Atalanta (August 2007) **38** (1/2): 203-212, Würzburg, ISSN 0171-0079

Description of *Hyles tithymali phaelipae* subspec. nov. from El Hierro Island (SW. Canary Ilands, Spain), based mainly on constant and characteristic differences in larval morphology

(Lepidoptera, Sphingidae)

by

FELIPE GIL-T. & ESTRELLA GIL-UCEDA

received January 16th 2007

Abstract: The morphology of the populations of *H. tithymali* (BOISDUVAL, 1832) is not very well known and that from El Hierro Island (the southernmost and westernmost island of the Canaries) was studied. The results of a comparison of this population with the nominate subspecies, as well as with other subspecies of *H. tithymali* (BDV.) which are geographically much closer, indicate that the El Hierro colony is a valid subspecies: *H. tithymali* ***phaelipae*** **subspec. nov.** is described.

The larvae of *H. tithymali* ***phaelipae*** **subspec. nov.** are clearly different from those belonging to the rest of the described subspecies of *H. tithymali* (BDV.): All larvae exhibit pronounced horizontally-elongated subdorsal eye-spots (circular in the other subspecies), with the black border of each eye-spot reduced to a dorsal and a ventral black stripe, both being horizontally separated. In 100% of the artificially reared larvae (L4, L5), all of the eye-spots are of a characteristically contrasting orange-ochre colour (red or white in the other sspp.) on a greenish-yellow ground. The dorso-lateral row of eye-spots is normally connected by a well-defined greenish-yellow stripe, when the caterpillars resemble those of *Hyles livornica* (ESPER, 1780). In nature, judging from around 120 larvae examined from El Hierro Island feeding on *Euphorbia obtusifolia*, nearly 100% showed this same stripe connecting the dorso-lateral row of eye-spots (in L4-L5). In captivity (when reared on the Spanish peninsular on *Euphorbia characias*, but at a different temperature) this stripe was present in 95% of 270 larvae artificially reared, while only 40-50% of the total in F_1 and F_2 (150 larvae) and F_3 (200 larvae) were so marked. The possible causal influence of different environmental conditions on the phenotype is rejected and we consider that the principal reason for this variation is its genetic constitution.

In the imago the main constant differences with regard to the variable nominate subspecies are: The median stripe on the forewings is narrower and of a different dull-white colour, and the ground colour of the wings, fringes and body is clearly a darker dark-olive hue. Also, the morphology of the larvae from El Hierro and La Palma (NW. Canary Islands) have been compared. They show a certain similarity in their elongated eye-spots but are clearly different in several other characteristics.

Resumen: Se estudia la morfología de la población de *H. tithymali* (BOISDUVAL, 1832), no muy bien conocida, de El Hierro island (isla más occidental y meridional de islas canarias). El resultado de la comparación de esta población con la subespecie nominal, así como con

otras subespecies de *H. tithymali* (Bdv.) (más cercanas geográficamente), indica que la población de tithymali de El Hierro es una subespecie válida: se describe *H. tithymali* ***phaelipae*** **subspec. nov.**

Las larvas de of *H. tithymali* ***phaelipae*** **subspec. nov.** se diferencian claramente de las pertenecientes a las demás subespecies descritas de *H. tithymali* (Bdv.): el 100% de las larvas muestran ocelos muy alargados horizontalmente (redondeados en las otras sspp.), con el borde negro de cada ocelo reducido a dos bandas horizontales separadas, una dorsal y otra ventral. En el 100% de las larvas desarrolladas (L4, L5), todos los ocelos son de un característico color naranja-ocre contrastado (rojo o blanco en otras sspp.) sobre un color de fondo amarillo-verdoso. Los ocelos de la la fila dorso-lateral están normalmente unidos por una definida banda amarillo-verdosa, que recuerda a la existente en las larvas de *Hyles livornica* (Esper, 1780). En la naturaleza (El Hierro, sobre *Euphorbia obtusifolia*, alrededor de 120 larvas), las orugas mostrando esta banda uniendo los ocelos de la fila dorso-lateral (en L4-L5) aparecen de forma constante (cerca del 100%). En cautividad (criados en España peninsular, usando *Euphorbia characias*, con diferente temperatura) el porcentaje de larvas que mostraron dicha banda fue el 95% in F_1 y entre el 40-50% in F_2 and F_3. Se descarta la posible influencia de diferentes condiciones del medio ambiente en el fenotipo mostrado y se considera como principal factor de esta variación a su constitución genética.

