

BREEDING SITES OF NEOTROPICAL DROSOPHILIDAE (DIPTERA).
I. LIVING FLOWERS OF *CESTRUM SCHLECHTENDALII*
(SOLANACEAE)

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ABSTRACT. A total of 7500 flowers of *Cestrum schlechtendalii* were collected at a rain forest reserve in São Paulo City between July, 1983 and July, 1986. Eighty unidentified parasitoids plus 1832 adults of five species of *Drosophila* belonging to the *flavopilosa* group and one species of *Zygothrica* emerged in the laboratory from the flowers: *D. cestri* Brncic, *D. cordeiroi* Brncic, *D. hollisae* sp. n., *D. incompta* Wheeler & Takada, *D. mariaehelenae* Vilela, and *Z. vittimaculosa* Burla. *D. hollisae* sp. n. is described, illustrated and compared to its closely related species: *D. crossoptera* Wheeler & Takada, *D. lauta* Wheeler & Takada and *D. flavopilosa* Frey. Illustrations of the terminalia of specimens (two being holotypes) belonging to the latter 3 species are also provided.

KEYWORDS. *DROSOPHILA*, *ZYGOTHRICA*, PARASITIDS, BREEDING SITES, *CESTRUM*.

INTRODUCTION

The living flowers of *Cestrum* spp. seem to be the main breeding site for the South American species of *Drosophila* belonging to the *flavopilosa* group (WHEELER *et al.*, 1962; BRNCIC, 1966, 1978; VILELA, 1984). PIPKIN *et al.* (1966) had bred them also from flowers of 16 species of plants of different genera and families collected in Panama.

BUDNIK *et al.* (1988) pointed out that in Chile, no species other than *D. flavopilosa* utilize flowers of *Cestrum parqui* as breeding sites, although in southern Brazil it represents a host plant for 4 synhospitalic *flavopilosa* group species (BRNCIC, 1978).

On the other hand, living flowers of *Cestrum intermedium*, besides being host for 4 species of the *flavopilosa* group, have also been reported as host plants for one unidentified species of *Drosophila* and for *Zygothrica vittimaculosa* (VILELA, 1984).

In addition to the 2 species of *Cestrum* cited above, the following 3 have been reported in the literature as being host plants for species ascribed to the *flavopilosa* species group: *C. calycinum* (BRNCIC, 1978), *C. eaunthes* and *C. tomentosum* (BRNCIC, 1966).

Although the *flavopilosa* group species are known to breed only in flowers, doubts remain whether or not they present any degree of host specificity. As part of our project of surveying the breeding sites of Neotropical drosophilids we have analysed the imagines which emerged from flowers of *Cestrum schlechtendalii*, which in São Paulo City has a very short blooming period of *ca.* 2 months per year during the winter season (ROSSI, 1987).

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MATERIALS AND METHODS

Living flowers of *Cestrum schlechtendalii* were collected at the "Reserva Ecológica da Cidade Universitária Armando de Salles Oliveira" (23° 33'S, 46° 44'W), São Paulo City, Brazil, once a year between July of 1983 and July of 1986. The flowers, in several stages of development, were broken off the blooming bushes, brought into the laboratory and kept at room temperature in glass bottles of 250 ml (100 flowers per vial) containing moist sand and plugged with a styrofoam stopper. The number of collected flowers varied from year to year as follows: 2300 in 1983; 1300 in 1984; 900 in 1985 and 3000 in 1986.

Unless otherwise noted, emerged parasitoids and flies were removed daily. The latter ones were retained alive for several days on standard banana medium to allow the exoskeleton to harden and then killed and pinned (double mounting). The male drosophilids were determined to species and the females to group, further studies being necessary to tell the females apart. No attempts were made to identify the parasitoids. Samples of both drosophilids and parasitoids were deposited in the "Museu de Zoologia da Universidade de São Paulo", São Paulo.

Additionally, the following holotypes and other specimens, kindly loaned to us by the National Museum of Natural History (NMNH) Washington D.C., were analysed and are included in the present paper for comparison purposes: holotype of *Drosophila crossoptera*; holotype of *D. lauta* and six specimens (2 ♂, 4 ♀) of *D. flavopilosa* collected at Montevideo in 1942 and labelled as cited in WHEELER *et al.* (1962:403).

