide the many species into smaller units, but without complete success. Certain forms fall logically into one of three such groups, centering around *hydei, repleta* and *mulleri.* Wharton (1944) divided the complex into four groups, adding a *mercatorum* section to the other three. At the present time it seems advisable to indicate the characteristics of the accepted smaller groups and to list those forms which are generally believed by us to belong to them.

Sub-group a. *hydei*-like species.

Costal index above 3.0; testis with many coils, ranging from a total of 22 *(nigrohydei)* to about 50 *(bifurca);* ventral receptacle very long and with many coils, ranging from about 245 *(hydei)* to about 735 *(bifurca);* fore coxae generally pale or light brown; lateral areas of abdominal tergites usually solid in color; without an obvious homogamic insemination reaction (cf. Wheeler, 1947). The species agreeing in all these characters are as follows:

D. hydei Sturtevant.
D. nigrohydei Patterson and Wheeler.
D. hydeoides Patterson and Wheeler.
D. bifurca Patterson and Wheeler.
D. pachea Patterson and Wheeler.
D. novemaristata Dobzhansky and Pavan.

Sub-group b. *repleta*-like species.

Costal index usually below 3.0; testis with moderate number of coils, ranging from 10 *(neorepleta)* to 16 *(melanopalpa);* ventral receptacle of moderate length with an intermediate number of coils, ranging from about 50 *(linearepleta)* to 116 *(melanopalpa);* fore coxae usually dark brown to black; lateral areas of abdominal tergites usually with some lighter portions; without an obvious homogamic insemination reaction. The species belonging to this sub-group are as follows:

D. repleta Wollaston.
D. neorepleta Patterson and Wheeler.
D. melanopalpa Patterson and Wheeler.
D. linearepleta Patterson and Wheeler.
D. brunneipalpa Dobzhansky and Pavan.
? *D. onca* Dobzhansky and Pavan.

D. canapalpa Patterson and Mainland.
D. nigrospiracula Patterson and Wheeler.
D. fuliginea Patterson and Wheeler.
? *D. fascioloides* Dobzhansky and Pavan.
? *D. fulvamacula* Patterson and Mainland (T).
D. limensis Pavan and Patterson.

The last-named form, *limensis*, is placed in this section on the basis of its behavior in crosses with certain other members, although it differs in several morphological characters from the diagnosis of the sub-group given above (e.g., only 6 coils in the testis; about 40 coils in the ventral receptacle).

Sub-group c. *mulleri*-like species.

Costal index usually below 3.0; testis with fewer coils, ranging from 4 *(anceps)* to 9 *(hamatofila)*; ventral receptacle shorter and with fewer coils, ranging from 14 *(buzzatii)* to 28 (several species); fore coxae usually light; eyes usually bright red; with a pronounced homogamic insemination reaction. The species which agree in all these characters are as follows:

D. mulleri Sturtevant.
D. aldrichi Patterson and Crow.
D. mojavensis Patterson and Crow.
D. arizonensis Patterson and Wheeler.
D. buzzatii Patterson and Wheeler.
D. hamatofila Patterson and Wheeler.
D. longicornis Patterson and Wheeler.
D. ritae Patterson and Wheeler.
D. peninsularis Patterson and Wheeler.
D. anceps Patterson and Mainland (T).
D. racemova Patterson and Mainland.
D. meridiana Patterson and Wheeler.

The following three species are essentially like the foregoing but differ in one or more characters as follows:

D. hexastigma Patterson and Mainland (T). (Costal index 3.6).
D. spenceri Patterson. (13 testis coils; 35 coils in receptacle).
D. mainlandi Patterson. (Costal index 3.4).

Unclassified species

The following species either have characters noticeably different from those enumerated above, have combinations of characters of several groups, or have not been described sufficiently well for purposes of grouping. We cannot, at present, satisfactorily assign them to any known subgroup.

D. nigricruria Patterson and Mainland.
D. brevicarinata Patterson and Wheeler.
D. leonis Patterson and Wheeler.
D. mercatorum Patterson and Wheeler.
D. poecilithorax Malloch.
D. betari Dobzhansky and Pavan.
D. fasciola Williston.
D. ramsdeni Sturtevant.
D. californica Sturtevant.
D. maculipennis Duda.

