

Elevational record of *Vanessa carye* (Hübner 1812) (Lepidoptera Nymphalidae) in the northern Chilean Altiplano Highlands

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Abstract. *Vanessa carye* (Hübner, [1812]) has been reported to have a wide latitudinal range from Venezuela to the south of Chile (Patagonia). Populations are established at 3500 m in Putre region of Chile, with occasional observations around 4500 m. This article reports a new elevational record of *V. carye* above 5200 m located at the Sora Pata Lake, northeast of Caquena, in the highlands of the Chilean altiplano. This finding is the highest population ever reported for this migratory butterfly and one of the highest in the genus *Vanessa*.

Introduction

The cosmopolitan butterfly genus *Vanessa* Fabricius, 1807 (Lepidoptera: Nymphalidae) is a small genus that comprises approximately 20 species present in all the continents except Antarctica. There are six species (*V. cardui*, *V. virginiensis*, *V. atalanta*, *V. indica*, *V. carye* and *V. dimorphica*) within this genus that show impressively large ranges spanning several thousand kilometers (Wahlberg and Rubinoff 2011). These species comprise a well-known migratory group of butterflies, exemplified by the Painted Lady, *V. cardui* and its particularly long migratory flights. Every year *V. cardui* crosses the Sahara Desert twice between Europe and the Afrotropics, a flightpath of at least 4000 km (Talavera and Vila 2016). In addition to such long flight paths, they seem to navigate rather extreme climates. For example, some individuals of *V. cardui* have been recorded in extremely cold localities, even close to the Arctic Circle (e.g. on islands such as Iceland and Svalbard, or in Norway) or towards the Antarctic (e.g. on the island of Marion, 46°55'S) In Chile two butterfly species, *Vanessa terpsichore* Philipi, 1859 and *Vanessa carye* (Hübner, [1812]), have the widest geographical ranges of species in the genus occurring there (Fig.1). The distributional range of the former is much more restricted, ranging from Coquimbo to Magallanes in Chile, compared to the latter. As a result of this limited range, *V. terpsichore* is considered to be a poor disperser within the genus (Wahlberg and Rubinoff 2011). By contrast, *V. carye* ranges from Venezuela to Patagonia and is suspected to be a long-distance migrant. It has been stated that due to its capacity to breed on natural and ornamental Malvaceae among other plants, *V. carye* is one of the most frequently

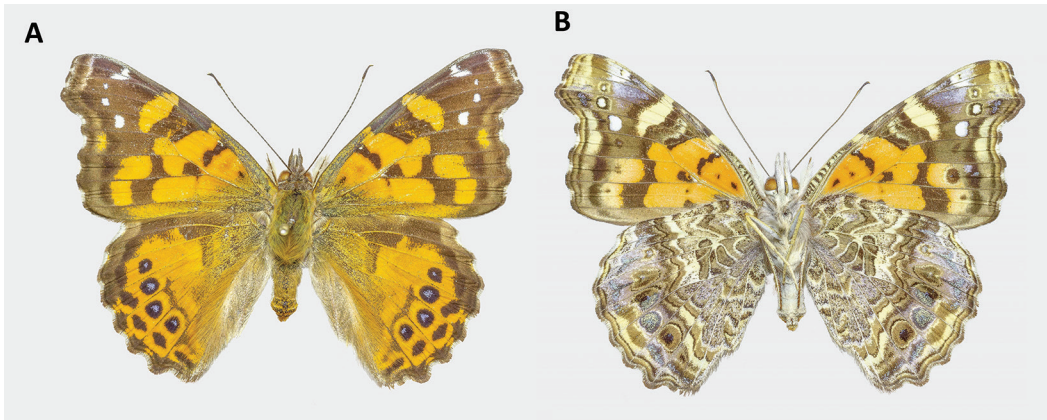


Figure 1. Dorsal and ventral view of *Vanessa carye* (Hübner, [1812]).

observed species in human modified landscapes in South America (Vargas 2013; Herrera 1987). Until now the highest elevation for *V. carye* was recorded at 4850 m in the Atacama region. This observation was made in conjunction with the description of the species pattern of long flight periods through the highest elevation areas in the Altiplano regions (Despland *et al.* 2012). Within the genus *Vanessa*, *V. cardui* has been one of the most studied migratory species, and it has been found that there is a strong correlation between its flight height and the presence of winds from the north of Africa between 1500 m to 3350 m (Shields 1992, Stefanescu *et al.* 2007). Likewise, there have been observations of migratory routes above 5118 m in the Himalayas and 5033 m. in Tibet (Shields 1992), but for *V. cardui* there are few published records of its elevational range (G. Talavera, *com. pers.*). Nevertheless, in South America, there is little available information regarding the full elevational range of *V. carye*, data that could provide important clues to understand the migratory routes and the pattern of climate adaptation of the species. Here, we report the first record for a population of *Vanessa carye* established at 5200 m. Records of thermal or climatic endurance limits in Lepidoptera and other organisms are not merely of factual interest. They may be significant to help explaining how some species attain vast geographic ranges and provide subjects for new models of investigation about other biological traits. However, even in a highly vagile genus like *Vanessa*, it is interesting that some species are highly restricted in distribution and evolutionary diversification can still occur (Talavera and Vila 2016; Wahlberg and Rubínoff 2011).