Except for 3 specimens belonging to the new species and for those loaned by the NMNH, the imagines were not dissected. The method of pressing the tip of the male abdomen (SPASSKY, 1957) was used for a prompt identification of the mature flies.

The methods for preparing the male terminalia are detailed in WHEELER & KAMBYSELLIS (1966) and KANESHIRO (1969). The abdominal structures, including the dissected terminalia, are kept in microvials filled with glycerin and attached by the stopper to the pin of the respective specimen. The terminology proposed by MCALPINE (1981) as interpreted and supplemented by VILELA & BÄCHLI (1990) was followed.

Illustrations were drawn using a camera lucida. Unless otherwise noted, all figures on the same page were drawn to the same scale.

In the description of the new species we followed MATHER (1955: 548) for body measurement and VILELA (1983:2) for wing measurement and indexes.

RESULTS AND DISCUSSION

A total of 80 microhymenoptera and 1832 (921 ♂; 911 ♀) flies belonging to five species of *Drosophila* of the *flavopilosa* group and to one species of *Zygothrica* emerged from the flowers of *Cestrum schlechtendalii* (tables I - IV). Eight out of the 921 emerged males belong to a new species of *Drosophila* which is described in the present paper.

TABLE I - Species of *Drosophila* and their parasitoids bred out in the laboratory from 2300 living flowers of *Cestrum schlechtendalii* G. DON (Solanaceae) collected at the "Reserva Ecológica da Cidade Universitária Armando de Salles Oliveira", São Paulo, SP, Brazil on 11/VII/1983.

	EMERGENCE DATA - JULY/AUGUST															
	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4-5	TOTAL
<i>Drosophila cestri</i> ♂	1	2	3	-	-	1	-	-	-	-	-	-	-	-	-	7
<i>Drosophila cordeiroi</i> ♂	-	3	1	6	-	-	-	-	-	-	-	-	-	-	-	10
<i>Drosophila incompta</i> ♂	-	-	-	3	40	131	136	38	7	2	1	-	-	-	-	358
<i>flavopilosa</i> group ♀	-	3	7	29	77	144	65	22	2	-	1	-	-	-	-	350
microhymenoptera	-	-	-	-	-	-	-	1	5	9	6	2	-	6	35	64
TOTAL OF FLIES	1	8	11	38	117	276	201	60	9	2	2	-	-	-	-	725

As can be observed in the tables I-IV, *Drosophila cestri* and *D. cordeiroi* were the first species to emerge, followed by *D. incompta* which is by far the most frequent species as it represents 68.8% of the emerged males. *D. mariaehelenae* is very rare in *Cestrum schlechtendalii*; just one male belonging to this species was identified (Table II) among the 920 *Drosophila* male specimens which emerged from the flowers during a four-year period. VILELA (1984) reported that 10 males of *D. mariaehelenae* were found among 21 male specimens belonging to the *flavopilosa* group which emerged from flowers of *Cestrum intermedium*.

TABLE II - Species of Drosophilidae and their parasitoids bred out in the laboratory from 1300 living flowers of *Cestrum schlechtendalii* G. DON (Solanaceae) collected at the "Reserva Ecológica da Cidade Universitária Armando de Salles Oliveira", São Paulo, SP, Brazil on 12/VII/1984

	EMERGENCE DATE - JULY									
	21-21	23	24	25	26	27	28-29	30	31	TOTAL
<i>Drosophila cestri</i> ♂	41	7	1	3	-	1	1	-	-	54
<i>Drosophila cordeiroi</i> ♂	1	7	7	3	1	-	-	-	-	19
<i>Drosophila incompta</i> ♂	-	-	3	3	37	16	9	1	-	69
<i>Drosophila mariaehelenae</i> ♂	-	-	-	-	1	-	-	-	-	1
<i>flavopilosa</i> group ♀	33	23	16	12	41	6	10	2	1	144
<i>Zygothrica vittimaculosa</i> ♂	-	-	-	-	-	-	-	1	-	1
<i>Zygothrica vittimaculosa</i> ♀	-	-	-	-	1	-	-	-	-	1
microhymenoptera	-	-	-	-	-	-	-	3	-	3
TOTAL OD FLIES	75	37	27	21	81	23	20	4	1	289

One surprising result is the presence of *D. hollisae* sp. n. in just one out of 4 years of collection (Table III), where it represents half of the emerged males.

