

***Cupido carswelli* (STEMPFER, 1927): Morphology of its chrysalis and genitalia compared with those of *Cupido minimus* (FUESSLY, 1775) and *Cupido lorquini* (Herrich-Schäffer, 1847)**

(Lepidoptera, Lycaenidae)

by

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Abstract: In this paper we confirm differences between the genitalia (in uncus, aedeagus and valve) of *C. carswelli* (STEMPFER, 1927) and *C. minimus* (FUESSLY, 1775) first mentioned in RILEY (1927) and STEMPFFER (1928). The morphological differences between the chrysalids (in the pattern of the spots on the dorsal and lateral zones of the abdomen and wing area) of *C. carswelli* (STEMPFER, 1927) and *C. minimus* (FUESSLY, 1775) first pointed out in GIL-T. (2003a) are also confirmed. New information is supplied concerning the different colouring of the pupal hairs between the three *Cupido* species mentioned. We also identify some distinctive differences within the chrysalids of *C. carswelli* (STEMPFER, 1927) and *C. lorquini* (HERRICH-SCHÄFFER, 1847), both of which have a similar morphology. We finally supply some brief notes regarding imago morphology of *C. carswelli* (STEMPFER, 1927) as well as its distribution in the southeast of the Iberian Peninsula (Spain). The Iberian endemic butterfly *C. carswelli* (STEMPFER, 1927) is generally considered throughout Europe to be an undoubtedly valid species. However, some Spanish authors consider it just a subspecies of *Cupido minimus* (FUESSLY, 1775) and this article is aimed principally at these researchers. in the hope they may broaden their horizons with regard to this taxon.

Resumen: En el trabajo actual, se confirman las diferencias en la genitalia (en uncus, aedeagus y valva) entre *C. carswelli* (STEMPFER, 1927) y *C. minimus* (FUESSLY, 1775) mencionadas en RILEY (1927) y STEMPFFER (1928). También se confirman las diferencias morfológicas entre las crisálidas (diseño de manchas-puntos negros en la zona dorsal y lateral del abdomen y zona alar) de *C. carswelli* (STEMPFER, 1927) y *C. minimus* (FUESSLY, 1775) señaladas en GIL-T. (2003a). Se señalan nuevos datos sobre el diferente color de la pilosidad existente en la pupas de las tres especies *Cupido* mencionadas. Se indican algunas diferencias distintivas entre las crisálidas de *C. carswelli* (STEMPFER, 1927) y *C. lorquini* (HERRICH-SCHÄFFER, 1847), ambas de morfología pupal parecida. Para completar este artículo, se añaden algunas notas sobre la morfología del imago de *C. carswelli* (STEMPFER, 1927) y sobre la distribución de este lepidóptero en el sureste de la Península Ibérica (Spain).

El lepidóptero endémico ibérico *C. carswelli* (STEMPFER, 1927) es considerado en toda Europa, sin duda aparente, como una especie válida. En contraste, es considerado como una subespecie de *Cupido minimus* (FUESSLY, 1775) por algunos autores españoles actuales. A estos autores, principalmente, va dedicado este artículo, con la esperanza que amplíen su conocimiento sobre este taxón.

Zusammenfassung: Durch diese Arbeit werden die Unterschiede der Genitalien (von Uncus, Aedoeagus und Valve) zwischen *C. carswelli* (STEMPFER, 1927) und *C. minimus* (FUESSLY, 1775) bestätigt, die von RILEY (1927) und STEMPFFER (1928) erwähnt wurden. Erneut wird das unterschiedliche Fleckenmuster der Puppen von *C. carswelli* (STEMPFER, 1927) und *C. minimus* (FUESSLY, 1775) im Lateral- und Dorsalbereich des Abdomens und der Flügelscheiden hervorgehoben (GIL-T., 2003a). Neue Angaben werden über die unterschiedlichen Farbtöne der Puppen der drei *Cupido*-Arten gemacht. Hervorgehoben werden auch markante Unterschiede bei den Puppen von *C. carswelli* (STEMPFER, 1927) und *C. lorquini* (HERRICH-SCHÄFFER, 1847), die sich ansonsten sehr ähnlich sehen. Letztendlich werden auch kurze Bemerkungen über die Morphologie der Imagines von *C. carswelli* (STEMPFER, 1927) sowie über deren Verbreitung im Südosten der Iberischen Halbinsel (Spanien) gemacht. Im Allgemeinen wird in Europa die auf der Iberischen Halbinsel endemisch vorkommende Schmetterlingsart *C. carswelli* (STEMPFER, 1927) als eigenständige Art nicht angezweifelt, im Gegensatz zu einigen spanischen Autoren, die diese nur als Unterart von *Cupido minimus* (FUESSLY, 1775) betrachten. Die Arbeit richtet sich vornehmlich an diese Autoren, in der Hoffnung sie zum Sinneswandel zu bekehren.

