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Source: Journal of Orthoptera Research, 10(1) : 113-119

Published By: Orthopterists' Society

URL: https://doi.org/10.1665/1082-6467(2001)010[0113:ATTOSL]2.0.CO;2

# Additions to the Orthoptera (*sens. lat.*) of the Canary Islands

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## Abstract

A new subspecies of Pamphagidae (*Purpuraria erna lanzarotensis*) is provided, and additional distributions, and nomenclature changes of Orthoptera (*sens. lat.* to include Blattaria, Mantodea and Phasmida) of the Canary Islands. A significant inter-island difference in body size of the acridid *Calliptamus plebeius* is discussed.

## Key words

Orthoptera, Canary Islands, Acrididae, Pamphagidae, Gryllidae, Blattaria, Mantodea, morphology, distribution.

## Introduction

Since the publication of the most recent annotated list of Orthoptera (*sens. lat.*) of the Canary Islands (Bland *et al.* 1996), new species and subspecies, and changes in distributions and nomenclature have occurred, as well as the need to make several additions and corrections to the list. In addition, it was discovered that often the body size of the endemic acridid *Calliptamus plebeius* (Walker) varied significantly among the five islands on which the specimens were collected. These subjects are addressed to update the annotated list.

## New taxa and distributions

Island abbreviations in Table 1 and Fig. 7 are as follows: F, Fuerteventura; C, Gran Canaria; G, La Gomera; H, El Hierro; L, Lanzarote; P, La Palma; T, Tenerife. Species collecting record abbreviations in Table 1 refer to the following: B, Bland & Gangwere (1998); D, Dambach & Beck (1990); G, García (1999); GO, García & Oromí (1999); GR, Grunshaw (1991); GV, Gorochov (1993); K, Kruseman (Zoölogisch Museum Amsterdam, Nederland); M, Morales collection; MIO, Martín *et al.* (1999); P, Paul collection; W, Wiemers (1993).

*Wernerella rugosa* Bland (Acrididae, Oedipodinae) is a new species collected on Fuerteventura and Lanzarote (Bland & Gangwere 1998). It was originally referred to as sp. 2 in Bland *et al.* (1996). Species 1 in Bland *et al.* (1996) was subsequently identified as *Sphingonotus sublaevis* (Bolívar) (Bland & Gangwere 1998). *Wernerella pachecoi* (Bolívar), collected at Maspalomas, Gran Canaria, in August 1992 by Morales Martín, was inadvertently omitted for this island by Bland *et al.* (1996).

A single female designated as *Purpuraria* sp. (Pamphagidae, Pamphaginae) was collected at Yaisa, Lanzarote, in 1977 by M. C. and G. Kruseman. Until then the only *Purpuraria* species recorded in the Canary Islands was the endemic *P. erna* Enderlein on Fuerteventura (Bland *et al.* 1996). Comparison of the specimen with *P. erna* showed it to be similar but with a few obvious differences. Since no males or additional females have been collected on Lanzarote for further study, the female specimen is designated only as a new subspecies of *P. erna*.

***Purpuraria erna lanzarotensis*** new subspecies

*Type.* — Holotype♀. Canary Islands (Spain), Lanzarote, Yaisa, 3 & 8 - III- 1977, collectors M. C. and G. Kruseman. Zoölogisch Museum Amsterdam, Nederland.

*Diagnosis*. — Figs 1B-6B. Lateral margins of fastigium slightly incurved (dorsal view) in middle third; prozona of pronotum tumid in anterior view due to convex sides, dorsum of prozona 2.5 mm above vertex of head; metanotum and first two abdominal terga with tuberculate and strongly elevated median ridge in lateral view; broadly triangular median lobe of subgenital plate about 1.5X wider at base than long; dorsal ovipositor valves with deeply incurved proximal margin, paired inner lobes at proximal margin midpoint, lateral margins narrowly black and weakly lobed, apical notch between valves extends about 1/3 distance to midpoint of proximal margin.

