

VII. Notes on the Taxonomy, Morphology, and Distribution of the Saltans Group of *Drosophila*, with Descriptions of Four New Species

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INTRODUCTION

The genus *Drosophila* includes several cases of sibling species—forms so similar that it is almost impossible to distinguish them on the basis of external morphology. Their specific identities, nevertheless, are perfectly well established. In these cases the general method for identification is cytological examination and test crosses. The morphology of the male genitalia has been applied in the identification of certain cases, such as *melanogaster-simulans* by Sturtevant (1921) and Salles (1947), the species of the *annulimana* group by Breuer and Pavan (1950) and of the *willistoni* group by Malogolowkin (1952), Spassky (1957) and Wheeler and Magalhaes (this bulletin).

In the saltans species group, Spassky (1957) studied two sibling species, and Magalhaes and Bjornberg (1957) studied 13 species, including several siblings. Five nominal species, at that time, were not available to these authors: *saltans*, *earlei*, *pilifacies*, *pulchella* and *cordata*. Except for the latter, the descriptions were not detailed enough to distinguish them from other species, and these species have not been reported in the collection records from Mexico and Central America although several trips into these areas have been made by the members of the genetics group of The University of Texas. These facts led us to believe that these species have been currently recognized under synonymous names rather than their original ones. In order to clarify this point the author has visited the U.S. National Museum collection (U.S.N.M.) in Washington, D.C., and examined the type series of some of these species. It was also possible to study some type specimens belonging to the American Museum of Natural History (A.M.N.H.), New York City, and some from the collection of the Dresden Museum, through the courtesy of Dr. R. Hertel. The results of the examination of these specimens are reported below. In addition we are including the known geographical distributions of the species of this group, and the descriptions of four new species which we found when we examined the material at The University of Texas. The type specimens of the new species have been deposited in The University of Texas collection in Austin.

Acknowledgments: We want to thank Dr. W. W. Wirth who made the U.S.N.M. specimens available for study; Mr. Geza Knipfer who helped to prepare the maps and made the final copies of most of the drawings; Mr. Nelson Buck for agreeing to include the description of *D. septentriosaltans* in this paper; and Dr. Harry M. Miller, Jr., and the Rockefeller Foundation for arranging the fellowship and financing the visit to Washington.

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We also want to thank Dr. M. R. Wheeler for helping to arrange the visit to the National Museum, assisting in the examination of the types, permitting us to use his collection records and the specimens in The University of Texas collection, and for assisting in the preparation of this manuscript; and to Dr. Wilson S. Stone of the Genetics Foundation for his generous hospitality during our research leave at the University, we wish to express our special gratitude.

THE SALTANS GROUP

The saltans group was established by Sturtevant (1942) as a member of the subgenus *Sophophora*; according to his definition of the group it included only the dark species and later it was extended to include yellow forms by Magalhaes (1956). The group was divided by Sturtevant (1942) into two subgroups: "(a) grayish marking on the mesonotum; minute hairs present below carina; (b) no gray mesonotal pattern; no minute hairs below carina." This subdivision later lost its significance because species without a gray mesonotal pattern but with minute hairs below the carina were found by Pavan and Magalhaes (1950) and by Magalhaes (1956). Magalhaes and Bjornberg (1957) divided the group into 5 subgroups, basing them on the characteristics of the male genitalia and external morphology of the body. Presently we are keeping the same subdivisions but are changing the name of the subgroups; we are using the name of one of the species instead of letters to name each subgroup.

Nineteen species of this group are now known, four of them previously undescribed. For quick reference, each species has been assigned a number which is used in the key and in the figures illustrating the key characters, as well as in the following discussion. The species are as follows:

- | | |
|---|---|
| 1. <i>saltans</i> Sturtevant | 9. <i>milleri</i> Magalhaes n. sp. |
| = <i>sellata</i> Sturtevant | 10. <i>rectangularis</i> Sturtevant |
| 2. <i>lusaltans</i> Magalhaes n. sp. | 11. <i>parasaltans</i> Magalhaes |
| 3. <i>prosaltans</i> Duda | 12. <i>subsaltans</i> Magalhaes |
| 4. <i>nigrosaltans</i> Magalhaes n. sp. | 13. <i>pulchella</i> Sturtevant |
| 5. <i>septentriosaltans</i> Magalhaes and | 14. <i>elliptica</i> Sturtevant |
| Buck n.sp. | 15. <i>emarginata</i> Sturtevant |
| 6. <i>austrosaltans</i> Spassky | 16. <i>neoelliptica</i> Pavan and Magalhaes |
| 7. <i>pseudosaltans</i> Magalhaes | 17. <i>neosaltans</i> Pavan and Magalhaes |
| 8. <i>sturtevanti</i> Duda | 18. <i>cordata</i> Sturtevant |
| = <i>earlei</i> Sturtevant | 19. <i>neocordata</i> Magalhaes |
| = <i>pilifacies</i> Malloch | |
| = <i>biopaca</i> Sturtevant | |

These species may be arranged in subgroups as follows:

1. Subgroup *saltans*. Dark species; pattern on the mesonotum and hairs below carina present; undermargin of the male genital arch with a horn-like process; forcipes small, semi-elliptical, with 20–25 teeth; penis with a pair of pincers. Species: *saltans*, *lusaltans*, *prosaltans*, *nigrosaltans*, *septentriosaltans*, *austrosaltans*, and *pseudosaltans*.

2. Subgroup *sturtevanti*. Species with pattern on the mesonotum and hairs

below carina; penis without pincers. Species: *sturtevanti*, *milleri* and *rectangularis*.

3. Subgroup parasaltans. Yellow species, hairs below carina present; genital arch with one or two horn-like processes on the anterior region of the undermargin. Species: *parasaltans*, *subsaltans* and *pulchella*.

4. Subgroup elliptica: Dark species (excepting *D. emarginata* from Peru); large cylindrical penis, with a pair of lateral pincers. Species: *elliptica*, *emarginata*, *neoelliptica* and *neosaltans*.

5. Subgroup cordata. Dark species without mesonotal pattern; small hairs below carina absent; penis with a cylindrical process, paired, fused to the apex of the apodeme. Species: *cordata* and *neocordata*.

GEOGRAPHICAL DISTRIBUTION

We present here, for each species, a list of the places where it has been collected. Our data come from the identification of pinned flies and of living stocks in The University of Texas collection; the records of collecting trips of members of the Genetics Foundation of The University of Texas from 1942 to 1959; the data present in Patterson and Wagner (1943) for the distribution in Mexico and Central America, Dobzhansky and Pavan (1943; 1950) and Pavan (1950; 1952) for South America, as well as the information in our own species descriptions. Almost all points of collection are shown on Plates I and II.

