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Short Communication

First host plant record for *Strymon davara* (Hewitson) (Lepidoptera, Lycaenidae) in the highly human-modified coastal valleys of the Atacama Desert



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ABSTRACT

Some native plants can survive the disturbances associated with agricultural activities, sometimes being considered weeds and objects of control practices. However, these plants can be very important to support populations of native insects in disturbed habitats. *Alternanthera halimifolia* (Lam.) Standl. (Amaranthaceae) is locally considered a weed, and here it is reported as the first host plant known for the Neotropical hairstreak *Strymon davara* (Hewitson, 1868) based on research performed in the coastal valleys of the Atacama Desert of northern Chile. Furthermore, field observations suggest that this is the only host of *S. davara* in this area. This case provides an example of the importance of a weed in the conservation of local populations of a butterfly in a highly human-modified environment.

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The arid environments of northernmost Chile are characterized by a low diversity of butterflies, with about 50 species recorded from the Arica and Parinacota Region, many of which are represented by peripheral populations of widely distributed Neotropical species that reach their southern limit in this area, while a few other species are endemic to the Andes (Peña and Ugarte, 1996; Vargas, 2013a; Vargas et al., 2015).

The coastal valleys of the Arica Province have been widely recognized as among the most important places for the biodiversity of the Atacama Desert (Estades et al., 2007; Vargas and Parra, 2009). However, they are currently submitted to high anthropological pressures, mostly associated with agricultural activities, and consequently the native vegetation is reduced to small, isolated patches (Luebert and Plissock, 2006). In this context of highly disturbed habitats, some native plants are able to breed in these adverse conditions, with the local farmers referring to them as weeds. These plants may become extremely valuable for the conservation of resident populations of butterflies whose larvae feed on them.

Strymon Hübner, 1818 (Lepidoptera, Lycaenidae, Theclinae, Eumaeini) is a New World hairstreak genus ranging from Canada to Argentina and Chile, and comprises 56 species, which currently are classified in nine species groups (Robbins and Nicolay, 2002;

Nicolay and Robbins, 2005; Grishin and Durden, 2012). Although the life histories of several species of *Strymon* remain insufficiently studied, host plants have been reported for many of them, and these involve more than 30 plant families (Robbins and Nicolay, 2002). While the larvae of some species are strikingly polyphagous, others have more restricted host ranges (Robbins and Nicolay, 2002; Silva et al., 2011, 2016). The larvae of the *S. serapio* and *S. ziba* species groups feed on Bromeliaceae and may reach pest status on pineapple (Robbins, 2010).

Two species of *Strymon* have been recorded in the coastal valleys of the Atacama Desert in the Arica Province (Peña and Ugarte, 1996): *Strymon bubastus* (Stoll, 1780) and *Strymon davara* (Hewitson, 1868). *S. bubastus* is widely distributed in the Neotropical Region, ranging throughout a greater part of mainland South America and the Caribbean Islands (Robbins and Nicolay, 2002; Nicolay and Robbins, 2005). It is a polyphagous species, with reported larval host plants belonging to six families (Beccaloni et al., 2008; Silva et al., 2014; Vargas et al., 2016). The populations of the Atacama Desert are associated with Malvaceae and Verbenaceae, upon which the larvae eat inflorescences and display host-associated polychromatism (Vargas et al., 2016). *S. davara* is a poorly known hairstreak with a narrower geographic distribution, ranging from southern Peru to northern Chile (Peña and Ugarte, 1996). Robbins and Nicolay (2002) indicated that, as also observed in many other species of the genus, the males of *S. davara* occupy mating territories where they perch. However, no data have been published on its

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immature stages. Accordingly, the objective of this contribution is to provide the first life history notes on *S. davara*, including the first host plant record, based on sampling performed on a native weed in the coastal valleys of the Atacama Desert of northern Chile.

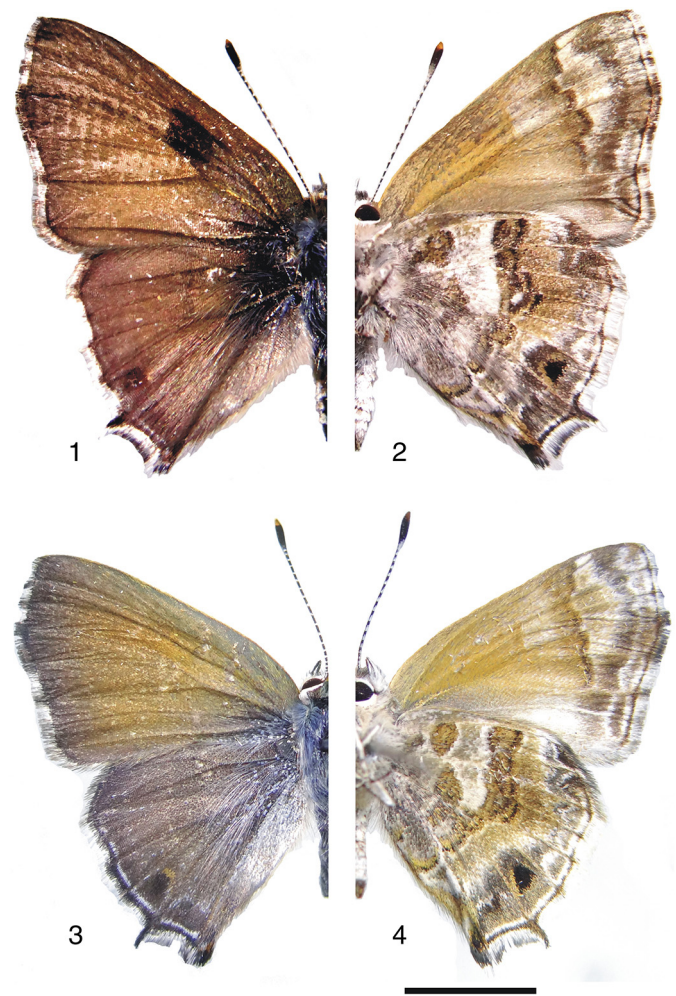
The study was carried out in the Azapa Valley (18°31'S, 70°10'W), Arica Province, northern Chile. This transversal valley extends from the Andes ranges to the Pacific Ocean in the Atacama Desert, an area characterized by a tropical hyper desertic bioclimate with mean annual precipitation about 0 mm (Luebert and Plissock, 2006). The transversal valleys of the Atacama Desert harbor perennial or semi perennial streams as a result of the summer rains that occur in the high plateau and the western slopes of the Andes, which supports native vegetation and agricultural activity (Vargas and Parra, 2009).