Material and methods

In April 2018, *Vanessa carye* butterflies were observed flying near Casiri lake (Fig. 2) at 4838 m (18.068°S, 69.0743°W) in the northern Altiplano close to Caquena village (Fig. 3). Peña and Ugarte (1996) report for Chile that the hostplants for *V. carye* are mostly Malvaceae and Urticaceae, nevertheless, other families are reported to be hostplants of *V. carye* in South America by the NHM hosts database including Geraniaceae and Asteraceae that could be potential hosts of Chilean populations (Robinson *et al.* 2010). During a second expedition in May 2019, the route of the butterflies was followed a few kilometers north up to Sora Pata lake at around 5200 m (18.0635°S,

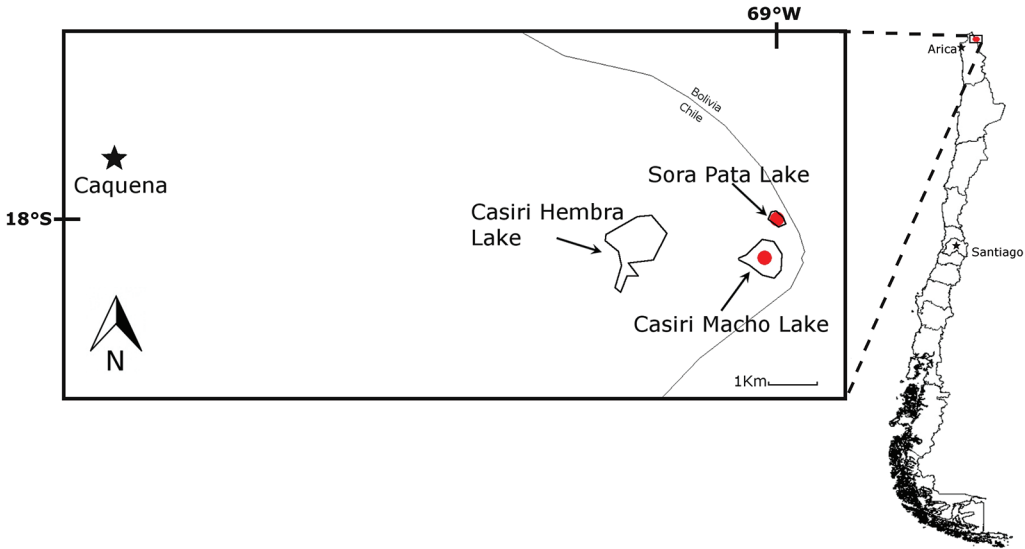


Figure 2. Map of the Northern Chile, Casiri Lake and Sora Pata Lake close to the border with Bolivia at 5200 m.



Figure 3. Casiri Lake, 4838 m 18.068°S, 69.0743°W (Northern Chile).

69.0662°W) (Fig. 4). An established population of *V. carye* was found flying and visiting a small Asteraceae, *Senecio serratifolius* (Meyen & Walp.) surrounding the lake. They were also observed to fly further up the mountain, presumably to hide and protect themselves from the wind.



Figure 4. Sora Pata Lake, 5200 m 18.0636°S, 69.0662°W (Northern Chile).

Results

This is the first *Vanessa* species ever reported in the high Andean Altiplano, flying at about 5200 m around Sora Pata Lake (Fig. 4). Furthermore, our observations indicate that this species may hide at a higher elevation at night, up to approximately 6000 m. Although ovipositing females were not observed among the *S. serratifolius*, signs of larval damage characteristic of *Vanessa* on these plants suggest an established population in the area. The Sora Pata lake is uniquely surrounded by mountains, providing this place with a unique microhabitat protected from the strongest winds at around 5200 m. An additional apparently significant observation was that individuals of *V. carye* were abundant and fresh (i.e., without broken wings) in 2019 in the month of May (when winds are particularly strong). Due to this abundance, 17 specimens could be collected for future molecular analysis.

Discussion

The genus *Vanessa* includes very well documented migratory butterflies, like the Painted Lady (*V. cardui*) which migrates from the Arctic Circle and crosses the Sahara Desert in Africa (Talavera and Vila 2016), and the Red Admiral (*V. atalanta*) which exhibit a seasonal migration throughout Europe and North Africa (Stefanescu 2008). This elevational record for *V. carye* establishes a starting point to analyse the general pattern of migration of this species, particularly in South America, where it has currently practically not been studied, in contrast to the breadth of knowledge already about *V. cardui*.

