

Larval colour morphs of *Danaus plexippus* (Linnaeus, 1758) in Costa Rica (Lepidoptera: Nymphalidae, Danainae)

T. van der Heyden & D. Jiménez

Abstract

Different larval colour morphs of *Danaus plexippus* (Linnaeus, 1758) from Costa Rica are reported. Possible causes of melanism in larvae of this species are mentioned.

KEY WORDS: Lepidoptera, Nymphalidae, Danainae, *Danaus plexippus*, larvae, melanism, pigmentation, Costa Rica.

Formas de color de las larvas de *Danaus plexippus* (Linnaeus, 1758) en Costa Rica (Lepidoptera: Nymphalidae, Danainae)

Resumen

Se reportan diferentes morfos de color de larvas de *Danaus plexippus* (Linnaeus, 1758) de Costa Rica. Se mencionan posibles causas de melanismo en larvas de esta especie.

PALABRAS CLAVE: Lepidoptera, Nymphalidae, Danainae, *Danaus plexippus*, larvas, melanismo, pigmentación, Costa Rica.

Farbmorphe von Larven von *Danaus plexippus* (Linnaeus, 1758) in Costa Rica (Lepidoptera: Nymphalidae, Danainae)

Zusammenfassung

Es wird über verschiedene Farbmorphe von Larven von *Danaus plexippus* (Linnaeus, 1758) aus Costa Rica berichtet. Mögliche Ursachen für Melanismus bei Larven dieser Art werden angeführt.

SCHLÜSSELWÖRTER: Lepidoptera, Nymphalidae, Danainae, *Danaus plexippus*, Larven, Melanismus, Pigmentierung, Costa Rica.

Introduction

Different larval colour morphs, especially dark ones, of *Danaus plexippus* (Linnaeus, 1758) were reported by various authors (DAVIS *et al.*, 2004; DAVIS *et al.*, 2005; SOLENSKY & LARKIN, 2003; WILLMOTT *et al.*, 2011). Especially temperature-induced melanism was discussed: Low(er) temperatures during the development of early stages of *D. plexippus* cause melanism and result in darker larvae than usually (DAVIS *et al.*, 2004; DAVIS *et al.*, 2005; SOLENSKY & LARKIN, 2003).

Since dark colours absorb more solar radiation than lighter colours, this response to temperature might represent a thermal adaption to suboptimal temperatures (SOLENSKY & LARKIN, 2003; DAVIS *et al.*, 2005).

However, the specific reasons for the phenomenon of dark larvae of *D. plexippus* are not clear in every case, yet. In general, genetic and environmental causes of melanism in larvae of *D. plexippus* were mentioned, “but it is unclear whether the dark larval morph results from genetic or environmental factors” (SOLENSKY & LARKIN, 2003). WILLMOTT *et al.* (2011) mentioned a “Danaini dark-banded caterpillar mimicry complex from Dominican Republic ... with geographically distinct phenotypes” which includes *D. plexippus*.

Larval colour morphs of *Danaus plexippus* in Costa Rica

Usually, larvae of *D. plexippus* show a light aspect with white, yellow and black vertical stripes (Figs. 1 and 2). The co-author found larvae of *D. plexippus* with different proportions of the three colours at two locations in the province of Cartago, Costa Rica:

The first site is a premontane wet forest in Navarro about 1362 m above sea level (geo reference: LAT 9° 47' 9.25" N, LONG 83° 55' 38.83" W) (Fig. 3). The average temperature is 20,3 C, the annual rainfall reaches 2500-3000 mm. The habitat is very sunny and humid. The second site is located in the backyard of the co-author in Paraíso about 1315 m above sea level (geo reference: LAT 9° 50' 6.74" N, LONG 83° 51' 56.48" W) with an average temperature of 20,3° C and annual rainfall of 1500-2000 mm. This site is much drier than the first one. *Asclepias curassavica* Linnaeus, 1753 (Apocynaceae, Asclepiadoideae), the host plant of the larvae of *D. plexippus* in the backyard of the co-author, grew under 75% direct sunlight. The distance between the two sites is approximately 10 kilometres.

