

SHORT COMMUNICATION

**Lycaenid caterpillars (Lepidoptera, Lycaenidae) eating flowers of *Dalea pennellii* var. *chilensis* (Fabaceae) in the northern Chilean Andes**

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**ABSTRACT.** Lycaenid caterpillars (Lepidoptera, Lycaenidae) eating flowers of *Dalea pennellii* var. *chilensis* (Fabaceae) in the northern Chilean Andes. The shrub *Dalea pennellii* var. *chilensis* (Fabaceae) is reported for the first time as a host plant for three Neotropical Polyommataini (Lepidoptera, Lycaenidae, Polyommatainae): *Hemiargus ramon* (Dognin, 1887), *Leptotes trigemmatius* (Butler, 1881) and *Nabokovia faga* (Dognin, 1895), based on two collections performed in the western slopes of the northern Chilean Andes in two consecutive summers. The relative abundance was always above 90% for *N. faga* while it was always less than 5% for *H. ramon* and *L. trigemmatius*. Furthermore, *N. faga* was not found on inflorescences of other native Fabaceae examined in the study site. This pattern suggests a close relationship between *N. faga* and *D. pennellii* var. *chilensis*, at least at a local scale.

**KEYWORDS.** Andean butterflies; Aridity; Fabales; florivory; inflorescence.

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Despite their generally ephemeral life, flowers are important resources for many phytophagous insects (Held & Potter 2004; Wardhaugh *et al.* 2012; Tsuji & Sota 2013). The feeding damage on any structure of developing floral buds or mature flowers before seed coat formation is known as florivory (McCall & Irwin 2006). In some cases the plant fitness can be seriously decreased by damage in flower structures (Straus *et al.* 2004). Some traits of the plants and the florivores involved in each particular system, such as their life histories and their spatial and temporal patterns of activity, are extremely important in determining the demographic consequences of the florivory for the plant (McCall & Irwin 2006; Alves-Silva *et al.* 2013).

Flower-feeding larvae have been reported for many families of Lepidoptera (Morais *et al.* 2009; Chung *et al.* 2011), including Lycaenidae (Chew & Robbins 1984; Fiedler 1996), with many records for representatives of the Neotropical fauna (Robbins & Aiello 1982). For instance, Lycaenidae was mentioned as the third most important lepidopteran family in number of flower-feeding species in an area of the Brazilian cerrado near Brasília (Morais *et al.* 2009). This specialized feeding behaviour is apparently widespread among the larvae of Neotropical Eumaeini (Badenes-Pérez *et al.* 2010; Kaminski & Freitas 2010; Kaminski *et al.* 2010, 2012, 2013; Silva *et al.* 2011; Bächtold *et al.* 2013; Robbins & Glassberg 2013; Vargas & Duarte 2014) and Polyommataini (Benyamini 1995; Duarte *et al.* 2001; Vargas & Parra 2009). Higher concentrations of proteins and amino acids and lower levels of alkaloids have been mentioned as possible causes underlying the specialization of lycaenid larvae to feed on rapidly

differentiating plant tissue, as flowers or developing fruits (Chew & Robbins 1984).

The western slopes of the northern Chilean Andes, at about 3,000 m elevation, are characterized by a tropical xeric bioclimate (Luebert & Plissock 2006), with a highly seasonal vegetation cover that generally reaches the higher levels about March–April after the summer rains, which provide the necessary water input to prompt vegetative growth (Muñoz & Bonacic 2006; Luebert & Plissock 2006; Vargas & Benítez 2013).

The prostrate shrub *Dalea pennellii* var. *chilensis* (Fabaceae) (Figs. 1–3) is one of the representatives of the native flora of these arid landscapes (Muñoz & Bonacic 2006). Despite the beautiful aspect of this plant during flowering, no studies dealing with its phenology are available in the literature. Preliminary field observations performed by the author indicate that flowering mostly occurs following the start of the leaf development, which begins shortly after the summer rains in the study site. Similarly, no previous studies dealing with insects associated with this shrub were found in the literature; however, Benyamini (1995) mentioned that flowers of another species of the genus, *Dalea cylindrica* var. *sulfurea*, were eaten by larvae of *Nabokovia faga* (Dognin, 1895), based on sampling performed in Putre, at about 3,500 m elevation in the Parinacota Province, northern Chilean Andes.