In Chile *V. carye* shares its territory with other species of its genus; in the mid north of Chile with *V. terpsichore*, and in the altiplano with *V. braziliensis* (Moore, 1883). *V. braziliensis* was discovered to be expanding its territory in the north of Chile within the last six years, particularly

around Socoroma and towns nearby (Vargas 2013). During the 2019 Altiplano expedition, the team found *V. carye* flying together with *V. braziliensis* along a steep elevational gradient near Chapiquiña village at approximately 3340 m. In Chile, the Altiplano corresponds to a narrow strip in the northeast corner of the country (from approximately 17°30'S to 24°S) and is limited in the west by the eastern Andes. With a mean elevation of approximately 5000 m, this area can be characterized by a dry, cold climate, which almost exclusively allows the development of steppe vegetation. Despite this extreme environment, specimens of other butterfly families were found (Lycaenidae, Pieridae and Hesperidae).

V. carye together with its European sister species *V. cardui* (Abbasi and Marcus 2015; Wahlberg and Rubinoff 2011), can be considered as “super butterflies” with the ability to survive in extreme environmental conditions. *V. carye* is considered to be a highly vagile species covering a large distribution in South America, including some oceanic islands like Easter Island, Juan Fernandez and the Tuamotu Archipelago (Field 1971, Wahlberg and Rubinoff 2011, Vargas 2013). As in other members of the genus, the expansive elevational range of *V. carye* is one of the most important facets of the ecological pattern of migration of one of the most outstandingly dispersive butterflies of the Andes and indeed South America.

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References

- Abbasi R, Marcus JM (2015) Color pattern evolution in *Vanessa* butterflies (Nymphalidae: Nymphalini): non-eyespot characters. *Evolution & Development* 17: 63–81. <https://doi.org/10.1111/ede.12109>
- Brattström O, Kjellén, N, Alerstam T, Åkesson S (2008) Effects of wind and weather on red admiral, *Vanessa atalanta*, migration at a coastal site in southern Sweden. *Animal Behaviour* 76: 335–344. <https://doi.org/10.1016/j.anbehav.2008.02.011>
- Despland E, Humire R, Martín SS (2012) Species richness and phenology of butterflies along an altitude gradient in the desert of northern Chile. *Arctic, Antarctic, and Alpine Research* 44: 423–431. <https://doi.org/10.1657/1938-4246-44.4.423>
- Field WD (1971) Butterflies of the genus *Vanessa* and the resurrected genera *Bassaris* and *Cynthia* (Lepidoptera: Nymphalidae). *Smithsonian Contributions to Zoology* 84: 1–105. <https://doi.org/10.5479/si.00810282.84>
- Herrera J (1987) Biología de *Cynthia carye* (Hübner, 1812), especie críptica de *C. annabella* Field, 1971 (Lepidoptera: Nymphalidae). *Acta Entomológica Chilena* 14: 65–116.
- Peña L, Ugarte A (1996) *Las Mariposas de Chile*. Editorial Universitaria, Santiago.
- Robinson GS, Ackery PR, Kitching JJ, Beccaloni GW, Hernández LM (2010) HOSTS – A Database of the World's Lepidopteran Hostplants. Natural History Museum, London. <http://www.nhm.ac.uk/hosts> [Accessed: 12 August 2019]

- Stefanescu C (2001) The nature of migration in the red admiral butterfly *Vanessa atalanta*: evidence from the population ecology in its southern range. *Ecological Entomology* 26: 525–536. <https://doi.org/10.1046/j.1365-2311.2001.00347.x>
- Stefanescu C, Alarcón, M, Àvila A (2007) Migration of the painted lady butterfly, *Vanessa cardui*, to north-eastern Spain is aided by African wind currents. *Journal of Animal Ecology* 76: 888–898. <https://doi.org/10.1111/j.1365-2656.2007.01262.x>
- Talavera G, Vila R (2016) Discovery of mass migration and breeding of the painted lady butterfly *Vanessa cardui* in the Sub-Sahara: the Europe–Africa migration revisited. *Biological Journal of the Linnean Society* 120(2): 274–285. <https://doi.org/10.1111/bij.12873>
- Wahlberg N, Rubinoff D (2011) Vagility across *Vanessa* (Lepidoptera: Nymphalidae): mobility in butterfly species does not inhibit the formation and persistence of isolated taxa. *Systematic Entomology* 36: 362–370. <https://doi.org/10.1111/j.1365-3113.2010.00566.x>
- Vargas HA (2013) First record of *Vanessa braziliensis* (Moore) (Lepidoptera: Nymphalidae) in Chile. *Gayana* 77(2): 171–173. <https://doi.org/10.4067/S0717-65382013000200009>