Larvae (mostly final instars) of *S. davara* were found on inflorescences of *Alternanthera halimifolia* (Amaranthaceae) between 2002 and 2015. On each occasion the larvae were collected and taken to the laboratory in individual plastic vials. Fresh inflorescences were added daily until the larvae finished feeding and started pupating. Pupae were periodically observed until adult emergence. Adults were pinned and spread following standard procedures. In addition, inflorescences of *A. halimifolia* were randomly collected in July 2015 with the purpose of finding eggs and younger larvae. Rearing procedures followed those mentioned above; a few larvae were successfully reared to adults, while some representatives of each stage were stored in ethanol 70% for subsequent morphological studies. Vouchers are deposited in the Colección Entomológica de la Universidad de Tarapacá (IDEA), Arica, Chile.

In order to assess the host range of *S. davara*, at least 20 plants representing the other species of Amaranthaceae of the study area (i.e. *Amaranthus* sp., *Atriplex* spp., *Chenopodium* sp.) were carefully searched for immature stages of this hairstreak. A similar survey was performed on species belonging to other families: Anacardiaceae (*Schinus molle*), Asteraceae (*Baccharis alnifolia*, *Grindelia tarapacana*, *Pluchea chingoyo*, *Tessaria absinthioides*), Bignoniaceae (*Tecoma fulva*), Boraginaceae (*Heliotropium curassavicum*), Euphorbiaceae (*Euphorbia* spp.), Fabaceae (*Acacia macracantha*, *Geoffroea decorticans*, *Prosopis alba*), Malvaceae (*Waltheria ovata*), Myricaceae (*Morella pavanis*), Salicaceae (*Salix humboldtiana*), Solanaceae (*Solanum peruvianum*) and Verbenaceae (*Phyla nodiflora*, *Pitraea cuneato-ovata*).

Twenty-four adults were obtained by rearing (13 males, 11 females), all of which were identified as *S. davara* based on wing pattern (Figs. 1–4). No parasitoids were detected in the laboratory rearing. All the larvae were feeding on inflorescences of *A. halimifolia* when they were collected, and continued to feed on it in laboratory conditions, mostly on the reproductive tissues of the plant. Molting was observed several times, and the subsequent instars continued to feed normally until pupation. Thus, *A. halimifolia* is effectively used as a host plant by larvae of *S. davara*. In contrast, immature stages of *S. davara* were not found on the other plants surveyed.

Adults fly throughout the year in the study site. Females deposited the eggs only on open flowers, close to the pistil, remaining concealed by the external tepals and bracts after anthesis (Fig. 5). The larvae feed only on the inflorescences, mostly on the pistil and young fruits. Four instars were observed. The first instar partially consumes the chorion to exit the egg; it starts consuming the plant tissue while concealed with the head toward the base of the pistil and the anal apex directed to the distal apex of the bracts (Fig. 6). Fecal pellets can be observed intermixed with the anthers and the tips of the bracts (Fig. 7). Subsequent instars become progressively more exposed. Third and fourth instars are cryptic (Figs. 8–10) and eat with the thorax and abdomen fully exposed and the head inserted into the inflorescences. These later two instars can be found on the shoots of the host when



Figs. 1–4. Adults of *Strymon davara* reared from larvae collected on *Alternanthera halimifolia*. 1–2, Male, dorsal and ventral view, respectively. 3–4, Female, dorsal and ventral view, respectively. Bar = 5 mm.

moving from one inflorescence to another. Although the integument of the last instar bears a dorsal nectary organ (DNO) and pore cupola organs (PCOs), no interaction with ants was observed. No pupae were found in the surveys. In a few instances ($n = 2$) pupation occurred on host leaves during the laboratory rearing, but pupation occurred mostly on the paper towel placed at bottom of the vials ($n = 22$), suggesting that pupation takes place off of the plant under field conditions, probably on the dried leaf litter. The pupal stage lasted 11–12 days. Immature stages of *S. davara* can be found throughout the year in association with the continuous activity of the adults and availability of inflorescences of *A. halimifolia* in the study site.

Weeds may be involved in many ecological interactions in agroecosystems, among which competition with cultivars is perhaps the most evident, mostly due to its negative economic consequences (Ma et al., 2015). However, weeds may also provide many other less evident but extremely important services, as when they are used as a food source or refuge for pollinators (Nicholls and Altieri, 2013).

Butterflies may use exotic weeds as host plants or nectar sources (Shapiro, 2002). Accordingly, exotic weeds could underlie expansions of geographic ranges or fly seasons of butterflies (Graves and Shapiro, 2003). Also, they may be the only or the most abundant host plant available to support local populations of native butterflies in highly human-disturbed habitats (Shapiro, 2002; Vargas, 2013b). However, the presence of exotic plants can be negative

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