

Notes on the preimaginal stages of *Vanessa vulcania* (GODART, 1819) and differences in the structure of the egg with respect to *Vanessa indica* (HERBST, 1794)

(Lepidoptera, Nymphalidae)

by

FELIPE GIL-T. & RAFAEL OBREGÓN

received 17.V.2012

Abstract: The study of the life cycle of *Vanessa vulcania* (GODART, 1819), an endemic macaronesian taxon (Canary and Madeira islands), indicates that the morphology of the larvae is little variable (according to the sample studied). Its preimaginal stages are compared with those of the Asian *Vanessa indica* (HERBST, 1794) as well as with those of the sympatric *Vanessa atalanta* (LINNAEUS, 1758). *Vanessa vulcania* (GDT.) was thought to be a subspecies of *V. indica* (HERBST), but currently is generally accepted to be a different species, based on certain differences in shape and wing pattern, besides other small differences in ♂ genitalia. In the current paper, we describe for the first time differences in the egg structure of the first two taxa: the number of longitudinal ribs (longitudinal projections or ridges) is different, 10 ribs in *V. vulcania* (GDT.), same as *V. atalanta* (L.), and 14 in *V. indica* (HERBST). The morphology of the chrysalis of *V. vulcania* (GDT.) is quite distinctive (colour and structure of some tubercles on the dorsal side).

Resumen: El estudio del ciclo de vida de *Vanessa vulcania* (GODART, 1819), un taxón endémico macaronésico (islas Canarias y de Madeira), indican que la morfología de las larvas es poco variable (de acuerdo a la muestra estudiada). Sus estadios preimaginales son comparados con los del taxón asiático *Vanessa indica* (HERBST, 1794) así como con los de *Vanessa atalanta* (LINNAEUS, 1758), taxón simpátrico. Se creía que *V. vulcania* (GDT.) era una subespecie de *V. indica* (HERBST), pero actualmente es generalmente aceptada como una especie diferente, basándose en ciertas diferencias en el diseño y forma de las alas, además de pequeñas diferencias en la genitalia del ♂. En el trabajo actual, por primera vez, se mencionan diferencias en la estructura del huevo de los dos taxones anteriores: el número de crestas longitudinales (proyecciones longitudinales) es diferente, 10 crestas en *V. vulcania* (GDT.), los mismos que *V. atalanta* (L.), y 14 en *V. indica* (HERBST). La morfología de la crisálida de *V. vulcania* (GDT.) es muy característica (colour y estructura de algunos tubérculos en la cara dorsal).

Introduction: *V. vulcania* (GDT.), the Canary red admiral, is a native and common butterfly in the Canary islands (La Palma, La Gomera, El Hierro, Tenerife and Gran Canaria islands) and Madeira island, in the Atlantic Ocean. However, very little or incomplete data have been published on its preimaginal stages. We have only found one reference (SCHURIAN, 1976), where the egg is studied and the larva is illustrated (one photo with 6 larvae showing only their dorsal aspect).

Vanessa vulcania (GODART) is treated by FIELD (1971) and in other old references as a subspecies of *V. indica* (HERBST). After LEESTMANS (1978) was of the opinion that *V. vulcania* (GODART) was a different species to *V. indica* (HERBST) on the basis of a number of small features in the ♂ genitalia, wing pattern and shape, as well as aspects of its colouration (persistently red rather than red-orange). However, some recent authors, eg TOLMAN & LEWINGTON (1997), still regard it as a subspecies of *V. indica* (HERBST).