*Description*. — **Female**: general morphology as in nominate species (Enderlein 1929, *cf*. Dirsh 1965 for illustration of entire female, Báez 1984). Comparison of head, thorax, abdomen, and ovipositor between female nominate species and subspecies shown in Figs 1-6. Body length (apex of fastigium to apex of ovipositor) 43 mm; antennae 10 segmented (apical 1-2 segments missing), segments 3, 4 and 5 are 3.8, 2.6 and 2.25 mm long respectively, size relationships of segments 3-5 similar to illustration by Dirsh (1965, Fig. 71) but not as illustrated by Báez (1984, Plate 1, Fig. 2)

**Table 1**. New species and distributions of Orthoptera (*sens. lat.*) of the Canary Islands. Asterisks indicate endemic species.

| | Islands | | | | |
|---|---|---|---|---|---|
| | F | L | C | T | P |
| Orthoptera | | | | | |
| Acrididae | | | | | |
| Eyprepocnemidinae | | | | | |
| *Heteracris littoralis* (Rambur) | P | | GR | | |
| Oedipodinae | | | | | |
| *Wernerella pachecoi* (Bolívar) | | | M | | |
| *Wernerella rugosa* Bland* | B | B | | | |
| Pamphagidae | | | | | |
| Pamphaginae | | | | | |
| *Purpuraria erna lanzarotensis* Bland | | K | | | |
| Gryllidae | | | | | |
| Mogoplistinae | | | | | |
| *Cycloptiloides canariensis* Bolívar* | | | D | | |
| Oecanthinae | | | | | |
| *Oecanthus dulcisonans* Gorochov | | | | GV | |
| Blattaria | | | | | |
| Blattellidae | | | | | |
| Pseudomopinae | | | | | |
| *Blattella germanica* (Linnaeus) | | | | | G |
| *Loboptera chioensis* Martín and Izquierdo* | | | | MIO | |
| *Loboptera lagunensis* Martín and Izquierdo* | | | | MIO | |
| *Loboptera penirobusta* Martín and Izquierdo* | | | | MIO | |
| *Loboptera teneguia* Izquierdo and Martín* | | | | | MIO |
| *Loboptera tenoensis* Izquierdo and Martín* | | | | MIO | |
| Euthyrrhaphidae | | | | | |
| Tiviinae | | | | | |
| *Zetha simonyi* (Krauss) | | | | | G |
| Mantodea | | | | | |
| Mantidae | | | | | |
| Amelinae | | | | | |
| *Ameles gracilis* (Brullé)* | | | | | GO |
| *Ameles limbata* (Brullé)* | | | | | GO |
| *Pseudoyersinia betancuriae* Wiemers* | W | | | | |

or by Enderlein (1930, Fig. 2) where segments 3 and 4 are equal in length and segment 5 is longest.