D. subviridis Patterson and Mainland.
D. inca Dobzhansky and Pavan.
D. obsoleta Malloch.
D. icteroscuta n. sp.

Drosophila icteroscuta, sp. nov.

External characters of imagines.

♂. Arista with about 8 branches. Antennae light brown. Front dark brown, appearing black when viewed from the side; ocellar triangle and posterior orbits strongly pollinose. Anterior orbits tannish brown. A fine pollinose line leads anteriorly from ocellar triangle to face. Middle orbital about ½ length anterior, ⅓ length posterior. One prominent oral, 2nd thin, not more than ⅓ length 1st. Palpi pale with few long hairs. Carina widest below, prominently sulcate. Cheeks grayish brown, their width about ⅓ greatest diameter of eyes. Eyes dark wine, with light colored pile.

Acrostichals in 8 rows; no prescutellars. Anterior scutellars divergent, occasionally merely straight or parallel. Mesonotum brownish with grayish pollinosity, most of the bristles and hairs arising from brown spots, these largely fused into a complex pattern appearing as brownish stripes and patches on a grayish pollinose background; viewed from above the principal pattern appears to be a broad brownish central stripe from scutellar base to about the level of the suture, and two narrower stripes continuing anteriorly from this point, one on each side of the first. Pleurae with patches of brown and pollinose gray; humeral callus dirty yellow. Scutellum light brown at base, becoming increasingly lighter apically so that the tip usually appears yellow. Lateral margin of scutellum, in vicinity of anterior scutellars, much darker. Halteres pale. Coxae of first legs and all femora dark brown, remaining portions lighter brown. All tibiae with a dark basal band, darkest on hind pair. Apical bristles on first and second tibiae, preapicals on all three.

Abdomen yellow, each tergite with a dark brown apical band, about ½ width of the segment, the bands of all but the first complete tergite extending anteriorly in the midline to base of previous segment; the bands expand again at the angle of the tergite to form solid lateral areas. On the first complete tergite only is the band narrowly interrupted in the midline. On the holotype male the right half of this tergite is malformed and atypical. Sternites pale. In both sexes there are a number of small greenish areas visible on the clear ventral surface. The external male genitalia are figured by Hsu (this bulletin).

Wings with a brownish cast, veins darker. Anterior crossvein with a slight cloud, posterior one with a more pronounced cloud. Some darkening at tip of L 2. Costal index about 3.3; 4th vein index about 1.6; 5x index about 1.3; 4c index about 0.7. Apex of first costal section with two prominent bristles, the terminal one distinctly stouter and blacker. Third costal section with heavy bristles on its basal ⅓.

Length body (in pinned specimen): 2.8 mm.; wings: 3.0 mm.

♀. The first complete abdominal tergite with a dark brown apical band, narrowly interrupted in midline, the band expanding at the angle. Bands of other tergites expand anteriorly in the midline, reaching the previous segment. These bands similarly expand at the angle of the tergite forming solid lateral areas except on the terminal segment, on which the band fades away at the angle. Ovipositor plates dark.

Internal characters of imagines.

Testes bright lemon yellow, with about 3 large outer and about 6 smaller inner coils. Ejaculatory sac diverticula quite short and blunt, similar to those figured for *D. peninsularis* (Patterson, 1943:151).

Spermathecae weakly chitinized at distal end, with a large enclosing envelope. Parovaria rather large. Ventral receptacle long, with about 37–40 loose coils.

Other characteristics, relationship, and distribution.

Eggs.—With 4 filaments, the anterior pair shorter than posterior which are slightly shorter than the egg itself (determined by dissection).

Distribution.—The only verified record is 6 specimens taken by the writer and Mr. F. A. Cowan about 19 miles east of Morelia, Mich., Mexico, on 8–30–47. They failed to breed in the laboratory.

Types.—Holotype male (No. 1796.11) as well as slide mounts of wings and genitalia of both sexes.