Introduction

Cupido carswelli (STEMPF.) is an endemic species limited to the SE of the Iberian Peninsula. Surprisingly, in some Spanish references it is considered to be a subspecies of *C. minimus* (FUES.) [i. e. in GOMEZ-BBUSTILLO & ARROYO (1981), FENANÁNDEZ-RUBIO (1991), VIVES (1994), GARCÍA-BARROS et al. (2004), etc.], although proof has never been documented. What is even more regrettable is that the species presence has been either ignored, considered of doubtful existence, or it has even been thought extinct (!?) in MUNGURIA & MARTÍN (1993). In GARCÍA-BARROS et al. (2004) the distribution of *C. carswelli* (STEMPF.) [considered here to be *C. minimus* (FUES.)] is erroneous and shows various localities in south Spain where the species does not exist or its existence is unconfirmed. In contrast, all of the European references, both new and old, have no doubt as to its specific status [see in MANLEY & ALLCARD (1970), HIGGINS & RILEY (1975), KUDRNA (1986), TOLMAN & LEWINGTON (1997), LAFRANCHIS (2004), etc.]. In RILEY (1927) [*C. carswelli* = *C. arcilasis*, in RILEY (1928)], the first author points out the specific status of this taxon, and in STEMPFFER (1928) a detailed study of the genitalia and of the morphology of the imago was performed, the results of which were compared to other species within the *Cupido* genus. HIGGINS & RILEY (1975) performed further genital studies which showed that, in spite of the fact that specimens were “scarce” and that “examinations were somewhat incomplete”, they had no doubt in considering it to be a valid species. Since then, *C. carswelli* (STEMPF.) has been considered by most European authors to be totally different from *C. minimus* (FUES.). Consequently, in this article we describe the differences that we have found in the ♂ genitalia (uncus, aedeagus and valve). In GIL-T. (2002, 2003a), for the first time, all the pre-imaginal stages (76 years has elapsed since the original description of the imago) of *C. carswelli* (STEMPF.) and the chrysalid (155 years has elapsed since the original description of the imago) and *C. lorquini* (H.-S.) are described - note: larvae of *C. carswelli* (STEMPF.), *C. lorquini* (H.-S.) and *C. minimus* (FUES.) are similar. In the last reference we pointed out the differences between the chrysalids of *C. carswelli* (STEMPF.) (on the basis of 5 pupae) and that of *C. minimus* (FUES.). In both *C.*

carswelli (STEMPF.) and *C. lorquinii* (H.-S.) the pattern on the pupae were similar in appearance, a feature which was then clearly outlined. We also pointed out the implications of a new study which compared pupae from other areas than those previously studied to confirm such differences. We were able to obtain pupae of this scarce and very local taxon from further sites. Examination of these chrysalids allowed us to confirm the differences referred to in GIL-T. (2003a). We also provide new data about several morphological differences in the pupae of both *C. lorquinii* (H.-S.) and *C. carswelli* (STEMPF.). Furthermore, and in order to highlight the characteristics pointed in our previous paper in respect to the morphology of the imago, notes and corresponding photographs are also added.

Materials and methods

We examined a total of 19 chrysalids of *C. carswelli* (STEMPF.) obtained ex ovo or ex larva from the following localities: Sierra de Orce (northeast of Granada province) and with Sierra Maria (north of Almeria province), which are the southernmost areas where the species is known to fly; north of Sierra de la Sagra (northeast limit of the province of Granada), situated at about 30 kilometres further north from the previous locality; and the Revolcadores massif (southwest of Murcia province), situated further north.

We respect to *C. lorquinii* (H.-S.), approximately 40 pupae were examined, as indicated in GIL-T. (2002), these being obtained from west of Sierra Nevada (Granada); 9 more pupae were taken from Sierra de la Almijara (southwest of the same province). Detailed examinations and studies carried out on ♂ genitalia corresponded to adult *C. carswelli* (STEMPF.) from Sierra Maria and Sierra de la Sagra. Specimens of *C. minimus* (FUES.) taken from the Valle de Aran (Lerida/Lleida province, Catalonia, Spain) and from the French Alps were also included. In order to obtain objectivity, we were of the opinion that the microscopic slide preparations should be executed by independent authors who were experienced in the field of small genital dissections.

Results

Notes about the distribution of *C. carswelli* (STEMPFER, 1927): In GIL-T. (2003a) detailed comments on the current reliable distribution of this taxa was published and new site locations were also added. Fig. 1, drawn up in UTM 10 x 10 km squares: NE. Almeria: Sierra Maria; NE. Granada: Sierra de la Sagra y Sierra de Orce; S. and SW. Murcia: Sierra Espuña (LT.= type locality) and Revolcadores massif; S. Albacete: S. Alcaraz ("?"= locality stated in bibliographic references to be confirmed).

