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First record of a bilateral gynandromorph of *Danaus chrysippus* (Linnaeus, 1758) from Mallorca (Balearic Islands, Spain) (Lepidoptera: Nymphalidae)

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Abstract

Danaus chrysippus (Linnaeus, 1758) was firstly reported in the Balearic Islands during the 1980s in Menorca, and in the 1990s in Mallorca. Since then several continuous reports have been documented over time. Here, in a new locality of distribution of the species in Mallorca (Balearic Islands, Spain), the first record of a bilateral gynandromorph of this species is described.
KEY WORDS: Lepidoptera, Nymphalidae, first record, bilateral gynandromorph, *Danaus chrysippus*, Balearic Islands, Spain.

Primer registro de un ginandromorfo bilateral de *Danaus chrysippus* (Linnaeus, 1758) procedente de Mallorca (Islas Baleares, España) (Lepidoptera: Nymphalidae)

Resumen

Danaus chrysippus (Linnaeus, 1758) fue documentada en las Islas Balares durante la década de los 1980 en Menorca y en los 1990 en Mallorca. Desde entonces continuos registros se han documentado a lo largo del tiempo. Aquí, en una nueva localidad de distribución de la especie en Mallorca (Islas Balares, España) se describe el primer registro de un ginandromorfo bilateral de esta especie.
PALABRAS CLAVE: Lepidoptera, Nymphalidae, primer registro, ginandromorfo bilateral, *Danaus chrysippus*, Islas Baleares, España.

Introduction

Danaus chrysippus (Linnaeus, 1758) is a cosmopolitan migrant butterfly which has been recorded in several tropical and subtropical areas ranging from Africa to Asia, reaching Australia and New Zealand (IDRIS, 2013; HAWKESWOOD & SOMMUNG, 2018). In Europe, there have been several recordings in countries of the Mediterranean basin where a settlement occurred (GIL, 2006; KOREN *et al*., 2019) and an expansion occurred (MASÓ & PÉREZ DE-GREGORIO, 1984). In mainland Spain it was reported in some localities (GONZÁLEZ-LÓPEZ *et al*., 1980; TORRES, 1981, MONTSERRAT & MONTES, 1983; OCHOTORENA, 1983) Regarding the Balearic Islands (Western Mediterranean, Spain), the first records of *D. chrysippus* were reported for the main island, Mallorca, in 1990 (ALOMAR *et al*., 1989-1990), and a private collection revision pointed out its presence as early as 1980 in Menorca (FIOL, 1991; CARRERAS *et al*.,

2004). Since these first records, sparse but continuous sightings have been recorded in the island of Mallorca (PINYA *et al*., 2012; WEIR, 2018). In Europe, *D. chrysippus* inhabits bushy and rocky areas, coastal areas, agricultural areas as well as gardens (TOLMAN & LEWINGTON, 2002). It is a polyvoltine species with a continuous biological cycle, with a flying period from March to November in North Africa and from May to October to Northern and Eastern Mediterranean basin (TOLMAN & LEWINGTON, 2002).

In the Balearic Islands, as well as in the mainland Spain, *D. chrysippus* occurrence has been associated to migration and dispersion events, escaped individuals and sporadic reproductive success (ALOMAR *et al*., 1989-1990; CARRERAS *et al*., 2004; FERNÁNDEZ-HAEGER, 1999). As occurs in other areas, naturalization events seem to be mainly related to the presence of several nutritious plant species of the Asclepiadaceae family (GIL, 2006; HAWKESWOOD & SOMMUNG, 2018). In Mallorca, the occurrence of the alien *Gomphocarpus fruticosus* (L.) Ait. has been pointed out as the main source of nourishment allowing *Danaus* species to establish (ALOMAR *et al*., 1989-1990; ENCINAS & VICENS, 2008). *Asclepias curassavica* L. is also reported from Mallorca as nutritious plant species (ALOMAR et al., 1989-1990), but is not recorded among the alien species capable of constituting natural populations (MORAGUES & RITA, 2005). Other potential nutritious plant species such as *Cynanchum acutum* L. and *Calistegia sepium* R. Br. also occur in Mallorca Island (PLA et al., 1992), and they could had also contributed to its establishment, but as far as we are concerned no records of larvae feeding on these plant species have been reported.