Vanessa indica (HERBST) has a wide distribution, ranging from eastern to southern Asia. The species appears regularly (as a migrant) in SE Siberia and has been found even in the Kamchatka peninsula (KORSHUNOV & GORBUNOV, 1995). Three subspecies have been described: *Vanessa indica indica* (HERBST) is found in central and eastern Asia: in the Himalaya, NE India, Nepal, Bhutan, Pakistan, Bangladesh, Myanmar, Korea, Thailand, Laos, Vietnam, Taiwan, China, Philippines (Luzon, Mindoro and Palawan), Japan, Russia (Siberia and Far East Russia at Kamchatka); *Vanessa indica pholoe* (FRUHSTORFER, 1912), which is endemic to the Western Ghats (southern India), and the very similar to the previous *Vanessa indica nubicola* (FRUHSTORFER, 1898) is found in Sri Lanka. The first two subspecies show minor differences in wing pattern and are indistinguishable on the base of the ♂ genitalia.

There is no record for any *indica*-like taxon in the vast area between the Asian populations and the Canary Islands, this fact has lead to several theories and hypotheses concerning the origin of *V. vulcania* (GDT.), some of which are perhaps improbable.

In WAHLBER & RUBINOFF (2011) a phylogenetic hypothesis is proposed for all species belonging to the genus *Vanessa* FABRICIUS, 1807 based on DNA sequences of nine gene regions (one mitochondrial and eight nuclear protein coding genes), resulting in a total of 22 species in *Vanessa* [FIELD (1971) considered 16 species, which he included in three separate genera] and though *V. vulcania* (GDT.) is accepted as a species on its own, they conclude that its position is unresolved with regards to the remaining species of the *V. indica* (HERBST) complex and that this taxon does appear to form a separate lineage from the other *Vanessa* spp.

Material and methods: The specimens of *V. vulcania* (GDT.) used for the present description of the preimaginal stages were collected as ova and larvae L1 at La Gomera island (near National Park of Garajonay, centre of the island) by the first author, on the hostplant *Urtica morifolia* POIR. These ova and larvae were collected in separate sites, several hundred metres distant from each other, in all cases from different ♀♀, in order to study the possibility of morphologic variation of the larvae. The sample was composed of a total of 31 larvae: 21 larvae of *V. vulcania* (GDT.), from ova and L1, were reared in captivity; and 10 fully grown larvae were observed in nature (these showed the same morphology as the previous larvae).

Extensive searching of the Internet has revealed very few images of the preimaginal stages of *V. indica* (HERBST).

Egg: Initially pale green, very similar to the egg of *V. atalanta* (L.), small, barrel shaped, broad at the base, height slightly greater than the width, with 10 transparent longitudinal ridges or ribs (fig. 1) that increase in height towards the summit, where they end abruptly. Usually laid singly on the hostplant, occasionally in pairs, on the upperside of the leaves.

SCHURIAN (1976) also indicates the presence of 10 ribs in *V. vulcania* (GDT.) eggs, just like those of *V. atalanta* (L.). The size of the egg of *V. vulcania* (GDT.) (height: near 0,8 mm) is similar to the egg of *V. indica* (HERBST), both unusually small in relation with the body size of the adults.

Despite the wide distribution range of *V. indica* (HERBST), we have been unable to find any reference whatsoever concerning the number of egg ribs of this species. We did, however, find several pictures of the egg of *V. indica* (HERBST) from India, China and Japan on the Internet, from these we were able to see and count perfectly the 14 ribs (fig. 1) of *V. indica* (HERBST) from India (ssp. *pholoe*, from Western Ghats) and Japan (ssp. *indica*). Dr. K. KUNTE (pers. comm.) confirmed to us that the egg illustration which appears in his reference (KUNTE, 2011) also presented 14 ribs. In the other photos we were only able to observe 13 ribs; this might be a false count because of the angle of vision, although this fact should not be taken as unusual considering that the number of ribs can vary in some species of *Vanessa* F. [e. g. *V. cardui* (LINNAEUS, 1758), which can present between 16-18 longitudinal ribs]. It is of interest to