Zygothrica vittimaculosa was represented by just a couple of flies in the second year of collection (Table II). It seems that this species utilizes *Cestrum* flowers only occasionally (cf. VILELA, 1984).

Under variable room temperature it might be estimated that the development from egg to adult, based on the later male specimens to emerge takes ca. 17 days for *D. cestri*, *D. cordeiroi* and *D. hollisae*, sp. n., 18 days for *Z. vittimaculosa* and ca. 24 days for *D. incompta*.

In São Paulo City, *Cestrum schlechtendalii* blooms just once a year for a very short period during June-July (Rossi, 1987) strongly contrasting with the long blooming period of ca. 8 months per year recorded for *Cestrum parqui*, which in Chile lacks flower only during the winter season (BRNCIC, 1966).

TABLE III - Species of *Drosophila* bred out in the laboratory from 900 living flowers of *Cestrum schlechtendalii* G. DON (Solanaceae) collected at the "Reserva Ecológica da Cidade Universitária Armando de Salles Oliveira", São Paulo, SP, Brazil on 22/VII/1985.

	EMERGENCE DATE - AUGUST							
	4	5-6	7	8	9	10-11	12	TOTAL
<i>Drosophila cestri</i> ♂	-	1	-	-	-	-	-	1
<i>Drosophila cordeiroi</i> ♂	1	-	2	-	-	-	-	3
<i>Drosophila hollisae</i> , sp. n. ♂	-	1	4	3	-	-	-	8
<i>Drosophila incompta</i> ♂	-	-	-	-	1	4	-	5
<i>flavopilosa</i> group ♀	-	-	1	-	3	2	2	8
TOTAL OF FLIES	1	2	7	3	4	6	2	25

Except for *D. hollisae*, sp. n., the remaining four *Drosophila* species belonging to the *flavopilosa* group emerged from flowers of *Cestrum schlechtendalii* were also reported as being bred from flowers of *Cestrum intermedium* collected in the vicinities of Santa Izabel, a town included in the São Paulo metropolitan area (VILELA, 1984). The latter species of *Cestrum* also appears to bloom once a year, around April. Thus, there seems no doubt that those *Drosophila* species, at least in the sampled area, exploit more than one host plant and are apparently able to migrate in search of blooming hosts. However, it is not known whether members of this group of flies in the larval stage exploit any other resource when flowers of *Cestrum* in the sampled area are not available, if such a condition ever occurred. About 150 species of *Cestrum* are reported to occur in Neotropical America (WILLIS, 1973) and flowers of *Cestrum* sp. are potentially available all year around as different species might bloom at different seasons in a given area. On the other hand, it should be pointed out that we have also bred *flavopilosa* group species (unpublished data) from flowers of *Cestrum nocturnum*, an ornamental plant, which is extensively cultivated and seems to bloom in São Paulo area more than once a year.

TABLE IV - Species of *Drosophila* and their parasitoids bred out in the laboratory from 3000 living flowers of *Cestrum schlechtendalii* G. DON (Solanaceae) collected at the "Reserva Ecológica da Cidade Universitária Armando de Salles Oliveira", São Paulo, SP, Brazil on 15/VII/1986.

	EMERGENCE DATE - JULY/AUGUST																		TOTAL
	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	13	14	18
<i>Drosophila cestri</i> ♂	-	3	13	17	14	2	1	1	1	1	-	-	-	-	-	-	-	-	53
<i>Drosophila cordeiroi</i> ♂	2	6	37	44	35	6	-	-	-	-	-	-	-	-	-	-	-	-	130
<i>Drosophila incompta</i> ♂	-	-	-	-	-	-	10	40	79	48	13	9	3	-	-	-	-	-	202
<i>flavopilosa</i> group ♀	1	3	10	34	61	55	51	87	69	27	8	2	-	-	-	-	-	-	408
microhymenoptera	-	-	-	-	-	-	-	-	-	-	-	-	-	6	2	1	1	1	13
TOTAL OF FLIES	3	12	60	95	110	63	62	128	149	76	21	11	3	-	-	-	-	-	793

Drosophila hollisae, sp. n.

