

## TWO NEW SPECIES OF THE *DROSOPHILA SERIDO* SIBLING SET (DIPTERA, DROSOPHILIDAE)

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### ABSTRACT

*Drosophila antonietae* sp. nov. and *D. gouveai* sp. nov. are members of the *D. buzzatii* cluster of the *D. replata* species group of the genus *Drosophila*. They can be distinguished from their cryptic species, *D. borborema* Vilela & Sene, 1977, *D. koepferae* Fontdevila & Wasserman, 1988, *D. serido* Vilela & Sene, 1977, and *D. seriema* Tidon-Sklorz & Sene, 1995 by morphological, genetic and ecological criteria.

KEYWORDS. *Drosophila*, *buzzatii* cluster, *serido* sibling set, Taxonomy, Neotropical.

### INTRODUCTION

The *serido* sibling set is part of the *buzzatii* cluster (*buzzatii* complex) of the genus *Drosophila*. The *buzzatii* complex consists of several cactus breeding species inhabiting South and Central America and sharing chromosomal similarities (RUIZ **et al.**, 1982; RUIZ & WASSERMAN, 1993). *Drosophila serido* was described in 1977 by VILELA & SENE, and in the following years populations of this species from several regions were studied by means of several genetic markers. These studies suggest that *D. serido* is a polytypic species based on the male genitalia morphology (SILVA & SENE, 1991), presence of paracentric inversions in the polytene chromosomes (TOSI & SENE, 1989), metaphase chromosome morphology (BAIMAI **et al.**, 1983), esterase isozyme pattern (LAPENTA **et al.**, 1995, 1998) and degree of reproductive isolation (MADI-RAVAZZI **et al.**, 1997). However, until recently the distribution pattern of these genetic markers was not fully understood (SENE **et al.**, 1982, 1988).

A comprehensive sampling program carried out in several locations in South America, has enabled a more detailed characterization of each member of these closely related species. In 1988, SENE **et al.** argued that the distribution of *D. serido* in South America is particularly interesting because some populations differ from others in several

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characters. This is the case for the Argentinean and Bolivian populations, raised to species level as *Drosophila koepferae* by FONTDEVILA *et al.* (1988), and for those living in the "Cadeia do Espinhaço" in Brazil. The latter were described by TIDON-SKLORZ & SENE (1995a) as *Drosophila seriema*.

At present, four species are included in the *Drosophila serido* sibling set: *D. koepferae* (Argentina and Bolivia), *D. borborema* VILELA & SENE, 1977 and *D. seriema* (both from northeastern Brazil), and the group of populations currently known as *D. serido* (in various areas of open vegetation in South America: VILELA *et al.*, 1983; TIDON-SKLORZ *et al.*, 1994; TIDON-SKLORZ & SENE, 1995b).

We describe *Drosophila antonietae* (previously classified as *D. serido* type D by SILVA & SENE, 1991 and references thereafter) and *Drosophila gouveai* (previously classified as *D. serido* type B by SILVA & SENE, 1991 and references thereafter), in terms of morphological, genetic and ecological differences.

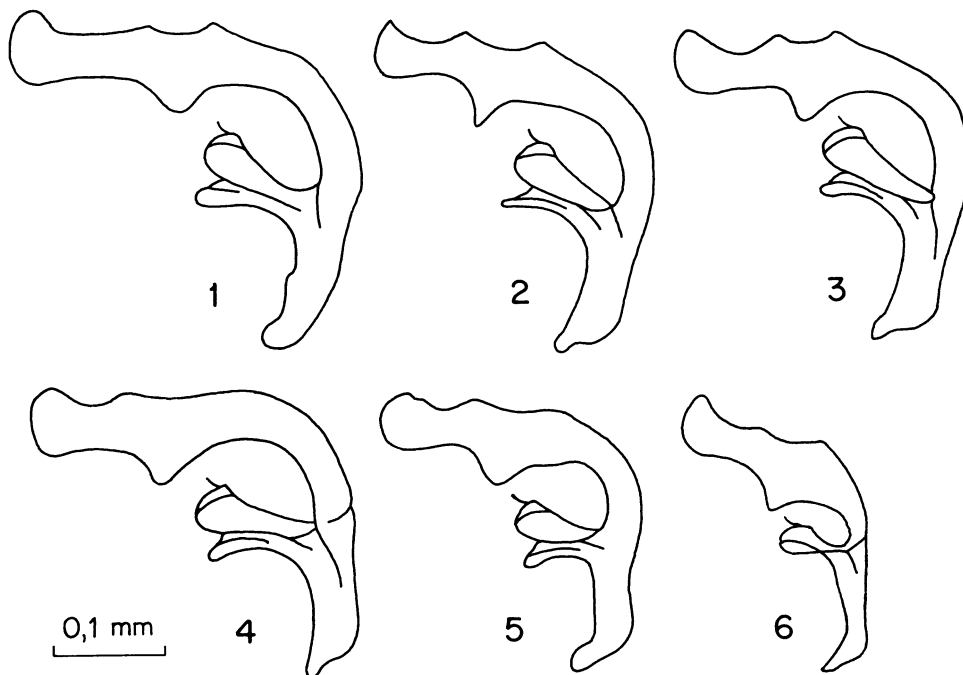
### *Drosophila (Drosophila) antonietae* sp. nov.