In general, the biology of the northern Chilean butterflies has been little studied, and their host plant relationships are not adequately known (Benyamini 1995). The objective of this study is to communicate the first observations on lepidopteran larvae feeding on inflorescences of *D. pennellii* var. *chilensis*,



Figs. 1–3. The study site and the host plant. 1, Typical landscape of *Dalea pennellii* var. *chilensis* and its flower-feeding Lycaenidae in the western slopes of northern Chilean Andes, Parinacota Province. 2, *Dalea pennellii* var. *chilensis* in January 2013. 3, Inflorescence of *Dalea pennellii* var. *chilensis* at beginning of the flowering in January 2013.

based on collections performed in the western slopes of the northern Chilean Andes in two consecutive summers.

In January 2013, as part of a survey of Lepidoptera associated with native plants in northern Chile, eggs and larvae of Lycaenidae were found on inflorescences of *D. pennellii* var. *chilensis* in the area around Socoroma village (18°16' S, 69°35' W), at about 3,300 m elevation in the Parinacota Province. The inflorescences were mostly at the bud stage, with a minor proportion beginning to flower. In order to determine the taxonomic identity and the abundance of the Lycaenidae, 10 plants were randomly selected and 10 inflorescences were randomly collected from each, which were brought to the laboratory to search for eggs and larvae. Some of these individuals were reared to adults to confirm the taxonomic identity and the remaining specimens were kept in ethanol 95% for subsequent studies. Rearing was carried out in individual plastic vials, where fresh inflorescences of the same plant were changed when necessary until the last instar larvae finished feeding. Pupae were periodically observed in order to verify adult emergence. The same collecting and rearing procedures were repeated in March 2014 in the same site when the plants were at the peak of flowering.

Additionally, as some other native Fabaceae were at flowering stage coinciding with *D. pennellii* var. *chilensis*, their

flowers were searched for eggs and larvae of Lycaenidae in January 2013 to determine possible additional host plant associations for the species collected on *D. pennellii* var. *chilensis*. All the inflorescences collected of *Adesmia spinosissima* (n = 30 plants), *Adesmia verrucosa* (n = 10), *Lupinus oerophilis* (n = 30) and *Senna birostris* var. *arequipensis* (n = 40) were carefully examined. Voucher specimens obtained in the rearing of the immature stages collected in the two sampling periods are deposited in the *Colección Entomológica de la Universidad de Tarapacá* (IDEA), Arica, Chile.

As a result of the sampling carried out in 2013, 68 individuals were counted in the 100 inflorescences of *D. pennellii* var. *chilensis* examined, 19 of which were eggs and 49 were larvae. Three species of the Neotropical Polyommataini were identified in the sample (Table I): *N. faga* was the most abundant (n = 62 individuals), while *Hemiargus ramon* (Dognin, 1887) and *Leptotes trigemmatum* (Butler, 1881) were represented by three individuals each. No eggs or larvae of Lycaenidae were found in the survey of the other flowering Fabaceae.

Table I. Number of eggs and larvae (n) and percentage relationships (%) of three flower-feeding species of Neotropical Lycaenidae collected in 100 inflorescences of *Dalea pennellii* var. *chilensis* (Fabaceae) in the western slopes of the northern Chilean Andes in January 2013 and March 2014.

Species	January 2013		March 2014	
	n	%	n	%
<i>Hemiargus ramon</i> (Dognin, 1887)	3	4.41	0	0
<i>Leptotes trigemmatum</i> (Butler, 1881)	3	4.41	1	4.76
<i>Nabokovia faga</i> (Dognin, 1895)	62	91.18	20	95.24
Total	68	100	21	100

Twenty one individuals were found in the 100 inflorescences of *D. pennellii* var. *chilensis* examined in the 2014 sampling, 10 of which were eggs and 11 were larvae. Differently from the previous year, only two species were represented in the sample (Table I): *N. faga* (n = 20) and *L. trigemmatum* (n = 1).

