Revista Brasileira de Entomologia 60 (2016) 68–72

REVISTA BRASILEIRA DE
Entomologia
A Journal on Insect Diversity and Evolution
www.rbentomologia.com

Biology, Ecology and Diversity

Biology of the immature stages of *Strymon crambusa* (Lycaenidae, Theclinae) on Oxalidaceae

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ARTICLE INFO

Article history:
Received 23 July 2015
Accepted 4 November 2015
Available online 28 November 2015
Associate Editor: Hector A. Vargas

Keywords:
Abundance
Cerrado grassland
Hemiargus hanno
Oligophagous
Papilionoidea

ABSTRACT

We document the biology and morphology of the egg, caterpillar, and pupa of *Strymon crambusa* (Hewitson, 1874), a Neotropical Eumaeini. In the Cerrado, the caterpillar feeds on the inflorescences and leaves of *Oxalis* L. *S. crambusa* has four larval instars, all of which are illustrated. The density of caterpillars on plants is higher than that recorded for leaf-feeding caterpillars and other flower-feeding Eumaeini, which suggests that the species is a specialist on Oxalidaceae in the Cerrado.

Introduction

The Eumaeini Tribe (Lycaenidae, Theclinae) is primarily Neotropical (Robbins, 2004) and is often considered the most diverse tribe of butterflies (Papilionoidea) (Fiedler, 1996; Quental, 2008). *Strymon* Hübner is one of the most species-rich genera of Eumaeini (54 species) (Robbins, 2004). It is widely distributed, with some species restricted to dry areas of Central America and South America (Austin and Johnson, 1997; Brown, 1993; Johnson et al., 1990; Nicolay and Robbins, 2005; Robbins and Nicolay, 2002). Some species are highly polyphagous, and more than 30 plant families are cited as food plants for this genus (Beccaloni et al., 2008; Robbins and Nicolay, 2002; Silva et al., 2011).

There are few published works on the biology of *Strymon* immatures in South America, except those related to bromeliads, especially pests of pineapple (Lacerda et al., 2007; Robbins, 2010; Schmid et al., 2010). *Strymon* caterpillars, as well as several other Eumaeini, have specialized in eating the reproductive structures of plants (Badenes-Pérez et al., 2010; Chew and Robbins, 1984; Daniels et al., 2005; Silva et al., 2011). For the Neotropics in general, though, little information is available on the biology of *Strymon* immatures and their food plants (Vila and Eastwood, 2006; Silva et al., 2014). In the Distrito Federal (DF) of Brazil, there are 10 recorded species of *Strymon* (Brown and Mielke, 1967; Pinheiro and Emery, 2006; Pinheiro et al., 2008), with local food plant records for five of them (Silva et al., 2011). This paper focuses on the biology of the immature stages of *Strymon crambusa* (Hewitson, 1874).

S. crambusa is a medium sized Eumaeini that is rarely sampled in adult inventories (Austin and Johnson, 1997; Paluch et al., 2011). The distribution of this species includes parts of Argentina, Bolivia and Brazil in the states of Rondônia, Pernambuco, Rio de Janeiro, Minas Gerais and DF (Austin and Johnson, 1997; Johnson et al., 1990; Paluch et al., 2011; Pinheiro and Emery, 2006; Zikán and Zikán, 1968). The only recorded food plant for *S. crambusa* is *Oxalis* sp. (Silva et al., 2011), noted during a survey of Eumaeini caterpillars in inflorescences in the Cerrado of DF. The plant has now been identified as *Oxalis densifolia* Mart. and Zucc.

Subsequently, specific searches have been made for immatures of *S. crambusa* on Oxalidaceae and, recently the species was observed also on *Oxalis cordata* A. Saint-Hilaire. The objective of the present work is to document these findings on the biology and morphology of immature *S. crambusa* in the DF of Brazil.

Material and methods

Study area

The survey was conducted in the Fazenda Água Limpa (FAL) (15°55′ S–47°55′ W) at 1050–1100 m elevation. The FAL is a 4500 ha

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http://dx.doi.org/10.1016/j.rbe.2015.11.003