(Figs. 2, 7)

External characters of imagines. Arista with 4 dorsal and 3 ventral branches; antennae yellowish with bases dark brown; front light brown, pollinose. Anterior, middle orbital, and posterior vertical arising from a yellowish area. Hairs of anterior orbits, posterior orbital, anterior vertical, and postvertical with basal dark spots. Middle orbital about half the length of other two. Second oral about half the length of first. Carina broad below, sulcated. Palpi pale yellow, with several bristles. Face yellowish brown. Cheeks yellowish gray, their greatest width about 1/4 greatest diameter of eye. Eyes vermilion slightly lighter than those of *D. gouveai*, with short black pile. Acrostichal hairs in 8 rows; no prescutellars; anterior scutellars convergent. Sterno-index about 0.8. Mesonotum gray, pollinose, bristles arising from dark spots with tendency to fuse. Scutellum gray with fused brown spots, pleurae brown. Halteres pale yellow. Legs uniformly light brown. Apical bristles on first and second tibiae, preapicals on all three. Abdomen pale yellow, each segment with strongly contrasting, interrupted, wide, dark brown band, this bending to anterior margin at angle of tergite, leaving a small irregular pale area. Wings clear, veins brown, apex of first costal section black. Costal index about 2.6; 4th vein index about 1.8; 5X index about 1.2; 4C index about 0.9. Two well-developed bristles at apex of first costal section; third costal section with heavy bristles on its basal 1/3. Length of body 2.2-3.1 mm (in living specimens); wings about 2.5mm.

Internal characters of imagines and terminalia. Testes orange, with about 3 inner and 2 outer coils. Epandrium with 7-16 bristles, usually 10. Cerci not fused. Surstylus with 9-13 primary teeth, usually 10. Aedeagus as in fig. 2.

Chromosomes. The basic metaphase plate of the *Drosophila buzzatii* cluster consists of four pairs of telocentric autosomes, one pair of small dot 6th chromosomes and one pair of sex chromosomes (X telocentric and Y acrocentric). Compared to the basic type, *D. antonietae* has a slightly larger 6th chromosome pair, the long arms of X and Y chromosomes are longer, and the whole X chromosome is more heterochromatic (BAIMAI *et al.*, 1983). The chromosomal arrangements are: fixed chromosomal inversions Xabc; 2abmx<sup>7</sup>z<sup>7</sup>; 3b; polymorphic inversions: 2y<sup>8</sup>, 2z<sup>8</sup> and 5e (described by TOSI & SENE, 1989, as "2e", "2d" and 5a, respectively).



Figs. 1-6. Right lateral view aedeagal apodemes and parameres of the the *Drosophila serido* sibling set species. 1, *D. koepferae* Fontdevila & Wasserman, 1988 (isofemale line B<sub>25</sub>D<sub>7</sub> from La Rioja, Argentina); 2, *D. antonietae* sp. nov. (paratype, Serrana, São Paulo); 3, *D. gouveai* sp. nov. (paratype, Analândia, São Paulo); 4, *D. serido* Vilela & Sene, 1977 (isofemale line B<sub>53</sub>Q<sub>5</sub> from Milagres, Bahia); 5, *D. seriema* (isofemale line B<sub>95</sub>C<sub>3</sub> from Serra do Cipó, Minas Gerais); 6, *D. borborema* Vilela & Sene, 1977 (isofemale line D<sub>54</sub>B<sub>5</sub>, from Grão Mogol, Minas Gerais).

**Other Features.** Eggs with 4 filaments. Puparia brownish, each anterior spiracle with ca. 14 branches, horn index ca. 2.2.