The first time the co-author found a dark larval colour morph of *D. plexippus* was on 08-IV-2012 in Navarro on *A. curassavica* (Fig. 4). Recently, the corresponding author contacted Sonia Altizer at the Odum School of Ecology, University of Georgia, United States of America, sending her the photo shown in figure 4. She had worked with dark larval colour morphs of *D. plexippus* and had published papers about these experiments as a co-author (DAVIS *et al.*, 2004; DAVIS *et al.*, 2005), but she was surprised by the amount of pigmentation this specific larva showed. Sonia Altizer wrote to the corresponding author that it was a very dark monarch larva, maybe as dark as she had ever seen (unpubl.). On 14-IV-2012 the co-author found another dark specimen at the same site as the larva shown in figure 4.

One year later the co-author visited the same location in Navarro again, searching for larvae of *D. plexippus*. The path had been cleared and there were only a few plants of *A. curassavica* left. Nevertheless, the co-author was able to find another dark specimen at exactly the same site on 19-IV-2013. This specimen showed a not so well-defined yellow, which contained a little white (Fig. 5).

One day later, on 20-IV-2013, the co-author collected a dark-coloured larva of *D. plexippus* (Fig. 6) feeding on *A. curassavica* in his backyard in Paraíso, where he found three larvae showing normal pigmentation and a few eggs, too. The dark specimen pupated shortly after being collected. Finally, on 07-V-2013, while this paper was already in press, the co-author found another dark-coloured larva in his backyard, which was just previous to pupate and very similar to the one collected on 20-IV-2013. At the same time and site the co-author found two larvae of *D. plexippus* with normal pigmentation.

Discussion and conclusions

Dark larvae of *D. plexippus* from the Dominican Republic mentioned by WILLMOTT *et al.* (2011) had been observed in the wild. WILLMOTT *et al.* (2011) stated “... we have otherwise not observed this phenotype outside the Caribbean”, referring to records on the islands Guadeloupe, Hispaniola and Puerto Rico. The records in Costa Rica reported in this publication add dark specimens from the Central American mainland to the list of sites.

Obviously, climate conditions, precisely lower temperatures, can cause melanism in larvae of *D. plexippus*. But the results published by DAVIS *et al.* (2004; 2005) and by SOLENSKY & LARKIN (2003) were obtained in artificial/experimental controlled conditions.

Most likely, temperature does not play a role in the case reported in this publication because dark and light larvae were found together at the same locations.

Further investigations regarding the phenomenon of dark-coloured morphs of *D. plexippus* found in the wild, especially in regions with a tropical climate, could be of certain interest.

Acknowledgements

We would like to thank Sonia Altizer for useful information.

BIBLIOGRAPHY

- DAVIS, A. K., FARREY, B. & ALTIZER, S., 2004.– Quantifying monarch butterfly larval pigmentation using digital image analysis.– *Entomologia Experimentalis et Applicata*, **113**: 145-147.
- DAVIS, A. K., FARREY, B. D. & ALTIZER, S., 2005.– Variation in thermally induced melanism in monarch butterflies (Lepidoptera: Nymphalidae) from three North American populations.– *Journal of Thermal Biology*, **30**: 410-421.
- SOLENSKY, M. J. & LARKIN, E., 2003.– Temperature-induced Variation in Larval Coloration in *Danaus plexippus* (Lepidoptera: Nymphalidae).– *Annals of the Entomological Society of America*, **96**(3): 211-216.
- WILLMOTT, K. R., ELIAS, M. & SOURAKOV, A., 2011.– Two Possible Caterpillar Mimicry Complexes in Neotropical Danaine Butterflies (Lepidoptera: Nymphalidae).– *Annals of the Entomological Society of America*, **104**(6): 1108-1118.

*T. v. d. H.
Immenweide 83
D-22523 Hamburg
ALEMANIA / GERMANY
E-mail: tmvdh@web.de