Los imagos muestran como principales diferencias (constantes), con respecto a la subespecie nominal (variable), las siguientes: la banda mediana en las alas anteriores es menos ancha y de diferente color (blanco apagado); el color de fondo de las alas, fringias y cuerpo es claramente más oscuro (oliva oscuro). También, se compara la morfología de las larvas de El Hierro and La Palma (NW. Canary islands). Ellas muestran una cierta similitud (elongated eye-spots), pero se diferencian claramente en varias características.

Introduction: Hundsdoerfer et al. (2005a) considers two morphotypes in larvae of *H. tithymali* (Bdv.) from the Canary Islands as "showing either round or elongate subdorsal eye-spots - together with an intermediate form, along a cline [sic] from east to west, with round eye-spots dominating in the east and centre of the archipelago, and elongate eye-spots dominating on the two westernmost islands [La Palma and El Hierro]"
During the period between March 27th and 31st 2006 we were able to examine around 120 larvae of *H. tithymali* (Bdv.) (from L3 to L5) in the SW of El Hierro Island (NE. Faro de Orchilla, the furthest western point of the island and of the Canary archipelago, Fig. 1, p. 212). The caterpillars were feeding on Euphorbia obtusifolia (p. 314, colour plate 8: 2), which is the main host plant of this hawkmoth in the western islands [Note: According to the recent reference of Molero & Rovira (2004), the correct name of *E. obtusifolia* is *Euphorbia lamarckii* Sweet], where *Euphorbia regis-jubae* does not exist (it is present in Gran Canaria, Fuerteventura and Lanzarote). All the mature larvae -L4, L5- (p. 314, colour plate 8: 2, 3) showed well contrasted and pronounced horizontally elongated subdorsal eye-spots of an orange-ochre colour [not red, rose-coloured, nor white, as is usually described for *H. tithymali* (Bdv.) s. l.], with the black border of each spot reduced to separate dorsal and ventral horizontal black stripes.

With respect to the morphology of the subdorsal eye-spots of the mature larvae of the numerous samples analysed from El Hierro (specimens both found in nature and

three generations reared in captivity), the results were not the same as the examples with elongated subdorsal eye-spots (78.9%) in HUNDSDOERFER et al. (2005a). Only 19 caterpillars from El Hierro were examined in this work and, furthermore, it was erroneously asserted that "the spotted pattern only develops in the second larval instars (L2), at which time the two morphotypes can already be mostly distinguished" HUNDSDOERFER (pers. comm.) reported" to us that some L3 larvae were used as material for his work. This is probably the reason (as well as the small size of the sample) why he obtained different results, as in L3 the eye-spots are not yet completely defined.

HARBICH (2000) studied specimens of *H. tithymali* (BDV.) from La Palma Island. The larvae from La Palma and El Hierro are the only ones within *H. tithymali* (BDV.) s. l. that all show pronounced elongated horizontal subdorsal eye-spots, with the black border of each spot reduced to a dorsal and a ventral horizontal black stripe. The caterpillars from both islands are different in the colour of their eye-spots, and also in other characteristics - in both larvae and adults - details of which are mentioned later.

Besides the characteristics previously mentioned, the presence of the greenish-yellow stripe (colour plate 8: 3) in larvae from El Hierro is quite striking. This stripe links all the dorso-lateral eye-spots (from the head shield up to the abdominal eye-spot on segment 8, near the horn), giving them a quite different appearance from the *H. tithymali* (BDV.) larvae of other islands, as for example from those of Tenerife (p. 314, colour plate 8: 4).

We sent HUNDSDOERFER and PITTAWAY some photographs of caterpillars taken in the field at El Hierro. Their replies are partly copied here below:

HUNDSDOERFER (pers. comm.): "I saw many like these on the Canary [in spite of this, the morphological features were never mentioned in her previous referred-to work]. But I had also already observed (in) 2001 (in a talk I gave at the BMNH [British Museum of Natural History] that they look like a hybrid between *H. livornica* and *H. tithymali*!). Nevertheless, genetic data do not give any indications in this direction until now"

- PITTAWAY (pers. comm.) also considers "that the larvae were hybrids between"*H. livornica* and *H. tithymali*"; and he significantly stated: "I have never seen this feature in any other population of either"*H. tithymali* or *H. euphorbiae*" (!).

On account of these uncertainties, we decided to analyse the offspring obtained from imagos of ex-larvae collected from El Hierro.

