

Arthropods associated with the
carnivorous plant *Drosera latifolia* (Droseraceae)
in an area of Atlantic Forest
(southeastern Brazil)

Artrópodes associados
à planta carnívora *Drosera latifolia* (Droseraceae)
em uma área de Floresta Atlântica
(sudeste do Brasil)

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Carnivorous plants often live in wet or seasonally humid, well-exposed habitats with nutrient-poor soils, and are capable of attracting, trapping, and digesting animal prey, mostly insects, as well as absorbing the results of digestion (GIVNISH *et al.* 1984, BENZING 1987, JUNIPER *et al.* 1989). Nitrogen and phosphorous are the most significant nutrients absorbed by carnivorous plants from their digested prey (PATE & DIXON 1978).

The genus *Drosera* L., commonly known as sundews, includes approximately 200 mostly perennial species found in temperate and tropical regions, with the main centre of diversity in the Southern Hemisphere (McPHERSON 2010). Although several species are widespread, there is a high degree of endemism. Nearly 30 taxa are known to occur in South

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America (GONELLA *et al.* 2014). *Drosera* are herbaceous plants, their leaves covered with stalked glands on the upper surface of the lamina, producing an adhesive mucilage that captures small arthropods. In the majority of species, the glandular tentacles, and often the leaves as well, will slowly bend over captured prey to aid digestion and absorption by increasing the surface contact with the leaves and their enzyme secreting glands (JUNIPER *et al.* 1989).

Drosera latifolia (Eichler) Gonella & Rivadavia (Fig. 1) is a variable and widespread species distributed from southern Brazil (near the border between Rio Grande do Sul and Santa Catarina) to central and eastern Minas Gerais. It is closely related to other members of the so-called *D. villosa*-complex: *D. villosa* A.St.-Hil. (native to southern Minas Gerais), *D. ascendens* A.St.-Hil. (native to central Minas Gerais), *D. graomogolensis* T.R.S.Silva (native to northern Minas Gerais), *D. chimaera* Gonella & Rivadavia (native to northern Minas Gerais), and *D. riparia* Rivadavia & Gonella (native to central Bahia) (GONELLA *et al.* 2014). The main similarities between these six species are the semi-erect oblong to lanceolate leaves, the small rectangular stipules, and microanatomical characters of the non-carnivorous leaf trichomes (GONELLA *et al.* 2014).

Drosera latifolia has been erroneously considered synonymous with *D. villosa* by most authors over the past 100 years (e.g.: DIELS 1906, SANTOS 1980, SILVA & GIULIETTI 1997, CORREA & SILVA 2005, SILVA 2013) and with *D. ascendens* in a few studies from the past 20 years (e.g.: RIVADAVIA *et al.* 2003, RIVADAVIA 2005, 2009). The taxonomic confusion

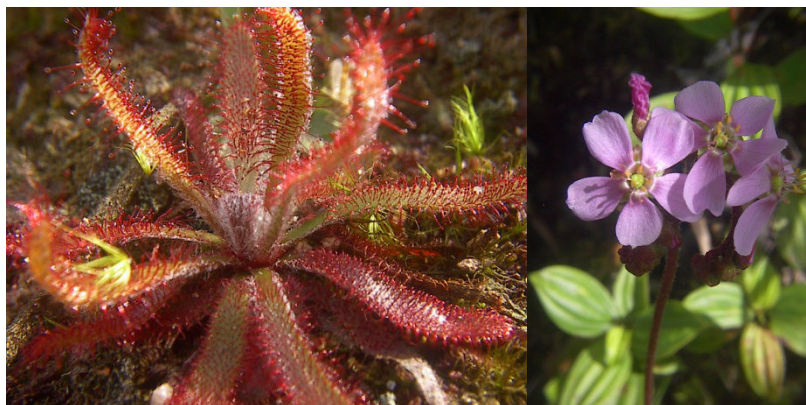


Fig. 1. *Drosera latifolia*: details of the leaf rosette (left) and flowers (right) at the study site in Petrópolis.

involving these taxa was finally resolved in a recent review of the *D. villosa*-complex (GONELLA *et al.* 2014).