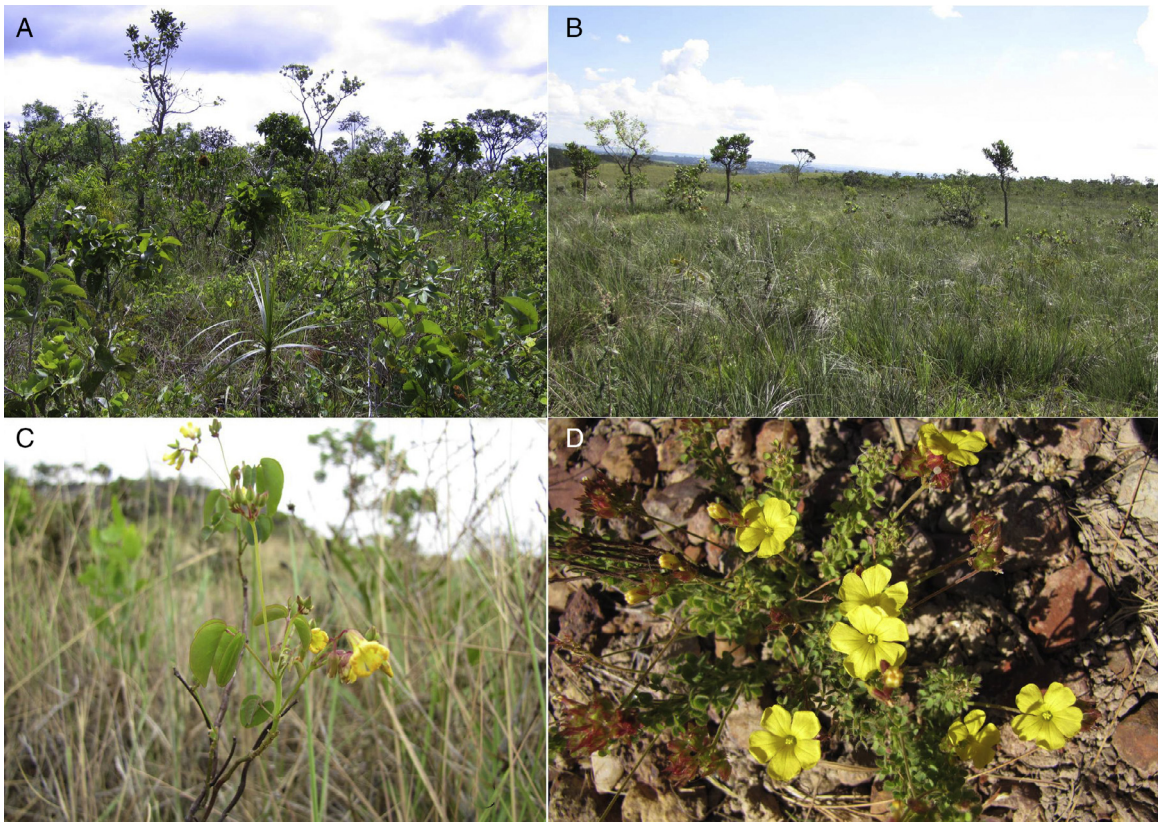

Fig. 1. Host plants and general view of the vegetation of study areas of *Strymon crambusa*. (A) cerrado *sensu stricto*; (B) "campo sujo" (Cerrado grassland); (C) *Oxalis cordata*; (D) *Oxalis densifolia*.

experimental farm with conserved and protected areas of Cerrado vegetation. It belongs to the Universidade de Brasília (UnB), being a part of the core of the Environmental Protection Area of Gama e Cabeça de Veado, DF, Brazil. The FAL vegetation has several Cerrado biome physiognomies, from open areas, such as grasslands, to gallery forests (Ratter, 1980; Munhoz and Felfili, 2005). Plants were searched in random areas of cerrado *sensu stricto* and "campo sujo" (Fig. 1A and B). "Campo sujo" is dominated by herbaceous plants, but may also contain shrubs and semi-shrubs, and cerrado *sensu stricto* is woody savannah with 15–30% tree cover (Munhoz and Felfili, 2006; Oliveira-Filho and Ratter, 2002). The region has defined dry (May–September) and wet (October–April) seasons, with a mean annual precipitation of 1417 mm, and a mean annual temperature of 22 °C (RECOR, 2014).

Food plants

There are approximately 185 recorded species of *Oxalis* L. (Oxalidaceae) in the Neotropics (Fiaschi, 2010). In the Cerrado of DF, this genus is represented by at least 10 native species, popularly known as "trevo" or "azedinha". *Oxalis* is well known for the presence of oxalic acid in its tissues (Cavalcanti and Ramos, 2001; Reis and Alvim, 2013). Two representative *Oxalis* species in the study areas, *O. cordata* (Fig. 1C) and *O. densifolia* (Fig. 1D), were inspected using similar methodology. These herbaceous shrub species can reach 50 cm tall, allowing the inspection of the plant as a whole. They possess nectaries on their leaves and yellow flowers. Without their flowers, it is not easy to see them in the vegetation. Seasonality of these plants is not well known. Flowering plants have been seen throughout the year, but *O. densifolia* blooms more frequently between October and January (Proença et al., 2006). *O. cordata* loses its leaves at the dry season peak (July and August). The subterranean root system of these *Oxalis* species allows them to re-grow and flower a few weeks after a fire in the Cerrado (Conceição and Giulietti, 1998; Munhoz and Felfili, 2006).

Collection and rearing

We searched for *S. crambusa* eggs and caterpillars from January to September 2012, and from August 2013 to July 2014. No plant was surveyed more than once. All eggs and caterpillars encountered in the field were collected, transferred to the laboratory in plastic bags with parts of the food plant. They were reared in individual plastic pots without temperature or humidity control. Caterpillars were supplied with the food plant *ad libitum*, and preferences for leaves or inflorescences were observed (following Silva et al., 2014). Head capsules were preserved and measured for each molt. Dead caterpillars and emerged parasitoids in the laboratory were fixed in *Kahle* solution and then preserved in 70% ethanol. We consulted Downey and Allyn (1984) and Stehr (1987) for the terminology of general morphology of immature stages. Photographs were taken with a Canon® PowerShot SX20 IS digital camera; measurements and general aspects of morphology were analyzed using a Leica® S8APO stereomicroscope with an attached micrometric scale. Measurements are presented as mean and standard deviation when possible. Immature and adult voucher specimens were deposited in the Coleção Entomológica do Departamento de Zoologia, UnB.

Results

We inspected 222 plants of *O. densifolia* and *O. cordata*. We found no immatures of *S. crambusa* on 67 (30.2%) plants without flowers. However, we found nine eggs and 13 caterpillars of *S. crambusa* (Table 1) on 21 (13.5%) of the 155 plants with flowers. These eggs and caterpillars were collected January–March, May,