Due to the distinctive differential morphologies of the larvae and imagos, we considered it appropriate to propose and describe the population of *H. tithymali* (BDV.) in El Hierro as a new subespecies: *H. tithymali* ***phaelipae*** **subspec. nov.**

Material and Methods:In order to eliminate the possible influences of the local environment during the larval stages in El Hierro we collected caterpillars from different localities in south-west of the island (feeding on *Euphorbia obtusifolia*) and reared them in captivity until pupation. From these pupae, three generations were obtained in captivity in the Granada province of peninsular Spain using a different host plant -*Euphorbia characias* - which we have used during diverse experiments when rearing larvae in captivity (as with *H. euphorbiae* (L.) and *H. tithymali* (BDV.), from different localities). Their larval development was completed as follows: In F1, 270 larvae; F_2 150 larvae; and in F_3 200. All these were compared with a sample of over 500 feral larvae from the islands of Tenerife, Gran Canaria

and Fuerteventura. Samples of larval varieties or forms obtained (all in L4-L5, with well defined morphology) from El Hierro were photographed laterally. The artificially reared adults belonging to the three previous generations were then compared with around 300 adults of the nominate subspecies.

Description of *Hyles tithymali* ***phaelipae*** **subspec. nov.**

Holotype ♂ (p. 315, colour plate 9: 12, top, right): F_1 from material collected in SW. El Hierro (F_0: larvae: 27-31/III/06, emerged: IV/06), 2 km NE. Faro –lighthouse- of Orchilla, 15-VI-[20]06.

Paratypes: All leg. et coll. GIL-T.: 2 ♀♀ F_0 27/IV/06; 15 ♂♂, 16 ♀♀ F_1 15-20/VI/06; 3 ♂♂, 13 ♀♀ F_2 25-30/07/2006. In EMEM (Entomologisches Museum EITSCHBERGER, D-Marktleuthem): 6 ♂♂, 4 ♀♀ (F_1 and F_3).

Morphology of the larvae: PITTAWAY (1997) asserts with respect to the nominate subspecies that the "young larvae are black at first, turning to olive black after feeding" and, when discussing ssp. *gecki* DE FREINA (1991) states that the young larva is initially matt black but that eventually the colouring changes to olive black. The recently hatched larvae that we studied from El Hierro Island were initially green but turned to a dark olive colour immediately. These then changed colour to olive black after feeding. We are unable to categorically confirm that there are genuine colour differences between the larvae of these three subspecies at this stage or whether the colour depends upon the amount of time which passes shortly after hatching.

In L3, immediately after the second moult, the larval pattern starts to become noticeable and well defined. At this stage the eye-spots start to show some of their typical characteristics: That is, elongated subdorsal spots, initially white, which turn to ochre-orange some days after starting L3.

In L4, all the larvae showed their final colour pattern: Spiracles very visible: pronounced elongated horizontal subdorsal eye-spots of orange-ochre colour in all larvae: the eye-spots on a high percentage of the caterpillars were found to be linked by a well defined greenish-yellow stripe, reminiscent of *H. livornica* (ESP.). A count revealed the following results: In F_1 262 larvae (97.4 %) had a well defined stripe (Figs. 5 & 6), although the remaining 7 larvae could not be unequivocally assigned to this morphotype as their lateral band was of a light yellow colour (there was no masking of the yellow colour by black) and the outline of the stripe linking the eye-spots was not clearly delineated (colour plate 8: 7). In F_2 (150 larvae) and F_3 (200 larvae), 40-50% showed the greenish-yellow stripe linking the eye-spots. We believe that the reason for the percentage difference in F_2 and F_3 to that in F_1 is also principally that the lateral bands in the majority of larvae were of a light yellow colour. It is significant that in those caterpillars with an almost black lateral band, or those strongly flushed with black, the stripe that links the eye-spots is well defined and maintains its "clean" greenish-yellow colouring.

According to several authors the colour of the subdorsal eye-spots varies in *H. tithymali* (BDV.) s. l.: They can be intensely red, bright white, or various shades of pink in between. In *H. tithymali gecki* DE FREINA there seems to be a predominance of white eye-spots over red and DE FREINA (1994) states that in *H. t. deserticola* STAUDINGER the percentage

of red eye-spots varies from 50-80%. In larvae from El Hierro (Figs. 8 & 9) the eye-spots are of a characteristic contrasting orange-ochre colour in 100% (L4-L5) of the larvae.

HARBICH (pers. comm.) considers that, without having studied the populations from El Hierro, in respect to the larvae from La Palma Island, "all these caterpillars look very differently from the typical morphotypes of the other Canary Islands" In HARBICH (2000), examples of La Palmas larvae are shown (also with elongated eye-spots). HARBICH (pers. comm.) asserts that in larvae L5 that "the eye-spots were really light orange-white" on a whitish ground colour (p. 314, colour plate 8: 9, 10). We have examined the larvae from La Palma illustrated in the previous reference, as well as several photos that this author supplied us, and their morphology is similar to those from El Hierro, except for the following characteristics:

a) The eye-spots are of different colour, as are their length and shape.
b) There are a different number of coloured eye-spots in L3-L4-L5.
c) The colour of the stripe that connects the eye-spots is different.
d) The colour of the dorsal stripe in full-grown larvae also differs.