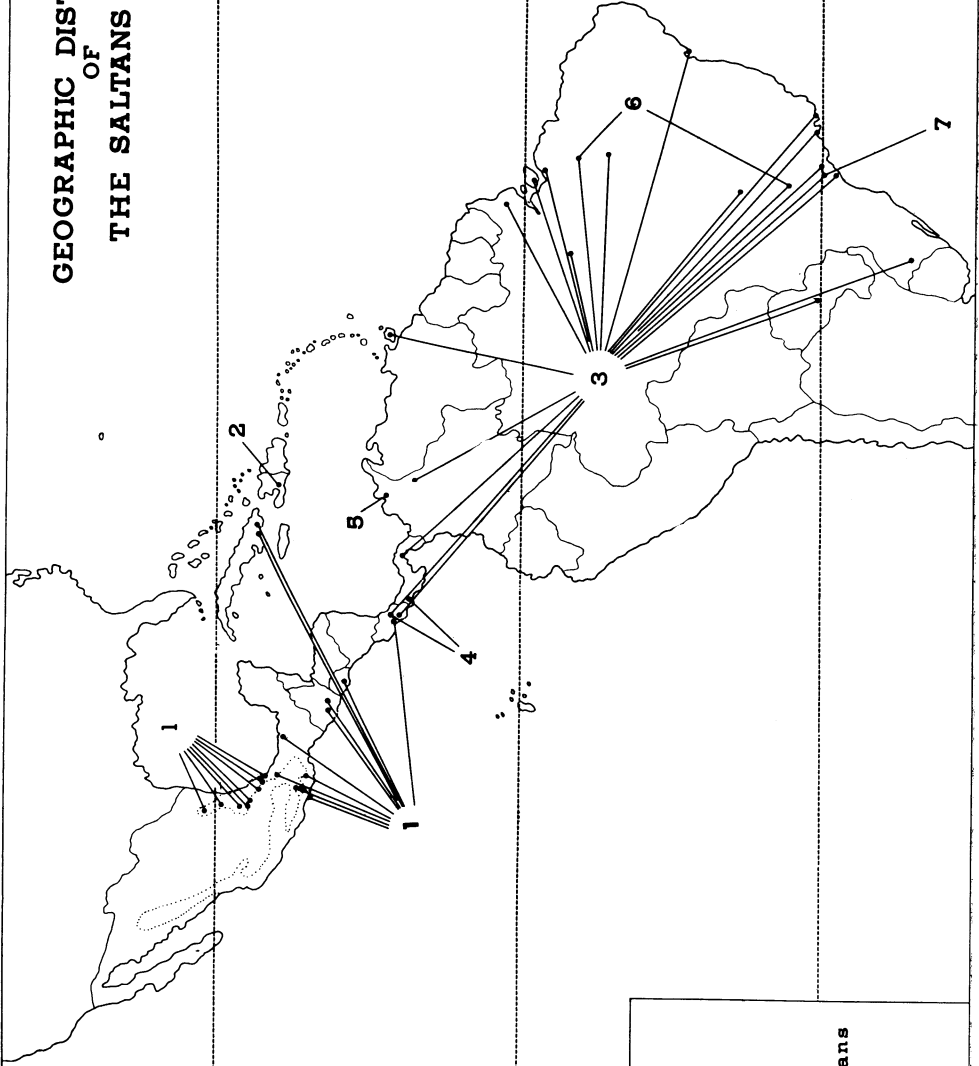
Flies from the saltans group are not very frequently found on baits. Usually when one species is present, it is generally a small number, sometimes only one fly. This does not necessarily mean, however, that the population size is very small. The number of flies on this basis depends on the attractiveness of the baits; this probably differs from species to species and it is impossible to get any idea about the true population size. Nevertheless the data show quite well the geographical distribution of these species. They are exclusively found in the Nearctic and Neotropical regions, preponderantly in the latter one. Patterson and Stone (1951) mention that *elliptica* is present only in the Nearctic region and *rectangularis* in both. We are not sure about the identification of *rectangularis* from the Nearctic region and we prefer to consider this form as belonging only to the Neotropical region. From our data *saltans* and *sturtevanti* occur in both regions. All the others have been found only in the Neotropical region.

Three species are found only in the Caribbean islands: *lusaltans*, *milleri*, and *pulchella*, suggesting that speciation has occurred on these islands. The others are found on the continent or on both. The most widespread species in the saltans group is *D. sturtevanti*, occupying almost all the range of distribution of the group. There are no special correlations among the subgroups and their geographic distribution, on the contrary, very closely related forms sometimes show a big gap in their distribution revealing either the incompleteness of the present data or, perhaps, different geographic distributions in the past.

1. *Drosophila saltans* Sturtevant

D. saltans Sturtevant 1916. Ann. Ent. Soc. Amer. 9: 328.
= *D. sellata* Sturtevant 1942. Univ. Texas Pub. 4213: 39.

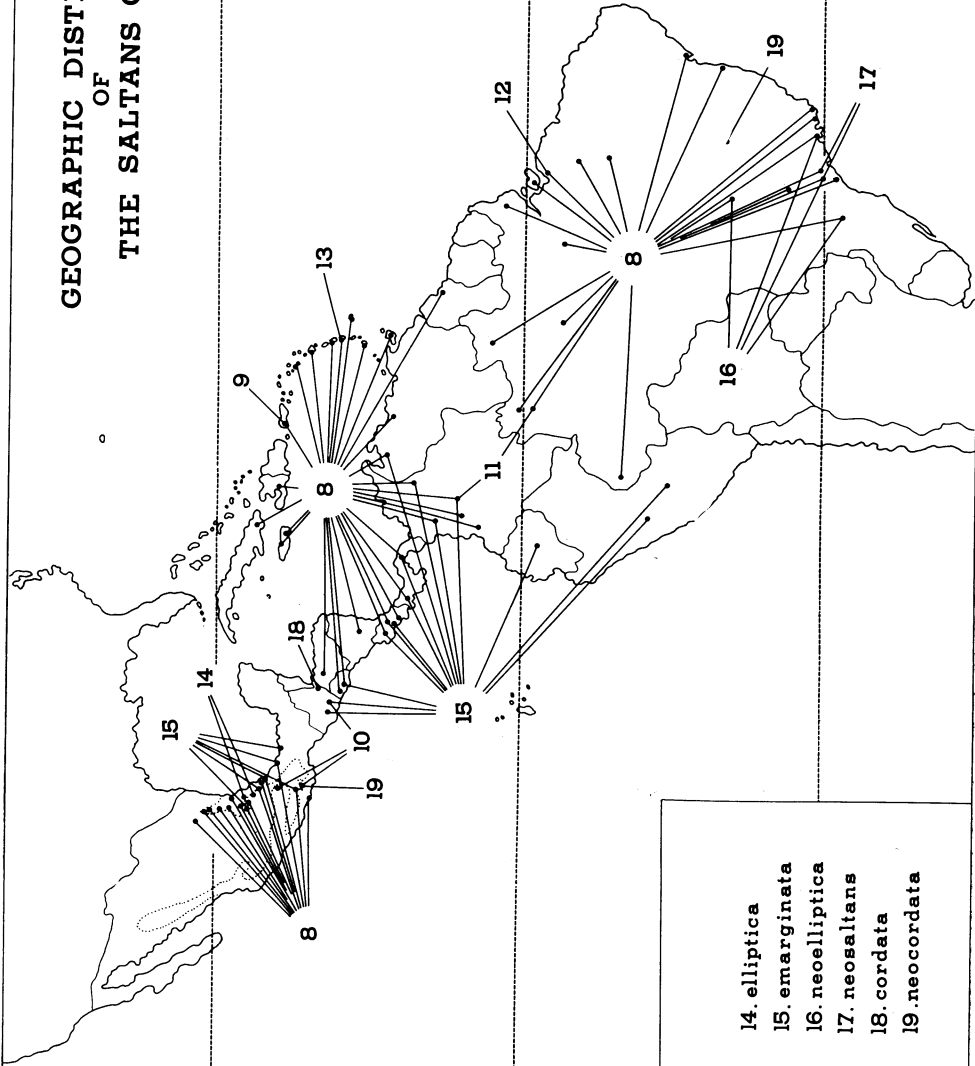
**GEOGRAPHIC DISTRIBUTION
OF
THE SALTANS GROUP**



DROSOPHILA:

- 1. saltans
- 2. lusaltans
- 3. prosaltans
- 4. nigrosaltans
- 5. septentriosaltans
- 6. austrosaltans
- 7. pseudosaltans

GEOGRAPHIC DISTRIBUTION
OF
THE SALTANS GROUP



DROSOPHILA:

- 8. sturtevanti
- 9. milleri
- 10. rectangularis
- 11. parasaltans
- 12. subsaltans
- 13. pulchella
- 14. elliptica
- 15. emarginata
- 16. neoelliptica
- 17. neosaltans
- 18. cordata
- 19. neocordata

Not = *D. prosaltans* Duda 1927. Arch. Naturg. 91A12 (1925): 164.