Note: in NE of Jaen the two question marks (?) indicate sites near the Sierras de Cazorla and Segura, for which confirmation is pending. The species presence here is still uncertain, although probable, taking into account other sites in the close vicinity of NE Granada where *C. carswelli* (STEMPF.) has been confirmed. We are confident that in the near future the butterfly will be found to be endemic in other areas near the boundaries of the grids previously referred to.

In GARCÍA-BARROS *et al.* (2004), parts of the distribution given by GIL-T. (2003a) were omitted while some of the given locations were doubtful, went unconfirmed, or were even not existent, which lead to erroneous reports on the species distribution. These facts were described and thoroughly corrected and amended in GIL-T. (2006a, 2006b), where

both addenda and corrigenda were added, not only in respect to this species, but also to more than 65 taxa.

Differences in the genitalia between *C. carswelli* (STEMPF.), *C. minimus* (FUES.) and *C. lorquini* (H.-S.)

STEMPFER (1928) considered the distinctive features of the ♂ genitalia of *C. carswelli* (STEMPF.) being “very constant”, this proving its specific status within this taxa. (Note: drawings of Fig. 2, 3, 4, 5 were taken from the previous work; only the numbering being added.) Furthermore, the remarkable work in RILEY (1927: 271) showed a comparative table indicating the basic genital differences (uncus, aedeagus, valve) between the different species of *Cupido*. Differences which were considered as constant were as follows:

Uncus (Fig. 2): in *C. minimus* (FUES.) (A): is almost geometric, slightly trilobulated; the medium lobule (1) is flat; the wing borders (2) are parallel and slightly concave. In *C. carswelli* (STEMPF.) (C): is smaller; the three lobules (4: medium lobule) is clearly separated by large depressions (3); the lateral borders are convex (5). The B drawing corresponds to *C. lorquini* (H.-S.).

Aedeagus (Fig. 3): in *C. minimus* (FUES.) (A): is more robust, especially at its base, and is therefore easily distinguished from that of *C. carswelli* (STEMPF.) (C). The drawing B corresponds to *C. lorquini* (H.-S.).

Valves (Fig. 4): those of *C. minimus* (FUES.) (A) are more elongated than those of *C. carswelli* (C); the outline of the upper border (A, 1) shows a small depression (1) and the elongations (2 and 3) are different to those of *C. carswelli* (STEMPF.) (C). The drawing B corresponds to *C. lorquini* (H.-S.). Both RILEY (1927), as STEMPFER (1928: 114) give the proportions between the elongations of these valve for both species. These parts of the genitalia are considered to be clearly differential and constant.

Detailed views of these prolongations (major membranous part and chitinous portion) of the valves (2 and 3 of Fig. 4) in Fig. 5.

The distinctive features of the ♂ genitalia, described in STEMPFER (1928) and previously referred to, are confirmed by the results obtained in our study. Verification is obtained when Fig. 6 (genital preparations and photo: Dr. A. EXPÓSITO *leg.*) and Fig. 7 (genital preparation and photo: Dr. U. EITSCHBERGER *leg.*) are examined:

Uncus: in *C. carswelli* (STEMPF.) (Fig. 6 left) it is smaller and rounded, the medium lobule (a) being flat in *C. minimus* (FUES.) (Fig. 6, right). In the last-mentioned the two lobules are separated from the central lobule (a) by clearly deep depressions. The lateral borders (c) are slightly concave in *C. minimus* (FUES.) and clearly convex in *C. carswelli* (STEMPF.).

Aedeagus: is quite different between both species, and is clearly thicker in *C. minimus*.

Valves: the difference in size is obvious, *C. minimus* (FUES.) *being the largest*. In *C. minimus* (FUES.), the outline of the upper border (d) shows a small depression, the elongation (e) is different in size and shape to that of *C. carswelli* (STEMPF.) and that at (f) is clearly longer and more prominent than in *C. carswelli* (STEMPF.).

The genital features of *C. minimus* (FUES.) previously referred to can also be observed and verified within the ♂ genitalia shown in FERNÁNDEZ-RUBIO (1991: 245).

Morphological descriptions of the differences between the chrysalids of *C. carswelli* (STEMPF.), *C. minimus* (FUES.) and *C. lorquini* (H.-S.) in GIL-T. (2002, 2003a), suggest that *C. carswelli* (STEMPF.) and *C. lorquini* (H.-S.) are similar but different to that of *C. minimus* (FUES.) (Fig. 8). Pupae were obtained from hibernated larvae (1st. annual brood), showing that their sizes (between 5,5 - 6,7 mm long, and between 2 - 2,3 mm in width at the thickest part of the abdomen), were similar. This lead us to the conclusion that these features are of significant taxonomic value.