This study is the first to present a list of prey items captured by *D. latifolia*, including information on habitat in a site of Brazilian Atlantic Rain Forest Region.

MATERIALS AND METHODS

The study was conducted in the city of Petrópolis (22° 30' 18''S / 43° 10' 43''W), located on the Serra dos Orgãos Mountain Range (Rio de Janeiro State, southeastern Brazil), where the observed population of *D. latifolia* occupies an area of 2.5 m x 5 m on a rocky slope covered with a thin layer of soil at an anthropic site near areas of Atlantic Tropical Rain Forest.

The arthropod fauna trapped as prey on the leaves of *D. latifolia* was exhaustively collected between 10:00 am and 12:00 pm over a period of seven non-consecutive days in the wet season of 2008, between January and March (Table 1). All macroarthropods present on the soil near the plants were collected as well. These were all preserved in 70% ethanol and deposited in the Entomological Collection of Instituto Oswaldo Cruz (CEIOC). Identification of the insect taxa followed BIDAWID AND FITTKAU (1995), BIDAWID-KAFKA (1996), CORREIA & TRIVINHO-STRIXINO (2007), EPLER (2001), SPIES & REISS (1996), TRIVINHO-STRIXINO (2011) and WIEDERHOLM (1989).

RESULTS

Only midges of the family Chironomidae (Diptera: Nematocera) were found trapped on the leaves of *D. latifolia*. The prey comprised taxa from subfamilies Chironominae and Orthocladiinae, with a clear preference for Chironominae. The most frequently caught prey taxon was *Chironomus stigmaterus* Say, 1823. Each midge taxon and its respective number of trapped individuals collected on each day is listed in Table 1.

Several other insects and spiders were observed on the soil surface near the plants (see Table 2), but were not found trapped on the leaves and are probably not typically part of the *D. latifolia* diet.

Although some species of Formicidae and Araneae were observed on the leaves of *D. latifolia*, these were freely moving around and did not appear to be immobilized by the adhesive glands.

Table 1. Prey taxa and number of specimens collected from the leaves of *D. latifolia*.

Taxa	Jan.5	Jan.13	Jan.19	Jan.26	Feb.17	Mar.2	Mar.9	Total
CHIRONOMINAE								
<i>Chironomus stigmaterus</i>		168	39	13	28	13	37	298
<i>Chironomus</i> sp.						8	5	13
Genus indet.				9				9
ORTHOCLADIINAE								
<i>Bryophaenocladus</i> sp	1							1
<i>Cricotopus</i> sp.			8	10	2			20
<i>Metriocnemus</i> sp.	1					8		9
Genus indet.							2	2

Table 2. Associated fauna found on the soil surrounding *D. latifolia*: major taxa and number of individuals collected.

Taxa	Jan.5	Jan.13	Jan.19	Jan.26	Feb.17	Mar.2	Mar.9	Total
Formicidae	4		6	7	3	3	1	24
Hym. (except Formicidae)	1	7			1			9
Diptera								
<i>Chironomus stigmaterus</i>			13	1				14
Diptera	2			2		5		9
Hemiptera		1		2		1		4
Orthoptera	1		1	1				3
Mantodea (exuvia)			1					1
Isoptera		1						1
Psocoptera			1					1
Araneae	1					1		1