With respect to the first dissimilarity (a): The pale orange-white colour of the eye-spots in larvae from La Palma contrasts poorly with the ground colour; the area occupied by the orange-white colour is clearly smaller than in the larvae from El Hierro (some ocelli are almost totally white and the extensive dark orange-ochre colouration contrasts well); and on the lower and lateral areas on the caterpillars from La Palma the spots are extensively white, whereas at El Hierro the spots are greenish-yellow. With respect to the second difference (b): At El Hierro, 100% of the larvae have eye-spots of an orange-ochre colour some days after starting L3; at La Palma [HARBICH (2000: 302) and HARBICH pers. comm.)] the eye-spots in L3 and L4 are always white, the spots only beginning to appear coloured with light orange-white at L5. With regard to the third difference (c): At El Hierro this stripe is always of a yellowish-green colour, while at La Palma (HARBICH, pers. comm.) it can be light yellow, greenish, or even whitish. Finally, with respect to the fourth difference (d): The dorsal stripe in the larvae from La Palma is yellowish (p. 314, colour plate 8: 9, 10), while those from el Hierro are reddish or wine-red (p. 314, colour plate 8: 2, 7).

HUNDSDOERFER & WINK (2006) suggest that "the two morphs observed may represent the first stage of differentiation between two lineages" and that "the contact between the populations on the eastern and western islands has been decreased and a morphological differentiation is already visible"

Our previous results from El Hierro show that the characteristic elongated subdorsal spots and their colour (in 100% of the larvae observed in nature and in the three generations obtained in captivity) is a product of its genotype and not due to environmental factors. The presence of a contrasting stripe connecting its eye-spots in a high percentage of larvae is also probably genetic, being in some cases a hidden character within its phenotype when the lateral band is of the same colour as the stripe. After sampling more than 500 larvae from Tenerife, Gran Canaria and Fuerteventura, we have been unable to find any with the previously mentioned characters (nor any intermediate forms) like those at El Hierro.

Figs. 8 & 9, plate 8, show that the larval characteristics are rather different to typical examples of the geographically nearest subspecies [Note: These taxa are considered as separate species by several authors, for example in DANNER et al. (1998)]; that is, *H. t.*

tithymali (Bdv.), *H. t. gecki* De Freina, *H. t. deserticola* Stgr.and *H. t. mauretanica*. According to Pittaway (1997) the larvae of *H. t. tithymali* (Bdv.) are almost identical to those of *H. t. mauretanica* Stgr. and *H. t. deserticola* Stgr.; the larvae of *H. t. mauretanica* Stgr. generally have a double row of white spots, as in *H. euphorbiae* (L.), not a single row as is usual in *H.tithymali* (Bdv.); the larvae of *H. t. deserticola* Stgr "cannot be distinguished from ssp. *tithymali* (Bdv.)"; the larvae of *H. t. gecki* De Freina in the third and fourth instars are, according to De Freina (1991), very similar to those of *H. t. mauretanica* Stgr., the full-grown larvae being also similar to that subspecies but differ mainly in having a much narrower yellow dorso-lateral stripe.

We have also totally ruled out that this morphotype is a result of hybridation between *H.tithymali* (Bdv.) and *H. livornica* (Esp.): There are no coincidences with the characters exhibited by the larvae of *H. livornica* (Esp.) if we exclude the stripe that links the dorso-lateral eye-spots present in *H. livornica* (Esp.), but in this species the differently coloured stripe literally "cuts" or divides the yellow eye-spots, whilst in the *H. tithymali* (Bdv.) larvae from El Hierro the stripe actually connects the orange-ochre eye-spots.

We collected an aberrant larvae (p. 314, colour plate 8: 11), in F_2, with two different, lateral sides: one similar to a typical *H. t.* ***phaelipae*** **ssp. nov.** larvae, but in the other (lower photo) the black colour was absent or blue, both, in the bands as well as in the borders of the eye-spots.

