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Relative similarity between subspecies of the western Canary Island lizard, *Gallotia galloti*

by

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Introduction

Although two subspecies of *galloti* have recently been recognised, *eisentrauti* in northern Tenerife (Bischoff 1982) and *insulanagae* on the Rogue de Fuera de Anaga off the north western coast of Tenerife (Martín 1985), the divergence of the populations on the main islands has long been recognised in the nomenclature (Boettger & Müller 1914). The nominate form, *G. galloti galloti* is found in south and central Tenerife, *G. galloti palma* is found on La Palma, *G. galloti gomerae* is found on Gomera and *G. galloti caesaris* is found on Hierro.

Whilst the divergence between populations of *G. galloti* has long been recognised there has been no attempt to quantify their interrelationships.

Materials and Methods

Five samples were taken from single localities representing the islands and subspecies (Fig. 1), i.e. north east Tenerife, south Tenerife, Gomera, La Palma and Hierro. The popu-

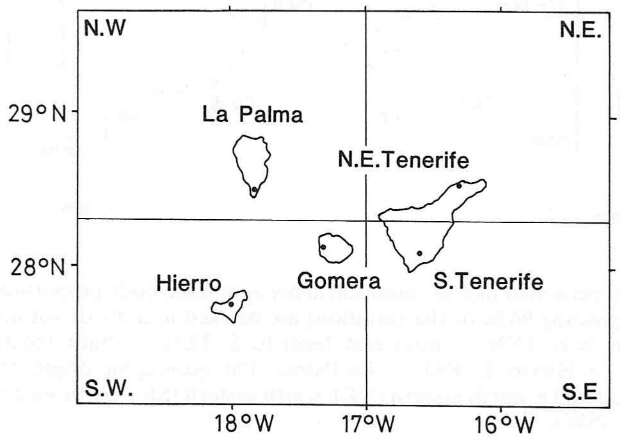

Fig. 1. Map of sample localities (solid circles) with north eastern (NE), south eastern (SE), north western (NW) and south western (SW) regions indicated.

lations from the various minor islets are not considered here. Separate canonical analyses were run on 28 quantitative scalation characters and 28 adjusted body proportions (Thorpe et al. 1985) using male samples whilst a principal coordinate analysis was run on the means of 11 colour pattern characters recorded from sexually active males as determined by testis size. The relative similarity of the populations as indicated by the ordination analyses are figured in three dimensional plots. In an attempt to help visualize the geographic relationships of the populations the ordination diagrams are divided into geographic sectors as in Fig. 1, i.e. north/south and east/west. The Tenerife populations are eastern whilst La Palma, Gomera and Hierro are western. La Palma and north Tenerife are northern whilst Gomera, Hierro and south Tenerife are southern.

Results and Conclusions

The canonical analyses of body proportions (Fig. 2) and scalation (Fig. 3) together with the principal coordinate analysis of colour patterns (Fig. 4) all have several features in common. Each population tends to be quite divergent from the others and with the exception of Gomera/Hierro body proportions all the D^2 values between populations are statistically significant. The five populations are not consistently split into tight clusters.

However there is a subtle relationship between geographic position and relative similarity of the populations. The phenetic differentiation is commensurate with the geographic position of the population insofar as each ordination diagram can be divided by latitude and longitude into the following regions: north western (La Palma), north eastern (north east Tenerife), south western (Hierro and Gomera) and south eastern (south Tenerife).

Fig.2

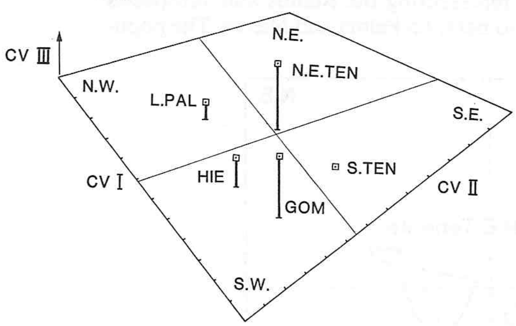

Fig.3

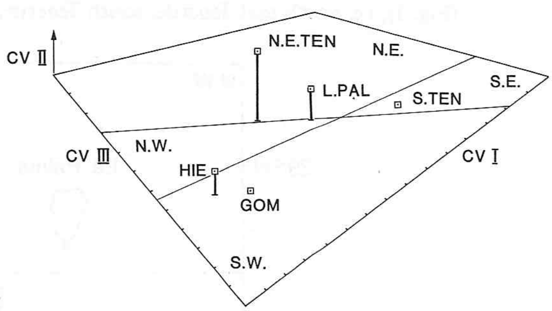

Fig. 2. Three dimensional plot of canonical analysis of male body proportions. The canonical axes (expressing 96 % of the variation) are marked in units of within-group standard deviation. N.E. TEN = north-east Tenerife, S. TEN = south Tenerife, GOM = Gomera, HIE = Hierro, L. PAL = La Palma. The geographic origin of the populations are indicated, i.e. north eastern (NE), south eastern (SE), north western (NW) and south western (SW).