Relationship.—Belongs to the unclassified portion of the repleta species group. It can be distinguished from all other known species in the group by the mesonotal pattern, divergent scutellars, and the yellow-tipped scutellum for which this form has been named. It might be mentioned, however, that still another member of the repleta group, as yet undescribed, also possesses a yellow-tipped scutellum, but is believed to have convergent scutellars and the typical spotted mesonotal appearance.

9. *robusta species group*

The following species have been assigned to this group by various authors:

D. robusta Sturtevant.
D. colorata Walker.
D. sordidula Kikkawa and Peng.
D. pullata Tan, Hsu, and Sheng.
D. cheda Tan, Hsu, and Sheng.

10. *melanica species group*

The following species may be assigned to this group:

D. melanica Sturtevant.
D. micromelanica Patterson.
D. nigromelanica Patterson and Wheeler.
D. melanura Miller.
D. melanissima Sturtevant.
D. afer Tan, Hsu, and Sheng.
? *D. pseudomelanica* Sturtevant.

Sturtevant (1942) points out that the form identified as *melanissima* by Kikkawa and Peng in Japan is a distinct species, and hence may be considered the eighth known member of the group.

11. *polychaeta species group*

Sturtevant (1942) lists the following species as members of this group:

D. polychaeta Patterson and Wheeler.
D. illota Williston.
? *D. grandis* Kikkawa and Peng.

12. *carbonaria species group*

This group, established by Sturtevant (1942), contains but the single species: *D. carbonaria* Patterson and Wheeler.

13. *cardini species group*

On the basis of the available evidence, the members of this group may be arranged as follows:

Sub-group a.

D. similis Williston.
D. prosimilis Duda.
D. bandeirantorum Dobzhansky and Pavan.

Sub-group b.

D. cardini Sturtevant.
D. neocardini Streisinger.
D. cardinoides Dobzhansky and Pavan.
D. polymorpha Dobzhansky and Pavan.

Unclassified species.

D. albirostris Sturtevant.
D. metzii Sturtevant.

As was recently indicated by Streisinger (1946), there is some confusion regarding the members of this group. Metz (1916) described the metaphase chromosomes of *cardini* as "Type F" having 5 pairs of rods and one pair of "m-chromosomes," now usually referred to as dots. The determinination was made on a strain from Cuba.

Patterson (1943) gave an extensive distribution for *cardini* and, on the basis of the chromosome analysis of Wharton (1943, using a strain from Lake Okeechobee, Fla.), stated that the configuration for this species was one pair of rods, 2 pairs of V's, and a pair of dots.

At about the same time Dobzhansky and Pavan (1943) described *cardinoides* from Brazil, its metaphase chromosomes agreeing with those described by Patterson and Wharton for *cardini*. The similarity of their species to *cardini* was pointed out and a new name proposed mainly on the difference in distribution and dissimilarity of the chromosomes to those given by Metz.

In our laboratory are maintained eight stocks of the cardini group, one of them, sent to us by Prof. Dobzhansky from Teffe, Brazil, being labeled *D. neocardini,* described by Streisinger (1946). An analysis of the chromosomes of our stocks (determined by C. Ward) and comparisons of the external morphology, including the external male genitalia, leads us to the following conclusions:

a. *D. cardini* does indeed possess 6 pairs of rods in its metaphase preparations, one pair being quite small (i.e., dots). We have strains of this

species from Monterrey, Atlixco, Durango, Oaxaca, and Mexico City, Mexico. Cuba may, of course, also be listed in its distribution.

b. Our stock labeled *"neocardini"* from Teffe, Brazil, is, in reality, *D. cardinoides,* as is also a stock from Guatemala City, Guatemala. This species is distinct from *cardini* and can be separated from it by certain morphological characters. The strain from Florida examined by Wharton (1943) was, very likely, also *cardinoides.*

c. Although we did not have the original stock of *neocardini* (also from Teffe, Brazil!), we did have a stock collected at Atlixco, Mexico, which undoubtedly belongs to this species, our chromosome analysis differing from that of Streisinger only in that the Y is a small V.