Morphology of the adults: The imagos of *H.tithymali* (Bdv.) s. l. are considered by some authors as highly variable. Meerman (1988) confirms that adults of the subspecies of *H. tithymali* (Bdv.) are not always easy to separate. *H. t. himyarensis* Meerman from Yemen with its strongly contrasting grey-white median stripe and *H. t. deserticola* Stgr. with its pale colours and yellow underside are the easiest to distinguish. In Pittaway (1997), it is asserted with respect to *H. t. tithymali* (Bdv.) that "many individuals resemble subsp. *mauretanica* Stgr."; *H. t. mauretanica* Stgr. is "highly variable, often resembling the nominate subspecies but tending to become smaller and paler towards desert areas", with some individuals being similar to *H. t. gecki* De Freina in coloration and pattern"; *H. t. gecki* De Freina (Note: This was a population that Pittaway (1983) regarded as *H. t. maureranica* Stgr., prior to De Freina's description) is "similar in coloration and pattern to some individuals of *H. t. maureranica* Stgr. from Morocco" and "the median stripe may also be off-white rather than of the normal pale creamy yellow colour"

With such a range of variability and resemblance between the imagos, both within the same and different subspecies, we do not consider that the morphology of the adults of *H. t.* ***phaelipae*** **ssp. nov.** is clearly distinctive [it is within the normal range of *H. t. tithymali* (Bdv.)], but it is very constant.

All the adults obtained from El Hierro Island (more that 500), when compared to the material from Tenerife and Gran Canaria (around 300), show, principally, the following features: Forewing upperside

Median stripe: In *H. t.* ***phaelipae*** **ssp. nov.** the stripe is narrower along its length than in *H. t. tithymali* (Bdv.) (which is highly variable and normally broader), especially in the medial (discal) area; the stripe in *H. t.* ***phaelipae*** **ssp. nov.** is a dark dull-white, whilst the normally variable colour of the same stripe in *H. t. tithymali* (Bdv.) is defined as being cream or pale creamy, depending upon the author.

Ground colour: In *H. t.* ***phaelipae*** **ssp. nov.** the basal-subbasal, subcostal, and postmedial-postdiscal areas are of a dark olive green, clearly darker than in *H. t. tithymali* (Bdv.) (which varies from a dark grey-brown to brown-olive).

Submarginal area: In *H. t.* ***phaelipae*** **ssp. nov.** it is dark grey, with fringes clearly of a darker grey colour than in ssp. *tithymali* (Bdv.), which normally has dark gold fringes. The ground colour and fringes of both taxa can be clearly seen in Fig. 14, colour plate 9, obtained by means of a scanner.

Venation: In *H. t. tithymali* (Bdv.), many specimens have a superimposed silvery venation, which is more pronounced (extreme case colour pl. 9: 12, bottom left) than in *H. t.* ***phaelipae*** **ssp. nov.**

Although it is considered that *Hyles dahlii* (Geyer, 1827) can be easily distinguished from *H. tithymali* (Bdv.) s. l. by its three pairs of black abdominal patches, which are absent in *H. tithymali* (Bdv.). We have obtained a specimen of *H. t.* ***phaelipae*** **ssp. nov.** which also exhibits these markings (p. 315, colour plate 9: 15). Furthermore, in Harbich (2000) a specimen is illustrated with this same characteristic from La Palma. Amongst other characters, the typical adults illustrated in the previous reference (from La Palma) can be separated from *H. t.* ***phaelipae*** **ssp. nov.** mainly by the median stripe, which is broader and of different colour.

Hindwing upperside: Basal area: Generally extensively and intensely marked with black, which makes the white anal patch small when compared to *H. t. tithymali* (Bdv.).
Post medial band: Generally broad, especially in its proximity to the apex.
Medial band (pink-red): The two previous characters (of width) generally makes the medial band in *H. t.* ***phaelipae*** **ssp. nov.** narrower than in *H. t. tithymali* (Bdv.).

Wings underside: Variable, their ground colour is very dark in the spring broods and lighter in the summer broods.

Discussion: Hundsdoerfer et al. (2005a) consider the larvae population of the Canary Islands as "a cline from east to west, with round eye-spots dominating in the east and centre of the archipelago, and elongate eye-spots dominating on the two westernmost islands"

Is it correct to define it as a cline?. If we follow for example Villiers (1977), where practical recommendations are listed for the correct application of infra-specific taxonomic categories, a cline occurs when populations are only different at the extreme ends in their area of distribution and where there is also a gradual and progressive variation of their distinctive characters in between (which is not the case on the Canary Islands).

Does there really exist a gradual progressive variation of the eye-spots (taking as distinctive characters the "strongly elongated eye-spots""and "round eye-spots"), taking into account the grown larvae (L4, L5)? We think not. We have only observed round eye-spots in the around 500 larvae (L4-L5) from Tenerife, Gran Canaria and Fuerteventura Islands, used for comparison. In Hundsdoerfer et al. (2005a), of a rather insignificant number of larvae, a similar but somewhat reduced percentage was obtained (between 11-18%) with "elongate spots""and only for the islands of La Gomera (3 larvae), Tenerife (3 larvae) and Gran Canaria. Additionally, even with the previous results, it cannot be ascertained that there is a gradual progressive variation (from the east of the archipelago to the two westernmost islands) of this distinctive character. The aforementioned results (both the percentage and as illustrated in the photos) quoted in the previous reference regarding the existence of "intermediate" eye-spots in larvae found in the centre and east of the archipelago, as indicated in the introduction of the present work, could be influenced by the collection of larvae L3 (when the eye-spots are not completely developed), and also perhaps some L2.