Fig. 3. Three dimensional plot of canonical analysis of male scalation. The three canonical axes express 97 % of the variation. Symbols as for Fig. 2.

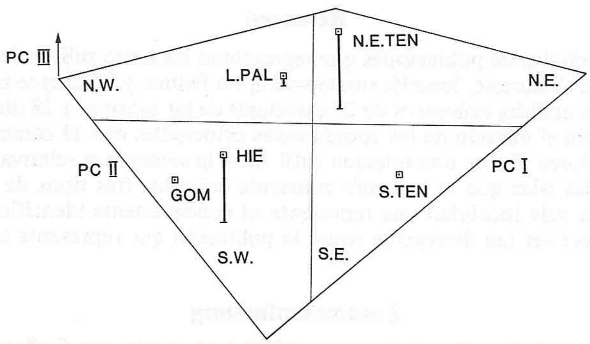

Fig. 4. Three dimensional plot of principal coordinate analysis of male colour pattern. The three principal coordinates express 94 % of the variation. Symbols as for Fig. 2.

Discussion

These phenetic analyses summarize the relative similarity between populations. The different character systems gives rather similar patterns and so the broad picture of relative similarity is presumably fairly reliable.

As a rule the results from thorough multivariate studies directly contradict the pattern of differentiation implied by conventional subspecies (Thorpe 1980, 1984b, c; Gardner 1984). Whilst these analyses can only be considered preliminary they do not obviously contradict the conventional nomenclature. In particular, the analyses consistently show that the differences between *galloti* (south Tenerife) and *eisentrauti* (north-east Tenerife) are often greater than the difference between the other subspecies. However, this paper does not address the problem of the nature of geographic variation within Tenerife which is critical to whether the subspecies should be used. If the geographic variation within Tenerife is a smooth cline there is little point in arbitrarily sectioning it into subspecies (Thorpe 1980, 1984b) but if there are distinct racial categories then the use of trinomials can possibly be justified. Preliminary studies (Baez & Thorpe 1985) suggest that, at least in scalation, the geographic variation within Tenerife is clinal rather than categorical.

Whilst the pattern of relative similarity can, in some circumstances, allow one to indirectly deduce the cause of the geographic variation (Thorpe 1979) in this case one needs to extend the analyses to include numerical phylogenetics (Thorpe 1984a).

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Resumen

La semejanza relativa de poblaciones que representan las cinco subspecies corrientes de *G. galloti* (Tenerife noreste, Tenerife sur, Gomera, La Palma, y Hierro) se investigan empleando distintos análisis cañonicos de 28 caracteres de las escamas y 28 dimensiones corpóreas y también el método de las coordenadas principales con 11 caracteres de configuración de colores. Existe una relación sutil entre la semejanza relativa y la situación geográfica de las islas que es bastante constante entre los tres tipos de caracteres. La muestra de una sola localidad que representa al recientemente identificado *G. galloti eisentrauti* parece ser tan divergente como la población que representa a muchas otras subespecies.

Zusammenfassung

Die Ähnlichkeit zwischen Populationen aus fünf Unterarten von *Gallotia galloti* (NO-Teneriffa, S-Teneriffa, Gomera, La Palma, Hierro) wurde mit multivariaten Methoden untersucht. 28 Merkmale der Beschuppung und 28 Körperproportionen wurden einer schrittweisen Kanonischen Analyse, 11 Färbungsmerkmale einer Hauptkomponentenanalyse unterzogen. Für alle drei Merkmalskomplexe zeigt sich eine subtile Beziehung zwischen relativer Ähnlichkeit und der geographischen Lage der Populationen. Eine untersuchte Stichprobe von *G. galloti eisentrauti* unterscheidet sich in ihren Merkmalen von *G. galloti galloti* ebenso stark wie von anderen Subspecies der Art.

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