Luckily enough, we were able to obtain a large number of *C. carswelli* (STEMPF.) pupae. This fact enabled us to confirm our previous conclusions. At the same time, we are also able to add new data obtained from this exhaustive study:

The pupae of *C. carswelli* (STEMPF.) (Fig. 12, 13 and 14), are very similar to *C. lorquini* (H.-S.) (Fig. 9, 10 and 11), in that the reduced size of the black spots on the lateral area of the abdomen are a constant feature when compared to the thicker dots on the pupae of *C. minimus* (FUES.) (Fig. 8). In any event, if we take a close look at the pupae of *C. lorquini* (H.-S.) and *C. carswelli* (STEMPF.), we are able to observe several more relevant differences, being these as follows:

Although the pilosity is abundant in the three species studied, with the dorsal zones of the thorax and abdomen covered with long hairs, in *C. carswelli* (STEMPF.) these are clearly yellow coloured (Fig. 13 & 14), while in *C. lorquini* they are white although a few may show a slight yellowish tone towards the tips. We also examined *Cupido osiris* (MEIGEN, 1829) pupae from Sierra de la Sagra (Granada) and found considerable differences in pilosity when compared with the previous pupae. In *C. osiris* (MEIG.) hairs are much scarcer, shorter and of whitish colour.

The majority (90%) of *C. lorquini*'s pupae exhibit an area of fine black dots -very small in diameter-, in the dorsal area of the abdomen (Fig. 10 and 11), which does not exist or is hardly noticeable in *C. carswelli* (STEMPF.) (Fig. 12 y 14).

The wing areas are visibly marked with black stripes. The outline or limit of this area - the external margins - are clearly marked in black in *C. lorquini* (H.-S.) (Fig. 9). Contrarily, this marking is very faint in *C. carswelli* (STEMPF.) (Fig. 13).

The pupae of *C. carswelli* (STEMPF.) are rather different than *C. minimus* (FUES.), these differences being as follows:

The lateral zone of the abdomen in *C. minimus* (FUES.) (Fig. 8) is marked with large greyish-black spots, this being a characteristic and constant feature when compared to those existing in the chrysalids of *C. carswelli* (STEMPF.) (Fig. 12 and 14)

Considerable pilosity, with long hairs in the dorsal zone of the thorax and abdomen, but of different colour, clearly yellow in *C. carswelli* (STEMPF.) (Fig. 13 and 14).

The ground colour of both pupae is different.

In the wing area, *C. carswelli*'s pupa exhibit black markings which are much more visible and conspicuous than in *C. minimus* (FUES.) (Fig. 13).

Brief notes on adult morphology (upper side)

In RILEY (1927), a comparative study was carried out between *C. carswelli* (STEMPF.), *C. minimus* (FUES.), *C. lorquini* (H.-S) and *C. osiris* (MEIG.). In this article and in STEMPFFER (1928), morphological differences were described within the ground colour of the upper and underside of the wings, in the arrangement of the black ocelli or spots [RILEY (1927: 271), STEMPFFER (1928: 107), GIL-T. (2003a: 49)] in the hind wing (Fig. 17), and in the colour of the blue scales of the underside basal wing area. These scales are of violet-blue in *C. carswelli* (STEMPF.) (these are easily visible in Fig. 15 and 16) and of silver-blue in *C. minimus* (FUES.) (Fig. 16, right). The underside ground colour on *C. carswelli* (STEMPF.) - including the fringes- is much darker (greyish-black) and stark in comparison to *C. minimus* (FUES.) which is dark brown. All of these morphological features have been described and accepted by diverse authors (unfortunately certain 'mediatic' Spanish authors are unable to see them...).

As we have a more extensive knowledge about the morphological differences between the chrysalids and the imago of *C. carswelli* (STEMPF.), and in those within their genitalia, we were surprised to read in the introduction to the recent work of PRIETO & MUNGUIRA (2004) [we have corrected the erroneous opinions of the second author about the biology and taxonomy of several Lepidopterous species before: in GIL-T. (2002, 2003b, 2004), GIL-T. & GIL-UCEDA (2005)] the following statements in respect of *C. minimus* (FUES.) and *C. carswelli* (STEMPF.): 1. - "It is very difficult to detect constant morphological differences" in the imagoes (?); 2.- "the biological features [sic] do not show any differences between each other as the characteristics of the ova are very similar"; 3.- "There is no significant differences in the proportions of the genitalia of *C. minimus* and *C. carswelli*"; and 4.- the "preservation [of *C. carswelli*] will not be a priority"

Finally, we would like to make the following comments: 1.- With regard to adult morphology, we refer to our previous comments in this article. For the remaining characters of the underside see contents in GIL-T. (2003a: 49-50), features which are supported and confirmed by various other authors. As far as we are concerned it is not "very difficult" to detect these differences; 2.- We notice some confusion with regard to "biological characters" when these refer to "characteristics of the ova". Despite this, we suggest referral to the differential descriptions of the chrysalids given above. Moreover, it is our understanding that egg morphology can be very similar or even identical between taxonomically related species. For example, this occurs between species like *Plebicula* (GIL-T., 2003b), *Maculinea*, *Agrodiaetus*, etc.; 3.- We are confident that the *C. carswelli* (STEMPF.) specimens illustrated in PRIETO & MUNGUIRA (2004) are correctly identified, and that this same species was taken in all of the other confirmed sites, as it seems curious that the results of an examination of their genitalia do not match either with those of RILEY (1927), STEMPFFER (1928) nor to those referred to in this article; and 4.- The written expression used relating to "preservation" suggests to us that this evaluation depends merely on the authors' personal opinion, this being answered in the following section.

