Two New *repleta* Group Species of the Genus *Drosophila* (Diptera: Drosophilidae) from Venezuela[1,2]

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ABSTRACT

Drosophila starmeri, n. sp., and *D. uniseta,* n. sp., from Venezuela are described. They are closely related to *D. martensis* Wasserman & Wilson, the only other *mulleri* complex species of the *repleta* group known to be endemic to South America. Genetic tests indicate that the 3 species are reproductively isolated from one another. The salivary gland chromosomes are described and used for determination of the relationships among the 3 species.

The *mulleri* complex of the *repleta* group of the genus *Drosophila* consists of ca. 15 described species (Wasserman 1962). These desert-inhabiting species show a very close cytological relationship to each other in that they share paracentric inversions and must have all originated from a single common ancestor. The complex seems to have evolved primarily in Mexico and the SW United States, where most of the species are found. Heretofore, only a single species, *D. martensis* Wasserman and Wilson, was known to be endemic to South America, where it has been collected in cactus regions in Colombia and Venezuela.

In a recent trip to Venezuela, one of us (B.L.W.) and W. T. Starmer collected 7 strains of *mulleri* complex species, one of which was *D. martensis.* However, the other 6 were representatives of 2 new species very similar morphologically and cytologically to *martensis.* Both new species utilize a giant columnar cactus, *Lemaireocereus griseus* (Haworth) Britton and Rose, as an oviposition site. These species are described here.

Drosophila starmeri, n. sp.

Fig. 1–4

External Characteristics of Imagines.—Male, female: Arista with 7 branches; antennae yellowish, base of the 2nd and 3rd joint dark brown. Front yellowish brown, orbits and ocellar triangle lighter, pollinose; hairs of anterior orbits, anterior and posterior orbitals, and anterior verticals with basal blackish spots. Middle orbital about ½ length anterior and ⅔ length posterior. Second oral about ½ length of 1st. Carina broadened below, sulcate. Palpi pale yellow, with 1 long terminal bristle, 2 long ventral bristles, and numerous smaller weaker bristles. Face brownish yellow. Cheeks yellowish gray, greatest width about ¼ greatest diam of eyes. Eyes reddish with short black pile.

Acrostical hairs in 8 rows; no prescutellars. Anterior scutellars convergent. Sterno index ca. 0.7. Middle sternopleural ca. ¼ length posterior. Mesonotum gray, bristles arising from brown spots with a slight tendency to fuse, giving a superficial appearance of 2 brown bands between the dorsocentral rows, separated by a thin pollinose stripe. Some fusion of spots outside of dorsocentral rows. Scutellum dark brown; pollinose spots at angle of scutellum between bristles and occasionally at base. Pleurae yellowish gray with indistinct fuscous bands going from wing-base to humerus, from base of haltere to fore-coxa, and near sternopleurals. Legs yellowish gray with indistinct black bands on distal ends of femora; black bands near bases of tibiae. Apical bristles on 1st and 2nd tibiae, preapicals on all 3.

Abdominal segments yellowish pollinose, 2nd–6th tergites with an interrupted black band with forward extensions at interruption, lateral margins, and angles of tergites. The last extensions widen rapidly at anterior margin, usually connecting laterally with lateral extensions to enclose irregular yellow area; dorsally, these extensions cut sharply into the yellow region.

Wings clear, veins brown; apex of 1st costal section darker. Costal index ca. 2.8; 4th vein index ca. 1.9; 5× index ca. 1.4; 4c index ca. 1.0. Two well-developed bristles at apex of 1st costal section; 3rd section with heavy bristles on basal ⅓.

Body length of female 2.6–3.8 mm, that of male 2.6–3.4 mm.

Internal Characters of Imagines.—Testes yellow, with 2 inner and 2½ outer coils. Ventral receptacle with 12–15 loose coils. Genital arch of male (Fig. 1) with 9–12 bristles localized in the lower half. Claspers with 4 large teeth and 8–9 smaller teeth. Fig. 2–4 show various views of penis apparatus and hypandrium.

Puparia.—Tan; each anterior spiracle with 11–17 branches; horn index 1.6–2.7.