(Figs. 1 - 9)

Type-material. Holotype male (dissected), labelled "Brasil SP, Cidade Universitária, São Paulo (23° 33'S, 46° 44'W), C.R. Vilela col. Emerged in VIII.1985 from flower of *Cestrum schlechtendalii* collected on 22.VII.1985/

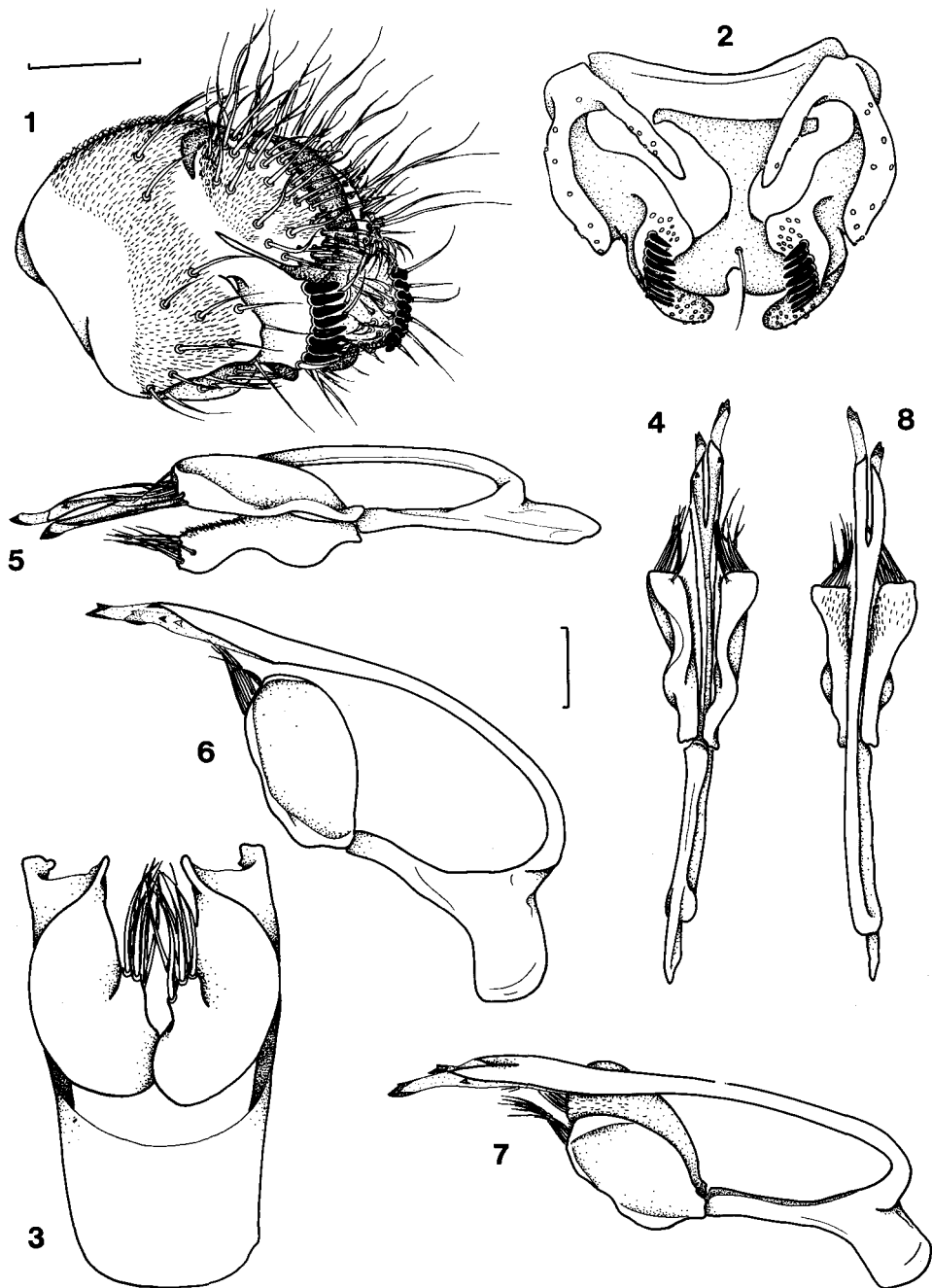


Fig. 1-8. *Drosophila hollisae*, sp. n. (holotype): 1, epandrium, cerci and surstyli, oblique posterior view; 2, surstyli and decasternum, ventral view; 3, hypandrium and gonopods, posterior view; 4-8, aedeagus, parameres and aedeagal apodeme, several views. Bars = 0.1 mm (horizontal = figs. 1-3; vertical = figs. 4-8)

HOLOTIPO *Drosophila hollisae* ♂. Seven male paratypes (2 dissected): same data as holotype; all specimens deposited in MZUSP, São Paulo. Type-locality: Cidade Universitária "Armando de Salles Oliveira", São Paulo, Brazil.