DISCUSSION

The prey composition of *D. latifolia* comprises mostly nematoceran flies of the families Chironomidae (non-biting midges), similar to the report of Nematocera (thread-horns) as main prey for other species of *Drosera*: *D. intermedia* (VAN ACHTERBERG 1973, THUM 1986, 1989) and *D. anglica* (VAN ACHTERBERG 1973, MURZA *et al.* 2005, HAGAN *et al.* 2008) and *D. rotundifolia* (VAN ACHTERBERG 1973, THUM 1986, 1989) in the Northern Hemisphere, as well as the Western Australian tuberous species *D. menziesii*, *D. pallida* and *D. stolonifera* (VERBEEK & BOASSON 1993). In the flat-rosetted tuberous Australian *D. erythrorhiza*, Nematocera constitute the second largest percentage of caught prey, following Collembola (DIXON *et al.* 1980, WATSON *et al.* 1982). The predominance of Chironomidae species as prey of *D. latifolia* seems to be related to the generally small size and the delicate body constitution of these insects. The mucilage of *Drosera* leaves has a limited retention capacity for prey, allowing only small arthropods to be captured (WATSON *et al.* 1982, ZAMORA 1990, GIBSON 1991). Besides their small size, adult midges frequently form swarms (OLIVER 1971, ARMITAGE *et al.* 1995), facilitating capture by the plants. Moreover, in combination to their mass occurrence in swarms and the soft-bodied nature, their attraction to glistening surfaces - several taxa of non-biting midges are feeding on nectar, honeydew, and sugary plant secretions, for example *Chironomus* sp. (ARMITAGE *et al.* 1995), moreover, they are known to be attracted to water surfaces which they recognize by the polarized light reflections (SCHWIND 1992) - makes Chironomidae a perfect and easy prey for the visual stimuli of the adhesive traps of *Drosera*. However it is yet unknown whether the insects are actively attracted towards the deceptive, glistening leaves of the *Drosera* in search of food or oviposition sites, or if they are just caught casually when passing by them.

Other insects and spiders found on the soil and near the plants probably are not trapped by the *D. latifolia* due to their morphological characteristics and behavior. Some bugs have an anti-adhesive, greasy, epicuticular layer that enables them to walk on sticky plant surface and many other insects have morphological and behavioral characteristics that contribute to this ability, such as a large body mass or long slender legs that help avoid entanglement in the glandular plant secretions (VOIGT & GORB 2010). Large and agile insects – such as ants and beetles – are known to be able to free themselves from the sticky mucilage tentacles

of *Drosera*. Moreover, some ants are even known to be able to steal prey from *Drosera* leaves in a kleptoparasitic manner (THUM 1989).

RESUMO

Um inventário preliminar da fauna de artrópodes associada à planta carnívora *Drosera latifolia* (Eichler) Gonella & Rivadavia é apresentado neste estudo, realizado na cidade de Petrópolis (estado do Rio de Janeiro, Brasil). O principal grupo de insetos coletados nas folhas foi o dos quiromídeos (Diptera: Chironomidae). Outros artrópodes foram coletados no solo perto das folhas, porém não foram capturados pelas plantas.

PALAVRAS-CHAVE: insetos; quiromídeos; Petrópolis; Serra dos Orgãos

SUMMARY

A preliminary inventory of the arthropod fauna associated with the carnivorous plant *Drosera latifolia* (Eichler) Gonella & Rivadavia is presented in this study, carried out in the city of Petrópolis, located on the Serra dos Orgãos Mountain Range (Rio de Janeiro State, Brazil). The main insect group collected from the leaves consisted of non-biting midges (Diptera: Chironomidae). Other arthropods were collected on the soil near the leaves but were not trapped by the plants.

KEYWORDS: insects; chironomes; Petrópolis; Serra dos Orgãos Mountain Range

RÉSUMÉ

Un inventaire préliminaire de la faune des arthropodes associés à la plante carnivore *Drosera latifolia* (Eichler) Gonella & Rivadavia est présentée dans cette étude, menée dans la ville de Petrópolis (Etat de Rio de Janeiro, Brésil). Le principal groupe d'insectes collectés dans les feuilles sont les quiromídeos (Diptera: Chironomidae). Autres arthropodes ont été recueillies dans le sol près des feuilles, mais n'ont pas été saisis par les plantes.

Mots-clés: insectes, mouchérons piqueurs, Petrópolis, Serra dos Órgãos

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