Dobzhansky and Pavan (1943) considered *sellata* to be a synonym of *prosaltans*, and they have been followed in this by most later authors. The male genitalia of *sellata* were described by Spassky (1957) who considered it to be a race of *prosaltans*. A more detailed study of the genitalia by Magalhaes and Bjornberg (1957) revealed some distinct differences between the two, and the authors concluded that *sellata* and *prosaltans* were distinct species. Hybridization studies now being carried out by the present author support this conclusion. Thus *D. prosaltans* remains as a valid species and is distinct from the species named *sellata*.

Four specimens from the type series of *D. saltans* have been examined: (1) Type male, No. 24129, A.M.N.H., labelled "Stock from Guantanamo, Cuba, V 1914" (i.e., May 1914). (2) Paratype female, No. 50010, U.S.N.M., labelled "bred pineapple, Guantanamo, Cuba, 1.13.14" (i.e., January 13, 1914). (3) Paratype female, A.M.N.H., with the same labels as the holotype male. (4) "Metatype" female, A.M.N.H., Panama, R.P., February–March, 1915.

Two of these specimens, paratype No. 50010 and the metatype do not agree with the type of *saltans*, but they do match *D. sturtevantii* very well. It is to be noted that the "metatype" came from an entirely different locality, and that the paratype did not come from "stock" but was "bred from pineapple," and also bears a different date.

The holotype and the other paratype, both from "stock", are clearly not *sturtevantii* but represent a different species which we identify as being the same as *sellata* on the basis of the male genitalia. In his original description of *saltans*, Sturtevant (1916, *op. cit.*) did not mention the characteristic median spot of the mesonotum, but in looking at the type one can see that the mesonotum is folded inward precisely where the spot should be, thus making it very difficult to see. No doubt exists that *sellata* and *saltans* are the same species, and different from *prosaltans*. The name *saltans* has priority, having been published long before the name *sellata*.

Geographical distribution: MEXICO: Hidalgo and Guemes in Tamaulipas; Huichihuayan, Matlapa, and Tamazunchale in San Luis Potosi; Jalapa, Cordoba, Puente Nacional, Veracruz, and Minatitlan in Veracruz; Zumpango, Chilpancingo, and Zopilote Canyon in Guerrero. GUATEMALA: Antigua and Guatemala City. CUBA: Guantanamo and Santiago de Cuba. EL SALVADOR: San Salvador. COSTA RICA: San José.

2. *Drosophila lusaltans* Magalhaes, new species

External characters of imagines.

♂, ♀. Arista with 10 branches. Antenna blackish brown. Front velvety reddish brown, the orbits and ocellar triangle black. Anterior orbital bristle nearly as long as the posterior one, middle orbital about 1/3 length anterior. Two prominent oral bristles, the second nearly as long as the first. Face blackish gray; carina narrow, black at its base and with minute hairs below. Cheeks almost black; their greatest width about 1/7 greatest diameter of the eyes, the latter dark red with black pile.

Acrostichal hairs in 6 regular rows; no prescutellars. Anterior scutellars divergent. Mesonotum pollinose dark grayish brown with blackish longitudinal stripes as follows: a short one in the middle of the mesonotum; a long pair just within the dorsocentral rows, and another just outside the dorsocentral rows broken in three spots. Scutellum with the same color as the mesonotum, and lighter lateral edges. Pleura black; anterior sternopleural $1/5$ length posterior. Legs brown, coxae and femora black; apical bristle on the second tibiae, preapical on all three. Halteres whitish.

Abdomen black, shining. Tergites 2-5 with a yellow band on the anterior margin of each, the bands interrupted in the middle and failing to reach the lateral edges of the tergite. Sixth tergite of the female with the same yellow anterior band and with a median rough area.

Wings with two prominent bristles at the apex of the first costal section; third costal section with heavy bristles on its basal $2/5$. Wing vein indices as follows: Costal index 2.0, ♀, 2.0, ♂; 4th vein index 2.1, ♀, 2.1, ♂; 5x index 1.6, ♀, 2.5, ♂. Body length, ♀, 3.0 mm, ♂, 2 mm.; wing length, ♀, 2 mm., ♂, 1.5 mm.

Other characteristics: Two anterior and two posterior branches of the Malpighian tubes with free ends. Testes yellow, with $3\frac{1}{2}$ inner and $3\frac{1}{2}$ outer coils. Ventral receptacle M-shaped as in other members of the saltans group. Spermatheca (Figure 1) nearly spherical, without apical invagination; a collar at base. The larvae skip. Puparium brown, the anterior spiracle with 8 branches.

Chromosomes: The metaphase plate shows two pairs of V's and one pair of rods.

Male genitalia: Genital arch as in *prosaltans*; hypandrium as in Figure 2, and penis as in Figure 3.

Relationship: Belong to the saltans subgroup of the saltans group.

Geographical distribution: HAITI: Petionville. Collected by Drs. W. B. Heed and H. L. Carson; July, 1959.

3. *Drosophila prosaltans* Duda

D. prosaltans Duda 1927. Arch. Naturg. 91A12 (1925): 164.

Geographical distribution: COSTA RICA: San Isidro del General and Turrialba. PANAMA: Balboa. TRINIDAD: Sangre Grande. COLOMBIA: Bucaramanga. BRAZIL: Ferreira Gomes in T. F. do Amapa; Marajó Island, Fordlandia, and Belém in Pará; Carolina and Imperatriz in Maranhão; Salvador in Bahia; Palma in Goiás; Angra dos Reis and Rio de Janeiro City in Rio de Janeiro; Pirassununga, Mogi das Cruzes, Cantareira, Bertioga, Itanhaen, and São Sebastiao in São Paulo; El Dorado in R. G. do Sul. PARAGUAY: Hohenau (Type locality).

The type female, loaned to us by the Dresden Museum, is somewhat paler, especially the legs and the mesonotal pattern, than described by Duda; however it may have lost some color since he saw the specimen about thirty-six years ago. The velvety tergital area is well preserved, and, except for the paleness, the type seems to represent the same species now being considered as *prosaltans*.

4. *Drosophila nigrosaltans* Magalhaes, new species

External characters of imagines.

Arista with 8-9 branches. Antenna blackish brown, third segment black. Front

velvety reddish brown, the orbits and the ocellar triangle black with silvery pollinosity. Anterior orbital bristle nearly as long as posterior one; middle orbital about $1/2$ length anterior. Three prominent oral bristles, the third about $2/3$ length of the other two. Face dark gray, the carina narrow and short, with some long hairs below. Cheeks almost black, their greatest width about $1/5$ greatest diameter of the eyes. Proboscis blackish. Eyes dark red with short black pile.