♂. Arista with 3-4 dorsal and 2-3 ventral branches plus terminal fork. Antennae and face yellow, pollinose. Front golden yellow, shining, except for the dull crescent-shaped anterior region; middle orbital about half of anterior one and 1/3 of posterior one. Carina narrow, ventrally slightly sulcate, pollinose. Palpi yellow, pollinose, with bristles on ventral surface. Cheeks yellow, pollinose, their greatest width 1/5 greatest diameter of eyes. Eyes red, with short black piles.

Acrostichal hairs in 6 irregular rows. Prescutellars absent. Anterior scutellars divergent. Mesonotum brownish yellow, pollinose, with two lighter longitudinal vittae, inner to dorsocentrals. Scutellum, pleurae and halteres brownish yellow, pollinose. Sterno-index about 0.6. Coxae, femora, tibiae and tarsi yellow. Apical bristles on 1st and 2nd tibiae, preapicalls on all three. Wings pale. Costal index about 4.0; 4th vein index about 1.6; 5x index about 1.7; 4c index about 0.6; M index about 0.5. Apex of first costal section with two enlarged bristles. Third costal section with heavy bristles on its basal 1/3. Wing length about 2.0 mm.

Abdomen uniformly brownish yellow.

Body length (pinned specimens) about 2.2 mm.

Terminalia (Figs. 1-9). Epandrium with about 24 lower and 3 upper bristles; ventral lobe crescent-shaped in ventral view. Cerci partially fused to epandrium. Surstylus with about 8 primary teeth, no secondary teeth and about 17 marginal bristles. Decasternum posteriorly bearing (not always) one long bristle at upper region (Fig. 2, 9). Hypandrium longer than epandrium; bow of hypandrium absent; gonopod bearing about 6 long bristles and linked to paramere by membranous tissue. Aedeagus long, curved, noticeably bifid and asymmetric at distal end (left branch 3/4 length of right branch; both bifid at tip), subapically membranous with a pair of tiny, sclerotized, arrowhead-shaped region; paramere ellipsoidal, bearing about 8 long bristles and mostly micropubescent at inner surface. Aedeagal apodeme broad and laterally flattened, as long as ventral rod.

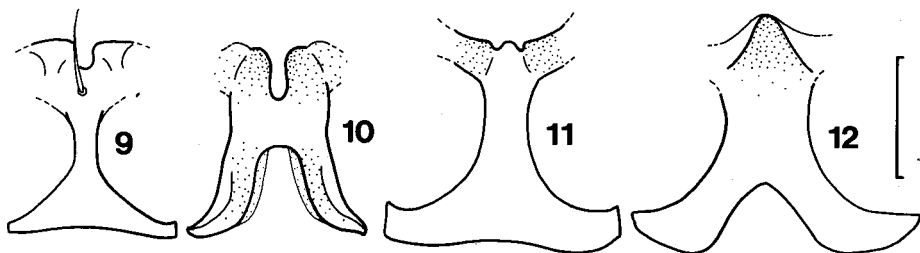


Fig. 9-12. Decasterna, ventral view: 9, *Drosophila hollisae* sp. n. (holotype); 10, *D. crossoptera* (holotype); 11, *D. flavopilosa* (Montevideo, Uruguay); 12, *D. lauta* (holotype). Dashed-lines = connection to surstyli. Bar = 0.1 mm.