us to outline that in FIELD (1971) three distinct genera are considered. These are *Cynthia* FABRICIUS, 1807: 9 species (hostplants: Compositae and Malvaceae); *Bassaris* HÜBNER, 1821: 2 species (hostplants: Urticaceae spp.); and *Vanessa* FABRICIUS, 1807: 5 species (hostplants: almost exclusively Urticaceae). Since CLENCH (in HOWE, 1975) these have all been included in the genus *Vanessa* F.; *Cynthia* is presently accepted as a subgenus or as a subjective junior synonym of *Vanessa*, and *Bassaris*, normally, regarded as a subjective junior synonym of *Vanessa*. In the *Cynthia* species (sensu stricto) we find 14 to 19 egg ribs, in *Bassaris* 8 (*Bassaris itea* FABRICIUS, 1775) or 9 (*Bassaris gonerilla* FABRICIUS, 1775), and the rest (*Vanessa*) have 10.

The eggs of *V. indica* (HERBST) have 14 ribs, a similar number to the *Cynthia* spp. and a feature which is clearly discordant with the view of FIELD (1971). That looks more like an exception within this group.

Hostplants: Only *Urtica* spp., mainly the endemic *Urtica morifolia* POIR (fig.2) has been recorded as hostplant for *V. vulcania* (GDT.). For *V. indica* (HERBST) sensu lato predominantly bushy stinging nettles of the genera *Girardinia*, *Urtica* and *Boehmeria* (Urticaceae). *Urtica morifolia* is a macaronesian endemic, present in the Canaries, Madeira, and the islands of Sao Miguel and Terceira in the Azores archipelago. It is a perennial bushy plant bearing serrated oval leaves with numerous stinging hairs like other Urticaceae plants.

In TOLMAN & LEWINGTON (1997) the authors affirm that the adults of *V. vulcania* (GDT.) lay their eggs on the leaves of plants located in the shade, and that *V. atalanta* (L.) does so on the leaves of plants situated in open and sunny areas. Our field observations demonstrate that this is incorrect in our own study area as all the eggs and larvae L1 samples collected were taken from leaves of plants situated in open and sunny areas (fig.2), consequently there are no significant differences with respect to the preferences of *V. atalanta* (L.) when it comes to choose a certain biotope for laying.

Larva: SCHURIAN (1976) found the caterpillars of *V. vulcania* (GDT.) and *V. atalanta* (L.) to be indistinguishable - a statement which we disagree. The larvae of *V. atalanta* (L.) are extremely variable (this variability makes a written description difficult). The body varies from pale brown or cream yellow with a yellowish stripe on the sides to black with small white spots and a broken white stripe on the sides. Each segment has a transverse row of long, branching dark or pale spines (scoli) with reddish bases. We have found multiple forms of *V. atalanta* (L.), both as Internet images and in several literature references; it appears to be polymorphic to such an extent that we have been unable to find a single example that is identical to our *V. vulcania* (GDT.) larvae.

The larvae of *V. vulcania* (GDT.), illustrated in SCHURIAN (1976) (a black and white photo of 6 larvae showing only their dorsal side) are very close to the only single morphotype obtained from our sample of larvae. The Internet has very poor photographic representation of *V. vulcania* (GDT.) larvae, some of which show other morphotypes different to ours [supposing that these larvae do not really belong to the sympatric species *V. atalanta* (L.)]. It is very likely that *V. vulcania* (GDT.) may also present several forms, though this variability is evidently much lower than in both *V. atalanta* (L.) and *V. indica* (HERBST) larvae.

The larvae of *V. vulcania* (GDT.) are initially pale grey. After eating the green leaves of the host plant, they gradually become darker until they finally turn to black (fig. 3). Just like the other *Vanessa* species, the larvae of all instars construct leaf shelters on the hostplant in which they hide from predators. The newly hatched larva builds a shelter by rolling or folding under the edge or tip of the leaf.

From the second instar onward, the caterpillars develop a series of white-yellowish markings on the sides (figs. 3-7). In subsequent instars the hairs develop into pointed, branched fleshy tubercles spines (scoli), which become progressively larger and better developed in each instar.