**Type Material.** BRAZIL. **São Paulo:** Serra do Japi, ♂ holotype, 23-30.III.1994, Sene et al. col.; 20 paratypes: 4 ♂, 4 ♀, same data as holotype; Serrana, 2 ♂, 2 ♀, 18-22.VIII.1997, Brito et al. col. **Paraná:** Sengés, 2 ♂, 2 ♀, 10-18.V.1995, Sene et al. col. **Rio Grande do Sul:** Guaritas, 2 ♂, 2 ♀, 10-18.V.1995, Sene et al. col. All in the Museu de Zoologia, Universidade de São Paulo (MZSP), São Paulo, Brazil.

**Distribution.** *Drosophila antonietae* is apparently limited to the Paraná river basin in southeastern South America (fig. 7) (with the exception of populations inhabiting the coast of the State of Rio Grande do Sul). We collected this species at the following sites: Brazil, Mato Grosso do Sul: Serra da Bodoquena; São Paulo: Sertãozinho, Serrana, Santa Maria da Serra, Campinas, Serra do Japi, Cabreúva, Itu, S. Paulo; Paraná: Rio Ligeiro, Sengés; Rio Grande do Sul: Jaguari, S. Francisco Assis, Tramandai, Guaritas. Argentina, Resistencia and Puerto Tirol (Chaco).

**Etymology.** Named in honor of the late drosophilist Maria Antonieta Milani de Moraes.

**Diagnosis.** *Drosophila antonietae* can be distinguished from the other species of the *D. serido* sibling set by the shape of the aedeagus (figs. 1-6), although the external morphology of these species is very similar. The metaphase plate, described above, is considered also an autapomorphic character state of this species.

**Classification.** *Drosophila antonietae* belongs to the *D. buzzatii* cluster of the *D. buzzatii* complex (*D. mulleri* subgroup) of the *D. repleta* species group.

Biology. Data on the breeding and feeding niches indicate that this species lives primarily on columnar cacti. We found this species in decayed portions of cacti *Cereus hildmaniannus* Schumman, 1890 and *Opuntia monacantha* Haworth, 1819.

***Drosophila (Drosophila) gouveai* sp. nov.**

(Figs. 3, 7)

The first part of the following description only lists the differences between *D. antonietae* and *D. gouveai*.

External characters of imagines. Antennae yellowish with brown spots. Eyes vermilion, slightly darker than those of *D. antonietae* with short black pile. Scutellum dark brown, pleurae dark brown. Legs uniformly dark brown. Costal index about 2.7. Length of body 2.4-3.0 mm (in living specimens); wings about 2.4mm.

Internal characters of imagines and terminalia. Testes orange, with 2.5 inner and 2.5 outer coils. Epandrium with 4-13 bristles, usually 8. Cerci not fused. Surstylus with 6-14 primary teeth, usually 8. Aedeagus as in fig. 3.

Chromosomes. The metaphase plate consists of four pairs of telocentric autosomes, one pair of small dot 6th chromosomes and one pair of sex chromosomes (X telocentric and Y acrocentric). This karyotype probably represents the ancestral configuration of the *repleta* group (BAIMAI et al., 1983). Fixed chromosomal inversions: Xabc; 2abmnz<sup>7</sup>e<sup>8</sup>. Polymorphic inversions: "2a" (TOSI & SENE, 1989).

Other Features. Eggs with 4 filaments. Puparia brownish, each anterior spiracle with ca. 14 branches, horn index ca. 2.2.

Type Material. BRAZIL. São Paulo: Altinópolis, ♂ holotype, 8-12.VIII.1996, Sene et al. col.; 18 paratypes: 3 ♂, 3 ♀, same data as holotype; Analândia, 3 ♂, 3 ♀, 12-16.XII.1994, Sene et al. col. Minas Gerais: Furnas, 3 ♂, 3 ♀, 04-08.X.1994, Sene et al. col. All in MZSP.

Distribution. *Drosophila gouveai* was collected in Central region of South America (fig. 7), at the following sites: Brazil, Pernambuco: Petrolina; Bahia: Xique-Xique, Santo Inácio, Barreiras, Ibotirama, Carirana; Goiás: Cristalina; Minas Gerais: Furnas; Mato Grosso do Sul: Miranda, Bela Vista; São Paulo: Altinópolis, Analândia (Brazil). Paraguay: Bella Vista.

Etymology. Named in honor of the drosophilist Antonio Fernando Gouvêa da Silva.

Diagnosis. *Drosophila gouveai* can be distinguished from the other species of the *D. serido* sibling set by the shape of aedeagus (figs. 1-6), although the external morphologies of these species are very similar.

Classification. *Drosophila gouveai* belongs to the *D. buzzatii* cluster of the *D. buzzatii* complex (*D. mulleri* subgroup) of the *D. repleta* species group.