Acrostichal hairs in 6 regular rows; no prescutellars. Anterior scutellars slightly divergent. Mesonotum pollinose, dark grayish brown with blackish longitudinal stripes as follows: a short one in the middle of the mesonotum; a long pair just inside the dorsocentral rows, and another just outside the dorso-central rows and interrupted at the transverse suture. Scutellum blackish brown, with lighter brown lateral edges. Pleura black. Legs black, the tibiae and tarsi lighter brown. Apical bristle on the second tibia, preapicals on all three. Halteres whitish.

Abdomen shining black; tergites 2-5 with silvery pollinose halfmoon shaped areas on each side of the median line near the anterior margin; sixth tergite all black, that of the female with a large rectangular, rough, median mark.

Wings brownish; apex of the first costal section with two bristles; third costal section with heavy bristles on its basal $1/3$. Wing indices as follows: Costal index 2.1, ♀, 2.0, ♂; 4th vein index 2.2, ♀, 2.0, ♂; 5x index 1.7, ♀, 2.4, ♂. Body length, ♀, 2.8 mm., ♂, 2.0 mm.; wing length, ♀, 2.0 mm., ♂, 1.8 mm.

Other characteristics: The two anterior and two posterior branches of the Malpighian tubes with free ends. Testes yellow, with $3\frac{1}{2}$ inner and $3\frac{1}{2}$ outer coils. Ventral receptacle M-shaped, as in other members of the group. Spermatheca (Figure 4) nearly spherical and with a strong apical wrinkled invagination. Egg with two filaments, expanded distally. The larvae skip. Puparium reddish brown, the anterior spiracle with about 7-8 branches. The chromosomes consist of two pairs of V's and one pair of rods.

Male genitalia: Genital arch as in *prosaltans*; hypandrium as in Figure 5 and penis as in Figure 6.

Relationship: Belongs to the saltans subgroup.

Geographical distribution: The species has been collected at Boquete, PANAMA (Type locality) by Drs. M. Wasserman and W. B. Heed in 1958. Also found in Turrialba, COSTA RICA.

5. *Drosophila septentriosaltans* Magalhaes and Buck, new species

Arista with 9-10 branches, usually 9. Antenna grayish brown, third segment darkened. Front velvety brown. Middle orbital $1/3$ other two; two prominent and equally long oral bristles; face darkened below carina, the latter narrow and with minute hairs below. Cheeks gray, their greatest width about $1/6$ greatest diameter of eye, the latter red with short, black pile.

Acrostichal hairs in 6-8 rows; no prescutellars. Anterior scutellars parallel. Mesonotum brownish gray, pollinose, with about the same darkened pattern as described for the two former species. Scutellum dark brown, pollinose, with black spots around the bristle bases. Pleura black; anterior stenopleural $1/2$ length posterior. Legs brown, the coxae and femora more blackish; apical bristles on

second tibiae, preapicals on all three. Halteres whitish.

Abdomen as described for the two former species, with tergites 2-5 black, shining, each with a yellow band on the anterior margin, the bands interrupted in the middle and failing to reach the lateral edges of the tergites. Female sixth tergite with a median rough area.

Wings clear; two prominent bristles at apex of first costal section; third costal section with heavy bristles on its basal 2/5. Wing vein indices as follows: Costal index 1.8, ♀, 1.6, ♂; 4th vein index 2.2, ♀, 2.3, ♂; 5x index 1.9, ♀, 1.8, ♂. Body length, ♂, 1.8 mm., ♀, 2.4 mm.; wing length, ♂, 2.0 mm., ♀, 1.8 mm.

Other characteristics: Two anterior and two posterior branches of the Malpighian tubes with free ends. Testes yellow, with 3½ inner and 3½ outer coils. Ventral receptacle M-shaped, as in other members of the saltans group. Spermatheca (Figure 7) nearly spherical, with a lateral invagination; the invagination is curved. Egg with two filaments. The larvae skip. Puparium brown, the anterior spiracle with about 8 branches. The chromosomes consist of two pairs of V's and one pair of rods.

Male genitalia: Genital arch as in *prosaltans*; hypandrium as in Figure 8 and penis as in Figure 9.

Relationship: Belongs to the saltans subgroup.

Geographical distribution: Collected at Sevilla, north of Aracataca, COLOMBIA, in December, 1955, by Dr. W. B. Heed.

6. *Drosophila austrosaltans* Spassky

D. austrosaltans Spassky 1957. Univ. Texas Pub. 5721: 57.

Geographical distribution: Pirassununga, São Paulo (Type locality); Carolina and Imperatriz, Maranhão, BRAZIL.

7. *Drosophila pseudosaltans* Magalhaes

D. pseudosaltans Magalhaes 1956. Rev. Brasil. Biol. 16: 273.

Geographical distribution: Cantareira, São Paulo, BRAZIL.

8. *Drosophila sturtevantii* Duda

D. sturtevantii Duda 1927. Arch. Naturg. 91A12 (1925): 167.

= *D. earlei* Sturtevant 1916. Ann. Ent. Soc. Amer. 9: 329.

= *D. pilifacies* Malloch 1926. Proc. U.S. Nat. Mus. 68 (Art. 21): 29.

= *D. biopaca* Sturtevant 1942. Univ. Texas Pub. 4213: 37.

Although the name *sturtevantii* is a junior synonym of both *earlei* and *pilifacies*, the best interests of science are served by continuing the use of the name *sturtevantii* since this is the only name which has been used for this species in numerous articles in the fields of taxonomy, geographic distribution, genetics, and evolutionary cytology.

An examination of the type female of *D. pilifacies* Malloch (Type No. 28464, U.S.N.M., San Mateo, Costa Rica) shows clearly the pair of lateral opaque areas on the sixth tergite which are quite characteristic for this species. In all other characteristics also, this specimen agrees with the species which has been known as *sturtevantii* for many years.

D. biopaca Sturtevant was placed as a synonym of *sturtevanti* by Dobzhansky and Pavan (1943). The type has not been re-examined since there is no reason to doubt the synonymy.

Three specimens from the type series of *D. earlei* have been examined: (1) Type male, No. 24146, A.M.N.H., Herradura, Cuba, January 28, 1915. (2) Paratype female, No. 49999, U.S.N.M., Herradura, Cuba. (3) Metatype male, A.M.N.H., Panama, R.P., February–March, 1915. All of the characteristics of the holotype male agree with the well-known *D. sturtevanti*. Unfortunately, a complete examination of the male genitalia has not been possible, but the visible structures, especially the large, pale forceps and the large pregenital plate, agree very well with the species called *sturtevanti*. The paratype female is clearly the same as *sturtevanti*. The male “metatype”, coming from an entirely different locality than the holotype, is, however, the same species.

We have also been able to examine the type female of *sturtevanti*, from Bolivia (from the Dresden Museum), and we have no doubt as to the identity of this species. Thus only one species seems to be involved in the complex of names: *earlei*, *pilifacies*, *biopaca* and *sturtevanti*.

The redescription of *D. sturtevanti* by Dobzhansky and Pavan (1943) is the most complete description of the species; the male genitalia was described by Magalhaes and Bjornberg (1957).