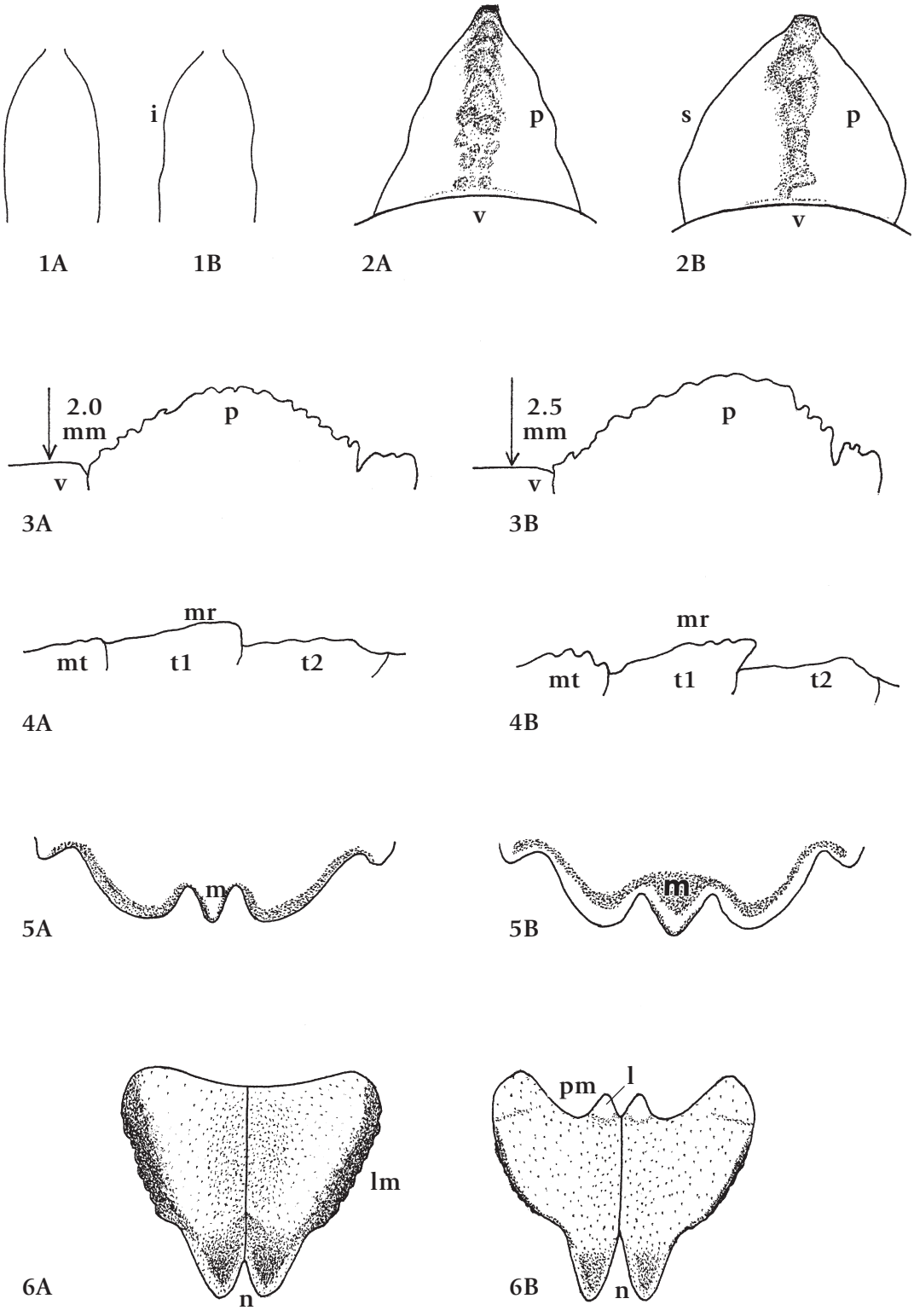
*Color*.— As in nominate species.

*Etymology*.— The subspecies name refers to Lanzarote, the island on which it was collected.

*Depository*.— Zoölogisch Museum Amsterdam, Netherlands.

***Heteracris littoralis*** (Rambur)
(Acrididae, Eyprepocnemidinae)

This species was overlooked by Bland *et al.* (1996). Grunshaw (1991) listed specimens collected at Maspalomas, Gran Canaria, by Guichard in 1966 and Kruseman in 1986. J. Paul (pers. comm.) also collected specimens at Caleta de Fuste on Fuerteventura in December, 1995. This species is apparently what Holzapfel (1970) erroneously referred to as *Eyprepocnemis cinerea* (Blanchard), although specimens under that name in the Natural History Museum (United Kingdom) could not be located and the species was listed as undocumented for the Canary Islands by Bland *et al.* (1996). The specimens of *H. littoralis* collected by Guichard in 1966




**Figs. 1-6.** External structures separating female *Purpuraria erna* (Figs 1A-6A) from female *P. erna lanzarotensis* (Figs 1B-6B). **1**. Dorsal view of fastigium; **2**. Anterior view of prozona of pronotum; **3**. Lateral view of pronotum; **4**. Lateral view of metanotum and abdominal tergites 1 and 2; **5**. Ventral view of subgenital plate; **6**. Dorsal view of dorsal valves of ovipositor. i, incurved margin; l, lobe; lm, lateral margin; m, medial lobe; mr, median ridge; mt, metanotum; n, notch; p, prozona;, pm, proximal margin; s, swollen side; t1, lst abdominal tergite; t2, 2nd abdominal tergite; v, vertex of head.