Conclusion

According to the overall view of the characteristics previously delineated, diagnosis of which have been commented upon and proved to be correct regarding the studied species, we consider the specific character of *C. carswelli* (STEMPF.) to be truly justified. It should

therefore appear as a valid species (a molecular study –DNA- or phylogenetic, would confirm once and for all its specific validity) in catalogues, inventories and bibliographic references of existing Rhopalocera in Spain. We have recommended preservation measures (classified as a “vulnerable” species in accordance with the categories and criteria stated in the Red List of endangered species UICN) in GIL-T. (2006b) for the Andalusia Region (S. Spain), on account of their extremely reduced distribution,, and to the fact that colonies are scarce and limited to a very few localities in the SE. Spain.

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Bibliography

- FERNÁNDEZ-RUBIO, F. (1991): Guía de mariposas diurnas de la Península Ibérica, Baleares, Canarias, Azores y Madeira. - Ed. Pirámide, Madrid.
- GARCÍA-BARROS, E., MUNGUIRA, M., MARTÍN, J., ROMO, H., GARCÍA-PEREIRA, P. & E. S. MARAVALHAS (2004): Atlas de las mariposas diurnas de la Península Ibérica e islas Baleares (Lepidoptera: Papilionoidea & Hesperioidea). Monografías Soc. Ent. Aragon. **11**, Zaragoza.
- GIL-T., F. (2002): *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847): Datos inéditos sobre la biología de sus estadios preimaginales [= Unpublished data about the biology of its preimaginal stages] (Lepidoptera, Lycaenidae). Bol. Soc. Ent. Aragon. **31**: 37-42. Zaragoza..
- GIL-T., F. (2003a): *Cupido carswelli* (STEMPFER, 1927): descripción de sus estadios preimaginales, biología y distribución. La morfología de la crisálida, ¿clave para su rango específico? [= description of its preimaginal stages, biology and distribution. The morphology of the chrysalids, the key to its specific status?] (Lepidoptera, Lycaenidae). - Bol. Soc. Ent. Aragon. **32**: 45-50, Zaragoza..
- GIL-T., F. (2003b): *Polyommatus (Plebicula) sagratrox* (AISTLEITNER, 1986): ecología, morfología comparada de sus estadios preimaginales con los de *Polyommatus (Plebicula) golgus* (Hübner, 1813), taxonomía y nuevos argumentos para su validez específica (Lepidoptera, Lycaenidae). - Bol. Soc. Ent. Aragon. **33**: 219-227, Zaragoza..
- GIL-T., F. (2004): New data about the biology of *Iolana iolas* OCHSENHEIMER (Lepidoptera, Lycaenidae) and its interaction with myrmecophilous, phytophagous and parasitoid Hymenoptera (Hymenoptera, Formicidae, Eurytomidae, Ichneumonoidea). - Bol. Soc. Ent. Aragon. **34**: 139-145, Zaragoza. [in Spanish]
- GIL-T., F. (2006a): Addenda y corrigenda al “Atlas de las mariposas diurnas de la Península Ibérica e islas Baleares” (García-Barros et al., 2004) desde Granada.” - Soc. Andaluza Entomol., in press.