Geographical distribution: MEXICO: Saltillo in Coahuila; Hidalgo, Guemes, Llera, C. Mantes, and Tampico in Tamaulipas; Matlapa, Huichihuayan, and Tamazunchale in San Luis Potosi; Jalapa, Puente National, Veracruz, and S. A. Tuxtla in Veracruz; Acapulco and Zumpango in Guerrero. HONDURAS: La Lima. EL SALVADOR: Lago Coatepec, Puerto de La Laguna, La Palma, San Salvador. NICARAGUA: El Recreo. COSTA RICA: San José, Turrialba, San Mateo, La Lola and San Isidro del General. PANAMA: Barro Colorado, Canal Zone, and Balboa. CUBA. PUERTO RICO: El Yunque and Mayaguez. JAMAICA: Kingston and Ocho Rios. BARBADOS; ST. LUCIA; ST VINCENT; GRENADA; MARTINIQUE; HAITI; GUADELUPE. COLOMBIA: Medellin, Sevilla, Palmira, Villavicencio, and Bucaramanga. VENEZUELA: Merida, Maracay, Rancho Grande and Cumbre de Choroni Aragua. BRITISH GUIANA: Georgetown. BRAZIL: Mucajai in T. F. Rio Branco; Ferreira Gomes in T. F. do Amapa; Icana, Uaupés, Moura, and Manaus in Amazonas; Marajo I., Fordlandia, and Belém in Pará; Cruzeiro do Sul and Palmares in T. F. Acre; Carolina and Imperatriz in Maranhão; Anápoliz in Goias; Salitre, Catuni, Salvador and Ilhéus in Bahia; Angra dos Reis and Rio de Janeiro City in Rio de Janeiro; Mucamba, Prata, Pirassununga, Cantareira, Agua Funda, Mogi das Cruzes, Itanhaen, Bertioga, Vila Atlantica and S. Sebastiao in São Paulo. BOLIVIA: Mapiri (type locality).

9. *Drosophila milleri* Magalhaes, new species

External characters of imagines.

Male. Arista with 9–11 branches. Antenna brownish gray. Front brownish gray, darkened on the posterior margin. Orbits with silvery pollinosity and with dark spot on the base of the third orbital bristle. Ocellar triangle black with silvery pollinosity at the angles. The second orbital 1/2 other two. Two oral bristles of

the same length. Face and carina light brown; few hairs below carina. Cheeks darker than the face, their greatest width about $1/6$ the greatest diameter of the eyes. Eyes wine red.

Acrostichal hairs in 6 regular rows. No prescutellars. Anterior scutellars divergent. Mesonotum tan with almost black longitudinal stripes as follows: one broad pair inside of the dorsocentral rows and fused on the middle like an "H". Another stripe outside of the dorsocentral rows and interrupted at suture, with the upper part large and surrounding the humeri. Scutellum blackish brown with lateral edge tan. Pleura tan with two longitudinal blackish brown stripes, the upper one covering the propleura and part of the meta- and hypopleura, the second one on the upper part of the sternopleura. Anterior sternopleural bristle about $1/2$ the length of the posterior. Legs yellowish tan. Halteres whitish.

Abdomen yellowish. Tergites 2-5 with greyish brown basal bands expanded in the middle and laterally, being lighter in this lateral expansion. Sixth yellowish and without band. Female sixth tergite with a pair of lateral opaque areas. Wings clear; two prominent bristles at the apex of the first costal section; third costal section with heavy bristles on its basal $2/5$. Wing vein indices as follows: Costal index 2.1, ♀, 1.9, ♂; 4th vein index 2.1, ♀, 1.9, ♂; 5x index 1.6, ♀, 2.0, ♂. Body length, ♀, 3.2 mm., ♂, 2.5 mm.; wing length, ♀, 2.5 mm., ♂, 2.0 mm.

Other characteristics: Two anterior and two posterior branches of the Malpighian tubes with free ends. Testes whitish or pale yellow; 5-6 outer coils. Ventral receptacle M-shaped like in other species of the saltans group. Spermatheca (Figure 10) nearly spherical, without apical invagination; collar at base. The larvae skip. Puparium brown, the anterior spiracle with 9 branches.

Male genitalia very similar to *sturtevanti*; small differences in the penis (Figure 11).

Relationship: Belong to the *sturtevanti* subgroup of the saltans group.

Geographical distribution: El Yunque, PUERTO RICO; collector Dr. W. B. Heed, January, 1956.

10. ***Drosophila rectangularis*** Sturtevant

D. rectangularis, Sturtevant 1942. Univ. Texas Pub. 4213: 38.

Geographical distribution: Orizaba, Veracruz (type locality); Tixtla, Guerrero, MEXICO.

11. ***Drosophila parasaltans*** Magalhaes

D. parasaltans Magalhaes 1956. Rev. Brasil. Biol. 16: 276.

Geographical distribution: BRAZIL: Uaupés in Amazonas (type locality). COLOMBIA: Villavicencio.

12. ***Drosophila subsaltans*** Magalhaes

D. subsaltans Magalhaes 1956. Rev. Brasil. Biol. 16: 277.

Geographical distribution: BRAZIL: Belém, Pará.

13. ***Drosophila pulchella*** Sturtevant

D. pulchella Sturtevant 1916. Ann. Ent. Soc. Amer. 9: 327, *nom. nov.* for *bellula* Williston 1896, not Bergroth 1894.

This little known species was placed in the saltans group by Wheeler (1957). Sturtevant (1921), who had examined the cotypes of *bellula* Williston from the island of St. Vincent, also identified as this species a single female from Montserrat, Trinidad. This female (U.S.N.M. collection) has been examined; it clearly represents *D. sturtevanti* and does not agree with a cotype of *pulchella* (A.M. N.H. collection), now on loan at The University of Texas.

Geographical distribution: St. Vincent, B.W.I.

14. ***Drosophila elliptica*** Sturtevant

D. elliptica Sturtevant 1942. Univ. Texas Pub. 4213: 35.

Geographical distribution: MEXICO: Pachuca (type locality) and Chapulhuacan in Hidalgo.

15. ***Drosophila emarginata*** Sturtevant

D. emarginata Sturtevant 1942. Univ. Texas Pub. 4213: 36.

Geographical distribution: MEXICO: Jalapa, Huatusco, Cordoba, San Andres Tuxtla, San Juan, Cotopec and Xico in Veracruz; Tamazunchale in San Luis Potosi. GUATEMALA: Quirigua (type locality) and Guatemala City. EL SALVADOR: La Palma. COSTA RICA: San José, La Lola, Turrialba, and San Isidro del General. PANAMA: Boquete and Cerro la Campana. COLOMBIA: Medellin, El Recuerdo, Villavicencio, and Bucaramanga. VENEZUELA: Merida. ECUADOR: Santo Domingo de los Colorados. PERU: Urubamba and Tingo Maria (yellow form).

16. ***Drosophila neoelliptica*** Pavan and Magalhaes

D. neoelliptica Pavan and Magalhaes 1950. Bol. Fac. Fil. Cien. Letr. Univ. S. P. 86: 13.

Geographical distribution: BRAZIL: Anápolis in Goias; Jaguariaiva in Paraná; Angra dos Reis in Rio de Janeiro; Agua Funda in São Paulo.

17. ***Drosophila neosaltans*** Pavan and Magalhaes

D. neosaltans Pavan and Magalhaes 1950. Bol. Fac. Fil. Cien. Letr. Univ. S. P. 86: 16.

Geographical distribution: BRAZIL: Mogi das Cruzes and Cantareira in São Paulo.

18. ***Drosophila cordata*** Sturtevant

D. cordata Sturtevant 1942. Univ. Texas Pub. 4213: 34.

Geographical distribution: GUATEMALA: Quirigua (type locality).