The following key will serve to separate the four known North American members of the group:

1. Anterior scutellars divergent ..... **similis** Williston
   Anterior scutellars convergent 2
2. Abdominal bands thin and narrow, disappearing laterally at about the angle of the tergite, lighter on terminal segments (last two without banding in male) ..... **neocardini** Streisinger
   Abdominal bands wide and black, expanding at the angle on some tergites to reach the base of the previous ones, darkest on terminal segments 3
3. Males 4
   Females 5
4. Last 2 tergites and genital arch solid black except for median V-shaped notch on 5th; bands expanded broadly at angle of 3rd tergite reaching previous one; crossveins more or less clouded ..... **cardini** Sturtevant
   Last tergite and genital arch black, 5th completely interrupted medially, 6th with a semi-circular notch in midline; bands expand slightly at angle of 3rd tergite, failing to reach a very narrow black strip basally; crossveins very slightly clouded or not at all ..... **cardinoides** Dobzhansky and Pavan
5. Genital arch largely yellow laterally, a small narrow black area basally; bands of 3rd tergite weakly connected to basal black area, those of 4th with an obvious connection ..... **cardini** Sturtevant
   Genital arch with a broad black area laterally surrounded by a narrow yellow region; bands of 3rd and 4th tergites are not connected to basal dark areas, with only a weak connection on the 5th ..... **cardinoides** Dobzhansky and Pavan

14. *immigrans species group*

This group is believed to contain the following:

D. immigrans Sturtevant.
D. spinofemora Patterson and Wheeler.
D. komaii Kikkawa and Peng.
D. nasuta Lamb.
D. monochaeta Sturtevant.
D. balneorum Sturtevant.
D. rubra Sturtevant.
D. nixifrons Tan, Hsu, and Sheng.
D. hexastriata Tan, Hsu, and Sheng.
D. signata Duda.
D. annulipes Duda.
D. ruberrima de Meijere.
D. subfasciata de Meijere.
D. mediostriata Duda.
D. maculifrons Duda.
D. setifemur Malloch.
D. virgata Tan, Hsu, and Sheng.
? *D. willowsi* Curran.

15. *macroptera species group*

This group is now considered by us to include the following species:

D. macroptera Patterson and Wheeler.
D. submacroptera Patterson and Mainland (T).
D. alafumosa Patterson and Mainland.
D. aurea Patterson and Mainland.
D. magnabadia Patterson and Mainland (T).

16. *rubrifrons species group*

The known members of this group may be arranged as follows:

Sub-group a.

D. rubrifrons Patterson and Wheeler.
D. rubidifrons Patterson and Mainland (T).
D. spadicifrons Patterson and Mainland.

Sub-group b.

D. uninubes Patterson and Mainland (T).
D. nubiluna n. sp.

The characters of *D. parachrogaster* Patterson and Mainland (T), including the male genitalia, indicate that it may belong to this species group but its affinities to either sub-group are not evident.

Drosophila nubiluna, sp. nov.

This new species is very similar, superficially, to *D. uninubes* to which it is seemingly closely related. The descriptive characters given below are primarily those which differ from the previously described form.

External characters of imagines.

♂, ♀. Adults with a peculiar hunch-backed appearance, the general body color being yellowish gray. Arista with about 9 branches, 3 below in addition to the terminal fork. Second oral short and thin, not more than ⅓ length first. Carina evenly broadened below, appearing as a rounded triangle, not sulcate. Scutellar and dorsocentral bristles exceptionally long and slender as are the other thoracic bristles.

Abdominal tergites with broadly interrupted dark brown bands about half the width of the segment. The bands bend anteriorly somewhat at the interruption and again at the angle of the tergites forming solid lateral areas. The external male genitalia are figured by Hsu (this bulletin).

Wings clear, veins rather dark. Both crossveins with narrow light brown clouds, that of the anterior crossvein quite faint. A fairly large and prominent cloud between apices of L 2 and L 3, originating a short distance beyond L 2 and extending an equal distance beyond L 3 except at the wing margin where the clouding is but slightly continued beyond L 3. The cloud thus forms a rough triangle of which the wing margin is

the longest side. Costal index about 4.0; 4th vein index about 1.38; 4c index about 0.56; 5x index about 1.4. Apex of first costal section with two well-developed bristles, the terminal one stouter and darker. Third costal section with heavy bristles on its basal 1/6.