- GIL-T., F. (2006b): *Cupido carswelli* (STEMPFER, 1927). In: Biodiversidad y Conservación de Invertebrados Continentales de Andalucía: Especies protegidas y otras especies amenazadas. - Ed. Consejería Medio Ambiente, Junta Andalucía (Spain), in press.
- GIL-T., F. & T. GIL-UCEDA (2005): *Agrodiaetus violetae* (GÓMEZ-BUSTILLO, EXPÓSITO & MARTÍNEZ, 1979): Morfología comparada y descripción de *Agrodiaetus fabressei subbaeticus* ssp. nov. del sureste de la Península Ibérica (Lepidoptera, Lycaenidae). Bol. S.E.A. **36**: 357-364.
- GÓMEZ-BUSTILLO, M. R. & M. ARROYO VARELA (1981): Catálogo sistemático de los lepidópteros Ibéricos (I). M. Agricultura y Pesca. Inst. Nac. Investig. Agrarias, Madrid.
- HIGGINS, L.G. & RILEY, N.D. (1975): The Classification of European Butterflies. - Collins, London.
- KUDRNA, O. (1986): Butterflies of Europe. Vol. 8. Aspects of the conservation of butterflies in Europe. - Aula-Verlag, Wiesbaden.
- LAFRANCHIS, T. (2004). Butterflies of Europe. - Ed. Diatheo, París.
- MANLEY, W. B. L. & H. G. ALLCARD (1970): A Field Guide to the Butterflies and Burnets of Spain. - E.W. Classey, Hampton.
- MUNGUIRA, M. L. & J. MARTÍN (1993): The conservation of endangered Lycaenid butterflies in Spain. - Biolog. Conserv. **66**: 17-22.
- PRIETO, C. G. & M. L. MUNGUIRA (2004): Diferenciación de especies de mariposas del género *Cupido* (Lycaenidae) utilizando caracteres biológicos y biométricos. XI Iberian Congress Entomology, Madeira (oral comm., unpublished).
- RILEY, N.D. (1927). A new european Lycaenid: *Cupido arcilacis*. - Entomologist **60**: 269-276. London.
- RILEY, N. D. (1928): *Cupido carswelli* STEMPFFER = *Cupido arcilacis* RILEY. - Entomologist **61**: 38, 91, London.
- STEMPFER, H. (1928): Contribution à l'étude de *Cupido carswelli* STEMPFFER. - Encycl. Ent. Ser. B. III Lep. **3**: 105-115, Paris.
- TOLMAN, T. & R. LEWINGTON (1997): Butterflies of Britain & Europe. - Harper Collins, London.
- VIVES MORENO, A. (1994): Catálogo sistemático y sinónimo de los lepidópteros de la Península Ibérica y Baleares (Insecta: Lepidoptera). - Ministerio Agricultura, Pesca y Alimentación. Madrid.

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Colourplate 2/ Farbtafel 2, p. 281

Fig. 8. Chrysalis of *Cupido minimus* (FUESSLY, 1775). Fig. 9. Chrysalis of *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847): ventral view. Fig. 10. Chrysalis of *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847): dorsal view. Fig. 11. Chrysalids of *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847). Fig. 12. Chrysalids of *Cupido carswelli* (STEMPFER, 1927): dorsal view. Fig. 13. Chrysalids of *Cupido carswelli* (STEMPFER, 1927): ventral view. Fig. 14. Chrysalids of *Cupido carswelli* (STEMPFER, 1927): lateral view. Fig. 15. Imago ♂ of *Cupido carswelli* (STEMPFER, 1927). Fig. 16. Imagines ♂♂ of *C. carswelli* (STEMPFER, 1927) (left) and *C. minimus*. Fig. 17. Imago of *C. carswelli* (STEMPFER, 1927) on *Anthyllis vulneraria*, larval host-plant.

Fig. 1

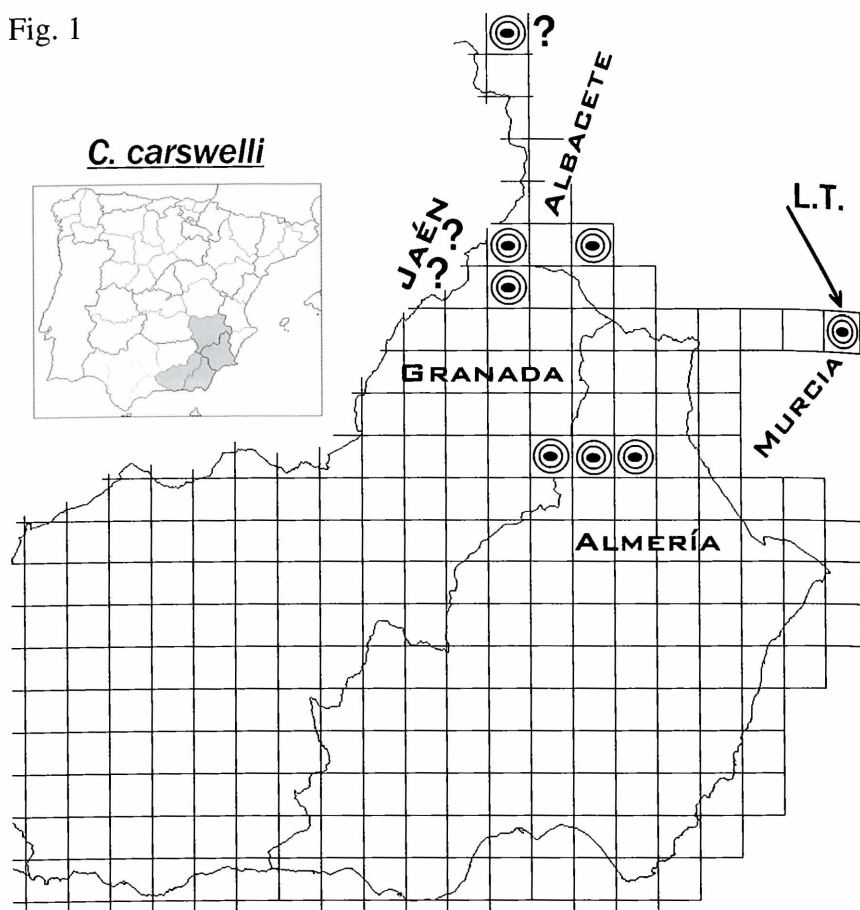


Fig. 1. Actual and probable distribution of *Cupido carswelli* (STEMPFER, 1927) (LT=Type locality) in Spain

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Fig. 2. Uncus of *Cupido minimus* (A); *Cupido carswelli* (C); y *Cupido lorquini* (B).