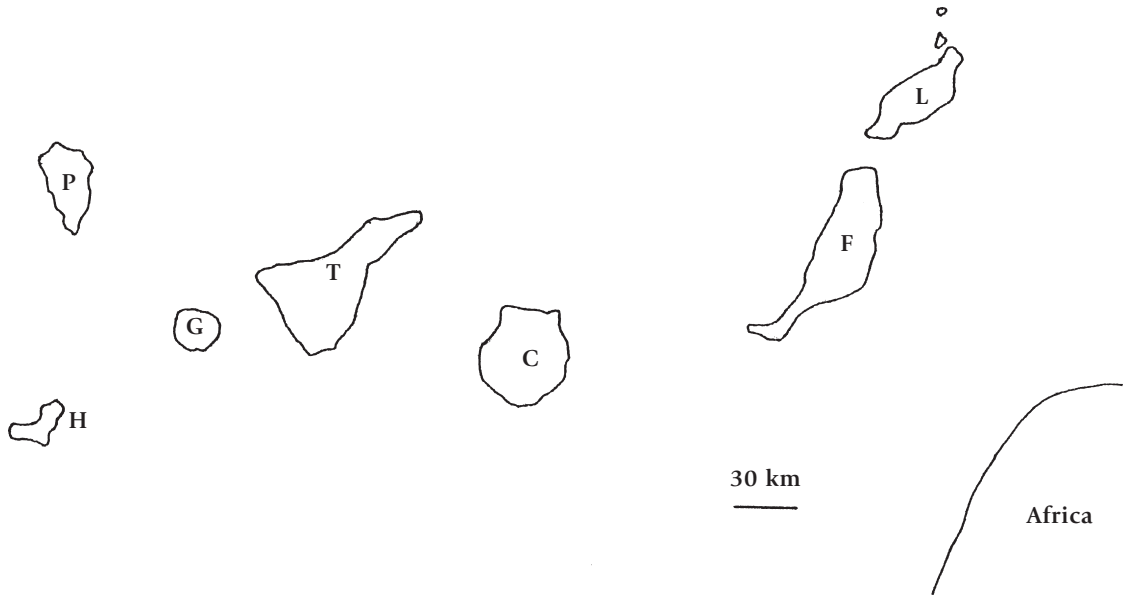



**Fig. 7.** Relative positions of the Canary Islands.

have the same locality, date of collection, and repository as "*E. cinerea*." *Heteracris littoralis* inhabits sparse vegetation on volcanic gravel behind beaches in the Canaries and ranges from the Cape Verde Islands through northern Africa, Mediterranean islands, and the Middle East to northern India.

***Cycloptiloides canariensis*** Bolívar
(Gryllidae, Mogoplistinae)

Previously known only from Tenerife, this was collected from Gran Canaria (no locality cited) and a culture maintained for use in behavioral studies (Dambach & Beck 1990). Paul (pers. comm.) collected a male *Pseudomogoplistes* sp. at Playa de Hermigua on Gomera that is unlike *P. squamiger* (Fischer) found on several other Canary islands. There is some evidence that the *P. squamiger* records for the Canary Islands may be erroneous based on the known distribution of this species.

***Oecanthus dulcisonans*** Gorochov
(Gryllidae, Oecanthinae)

This is a new cricket species described from museum specimens by Gorochov (1993). The holotype was collected on Tenerife (without date or locality) and the distribution of known specimens, disjunct so far, includes Saudi Arabia, Oman, Palestine, and Cyprus.

***Loboptera*** Brunner

Martín *et al.* (1999) have described five new Canarian species of hypogean *Loboptera* cockroaches along with a new diagnosis of the genus, a redescription of *L. fortunata* Krauss, and a revision and distribution of all of the Canarian *Loboptera* species. The new species and their distributions are listed in Table 1. Their local distribution ranges from only a single lava tube cave to multiple caves in a general region of an island. Of the 30 species of *Loboptera* now known from the greater Mediterranean region and the Canary Islands, 12 occur in the Canaries and all but one (*L. canariensis* Chopard) are endemic. Eight occur on Tenerife, two on La Palma, and one on El Hierro. The revised description of *L. fortunata* places the record of this species on Gran Canaria (Bland *et al.*1996) in question. Martín *et al.* (1999) provide references to studies that include *Loboptera* specimens collected on the Canary Islands by other investigators. Not included are data from a cave on Tenerife (Arechavaleta *et al.* 1999) and caves on La Palma (García 1997 in which the *Loboptera* sp. listed was identified subsequently as *L. teneguia* Izquierdo & Martín (García pers. comm., García & González 1997). Two cockroach species have been recorded as new to La Palma, *i.e.*, the cosmopolitan *Blattella germanica* (Linnaeus) and the small, 8 mm long, *Zetha symonyi* (Krauss) (García 1999).