Chromosomes.—The autosomes consist of 4 pairs of rods and 1 pair of dots. The X chromosome is a rod ca. ⅓ longer than autosomes, with distinct but dot-like short arm. The Y chromosome is a submetacentric, with short arm ca. ¼ length of longer arm; a secondary constriction divides longer arm into 2 equal parts; total length of the Y is equal to that of autosomes.

Distribution.—Type-locality 10–15 km W of Barquisimeto, Lara, Venezuela, on Highway 7, where adults were aspirated and larvae were reared from a rot pocket of *Lemaireocereus griseus* (Haworth) Britton and Rose. Also collected 15–20 km N of Barquisimeto, near the towns of Las Palmares and Tacarigua. Collections made by B. L. Ward and W. T. Starmer in late January, 1971.

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Holotype male, allotype female, and a series of paratypes are deposited in the collection of the Genetics Foundation, University of Texas at Austin; additional paratypes are in the collection of the U. S. National Museum of Natural History, Washington, D.C.

The species is named for Dr. W. T. Starmer, one of the collectors of the type-specimens.

Drosophila uniseta, n. sp.

Fig. 5–8

Very similar to *D. starmeri,* from which it differs by the following characteristics:

Characters of Imagines.—Males, female: Arista with 6 branches, only a single ventral branch excluding terminal fork. Middle orbital about ⅜ length