Morphological variability has been studied among subspecies and individuals from *D. chrysippus* (IDRIS, 2013 and references therein), but information regarding morphological abnormalities are scarce. Among these, gynandromorphy is a well-known abnormality with several examples in Lepidoptera species (FUENTES *et al*., 2002; CERVELLÓ & ZSOLT, 2007; VIDAL, 2015). Gynandromorphy is defined as the presence of both male and female morphological traits in the same individual (FUENTES *et al*., 2002). Two types of gynandromorphy can be distinguished: a bilateral one, when male and female traits are scattered each at the wings of one side (right or left); and in mosaic, when abnormalities are only displayed on one part of the wings (FUENTES *et al*., 2002). As these abnormalities are rare or sometimes hard to perceive, any observation is regarded as of great interest and considered under need to be reported (PEIGLER, 1993; VIDAL, 2015).

A population of *D. chrysippus* from the Puig de Son Vila locality, between Sa Pobla and Alcudia municipalities (Mallorca, ETRS89, 31 S 503084 4407190, 250 masl) was surveyed on 9-IX-2019. Further field work allowed to spot several caterpillars feeding on *G. fruticosus* plants. This plant species is locally abundant, with hundreds of adult plants distributed in two main subpopulations (see RIBAS *et al*., 2019 for more details). Fifteen caterpillars were collected in early September (7-IX-2019). During the subsequent breeding attempts under glasshouse conditions (temp: 25ºC, humidity: 75 %), one specimen of the first generation was observed to display an unusual morphological pattern that could be identified as a case of bilateral gynandromorphy. This specimen was preserved in the Interdisciplinary Ecology Group entomological collection with the inventory code EI-1116 (University of the Balearic Islands, Palma de Mallorca, Spain).

Considering the previous statements, and as part of a deeper study on the ecology of different Lepidoptera species, here we report the first record of a bilateral gynandromorph within *D. chrysippus*.

The specimen showed a bilateral gynandromorph displaying female traits in the left side and male traits in the right side (obverse view and inverted for reverse view) (Figure 1). Regarding colour, black and white spots displayed with equal intensity as occurs between males and females. In the case of the orange tonality, the male side (right) exhibited a brighter orange that contrasted

with the darker tonality displayed at the female side (left). However, colour intensity has been indicated to be variable among male and female individuals, depending further of the region and season (TOLMAN & LEWINGTON, 2002).

Figure 1.– A gynandromorph of *Danaus chrysippus* (L.) observed (Mallorca, Balearic Islands, Spain). Dorsal view is represented with **A** picture, while ventral view is represented with **B** picture.

Concerning those distinctive patterns that do allow a proper distinction and assignment of both male and female sides, these are mainly indicated by the hindwings. In the case of the obverse view of the hindwings, the male side displayed three small black spots accompanied with an additional larger black spot, identified as the androconia which is distinctive of male adults. In contrast, the female side only displayed the three small spots lacking the so-called androconia. In the case of the reverse view of the hindwing, a distinctive white spot with black outline could be appreciated in the male side, and as occurs in female individuals, it was absent in the female side. Regarding the forewings, the only contrasting traits between both sides could be appreciated in the relative size of the white spots that conforms *D. chrysippus* colour patterns. In the case of the male forewing these spots could often be larger in comparison with the female forewing. This trait could also be appreciated in a lesser degree for hindwings, specifically in the external side spots in the reverse view and the small spots at the base of the obverse view.

Furthermore, the locality where *D. chrysippus* was recorded constitutes a new locality for the species distribution at Mallorca island once the literature about *D. chrysippus* distribution were consulted (ALOMAR *et al*., 1989-1990; PINYA *et al*., 2012; WEIR, 2018) as well as after consulting the public distribution species database Bioatles from the Balearic Islands Government (https://www.bioaltes.caib.es) and the public biodiversity database BiodiBal from the University of the Balearic Islands linked to GBIF (https://www.biodibal.uib.cat).

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