19. ***Drosophila neocordata*** Magalhaes

D. neocordata Magalhaes 1956. Rev. Brasil. Biol. 16: 275.

Geographical distribution: MEXICO: Tixtla in Guerrero. BRAZIL: Montes Claros (type locality) in Minas Gerais.

NOTES ON COMPARATIVE MORPHOLOGY

Wheeler (1960) first described the vestigial remnants of the true first sternite in *Drosophila* species and the sensilla of these and other sternites. The sensilla of the first sternite and the sensilla of the seventh sternite of males have been observed in all of the species of the saltans group which were available for this study (Table 2). Vestigial plates of the first sternite are clearly present in some species, highly reduced in others, and seem to be completely absent in the rest. From our study it seems probable that in some species the presence or absence of vestigial first sternite plates may be a good specific character, but in others considerable variation occurs. Table 1 illustrates this for *D. sturtevantii*. The per-

TABLE 1
Presence of vestigial plates of first sternite in strains of *Drosophila sturtevantii*

		Number examined	Females Per cent with plates	Ratio	Number examined	Males Per cent with plates	Ratio
Mainland strains							
H 25.5	El Salvador	20	100.0	1:0	20	100.0	1:0
H 66.2	El Salvador	96	47.7	.9:1	42	76.2	3.2:1
H 50.3	Honduras	20	100.0	1:0	20	100.0	1:0
H 73.3	Costa Rica	20	65.0	1.8:1	20	85.0	5.7:1
H158.1	Costa Rica	38	7.9	.09:1	22	29.4	.42:1
H166.6	Costa Rica	50	4.0	.04:1	20	11.1	.12:1
H 79.1	Panama	40	14.2	.17:1	20	17.6	.21:1
H101.2	Colombia	20	42.1	.73:1	24	62.5	1.67:1
H103.6	Colombia	50	62.0	1.6:1	50	86.0	6.1:1
2374.4	Brazil	40	100.0	1:0	30	100.0	1:0
F ₁ of 2374 ♀ × 166 ♂		25	16.0	1.9:1	20	20.0	.25:1
Island strains							
H352.13	Jamaica	21	90.4	9.4:1	14	100.0	1:0
H254.8	Puerto Rico	12	0	0:1	21	9.5	.10:1
H252.16	Guadeloupe	63	85.7	5.9:1	37	86.0	6.1:1
H119.1	Barbados	..	0	0:1	..	0	0:1
H121.8	St. Lucia	..	100.0	1:0	..	100.0	1:0

centage presence in different geographic strains ranged from 100 through various intermediate values to complete absence, although the latter was observed only in strains from Puerto Rico (females only) and from Barbados (both sexes). There does not seem to be any geographic gradient for this character among the strains tested.

The stock of *emarginata* from Peru differs from the typical in several ways (Table 2), especially in body color, subcarinal hairs, and presence of vestigial plates of the first sternite. Hybrids between the two types were intermediate in body color, possessed subcarinal hairs and lacked vestigial sternite plates. In this intraspecific cross, then, the presence of subcarinal hairs appeared to be dominant to their absence, while the absence of vestigial first sternite plates seemed to be dominant to their presence. This relationship was not so clear, however, in a cross of *sturtevantii* females from Brazil (in which both sexes have well-developed sternite plates; see Table 1) to males from Costa Rica (stock H166.6, in which

TABLE 2

Comparison of certain morphological characters in species of the saltans group

Species	Characters*												
	1	2	3	4	5	6	7	8	9	10	11	12	13
saltans	+	+	+	—	+	+	0	0	153	59.4	38.9	30.8	20.1
prosaltans	+	+	+	—	+	+	0	0	155	50.3	32.5	31.8	20.7
austrosaltans	+	+	+	—	+	+	R	R	168	57	33.9	30	17.8
pseudosaltans	+	+	+	—	+	+	R	R	180	60	33.3	0	0
septentriosaltans	+	+	+	—	+	+	0	0	150	37	24.6	20	13.3
lusaltans	+	+	+	—	+	+	R	R	256	88	34.3	54	21.0
nigrosaltans	+	+	+	—	+	+	0	0	182	69	37.9	40	21.9
sturtevantii	+	+	+	—	+	+	(Table 1)		157	23 ¹	14.6 ¹	—	—
milleri	+	+	—	+	+	+	0	0	280	36 ¹	12.8 ¹	—	—
rectangularis	+	+	+	—
pulchella	—	+	—	+
parasaltans	—	+	—	+	+	+	0	0	..	..	..	..	..
subsaltans	—	+	—	+	+	+	0	0	187	65	34.7	—	—
neosaltans	—	+	+	—
elliptica	—	—	+	—	+	..	+	..	190	42	22.1	—	—
neoelliptica	—	—	+	—	+	+	+	+	192	32	16.6	24	12.5
emarginata	—	—	+	—	+	+	+	+	190	32	16.8	—	—
emarginata (Peru)	—	+	—	+	+	+	0	0	..	..	..	..	..
cordata	—	—	+	—
neocordata	—	—	+	—	0	0	186	..	..	—	—

* Characters are as follows: 1, presence of mesonotal pattern; 2, presence of subcarinal hairs; 3, dark body color; 4, yellow body color; 5, presence of sensilla of first sternite; 6, presence of sensilla of seventh sternite of male; 7, presence of vestigial plates of first sternite, female (R= reduced but not wholly absent); 8, as 7, male; 9, total area of sixth tergite of female, in arbitrary units; 10, area of dull, velvety tergal marks; 11, per cent of tergite occupied by dull tergal marks; 12, area of sixth tergite occupied by yellow coloration, female; 13, per cent of sixth tergite with yellow coloration.

¹ Since there are two dull areas on the sixth tergite, the figure may be doubled to obtain the total area occupied by such marks.

TABLE 3

Variation in sixth tergite of females of *D. saltans* and *prosaltans* from various geographic strains. The morphological characters are the same as those with corresponding numbers in Table 2

	9	10	11	12	13
<i>saltans</i>					
strain 1	123	51	41.4	28	22.7
strain 2	177	65	36.7	46	25.9
strain 3	150	64	42.6	28	18.6
strain 4	157	57	36.3	25	15.9
strain 5	142	52	36.6	30	21.1
strain 6	162	61	37.6	33	20.3
strain 7	160	66	41.2	26	16.2
Average	153	59.4	38.9	30.8	20.1
<i>prosaltans</i>					
strain 1	127	39	30.7	30	23.6
strain 2	166	58	34.9	30	18.0
strain 4	149	49	32.8	33	22.1
strain 5	161	50	31.0	32	19.8
strain 6	162	50	30.8	32	19.7
strain 7	162	56	34.5	34	20.9
Average	155	50.3	32.5	31.8	20.7

only 4% of the females and 11% of the males showed the vestiges), since 16% of the hybrid females and 20% of the hybrid males showed the plates. Even in this case, however, the genes for absence seemed to have more effect than those for presence.

As was first pointed out by Sturtevant (1942), a most unique characteristic of the saltans group is the presence of velvety-opaque areas on the sixth tergite of the females of many species. Similar modifications have not been reported from flies of any other species group. The distribution of their presence in the saltans group is given in Table 2, columns 10 and 11. The shapes of these areas are often useful in identification, and the common types are illustrated, all to the same scale, in Figure 13. In *cordata* and *neocordata*, however, the modification takes the form of an internal flattened pouch which appears, after clearing and when viewed under high magnification, to be filled with minute hairs.