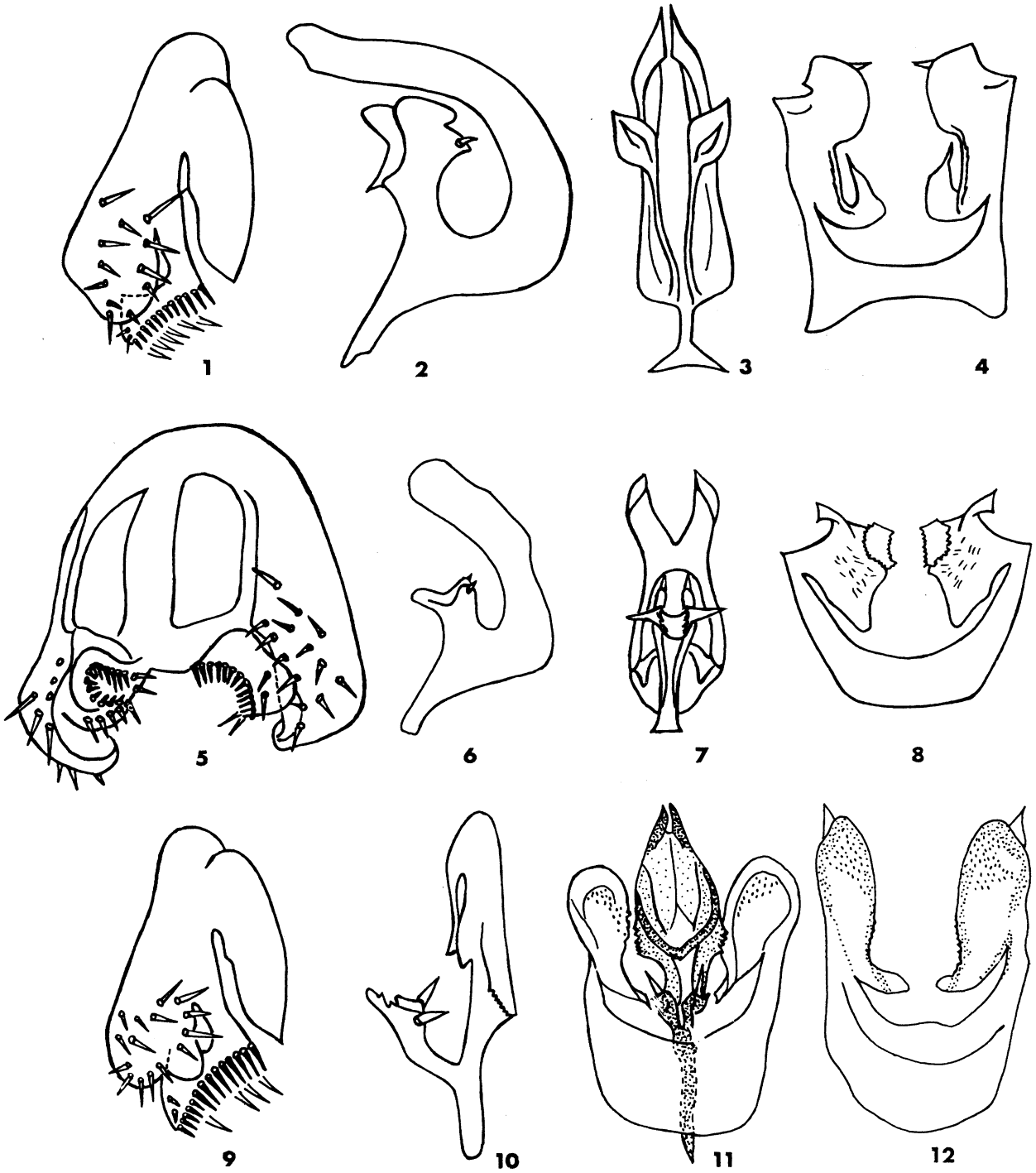

FIG. 1–12.—Male genitalia of: 1–4 *D. starmeri;* 5–8 *D. uniseta;* 9–12 *D. martensis.* For each is shown the genital arch and clasper (1 and 9 in lateral view, 5 in semiventral view); the penis in lateral (2,6,10) and ventral (3,7,11) views; and the hypandrium in ventral view. All drawings are to the same scale except 5, which is slightly larger.

of anterior orbital, which is equal in size to posterior orbital. Middle sternopleural absent or minute, up to ¼ length of posterior.

Abdominal markings in female as in *D. starmeri,* but boundaries of bands less distinct; median interruption of bands narrow and sometimes indistinct.

Male abdomen yellowish; 2nd–6th tergites with a narrowly interrupted dark band with forward extensions at interruption, bands fading at angles of tergites.

Body length of female 2.4–3.0 mm; that of male 2.2–2.6 mm.

Testes yellow, with 1½ inner and 2½ outer coils. Genital arch of male (Fig. 5) with 14–17 bristles on lower half; toe of genital arch curves in under claspers. Claspers with 13–16 teeth of equal length. Fig. 6–8 show various views of the penis apparatus and the hypandrium. Each lobe of the hypandrium with serrated projection extending posteriorly.

Puparia.—Tan; each anterior spiracle with 10–14 branches; horn index greater than that of *D. starmeri,* ranging from 3.1 to 3.8.

Chromosomes.—The metaphase plate shows that the autosomes consist of 4 pairs of rods and 1 pair of dots. The sex chromosomes are equal in length and slightly longer than autosomes. The X chromosome is a rod; the Y chromosome is a submetacentric, with secondary constriction in the longer arm dividing the chromosome into 3 approximately equal parts.

Distribution.—The type-locality is 2 km E of Coro, Falcon, Venezuela. Other Venezuelan localities are Maracaibo, Zulia; 10 km W of Punto Fijo, Peninsular de Paraguana, Falcon; and Ocumare, Aragua. Collections were aspirated and reared from rot pockets of *Lemaireocereus griseus* by B. L. Ward and W. T. Starmer in late January and early February.

Holotype male, allotype female, and a series of paratypes are deposited in the collection of the Genetics Foundation, University of Texas at Austin; additional paratypes are in the collection of the U. S. National Museum of Natural History, (USNM) Washington, D.C.

The name *D. uniseta* refers to the fact that, excluding the terminal branch, there is only a single ventral bristle on the arista.

Drosophila martensis, Wasserman and Wilson

Fig. 9–12

A complete description is given in Wasserman and Wilson (1957). It is, however, useful to indicate here the major key differences between *martensis* and *D. starmeri.* The external pattern is similar, except that in *martensis* the 6th abdominal tergite has an interrupted indistinct black band which fades at the angle.

Genital arch of male (Fig. 9) with 0–2 bristles on dorsal half and 12–16 bristles on ventral half; toe prominent. Claspers with 8 or 9 large teeth and 5 smaller teeth. Fig. 10–12 give various views of the penis apparatus and hypandrium. Lateral margins of the penis serrated. Lobes of hypandrium are roughened, with short, blunt spines.

The metaphase plate shows that the autosomes consist of 4 pairs of rods and a pair of dots. The X chromosome is a rod ca. 25% longer than the autosomes. The Y chromosome is a submetacentric with a total length slightly smaller than that of the autosomes.