***Pseudoyersinia*** Kirby

New data on the 5 Canarian mantid species in the genus *Pseudoyersinia* Kirby were provided by García & Oromí (1999). They included a key to the Canarian species, locality information, and a first description of the male of *P. canariensis* Chopard. The fifth species, which was not listed in Bland *et al.* (1996), is *P. betancuriae* Wiemers. It was first described by Wiemers (1993) and is endemic to Fuerteventura. In addition, the distribution of two mantid species, *Ameles limbata* (Brullé) and *A. gracilis* (Brullé), is extended to La Palma (García and Oromí 1999).

**Table 2.** Size variation of male and female *Calliptamus plebeius* on five Canary Islands. Body length is the distance from the frons to the apices of the folded tegmina following the method of Jago (1963) whose data, primarily from Gran Canaria, are also included below. Means followed by the same letter are not significantly different ($p<0.05$ level; ANOVA).

| | Body length (mm) | | | | | | | | Cercus length (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | | | Female | | | | Male | | |
| | Mean | N | Range | SD | Mean | N | Range | SD | Mean | Range | SD |
| Gran Canaria Jago | 22.6 | 8 | 17.8-24.1 | --- | 31.3 | 4 | 29.2-34.8 | --- | --- | --- | --- |
| Gran Canaria | 20.7 | 30 | 15.5-23.0 | 1.84 | 32.4 | 14 | 31.0-34.5 | 1.19 | 3.3 | 3.0-3.5 | 0.21 |
| La Gomera | 18.4a | 27 | 17.0-20.0 | 1.04 | 28.6a | 31 | 25.5-31.0 | 1.10 | 3.1a | 2.8-3.3 | 0.13 |
| Tenerife | 17.1bc | 24 | 12.5-20.0 | 1.78 | 27.5a | 20 | 20.0-32.0 | 2.61 | 3.1a | 2.7-3.3 | 0.15 |
| El Hierro | 17.5abc | 19 | 15.0-20.5 | 1.36 | 25.7b | 31 | 21.5-29.0 | 1.96 | 2.9a | 2.7-3.3 | 0.20 |
| La Palma | 16.4b | 23 | 15.0-17.5 | 0.73 | 25.0b | 42 | 23.0-30.0 | 2.01 | 3.1a | 2.9-3.7 | 0.23 |

### Miscellaneous references

Haes (1979) recorded a variety of orthopterans from Gran Canaria. Hochkirch (1997) described the habitats and local distribution of nine species of Orthoptera from valleys near the southern coast of La Gomera. The complete citation for the Phasmida record on Tenerife (Báez 1996) is now listed in the reference section.

### Nomenclature changes

Jago (1996a) indicated that the genus *Leva* (I. Bolívar) was incorrectly synonymized with *Stenohippus* (Uvarov) by Jago (1971). *Leva (Stenohippus) bonneti* (Bolívar), a species listed in Bland *et al.* (1996), was determined to be a synonym of *Stenohippus mundus* (Walker) (Jago 1996a).

The subfamily Truxalinae has been synonymized by Jago (1996b) under the subfamily Acridinae. With this change, *Truxalis nasuta* (Linnaeus), found on Gran Canaria and Tenerife, is transferred from Truxalinae to Acridinae.

The synonymy of *Gryllodes sigillatus* (Walker) under *G. supplicans* (Walker) was originally recognized by Kevan (1980) and not by Kevan & Hsiung (1992) as written in Bland *et al.* (1996). Vickery (pers. comm.) notes that his work (unpublished), with macropterous and brachypterous crickets from the same field population in Baja California, showed that the genitalia of individuals of both forms were identical. These results agree with those of Ghouri & McFarlane (1958) and Toms (1993) and support the assertion by Kevan & Kevan (1995) and Vickery (1996) that *G. sigillatus* is a junior synonym of *G. supplicans*.

### Morphological variation in *Calliptamus* Serville

While looking at a series of specimens of the endemic grasshopper *Calliptamus plebeius* (Walker), it was apparent that the length of the body of males and females and cerci of males varied by island. Jago (1963) revised the genus and included measurements of body length from Gran Canaria, El Hierro, and Tenerife. However, all but two of the 69 specimens were from Gran Canaria and, thus, he made no comment on the size of specimens from other islands.

Using ANOVA and Tukey's pairwise comparisons ($p<0.05$) of specimens from the five islands on which the species occurs, I determined that the body length of males and females from Gran Canaria was significantly longer than that from all other islands (Table 2). The next longest were males and females from La Gomera; males from here were significantly longer than males from Tenerife and La Palma and females significantly longer than those from El Hierro and La Palma. Grasshoppers from Tenerife and El Hierro were intermediate in size and females (but not males) from Tenerife were significantly longer than those from El Hierro. Males and females from La Palma had the shortest mean length, although they were not significantly shorter than those from El Hierro. The length of cerci of males from Gran Canaria was significantly longer than that of males from all other islands, but differences in mean cercal length among specimens from other islands were not significant.