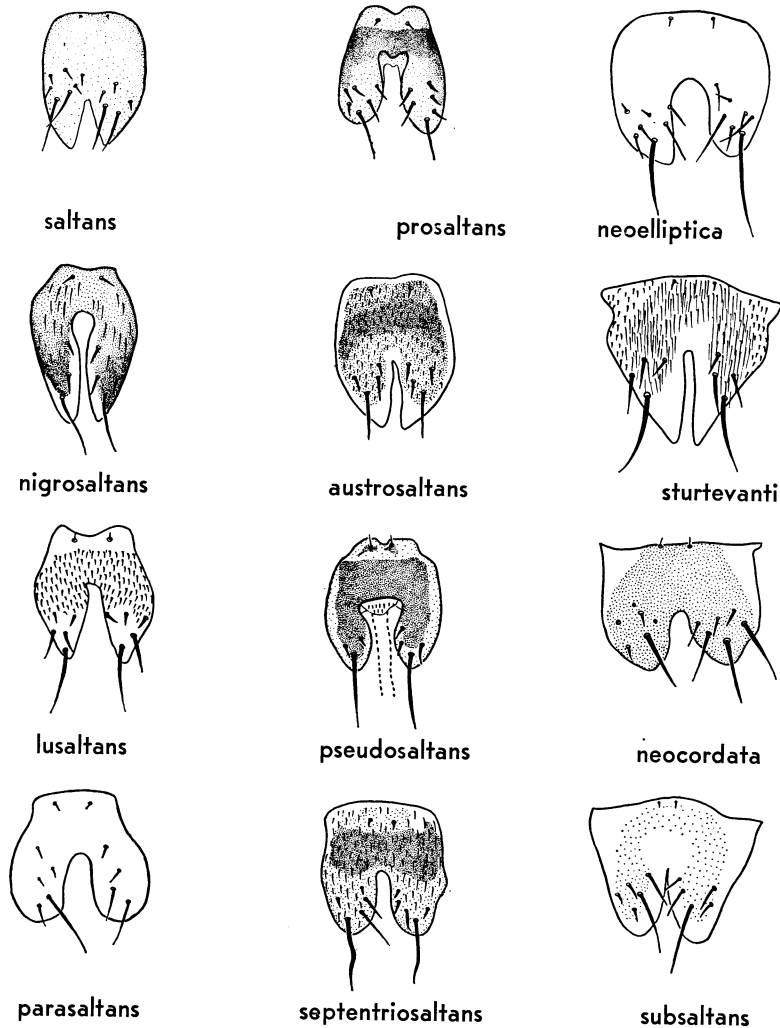


FIG. 12. Shape of seventh sternite of females of the saltans group.

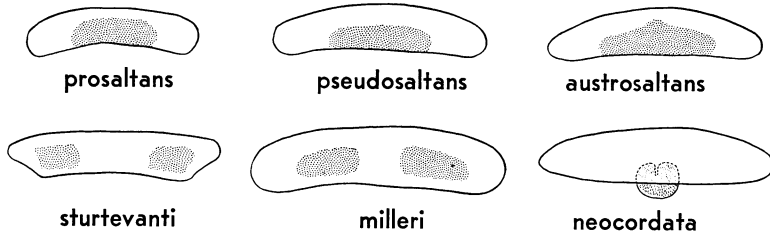


FIG. 13. Sixth tergite of females of some species of the saltans group, showing the relative size and shape of the dull velvety tergal areas. In *neocordata*, as in *cordata*, velvety areas are absent, but there is an internal flattened pouch.

A second useful characteristic of the group is the presence of subcarinal hairs in many species. Their number is not constant, however, so that when very few (*e.g.*, one or two) are present, they can easily be overlooked. The distribution of this character among the various species is shown in Table 2, column 2.

The seventh sternites of females often show characteristic shapes and differ in the pigmentation pattern and distribution of bristles and hairs. Some representative examples are shown in Figure 12.

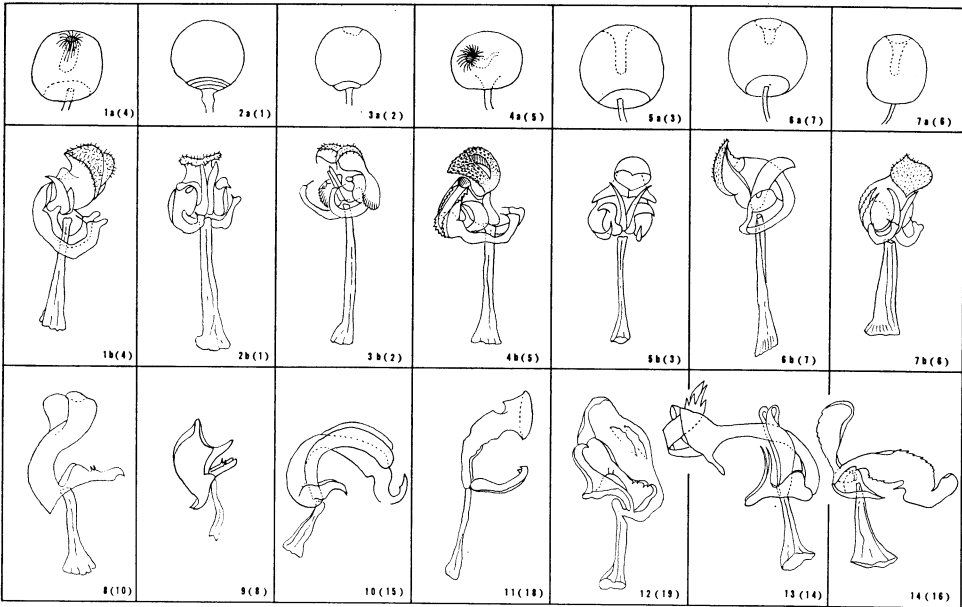


PLATE III. Illustrations of important key characters. For each figure the first number given corresponds to the figure reference in the key couplet in which the structure is used; the second number, in parenthesis, is the "species number" as used throughout the text and in the key.

KEY TO THE SPECIES OF THE SALTANS GROUP

- 1 Dark species, the mesonotum with striped or spotted pattern; some small hairs below carina 2
- 2 Dark to yellowish species, the mesonotum unicolorous, without clear pattern; subcarinal hairs present or absent 10