Fig. 3. Aedeagus of *Cupido minimus* (A); *Cupido carswelli* (C); and *Cupido lorquini* (B).

Fig. 4. Valves of *Cupido minimus* (A); *Cupido carswelli* (C); and *Cupido lorquini* (B).

Fig. 2

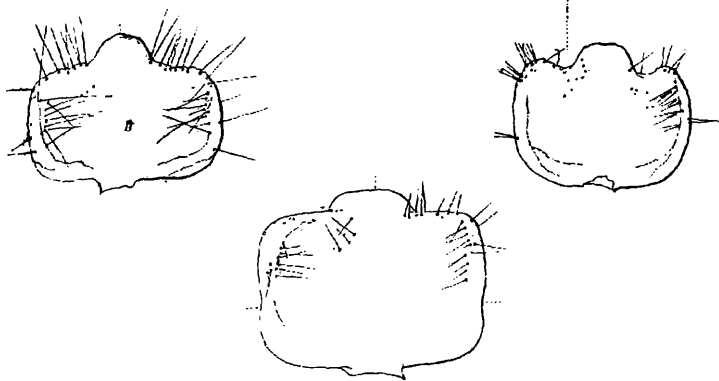


Fig. 3. — Gentalia ♂ — UNCUS (Objectif 4, Oculaire 3).

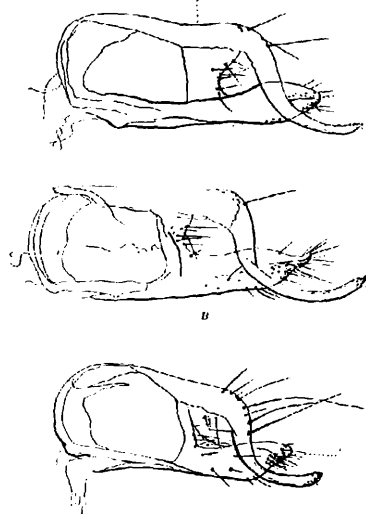
A : *C. minimus* Fausst., Lautaret (Hautes-Alpes) ; a, a' : cavités des bords latéraux ; d : épaississement du lobe médian. — B : *C. borquini* H.-S., Konia (Anatolie) ; p : lobe médian. — C : *C. caravelle* Stempffer, Sierra de España (Espagne) ; d, d' : dépressions séparant les lobes.

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l'uncus. Elles paraissent assez semblables de forme, et, subissant des déplacements au cours de la préparation, on ne peut comparer exactement leurs positions respectives.

Fig. 3

Fig. 4



Gentalia ♂ — VALVE : a prolongement membraneux ; prolongement chitineux (Objectif 4, Oculaire 1).

A. *C. minimus* Fausst., Bouray (Seine-et-Oise) ; a : dépression du bord supérieur.
B : *C. borquini* H.-S., Konia (Anatolie). — C : *C. caravelle* Stempffer, Sierra de España (Espagne).

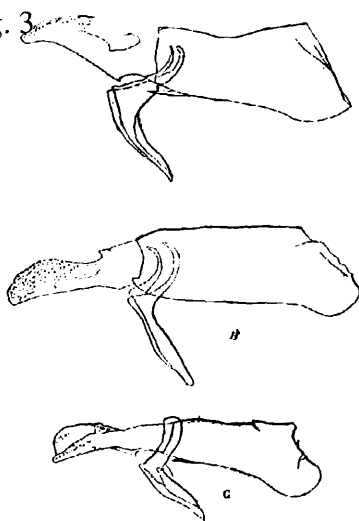


Fig. 5. — Gentalia ♂ — ABEDEGUS (Objectif 4, Oculaire 1).

A : *C. minimus* Fausst., Lautaret (Hautes-Alpes) ; B : *C. borquini* H.-S., Konia (Anatolie) ; C : *C. caravelle* Stempffer, Sierra de España (Espagne).

sions profondes ; d et d'. Les bords latéraux sont très nettement convexes.