Furthermore, the consideration as "intermediate" those eye-spots in some photographed larvae is very subjective, as some of these could be considered as "round" eye-spots by other authors.

In the case of the Canary Islands there are two distinct and uniform larval populations (one in El Hierro and La Palma, the other in the rest of the archipelago) but each is different in that larvae may exhibit just a narrow stripe (unproven from the data in the previous reference) in which the characteristics that serve for distinguishing one population from the other appear as a hybrid form, in which case, and in accordance with the correct application of the infra-specific taxonomic categories, it would be correct to award the category of subspecies to these populations [*H. t.* ***phaelipae*** **ssp. nov.** and *H. t. tithymali* (Bdv.) i respectively].

Hundsdoerfer et al. (2005b) considers that "the population of *H. t. tithymali* (Bdv.) on the Canary Islands can be regarded as genetically homogeneous", and that "the mt-DNA data rather indicates that the hawkmoth populations of the seven island's moth populations appear to be continuously in contact, maintain(ing) a constant genetic exchange throughout the archipelago" We regard that this consideration seems to conflict with the results of Hundsdoerfer & Wink (2006), where they quote the following: a).-"nine haplotypes occurred only on the westernmost islands"; b).-"it may be that only a very small genetic change is responsible for the morphological difference, too small to be detected in a preliminary genetic screening of these populations" and c).-"the contact between the populations on the eastern and western islands has been decreased and a morphological differentiation is already visible"

Examining the hypothesis of "a constant genetic exchange" between islands, it would be extremely strange if the larvae of El Hierro (and in La Palma) were able to maintain 100% of a constant, distinctive and unique morphotype. Furthermore, if the populations on a different island were to be "continuously in contact", this morphological characteristic would also appear in a significant proportion (in progressive variation) in other islands in the centre -at least- or in the east of the archipelago, which we have found does not occur. After an interesting discussion about the previous subject, A. Hundsdoerfer (pers. comm.) admitted the following: "I agree with you that I also don't believe in ongoing gene flow between all islands .... I think that it may be a very young process of a splitting up of populations becoming more and more isolated"

We have also dismissed the idea that the phenotype shown by larvae and adults of *H. t.* ***phaelipae*** **ssp. nov.** could be influenced by environmental factors, as both the host plants supplied to the three generations obtained in captivity and the temperature (in the South Iberian peninsula there were high temperatures between May and August 2006) were quite different from those existing in the original biotype on El Hierro.

The Canary Islands are of volcanic origin and they have never been joined to the African continent. El Hierro is the youngest island of the Canary archipelago, and is of a geological age of around 1.1 My (La Palma is 1.6 My). The remaining islands are even older: La Gomera is 12 My, Tenerife 15 My, Gran Canaria 16 My, Lanzarote 19 My and Fuerteventura 22 My. Therefore, the source of the colonization of the different Canary Islands by the taxon *tithymali* (Bdv.) is doubtless of an exogenous continental source (Africa) which began after the formation of the first islands [a colonisation which apparently continues in Fuerteventura, according to Gil-T. (2002) and Eitschberger & Saldaitis (2006)]. This colonization has evidently been more recent in El Hierro and in La Palma than in the other islands, in accordance with their geological history, and is undoubtedly a consequence of passive wind dispersion (a common meteorological phenomenon in the Canary archipelago) coming from the Sahara in an east to

west direction. Nevertheless, in El Hierro and in La Palma this taxon has evolved in a different manner than those from the rest of the islands, most probably on account of two main factors: The isolation of the islands and also the highly reduced or absence of contact between the population on El Hierro (at La Palma) with the rest of the islands, which is the only way that the morphological characteristics previously mentioned could have been maintained, this especially being the case with the larvae.

We therefore consider it appropriate to award the taxonomic category of subspecies to the population of *H. tithymali* (Bdv.) in the Hierro Island.

Note: We consider that the population of *H. tithymali* (Bdv.) on La Palma needs further investigation and discussion, and some sort of complementary field study, to finally decide its status – this perhaps even being its adscription to *H. t.* ***phaelipae*** **ssp. nov.** (This suggestion should not be quickly dismissed as, like in plants, some species are exclusive to these two islands, eg. *Gonospermum canariense* and *Polycarpaea smithii*).

