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Short Communication

First high-altitude record of *Bucculatrix mirnae* Vargas and Moreira (Lepidoptera, Bucculatricidae) on a newly documented host plant: the importance of host plant distribution for conservation on the western slopes of the Andes mountains of northern Chile

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ABSTRACT

Bucculatrix mirnae Vargas and Moreira, 2012 (Lepidoptera, Bucculatricidae) is a micromoth native to the coastal valleys of the Atacama Desert previously known to occur only in the type locality of the Azapa Valley, close to sea level. Its immature stages are associated with the shrub *Baccharis salicifolia* (Ruiz & Pav.) Pers. (Asteraceae). We report data on the occurrence of *B. mirnae* found for the first time at 3500 m above sea level on the western slopes of the Andes mountains of northern Chile. In addition, *Baccharis alnifolia* Meyen & Walp. is recorded as a new host plant for *B. mirnae*. The implications of this finding for conservation in the arid western slopes of the Andes habitats in northern Chile are discussed.

Mountain ecosystems typically harbor a wide range of habitats distributed across altitudinal gradients, along which several parameters related to insect populations and communities can be strikingly affected (Brehm and Fiedler, 2003; Pyrcz et al., 2009; Choi and An, 2010; Pellissier et al., 2012; Carneiro et al., 2014; de Groot and Kogoj, 2015; Gillette et al., 2015). Thus, descriptive studies on the biodiversity of little-known mountain ecosystems are essential to improve the understanding of ecological and evolutionary aspects of such biota, making it possible to implement better planning and conservation management (Costa et al., 2015).

The Andes mountains of northern Chile are characterized by the presence of several vegetation belts, restricted to specific altitudinal ranges, whose biota have been only partially studied (Luebert and Pliscoff, 2006). Within the Lepidoptera found in this area, butterflies have been relatively well inventoried and investigated in relation to their ecology and conservation status (Despland et al., 2012; Vargas and Benítez, 2013; Despland, 2014; Vargas et al., 2015). On the other hand, micromoths have received little attention in the scientific literature, probably due to their inconspicuousness, which has resulted in a very limited sampling effort. Accordingly, the taxonomic composition of the micromoth families remains unknown for the different high-altitude arid habitats of this part of the Andes.

Bucculatricidae is a widely distributed family of micromoths with approximately 250 species described around the world, most of which are represented in the Nearctic region (Braun, 1963). Contrastingly, the Neotropical fauna of this family has not yet been comprehensibly studied, as just a few species are recorded in this region (Davis and Miller, 1984; Davis et al., 2002).

Larvae of Bucculatricidae are characterized by hypermetamorphic development with up to three morphs in the ontogeny (Friend, 1927; Vargas and Moreira, 2012). Most species are leaf miners in their early instars, becoming either skeletonizers or stem borers in later instars (Davis and Robinson, 1998). On the other hand, there are a number of species that are exclusively leaf miners or gall inducers throughout their lifetime (Braun, 1963). Interestingly, in such species whose larvae become external feeders, a smooth molting cocoon is constructed by third and fourth instars, which makes them strikingly different from the conspicuously ridged pupal cocoon constructed by the fifth (last) instar (Braun, 1963).

Bucculatrix mirnae Vargas and Moreira, 2012 is the only species of Bucculatricidae from Chile that has been described to date. Its larvae are associated with *Baccharis salicifolia* (Ruiz & Pav.) Pers. (Asteraceae), feeding internally as leaf miners during the first three

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Figs. 1–2. The habitats of *Bucculatrix mirnae* in the arid northern Chile. (1) The lowland Azapa Valley (type locality) located in the coastal Atacama Desert close sea level. (2) The highland neighborhood of Putre village at about 3500 m elevation on the western slopes of the Andes.

instars, and subsequently changing to external feeding as leaf skeletonizers in the fourth and fifth instars (Vargas and Moreira, 2012). Although the geographic range of *B. mirnae* could include additional coastal valleys of the Atacama Desert, records are currently restricted to the type locality of the Azapa Valley (Fig. 1), in the Arica Province, in northern Chile. The objective of this contribution is to expand the altitudinal range of *B. mirnae*, to report a new host plant association, and to discuss the importance of host plant distribution to conserve *B. mirnae*.

As part of a study of the Lepidoptera associated with the native vegetation of northern Chile, nine skeletonizer larvae of Bucculatricidae were found actively feeding on leaves of *Baccharis alnifolia* Meyen & Walp. (Asteraceae) in July 2013 near Putre village (Fig. 2), in Parinacota Province, at about 3500 m above sea level. The larvae were collected and brought to the laboratory in plastic vials. Leaves of the same plant were added daily until the last instar started to construct the pupal cocoon. Vials were periodically examined to verify adult emergence. The adults obtained were mounted and studied, following standard procedures for taxonomic identification (Basilio et al., 2015). Voucher specimens were deposited in the "Colección Entomológica de la Universidad de Tarapacá" (IDEA), Arica, Chile.

Four male and five female adults of *B. mirnae* were obtained from the larvae collected in the field. This finding expands the altitudinal range of this micromoth by more than 3000 m since it has previously been recorded only at near sea level. In addition, this is the first record of *B. alnifolia* as a host plant for *B. mirnae*, as the previous record was on the species *B. salicifolia* (Vargas and Moreira, 2012).

Although several Asteraceae-feeding *Bucculatrix* have been reared from just one host plant, some species are associated with a few congeneric hosts or with a few hosts belonging to different genera (Braun, 1963). Based on the findings reported here, it seems that the capacity of *B. mirnae* to use different plants of *Baccharis* would allow it to survive in both lowland and highland habitats. However, it is known that depending on their dispersal abilities, insect populations can undergo local adaptations and genetic differentiation associated with habitat diversity along altitudinal gradients (Hodkinson, 2005). For instance, cryptic differentiation correlated with elevation was reported for an endemic micromoth from the Galapagos Islands, clearly associated with different habitats (Schmitz et al., 2008). In addition, differential host plant use can play an extremely important role in the ecology and evolution of Lepidoptera (Ohshima, 2008; Jorge et al., 2011; Benítez et al., 2015), and cryptic species of micromoths can be associated with different host plants (Huemer et al., 2014; Kawakita and Kato, 2016).

A considerable habitat diversity is represented throughout the altitudinal gradient displayed from the lowland coastal area of the Atacama Desert to the highland Altiplano area of the Andes region in the northernmost part of Chile, where several species of *Baccharis* are represented (Luebert and Pliscoff, 2006). In the case of butterflies, for instance, their distribution and abundance on different altitudinal belts appear to be determined by the presence of adequate host plants (Benyamini, 1995; Despland et al., 2012; Vargas and Benítez, 2013; Despland, 2014; Vargas, 2014). Thus, documenting the geographical distribution of the scattered host plants of *B. mirnae* becomes essential in order to conserve suitable habitats for this micromoth species. Additionally, decision making based upon host plant distribution would allow the conservation of a wide range of high altitude habitats on the western slopes of the Andes mountains of northern Chile, an area with arid habitats under severe threat due to shifts in land use that favor either mining or tourism (Despland et al., 2012; Despland, 2014). New species records and associations such as the one presented in this study contribute to reinforce the importance of utilizing new species records to conserve species as well as habitats.

Conflicts of interest

The authors declare no conflicts of interest.

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