Biology. *Drosophila gouveai* is found in vegetation of rock outcrops: granite inselbergs and sandstone table mountains. Data on the breeding and feeding niches indicate that this species lives, primarily, on columnar cacti. We have found specimens in decayed portions of cacti *Pilosocereus machrisii* Dawson, 1960 in Altinópolis, São Paulo, and *Opuntia ficus-indica* Miller, 1788 in Bela Vista, Mato Grosso do Sul (PEREIRA et al., 1983).

Reproductive isolation. Although individuals identified as *Drosophila gouveai* produce offspring when crossed (without mate choice) with closely related species (MADIRAVAZZI et al., 1997), the resulting hybrids generally have low fertility or are sterile.

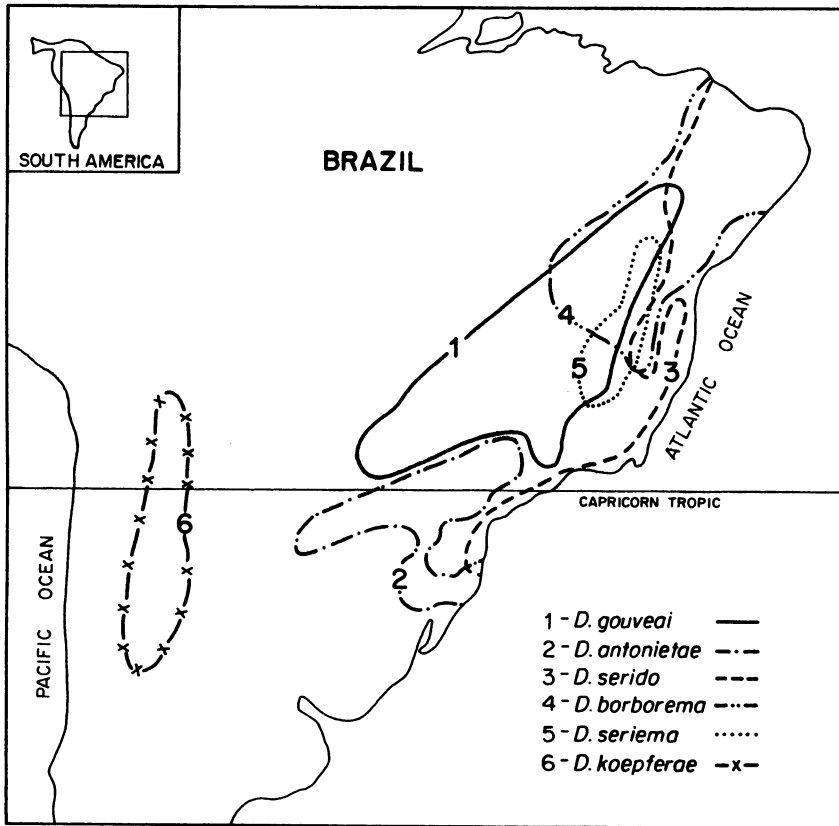


Fig. 7. South America distribution of the known *Drosophila serido* sibling set.

## DISCUSSION

Several studies of populations of the *buzzatii* cluster using different markers have shown very clearly that *D. serido* corresponds to a polytypic species. A phylogenetic analysis of characters obtained with these markers, however, demonstrated that the taxon *D. serido* corresponds to a non-monophyletic entity (TIDON-SKLORZ & SENE, 1995c). The description of *D. koepferae* and *D. seriema* on the one hand, and *D. antonietae* and *D. gouveai* on the other, removed from this sibling set of species differentiated monophyletic groups of populations that deserve specific status.

It is interesting to emphasize that species of this set are morphologically very similar to each other: females are undistinguishable and males can only be identified by their terminalia. However, these species show genetic differences (such as fixed and polymorphic chromosomal inversions), ecological preferences (host plants) and therefore belong to distinct phylogenetic lineages. *Drosophila antonietae* shares the  $2x^7$  inversion with *D. serido* (**stricto sensu**), the latter occurring in the northeastern and eastern coast of South America and having a different metaphase plate and terminalia from the former. *Drosophila gouveai* shares the  $2e^8$  fixed inversion with *D. seriema* and *D. borborema*. These three species, nevertheless, differ with respect to morphology of male terminalia, polymorphic chromosomal inversions and, in addition, are reproductively isolated. The morphological resemblance among the species of this sibling set is probably due to a

recent common phylogenetic origin, coupled with an apparent absence of selective pressure that led to morphological differentiation (since these species are cactophilic and live in similar environments). This suggests the occurrence of stable coadapted genic complexes, responsible for the external phenotype.

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