Acknowledgements: We should like to express our heartfelt gratitude to Rafael Estévez Rodríguez (E-Vigo) for his essential help in translating the Spanish text of this paper into English; to Heimo Harbich (D-Salz) for his valuable information and comments on material from La Palma Island, in providing us with several photographs of larvae and for his kind authorisation to include two of them in the present work (Fig. 10); to Stefan Schroeder (D-Koeln) for his help in obtaining several reprints and in the translation of their German text into English. Also to Anna Hundsdoerfer (D-Dresden) and Tony Pittaway (England) for their kind communications.

References

Danner, F., Eitschberger, U. & B. Surholt (1998): Die Schwärmer der westlichen Palaearktis. Bausteine zu einer Revision (Lepidoptera: Sphingidae). - Herbipoliana **4** (1):1-368, **4** (2):1-720, Verlag Eitschberger, Marktleuthen..

De Freina, J. J. (1991): Über Biologie und Morphologie der auf Madeira beheimateten *Hyles euphorbiae gecki* ssp. n. (Lepidoptera, Sphingidae). - NachrBl. bayer. Ent. **40** (3): 65-72, München.

De Freina, J. J. (1994): Über Biologie, Morphologie und Taxonomie von *Hyles tithymali deserticola* (Bartel)[sic], mit vergleichenden Studien zu *Hyles euphorbiae mauretanica* (Staudinger) (Lepidoptera: Sphingidae). - Ent. Z. **104**: 33–41, Stuttgart.

Eitschberger, U. & A. Saldaitis (2006): *Hyles deserticola* (Staudinger, 1901) auf der Kanaren-Insel Fuerteventura (Lepidoptera, Sphingidae). Neue Ent. Nachr. **59**: 398-400, Marktleuthen.

Gil-T., F. (2002): *Hyles tithymali deserticola* (Staudinger, 1901) in the island of Fuerteventura, a new taxon for the Canary Islands (Lepidoptera, Sphingidae). Bol. Soc. Ent. Aragonesa 31: 121-124, Zaragoza (in Spanish).

Harbich, H. (2000): Der Hyles euphorbiae-Komplex ein taxonomisches Problem? (Lepidoptera: Sphingidae) 8. Teil. - Ent. Z. **110**: 301-304, Stuttgart.

Hundsdoerfer, A.K., I.J. Kitching & M. Wink (2005a): The morphological variability of *Hyles t. tithymali* (Boisduval) caterpillars on the Canary Islands (Lepidoptera: Sphingidae). Ent. Z. **115**: 29–33, Stuttgart.

HUNDSDOERFER, A. K., KITCHING, I. J. & M. WINK, M., (2005b): The phylogeny of the *Hyles euphorbiae* complex (Lepidoptera: Sphingidae): Molecular evidence from sequence data and ISSR-PCR fingerprints. - Organisms, Diversity & Evolution 5: 173–198,Elsevier, Spektrum Akademischer Verlag, München.

HUNDSDOERFER, A. K., & M. WINK (2006): Incongruence of morphology and genetic markers in *Hyles tithymali* (Lepidoptera: Sphingidae) from the Canary Islands. - J. Zool. Syst. Evol. Res. **44** (4): 316–322, Blackwell Verag, Berlin.

MEERMAN, J. C. (1988): The subspecies of *Hyles tithymali* with a description of a new subspecies (Lepidoptera: Sphingidae). - Ent. Ber. **48**: 61–67, Amsterdam.

MOLERO, J. & A. ROVIRA (2004): *Euphorbia lamarckii* SWEET, correct name for *E. obtusifolia* POIR non LAM. - Vieraea **32**: 117-122, Tenerife Island, Spain.

PITTAWAY, A. R. (1983): An annotated checklist of the Western Palaearctic Sphingidae (Lepidoptera). - Ent. Gaz. **34**: 67-85, Classey, Faringon.

PITTAWAY, A. R. (1997). Sphingidae of the Western Palaearctic: *Hyles tithymali* (BOISDUVAL, 1832). [http://tpittaway.tripod.com/sphinx/h_tith.htm].

VILLIERS, E. (1983): Faune des coleopteres de France. Cerambycidae. Vol. 1. Ed. Le Chevalier. Paris.