Gran Canaria is *ca* 226 km west of the northwestern coast of Africa (Fig. 7) and closer than the other islands inhabited by *C. plebeius*, suggesting that if colonizing individuals arrived from this mainland, they may have survived first on Gran Canaria. The two more arid islands between Gran Canaria and the mainland, Lanzarote and Fuerteventura, do not support populations of the grasshopper. Canarian acridids also have Iberian-Mediterranean affinities. The relatively close Iberian Peninsula is particularly important because the Canarian current sweeps past the western coast

of the Peninsula (as well as the northwestern coast of Africa) before reaching the Canaries (Holzapfel 1970).

The large body size of males and females from Gran Canaria also may indicate that this is the oldest population. Smaller specimens are more likely to have been transported successfully by prevailing winds (from the northeast most of the year) and water currents moving past Gran Canaria to the more westerly, remote islands. La Gomera, with the second largest specimen size, is relatively close to Gran Canaria (*ca* 125 km W), as is Tenerife (*ca* 60 km NW) with its intermediate sizes. La Palma and El Hierro are the most distant (both *ca* 207 km NW and SW, respectively) and La Palma has the smallest specimens. The intermediate rather than small size of El Hierro individuals is unexplained in this scenario. However, El Hierro is directly in line with Gran Canaria whereas La Gomera and Tenerife are between Gran Canaria and La Palma (Fig. 7). The two islands may have had a blocking or filtering effect on the colonization of La Palma by wind and/or water that resulted in smaller individuals arriving at a later date.

Gran Canaria is the second largest island (1523 km$^2$) of the five on which *C. plebeius* occurs. Tenerife is the largest (2058 km$^2$); much smaller are La Palma (728 km$^2$), La Gomera (378 km$^2$) and El Hierro (277 km$^2$) (Oromí & Izquierdo 1994). The two largest islands may have provided a diversity of habitats for optimal colonization that helped maintain a relatively diverse gene pool characterized, in part, by the relatively large body size typical of the genus. The smaller islands do not have landscapes identical to the largest islands and it is unlikely that all of the islands have changed over time in the same manner. In effect, ecological similarity decreases with distance and small islands provide limited ecological opportunities that may eventually produce a shift in some gene frequencies (Grant 1998). Evidence of this in *C. plebeius* may be its smaller body size in the smaller, more remote, islands.

The western Canaries have not been joined together to the mainland (Carracedo 1979) and it is likely that any *C. plebeius* colonization sequence would have occurred in a westward direction from old to younger islands. Gran Canaria, Tenerife, and La Gomera are the oldest (16, 15 and 12 MA, respectively), and western La Palma and El Hierro are much younger (1.6 and 0.8 MA, respectively) (Oromí & Izquierdo 1994). For example, statistical analysis and molecular affinities of a Canarian lizard species with differences that included body dimensions among islands, showed that it arose on the oldest islands and colonized younger islands to the west (Thorpe & Malhotra 1998). *Drosophila* fruit fly colonization in the Hawaiian Islands occurred repeatedly from older to younger islands (Hollocher & references therein 1998). A founder event and selection for smaller size in *C. plebeius* may have evolved from a smaller-bodied single pair or single, fertilized female colonizer. The colonizing population has fewer genes than the entire mother population and this would lead to changed gene frequencies on the younger islands such as La Palma and El Hierro.

Larger populations of *C. plebeius* need to be studied to determine if one or more combinations of environmental conditions such as habitat, food shortage or sub-optimal food, and climate have caused the significant size differences on specific islands. Further character analysis is needed to substantiate subspecies status for one or more of the populations. DNA analysis and interbreeding studies would help determine if these differences are evidence of speciation in progress.

## Acknowledgments

I particularly thank John Paul for alerting me to new references, taxonomic changes, and for a list of his collecting records. Rafael García also provided useful references. Manuel Morales Martín brought the *Purpuraria* specimen to my attention and Willem Hogenes (Zoölogisch Museum Amsterdam, Netherlands) provided the specimen.

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