The marginal wing cloud differs noticeably from that of *uninubes* in which the cloud is concentrated around the apex of L 2, originating slightly before this point and continuing laterally toward L 3 but never reaching it. The cloud is not directed toward the apex of L 3, although there is a small, indistinct cloud, unconnected with the larger one, at the apex of L 3.

Other characteristics, relationship, and distribution.

Distribution.—One male and one female were collected at the edge of the highland forest about 19 miles east of Morelia, Mich., Mexico, on 8–30–47 by Mr. F. A. Cowan and the writer. This pair died soon after reaching the laboratory.

Types.—Permanent slides were made of the wings and genitalia of this pair of flies, these slides constituting the only type material (No. 1796.13).

Relationship.—Belongs to the uninubes portion of the rubrifrons species group of the subgenus Drosophila.

Notes.—A single male specimen, similar to the above, was also taken by us near Morelia, but died shortly after capture. Study of the pinned specimen, however, shows that it differs from *nubiluna* in several respects. This male was yellowish brown in color, was not hunch-backed, and had an abdominal pattern different from either *uninubes* or *nubiluna*. The bands of the abdominal tergites were strongly expanded on either side of the interruption, reaching the previous segment, so that the series of yellow interrupted areas formed a more or less continuous line down the mid-region. The interruptions were rather narrow, and the bands continued to the margin without further expansions.

A description of the wings is as follows: Wings with a light brown cast, veins darker. Both crossveins with light clouds, that of the anterior crossvein very faint. A larger, more prominent cloud at apex of L 2, originating a short distance before the apex and extending a shorter distance beyond it, the major portion extending back along the vein and laterally toward L 3, reaching about 2/3 of this distance. Costal index about 4.6; 4th vein index about 1.2; 4c index about 0.45; 5x index about 1.3. Apex of first costal section with two prominent bristles, the terminal one stouter and darker. Third costal section with heavy bristles on its basal 1/6.

In shape, the marginal wing cloud of this specimen resembles that of *nubiluna* while its position is approximately that of *uninubes*. Although no distinguishing name is being applied to this individual, in the opinion of the writer it probably represents still a third member of the uninubes complex. Slide mounts have been made of the wings, antennae and abdomen (No. 1796.18).

17. *annulimana species group*

This group has recently been established by Pavan and da Cunha (1947) for two previously known species and three new forms which they have described from Brazil. The known members are as follows:

D. annulimana Duda.
D. gibberosa Patterson and Mainland.
D. arassari da Cunha and Frota-Pessoa.
D. ararama Pavan and da Cunha.
D. arapuan da Cunha and Pavan.

Mention may also be made of a single male specimen, apparently belonging to this group (cf. Hsu, this bulletin), collected by G. B. Mainland at Sedeño Canyon, Jalapa, Vera Cruz, Mexico, in August, 1943. This individual, labeled "giant," was recorded among specimens of *mercatorum* and hence may be assumed to have had a spotted pattern on the thorax. The writer found this individual in the pinned collection of the laboratory at which time the specimen was in very poor condition. The wings were dark but not noticeably clouded; costal index: 3.46, 4th vein index: 1.4, 5x index: 0.9. The third costal section had heavy bristles on its basal half. The thorax was dark tan, the abdomen yellowish, each segment with a dark posterior band, narrowed in midline and broader on each side. The bands were distinctly lighter on posterior tergites. In this connection it is of interest to compare Pavan and da Cunha's statement that in *D. ararama* there is a greater darkening on anterior tergites.

18. *melanderi species group*

This new group contains the following two known species:

D. melanderi Sturtevant.
D. magnafumosa Stalker and Spencer.

19. *bizonata species group*

This new group, erected by Tan, Hsu, and Sheng (this bulletin), has the following members:

D. bizonata Kikkawa and Peng.
D. heterobristalis Tan, Hsu, and Sheng.
D. meitanensis Tan, Hsu, and Sheng.

20. *guaraní species group*

On the basis of a careful cytological and morphological study, King (1947a; 1947b) recommends the following arrangement for the members of the group:

Sub-group a.