Je n'ai pas figuré dans les trois espèces les apophyses latérales de

Fig. 5

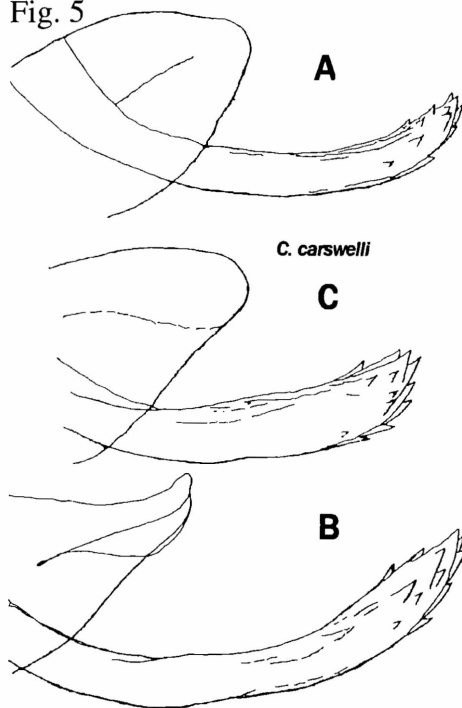


Fig. 6

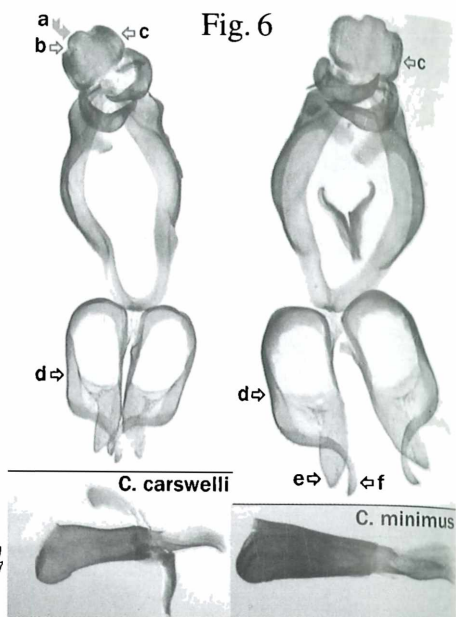


Fig. 7

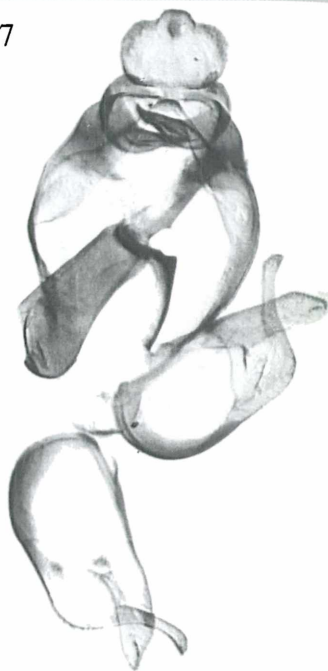


Fig. 5. Quatinous prologation of valves in *C. minimus* (FUESSLY, 1775) (A); *C. carswelli* (C); and *C. lorquini* (HERRICH-SCHÄFFER, 1847) (B).
 Fig. 6. Genitalia of *Cupido carswelli* (STEMPFER, 1927) (left) and *Cupido minimus* (FUESSLY, 1775) (photo: Dr. A. EXPÓSITO).
 Fig. 7. Genitalia of *Cupido carswelli* (STEMPFER, 1927) (photo: Dr. U. EITSCHBERGER).

Colour plate 2/ Farbtafel 2 (p. 281)

GIL-T., F.: *Cupido carswelli* (STEMPFER, 1927): Morphology of its chrysalis and genitalia compared with those of *Cupido minimus* (FUESSLY, 1775) and *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847) (Lepidoptera, Lycaenidae). - Atalanta (2006) 37 (1/2):150-160, Würzburg.

Fig. 8. Chrysalis of *Cupido minimus* (FUESSLY, 1775).

Fig. 9. Chrysalis of *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847): ventral view.

Fig. 10. Chrysalis of *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847): dorsal view.

Fig. 11. Chrysalids of *Cupido lorquinii* (HERRICH-SCHÄFFER, 1847).

Fig. 12. Chrysalids of *Cupido carswelli* (STEMPFER, 1927): dorsal view.

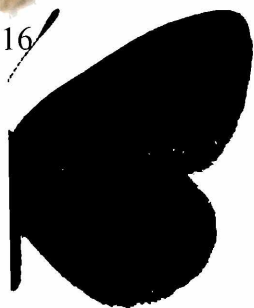
Fig. 13. Chrysalids of *Cupido carswelli* (STEMPFER, 1927): ventral view.

Fig. 14. Chrysalids of *Cupido carswelli* (STEMPFER, 1927): lateral view.

Fig. 15. Imago ♂ of *Cupido carswelli* (STEMPFER, 1927).

Fig. 16. Imagines ♂♂ of *C. carswelli* (STEMPFER, 1927) (left) and *C. minimus* (FUESSLY, 1775) (right). Fig. 17. Imago of *C. carswelli* (STEMPFER, 1927) on *Anthyllis vulneraria*, larval host-plant.

Colour plate 2/ Farbtafel 2



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