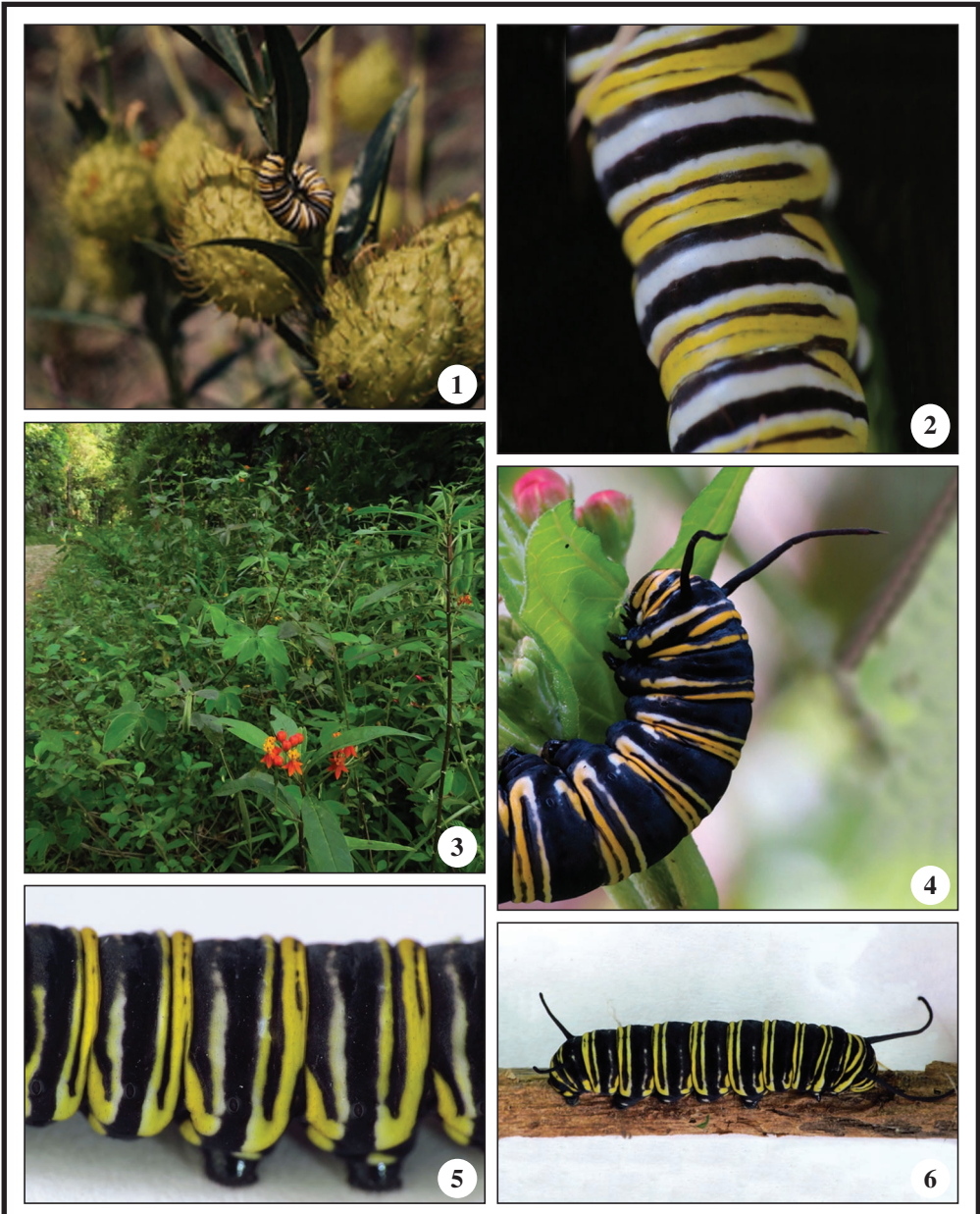
D. J.
Apartado 70-7100
Cartago
COSTA RICA / COSTA RICA
E-mail: admin@tools.co.cr

*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 27-IV-2013)

(Revisado y aceptado / *Revised and accepted* 6-VII-2013)

(Publicado / *Published* 30-XII-2013)



Figures 1-6.— 1. Light larva of *Danaus plexippus* (L.) feeding on *Gomphocarpus fruticosus* (L.) W. T. Aiton, 1811, Barranco de los Palmitos, Gran Canaria, Spain, 1988 (Photo: Torsten van der Heyden). 2. Detailed view of a light larva, Paraíso, Cartago, Costa Rica, 20-IV-2013. 3. Location in Navarro, Cartago, Costa Rica, where dark larval colour morphs were found. In the foreground plants of *Asclepias curassavica*. 4. Detailed view of a dark larval colour morph, Navarro, Cartago, Costa Rica, 08-IV-2012. 5. Detailed view of a dark larval colour morph, Navarro, Cartago, Costa Rica, 19-IV-2013. 6. Dark larval colour morph, Paraíso, Cartago, Costa Rica, 20-IV-2013 (Photos: Daniel Jiménez).