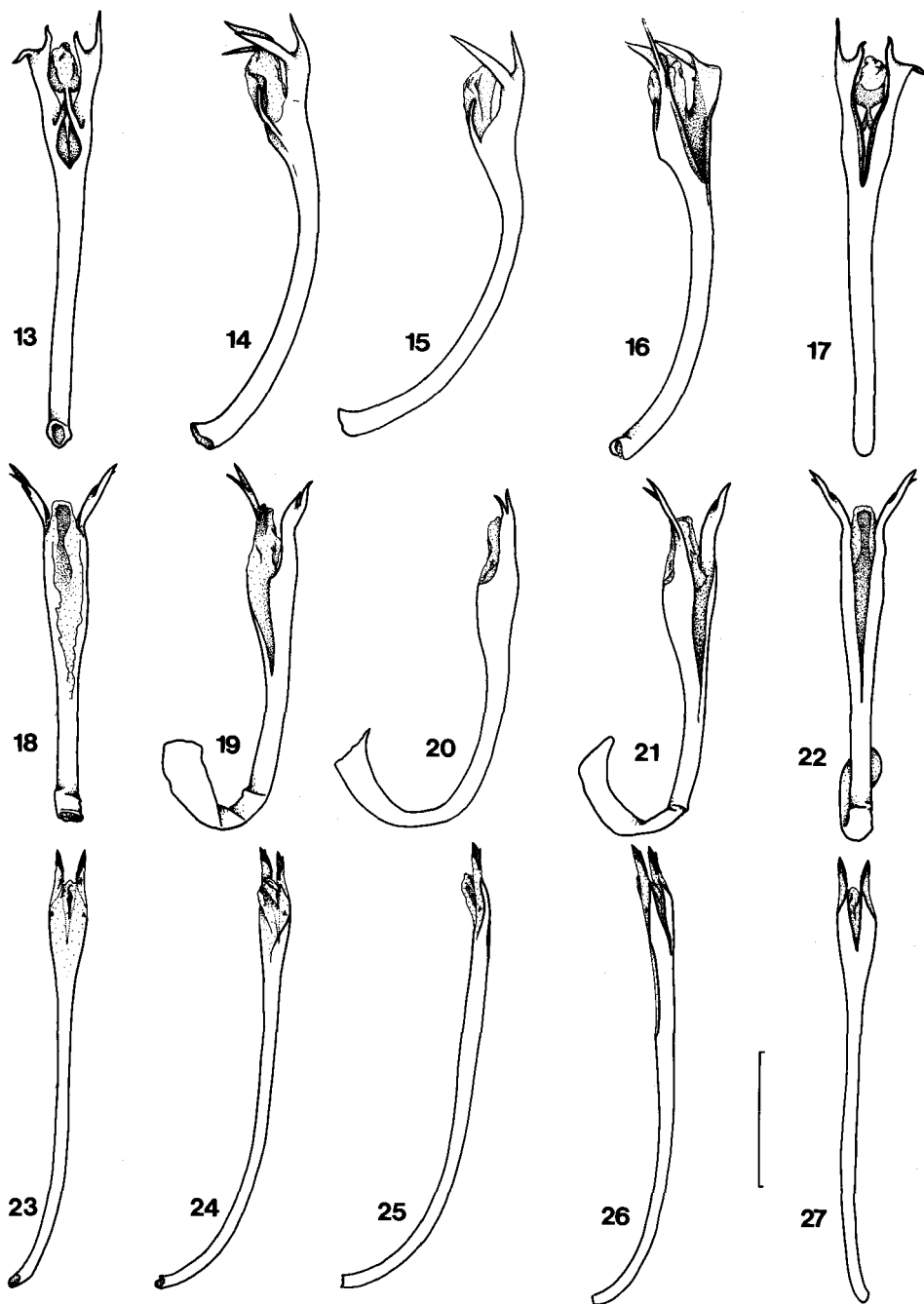


Fig. 13-27. Distal portion of aedeagi, several views from ventral to dorsal: 13-17, *Drosophila lauta* (holotype); 18-22, *D. flavopilosa* (Montevideo, Uruguay); 23-27, *D. crossoptera* (holotype). Bar = 0.1 mm.

Relationship. Belongs to the *flavopilosa* subgroup of the *Drosophila flavopilosa* species group of the subgenus *Drosophila*. It is very closely related to *D. crossoptera* Wheeler & Takada, from Panama and Colombia (Figs. 10, 23-27), from which it differs mainly by having the distal end of the aedeagus conspicuously asymmetric, by having a long bristle (absent at least in one paratype) in the decasternum, and by having a normal costal margin (without long and thin curved hairs) in the male wing. It is also allied to *D. flavopilosa* Frey (Figs. 11, 18-22) and to *D. lauta* Wheeler & Takada (Figs. 12-17), from which it differs chiefly by having an aedeagus with a quite distinct shape (cf. WHEELER *et al.*, 1962).

Etymology. The epithet *hollisae* honors our good friend Hollis B. Williams (NMNH), whose assistance is greatly appreciated.

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