These are the first data dealing with lycaenid larvae feeding on *D. pennellii* var. *chilensis* inflorescences in the northern Chilean Andes. Knowledge about the host range of phytophagous insects is an important aspect for ecological and evolutionary studies (Fiedler 1995, 1996). It is known that egg-laying strategies in butterflies may be locally modified, including differentiation in host use pattern between different populations (Bowers & Richardson 2013; Dolek *et al.* 2013; Vargas 2013). Thus a detailed documentation of host plant relationships at the local scale is crucial to understand the local biology of butterflies.

Host plant associations with representatives of Fabales are widespread in Lycaenidae (Fiedler 1995). The larvae of the three species of Polyommataini recorded here have been already described as Fabaceae-feeding. Previous host plant records available for *H. ramon* are based on collections and rearing performed near sea level in the coastal valleys of the

northern Chilean Atacama Desert on inflorescences of the native *Acacia macracantha* and the exotic *Medicago sativa* (Benyamini 1995; Vargas & Parra 2009). These same two plants are also consumed by larvae of *L. trigemmatius* in the same habitats (Benyamini 1995; Vargas & Parra 2009). In addition, *Prosopis tamarugo* is an important host plant of *L. trigemmatius* in the Pampa del Tamarugal, another hyper-arid area of the Atacama Desert located at about 1,000 m elevation. Also, the exotic plants *Aloysia looseri* (Verbenaceae) and *Plumbago capensis* (Plumbaginaceae) have been reported as hosts for *L. trigemmatius* in central Chile (Benyamini 1995; Peña & Ugarte 1996).

This is the first report of the plant genus *Dalea* as a host for *H. ramon* and *L. trigemmatius*. Although the low abundance detected for both species in the assemblage suggests a weak relationship between these butterflies and *D. pennellii* var. *chilensis*, this new record is helpful to understand the presence of both butterflies in the study area, where their other native host plants are absent. Furthermore, these weak host plant relationships and the absence of other native hosts could be underlying factors of the low abundance generally observed for adults of both species in many sites of the northern Chilean Andes (unpubl. data), contrasting with other landscapes of northern Chile where other native host plants (e.g.: *A. macracantha* and *P. tamarugo*) are available for egg-laying and larval development, and adults of both species can be easily found at least during part of the year (Benyamini 1995).

Besides the previous host record of *D. cylindrica* var. *sulfurea* for *N. faga*, Benyamini (1995) also indicated the Fabaceae *Adesmia melanthes* as a host plant for this species. Thus *D. pennellii* var. *chilensis* is the second host plant in the genus *Dalea* recorded for *N. faga*. The data presented here suggest a strong relationship between *D. pennellii* var. *chilensis* and *N. faga*, as this species was always the most abundant in the assemblage (Table I). This suggestion is also corroborated by the absence of eggs and larvae of *N. faga* on all other native Fabaceae examined in the study site at the same time that these were abundant in the inflorescences of *D. pennellii* var. *chilensis*.

Interestingly, the abundance of *N. faga* was more than three times greater in the 2013 sampling, when the inflorescences were mostly at bud stage, than in the 2014 sampling with the inflorescences at flowering peak (Table I). Unfortunately, the phenology of the northern Chilean Andes butterflies has been little investigated. However, as also mentioned for some other Neotropical lepidopterans (Bendicho-Lopez *et al.* 2003; Pessoa-Queiroz *et al.* 2008; Muniz *et al.* 2012), an important role of the host plant phenology was mentioned for the temporal variation of the host-specialist butterfly *Teriocolias zelia andina* Forbes, 1928 (Pieridae, Coliadinae) in the same study site (Vargas 2012; Vargas & Benítez 2013). Thus the pattern here reported for *N. faga*, with a striking variation in the abundance between two successive summers, deserves further attention as the collections were performed at different flowering stages.

*Nabokovia faga* occurs in the Andes from southern Ecuador to northern Chile (Peña & Ugarte 1996; Bálint & Wojtusiak 2005). The fabacean genus *Dalea* is well represented through a great part of this range (Baldeón *et al.* 2006) which suggests the availability of many potential host plants for this butterfly. At a local scale, additional field and laboratory studies are required in order to characterize better the host plant range and the field biology of *N. faga* in the western slopes of the northern Chilean Andes.

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