D. guaraní Dobzhansky and Pavan.
D. guarú Dobzhansky and Pavan.
D. subbadia Patterson and Mainland (T).

Sub-group b.

D. guaramunú Dobzhansky and Pavan.
D. griseolineata Duda.
D. guarajá King.

According to Dobzhansky and Pavan (1943), *D. ornatifrons* Duda probably belongs to this group also.

Species unclassified as to grouping

For the purposes of this paper it may be assumed that those species not listed previously must belong to this unclassified section.* We will include in this section the descriptions of two new species whose relationships are not known at present.

Drosophila fragilis. sp. nov.

External characters of imagines.

♂, ♀. Antennae light brown. Face and front pale tannish yellow, orbits and ocellar triangle slightly darker tan. No differentiated proclinate orbital, the middle orbital but slightly developed, appearing as an enlarged hair; posterior reclinate large, about 6–7 times length of middle one. One prominent oral, second thin, about ½ length first. Carina very pale, evenly rounded below. Palpi pale with but one prominent bristle. Cheeks pale yellow, their width about 1/6 greatest diameter of eyes. Eyes bright red, with light colored pile.

Acrostichals in 6 rows; no prescutellars. Anterior scutellars divergent. Mesonotum light tannish brown, rather shiny, without markings. Scutellum tannish brown. Pleurae pale yellow. Halteres pale, brownish distally. Posterior sternopleural quite pronounced, the other two much thinner, the anterior one about 5/8 length of posterior. Legs pale yellow, without markings. Apical bristles on first and second tibiae, preapicals on all three.

Female abdomen yellow, first two segments with brown to blackish-brown apical bands, about half width of the tergite, ending abruptly at or slightly before the angle; band of first tergite slightly lighter in midline. Apical band on third complete tergite narrower, ending less abruptly and less obviously before reaching the angle, and expanded in the midline to form a rather wide basal connection with the previous segment. Pattern of last two tergites consists only of the midline connection, the bands extending very little or not at all toward the angle. Abdominal banding of male same as the female on first two tergites, the following three with a midline connection, becoming progressively wider on terminal segments. On the third complete tergite the main band dwindles toward the edge but continues to the angle; the band dwindles more quickly on the fourth but a small apical portion continues to the angle; on the fifth the midline connection and apical bands are fused, forming

*The following species, which could not logically be placed in the text, are the remaining forms whose types are maintained by this laboratory: *Leucophenga paludicola, L. pulcherrima, D. ponderosa, D. pollinospadix, D. macropolia, D. crassa, D. bipunctata, D. setapex, D. castanea.*

a large, black central spot, narrowing toward the margin. The external male genitalia are figured by Hsu (this bulletin).

Wings with a slight brownish cast, veins darker. Both crossveins with narrow, pale brown clouds. Costal index about 4.1; fourth vein index about 1.5; 4c index about 0.61; 5x index about 1.3. Apex of first costal section with but a single large bristle. Third costal section with heavy bristles on its basal 1/6.

Length body, male (in pinned specimen) : 2.5 mm.; wings: 2.8 mm.
Female: 2.8 mm.; wings: 3.0 mm.

Internal characters of imagines.

Testes creamy white, with about 4 large, tight inner coils surrounded by 7–8 thin, tight outer coils. Ejaculatory sac with two prominent posterior diverticula, similar in shape to those of *D. cardini*, figured by Patterson (1943: 179), those of *fragilis* being somewhat shorter and stouter.

Spermathecae large, pear-shaped, only slightly chitinized, appearing yellowish. Parovaria also large with long stalks. Ventral receptacle quite long, with 80–100 tight coils.

Other characteristics, relationship, and distribution.

Distribution.—The only record is one male and one female captured by the writer and Mr. F. A. Cowan along a stream about one mile south of Atlixco, Puebla, Mexico, on 9–5–47.

Types.—Holotype male, one paratype female and four paratype males, as well as slide mounts of wings and genitalia of both sexes (No. 1802.21).