- 2(1) Mesonotal pattern includes, among the stripes or spots, one unpaired dark brown to black median streak or spot in front of the anterior dorsocentrals 3
 Without an unpaired dark brown to black median mesonotal streak or spot 9
- 3(2) Cheeks blackish; spermatheca with strong apical invagination, wrinkled (Figure 1a); penis with lateral flap, the flap with a smooth edge (Figure 1b); Panama (4) *D. nigrosaltans*
 Cheeks brownish or grayish, not very dark; spermatheca with or without invagination, if with invagination, not wrinkled 4
- 4(3) Spermatheca without invagination, showing a light circular area on the apex; penis not cylindric, without lateral flap 5
 Spermatheca with invagination; penis cylindric or not and with or without lateral flap 6
- 5(4) Spermatheca without invagination; without collar at base (Figure 2a) (very short apical invagination found in one strain from El Salvador); penis as in Figure 2b; from southern Mexico to the middle of Costa Rica, also in Cuba (1) *D. saltans*
 Spermatheca with collar at base (Figure 3a); penis as in Figure 3b; Haiti (2) *D. lusaltans*
- 6(4) Spermatheca with invagination not apically (located on the side); the invagination is curved (Figure 4a); penis with two pairs of lateral flaps, the flaps with sawtooth edges (Figure 4b); Colombia (5) *D. septentriosaltans*
 Spermatheca with apical invagination; penis not as above 7
- 7(6) Spermatheca with long invagination (Figure 5a); penis without lateral flaps (Figure 5b); from central Costa Rica to south Brazil (3) *D. prosaltans*
 Not as above 8
- 8(7) Spermatheca with apical invagination (Figure 6a); penis cylindric and curved; Cantareira, S.P., Brazil (7) *D. pseudosaltans*
 Spermatheca with thin invagination (Figure 7a); penis as in Figure 7b; Pirassununga, Brazil (6) *D. austrosaltans*
- 9(2) Sixth tergite of the female with a median rectangular opaque area; penis cylindric and curved, without pincers (Figure 8); Mexico and Nicaragua (10) *D. rectangularis*
 Sixth tergite of the female with one opaque area in each side, near the posterior margin; penis smaller than in the above (Figure 9); from Mexico to south Brazil and Caribbean Islands (8) *D. sturtevanti*
- 10(1) Yellowish species; the abdomen yellow 11
 Dark species; the abdomen dark brown to black 15
- 11(10) Mesonotum and pleura with very distinct brownish stripes; Puerto Rico (9) *D. milleri*
 Mesonotum and pleura without distinct brownish stripes 12
- 12(11) Mesonotum dark reddish brown, with three indistinct yellow stripes; St. Vincent, B.W.I. (13) *D. pulchella*
 Mesonotum yellowish, without stripes 13

- 13(12) Abdomen bright yellow with indistinct brown basal bands; penis (Figure 10); Peru (see couplet 16) (15) *D. emarginata*
 Abdomen bright yellow with dark brown basal bands 14
- 14(13) Dark brown basal band of the 5th tergite does not reach the lateral edges, but leaves a yellow lateral area; Uaupés, Brazil
 (11) *D. parasaltans*
 Dark brown basal band of 5th tergite reaching the lateral edges of the tergite; Belém, Brazil (12) *D. subsaltans*
- 15(10) Hairs below carina present; Cantareira, S.P., Brazil
 (17) *D. neosaltans*
 Subcarinal hairs usually absent, rare on *emarginata* males 16
- 16(15) Mesonotum yellowish brown; pleura brown; legs yellowish brown, femora darker; penis cylindric with distal end slender and bent backward (Figure 10); Mexico to Colombia (15) *D. emarginata*
 Mesonotum dark brown, tan or blackish 17
- 17(16) Abdomen shining black; legs yellowish brown, femora darker; pleura brown, paler below; 6th tergite of the female with a median opaque area, that is shaped like a conventionalized heart; penis as in Figure 11; Guatemala (18) *D. cordata*
 Not as above 18
- 18(17) Sixth tergite of the female without a median opaque area; penis as in Figure 12; Mexico and Minas Gerais, Brazil (19) *D. neocordata*
 Sixth tergite of the female with median opaque area; penis large, cylindric, and with a pair of lateral pincers 19
- 19(18) Entire thorax blackish brown, dull; penis as in Figure 13; Mexico (14) *D. elliptica*
 Thorax tan, shining, sometimes very dark; penis as in Figure 14; São Paulo, Brazil (16) *D. neoelliptica*

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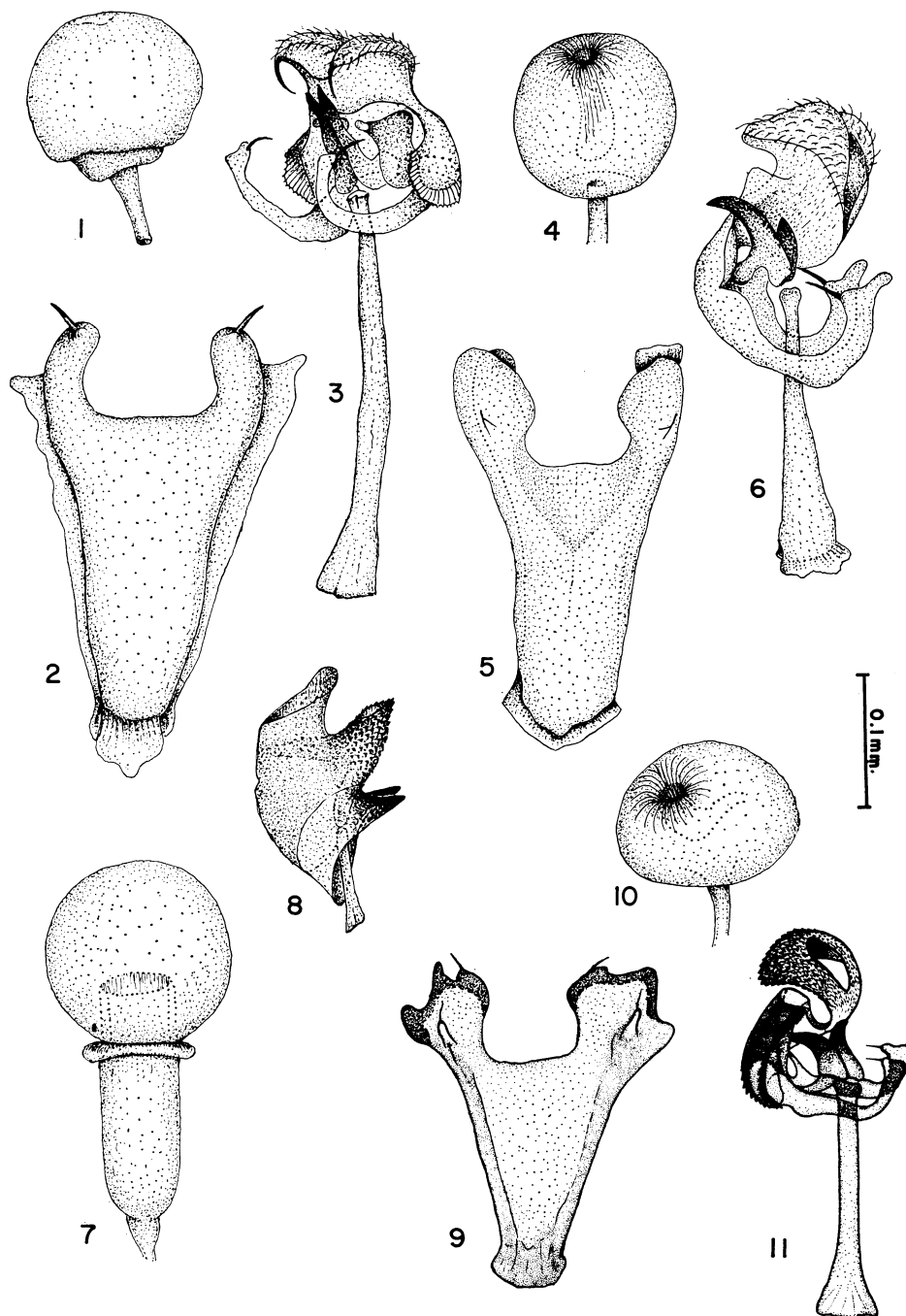


PLATE IV. Male genitalia and female spermathecae of the new species. Figs. 1-3, spermatheca, hypandrium and penis of *D. lusaltans*. Figs. 4-6, spermatheca, hypandrium and penis of *D. nigrosaltans*. Figs. 7-8, spermatheca and penis of *D. milleri*. Figs. 9-11, hypandrium, spermatheca and penis of *D. septentriosaltans*.

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