Relationships.—The 3 South American species, although distinct, show much morphological similarity.

Reproductive isolation among the 3 species was tested by making the 42 different possible combinations of crosses among the 7 Venezuelan strains which were used for this study. The results were unequivocal. All intraspecific interstrain crosses produced a large number of vigorous and fertile offspring. No offspring were obtained from any of the interspecific crosses. The 3 species are clearly genetically isolated and distinct from one another.

By comparing banding patterns found in the salivary gland chromosomes of different species, it is possible to determine inversion differences. Since inversions are unique events, any 2 species which have the same inversion, or have had it in the past, are more closely related to each other than either is to a 3rd species which lacks this rearrangement (see Wasserman 1963, for discussion). Moreover, our comparisons allow us to identify all successful inversions which have been incorporated into the past cytological history of the species. In effect, each species contains a complete living fossil record of its past cytological evolution. If the number of inversions is not too great, we can literally read the phylogenetic history of the species group.

It was found that the *mulleri* subgroup differs from *D. repleta*—the species whose chromosomes were chosen as the standard—in that they are homozygous for 6 inversions, Xabc; 2ab; 3b (Wasserman 1963). In addition the *mulleri* complex has been defined as those species which have descended from a widely distributed ancestor whose various populations became fixed for one or more of the following 6 inversions: 2c,f,g,h; 3a,c (Wasserman 1962).

Table 1 gives the results of our examination of the salivary gland chromosomes of these 3 species. A

Table 1.—Inversion formulae of species.

Species	Basic sequence for *mulleri* subgroup				
	Xa,b,c	2a,b	3b	4	5
D. martensis	j	c,d^2,e^2,f^2,g^2/+	a,k	+	+
D. starmeri	j,q,s/+	r^6,w^6,x^6,y^6,z^6,a^7,b^7,c^7/+	a,v,w	+	+
D. uniseta	j,r	r^6,s^6,t^6,u^6,v^6/+	a,v,w	+	+

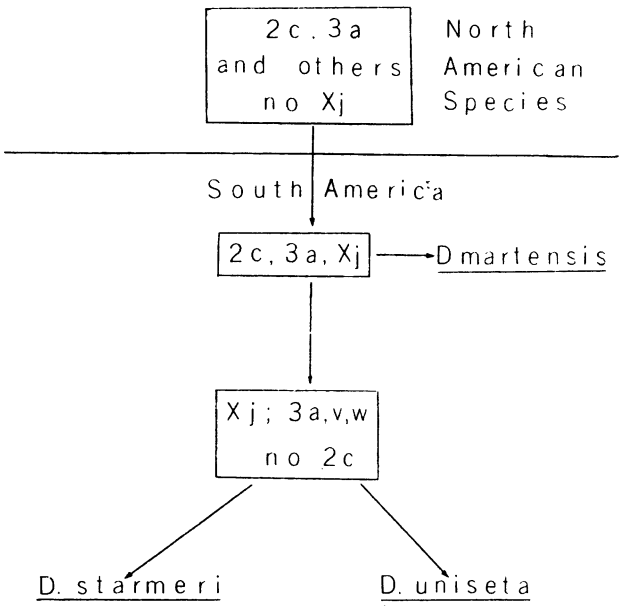

FIG. 13.—Phylogenetic relationships among the South American *D. mulleri* complex species.

detailed description of these inversions will eventually be published elsewhere, but the results can be summarized here.

Each species has its own unique inversions. However, there are 6 inversions (Xj;2c,r^6; 3a,v,w) which are particularly important, because they allow us to determine phylogenetic relationships. The presence of Xj in all these 3 species, but nowhere else, demonstrates their close relationship. All 3 species also have 3a, an inversion characteristic of the *mulleri* complex. Inversion 2c, another *mulleri* complex indicator is present in *martensis* but not in *starmeri* and *uniseta,* demonstrating that *martensis* is more closely related to the hypothetical primitive ancestor than are the 2 last-mentioned species. Moreover, both *starmeri* and *uniseta* have 3v and 3w which are found nowhere else, indicating that they share a common ancestor. The phylogenetic relationship is therefore as shown in Fig. 13.

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