Relationship.—The complete absence of a proclinate orbital is strongly suggestive of the genus *Microdrosophila* Malloch. Other characters given for this genus, however, are not present in this species. On the other hand, since *Microdrosophila* was established for the single species, *M. quadrata* Sturtevant, it seems possible that many of the characters cited as generic are in reality specific characters of this species and that *D. fragilis* will, in reality, fit the characters of the genus when they are better known and defined.

Notes.—The original female laid many eggs on culture media and a fair number of first generation flies were secured. These failed to breed further, however, and were eventually used in preparing the description and setting up the type material. The name refers to its exceptional fragility as noted in the laboratory, every fly observed having numerous bristles broken off, large areas of the wings lost, etc. Not a single specimen was found with an intact arista when the flies were taken for description.

Drosophila triangula, sp. nov.

External characters of imagines.

♂, ♀. Arista with about 10 branches, 3 below in addition to the terminal fork. Antennae tannish brown. Front and orbits tannish brown, ocellar triangle slightly lighter. Middle orbital about 1/4 length anterior

which is about ¾ length posterior. One prominent oral, second undeveloped. Palpi pale. Carina widened below, rounded and not sulcate. Cheeks pale yellow, their width about 1/6 greatest diameter of eyes. Eyes bright scarlet with light colored pile.

Acrostichals in 6 rows, slightly irregular; no prescutellars. Anterior scutellars widely divergent. Mesonotum tannish brown, without markings. Scutellum brown. Pleurae pale yellowish brown, halteres pale. Middle sternopleural about as long as anterior which is about ¾ length of posterior and noticeably thinner. Legs pale, yellow; apical bristles on first and second tibiae, preapicals on all three; apicals and preapicals of second tibiae quite stout, black.

Abdomen of female yellow, each tergite with an apical black band, widely interrupted medianly. Bands are expanded basally on both sides of the interruption, progressively less so on terminal segments. The bands continue laterally, about 1/3 the width of the tergite, becoming progressively fainter as they approach the margin. On the last two tergites they disappear at the angle, leaving two pairs of black triangles adjacent to the interruption. In the male the bands diminish toward the margin more rapidly, failing to reach the margin of the tergites. On the last complete tergite the median interruption is scarcely visible so that the entire central area as far as the angle appears black. Two triangular black spots, as described for the female, are visible on the previous segment. In both sexes the sternites are pale.

Wings with a slight brownish cast, veins dark. Posterior crossvein with a faint narrow cloud. Costal index about 3.5; fourth vein index about 1.2; 4c index about 0.6; 5x index about 0.9. Apex of first costal section with but one prominent bristle. Third costal section with heavy bristles on its basal ¼.

Length body, male (in pinned specimen): 3.0 mm.; wings: 3.5 mm.
Female: 4.0 mm.; wings: 4.5 mm.

Internal characters of imagines.

Testes pale, with a very slight yellowish cast; each consists of about 3 outer and 5 inner coils. Ejaculatory sac with two short, S-shaped diverticula, similar in appearance to those figured for *D. macrospina* (Patterson, 1943: 113).

Spermathecae with large, weakly chitinized centers. Ventral receptacle elongate, with about 30 large but tight coils.

Other characteristics, relationship, and distribution.

Eggs.—With four filaments, the anterior pair about ½ length of posterior pair and much thinner. Posterior pair are at least 1/3 longer than length of the egg itself. Females deposited the eggs on the glass along the side of the vial, very few being observed on the food mass.

Puparia.—Anterior horns of puparia rather short, with about 17 branches.

Distribution.—Four individuals of this new species were taken by the writer and Mr. F. A. Cowan about 19 miles east of Morelia, Mich., Mexico,

on 8–30–47. A number of eggs were laid in the laboratory which resulted in about 17 puparia. Most of these, however, failed to expand the anterior spiracles and adults failed to emerge. A total of 6 first generation flies were obtained but these failed to breed and were used in preparing the description and in setting up the types.

Types.—Holotype male and 4 paratype females, as well as slide mounts of wings, genitalia, anterior spiracles of puparia and larval cephalopharyngeal skeletons (No. 1796.9).

Relationship.—Belongs to the subgenus *Drosophila.*

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