Larvae of length less than approximately 20-25 mm present black coloured scoli (fig. 4); at a length greater than 25 mm (fig. 5) the scoli become pale translucent with several ramifications in each, terminating with very fine black hairs. The white-yellowish markings form a wide and visible lateral stripe (fig. 6, 7).

In the final instar the dorsal background colour (fig. 6, 7) is paler than the rest of the larvae body because of a number of yellowish markings. The head of the larva remains black but with prominent white tubercles (figs. 6). There are usually 7 scoli on each segment (3 dorsal scoli; and 2 lateral - on top and under each spiracle, see fig. 7), except in the first thoracic segment which has none and the second and third thoracic segments which normally have 4 scoli each. Normally, ochre patches can appear in the lateral area of the second and third thoracic segments (fig. 7), these patches may sometimes also appear in the abdominal segments.

Prepupa: When comparing the prepupae of *V. vulcania* (GDT.) (fig. 8 A) and *V. atalanta* (L.) (fig. 8 B) we can observe in the first taxon a conspicuous lateral yellowish stripe and the pale translucent colour of the scoli.

Pupa: The colour of the pupae of *V. vulcania* (GDT.) is variable (figs. 10, 11): grey, ash-grey, occasionally with small areas of gold-coloured (fig. 11) on the dorsum, whilst others may present ochraceous coloured abdomens.

On the abdominal dorsum there are three rows of tubercles which increase in size towards the thorax. The last three pairs of tubercles, just behind the pointed projection on the dorsal side of the thorax (fig. 8 A; indicated with red lines) are very characteristic and distinctive in *V. vulcania* (GDT.) [similar to *V. indica* (HERBST)], differentiating their pupae (figs. 10, 11) of other sympatric *Vanessa* spp., e.g., *V. atalanta* (L.), where such tubercles are of gilded colour (fig. 8 B; indicated with red lines). These last three pairs of tubercles [*V. vulcania* (GDT.)] have the bases much larger, and both the bases and the tubercles (figs. 10, 11) are of pearl colour with some golden highlights in pupae of several days. There is an additional pair of small tubercle on the thorax also of pearl colour. In newly formed pupae (very recent; see fig. 9) the colour of these last three pairs of tubercles is similar to the colour of the yolk and white of a bird egg.

Acknowledgements: We would like to express our sincere thanks to our friend RAFAEL ESTEVEZ RODRIGUEZ (Vigo, Pontevedra, Spain) for his help in revising the English text of this paper and to Mr. COLIN W. PLANT (Bishops Stortford, England) for linguistic help. Also, we are grateful to Dr. HISASHI OMURA (Hiroshima University, Japan) who kindly helped us in our search for pictures of the egg of *V. indica* (HERBST) in several Japanese websites, and to Dr. KLAUS SCHURIAN (Kelkheim, Germany) who kindly helped us with some reference of our interest.

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Address of the authors

FELIPE GIL-T.
 C/ Corral del Veleta, 1, 2-A
 E-18008 Granada

RAFAEL OBREGÓN
 Universidad de Córdoba
 Dpto. Botánica, Ecología y fisiología Vegetal
 E-14071 Córdoba

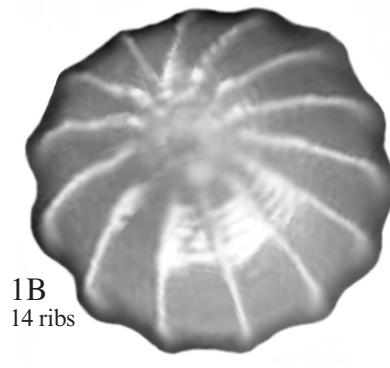
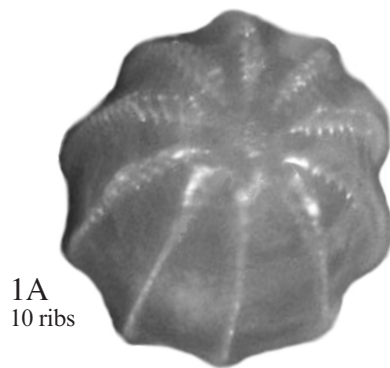


Fig. 1: Egg (A) of *Vanessa vulcania* (GODART, 1819) and egg (B) of *Vanessa indica* (HERBST, 1794).