Address of the authors
FELIPE GIL-T. & ESTRELLA GIL-UCEDA
Aptdo. 3042
E-18080 Granada, Spain

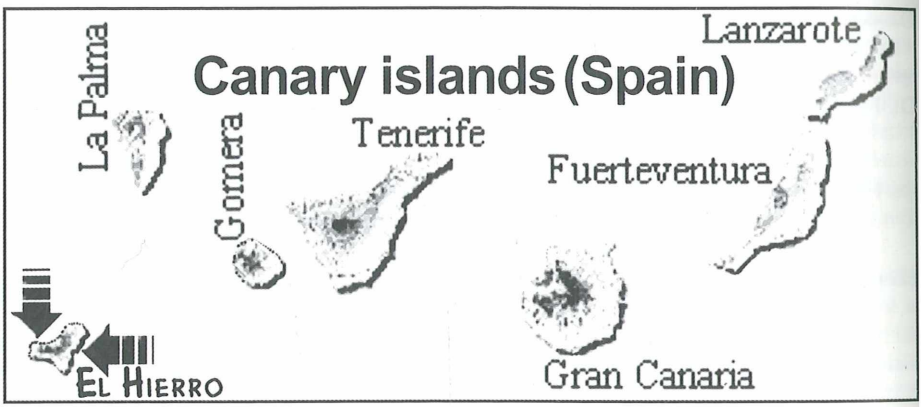
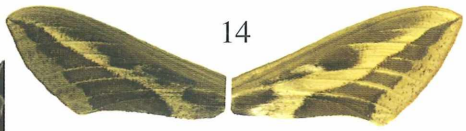
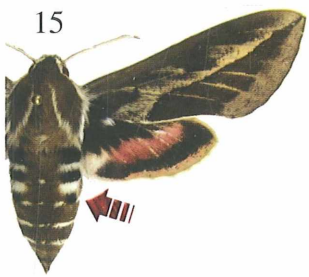


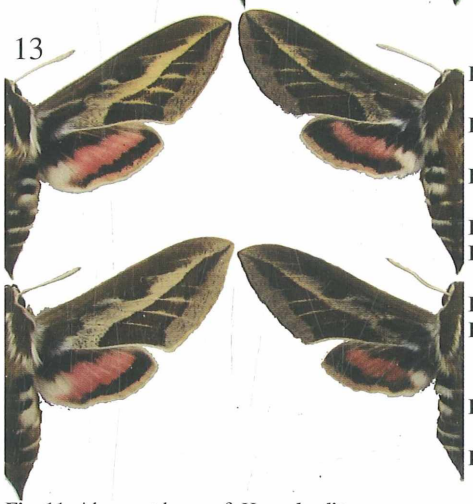
Fig. 1: Canary Islands, comparative position of El Hierro Island.

Colour plate 8/ Farbtafel 8

Colour plate 9/ Farbtafel 9







Colour plate 8-9/ Farbtafel 8-9

GIL-T., F. & E. GIL-UCEDA: Description of *Hyles tithymali* ***phaelipae*** **subspec. nov.** from El Hierro Island (SW. Canary Ilands, Spain), based mainly on constant and characteristic differences in larval morphology (Lep., Sphingidae). - Atalanta **38** (1/2): 203-212.

Fig. 2: Larva in nature of *H. t.* ***phaelipae*** **ssp. nov.** on *Euphorbia obtusifolia*.

Fig. 3: Larvae in nature (El Hierro Island) of *H. t.* ***phaelipae*** **ssp. nov.**

Fig. 4: Larvae of *H. t. tithymali* (BDV.) from Tenerife Island.

Fig. 5: Typical larvae of *H. t.* ***phaelipae*** **ssp. nov.**

Fig. 6:Typical larvae of *H. t.* ***phaelipae*** **ssp. nov.**, dark forms.

Fig. 7: Larvae of *H. t.* ***phaelipae*** **ssp. nov.**, light forms.

Fig. 8: Comparison of the eye-spots in larvae of *H. t.* ***phaelipae*** **ssp. nov.** (H) and *H. t. tithymali* (BDV.) (T).

Fig. 9: Comparison of the eye-spots from El Hierro (H), Tenerife (T) and La Palma (P) Islands.

Fig. 10: Larvae L5 from La Palma Island (photo: HEIMO HARBICH).

Fig. 11: Aberrant larva of *H. t.* ***phaelipae*** **ssp. nov.**, reared in captivity.

Fig. 12: Comparison of ♂♂ of *H. t.* ***phaelipae*** **ssp. nov.** (right) and *H. t. tithymali* (BDV.).

Fig. 13: Comparison of ♀♀ of *H. t.* ***phaelipae*** **ssp. nov.** (right) and *H. t. tithymali* (BDV.).

Fig. 14: Ground and fringe colouring of *H. t.* ***phaelipae*** **ssp. nov.** (left) and *H. t. tithymali* (BDV.).

Fig. 15: ♀ of *H. t.* ***phaelipae*** **ssp. nov.** exhibiting three pairs of black abdominal patches.