Fig. 2-5: *Vanessa vulcania* (GODART, 1819).

Fig. 2: ♀ on its hostplant *Urtica morifolia*.

Fig. 3: L3 larvae: length around 10 mm.

Fig. 4: L4 larvae: length about 15 mm.

Fig. 5: L4 larvae: length more than 25 mm.

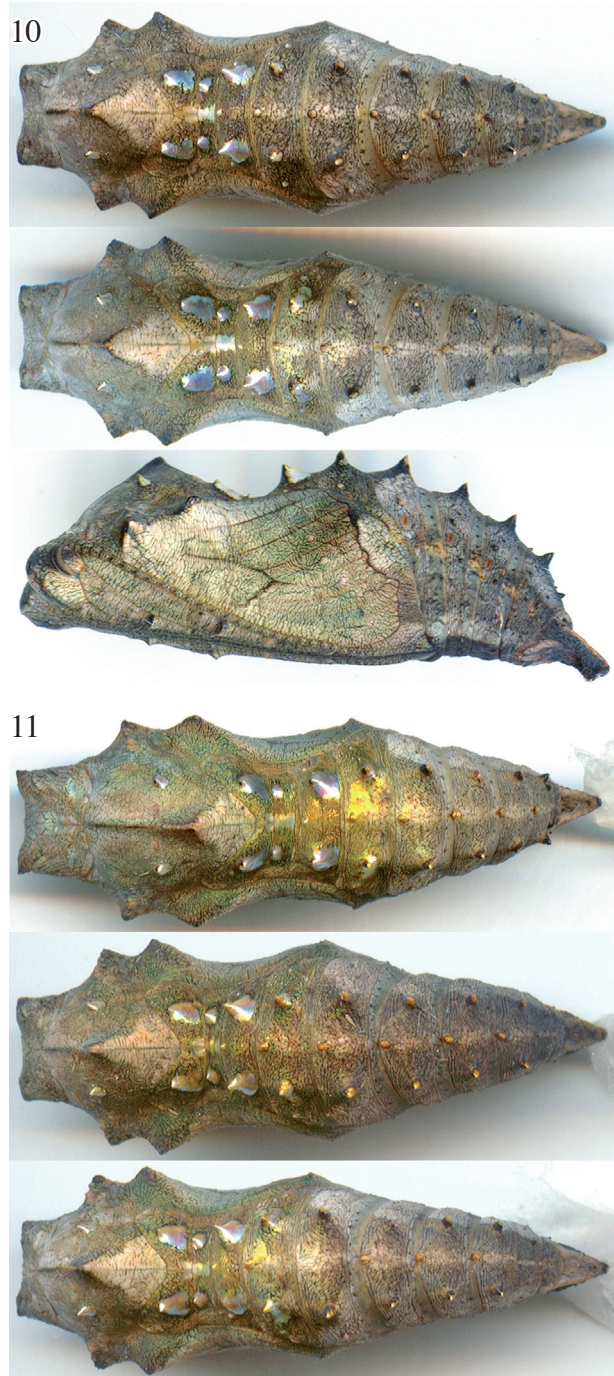


Fig. 6, 7, 9-11: *Vanessa vulcania* (GODART, 1819)
 Fig. 6: L5 larvae: length more than 35 mm.
 Fig. 7: L5, fully-grown larvae (about 40-43 mm).
 Fig. 8: Prepupae and pupae: A = *Vanessa vulcania* (GODART, 1819); B = *Vanessa atalanta* (LINNAEUS, 1758).
 Fig. 9: Young pupae.
 Fig. 10, 11: Pupae.

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Autor(en)/Author(s): Gil-T. Felipe, Obregon-Romero Rafael

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