

SPECIATION BY ISSIDAE (FULGOROIDEA) IN THE GALAPAGOS ISLANDS:
HOW MANY *PHILATIS* SPECIES ARE THERE?

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The Galápagos islands, situated 800km (600 miles) west of mainland Ecuador, consist of a total land area of 7,800 square kilometres (3,000 square miles) spread over 45,600 square kilometres (23,000 square miles) of the Pacific Ocean. They are volcanic in origin and only about 3 - 5 million years old. Since Charles Darwin visited the islands in 1835 this archipelago has been at the centre of much evolutionary interest because of its unique endemic fauna. We have initiated examination of the extent of radiation and endemism of the issid genus *Philatis* on the different islands of the archipelago. Prior to this study *Philatis* was known to comprise 18 endemic species (11 of which were described by Fennah 1967), known from 11 out of the 16 islands. Only one species (the type species *P. productus* Stal) is recorded from Panama and Peru as well as Galapagos but specimens from these other localities have not yet been examined. For this study over 600 specimens were available, collected by Prof. Stewart Peck (Carleton University, Canada) between 1987-1992, from 13 islands, including 5 islands from which *Philatis* had not previously been recorded. Only 70 specimens were examined by Fennah in 1967. The objectives were to determine biological diversity of *Philatis* species in samples from the Galapagos Archipelago and to determine relationships among species and test patterns of speciation.

Standard preparation techniques were used to obtain data from selected individuals, including genitalia and wing preparations. A series of quantitative characters were established from a diverse set of morphological features e.g. width of head, length of head + mesonotum, total length etc. using standard image analysis techniques (Sigma Scan3.1). Observations on whole insects, genitalia and wing preparations were made using a calibrated eyepiece and binocular microscope. A wide variety of characters was selected primarily to compare shapes, but also size and colour differences. Data analysis of distance and angle measurements was made using Principle Component Analysis (PCA) and Discriminant Function Analysis (DFA) (Claridge & Gilham, 1992) where sample numbers allowed. 6 distance measurements were made of the body, and 4 of the wing. 20 angle measurements of the head were made and 5 of the wing. In total 35 characters were used for PCA and DFA analyses. Males and females were entered separately into the analyses to avoid any separation due to sexual dimorphism. Angle measurements were particularly preferred since they were independent of body size. Preliminary analysis of characters in the male genitalia have also been made

Preliminary statistical analyses using angle and distance measurements were made using PCA and DFA. The use of PCA did not resolve the islands clearly. Discriminant Function analyses on mixtures of data sets and grouping of data by locality, vegetation zone, and altitude were more useful. The preliminary indications for both males and females are that they are different for each locality. This suggests that each island has at least one endemic morphological species. Further statistical analyses are required to confirm this. The male genitalia viewed laterally are mostly very similar and hard to distinguish but new characters in the aedeagus were found when viewed from the dorsal aspect. These characters will be further investigated. These new data suggest that there are at least 5 or at most 18 new species each confined to a separate island. The limited ecological data suggest that each is usually confined to separate vegetation and altitude zones. If this is confirmed by further work then *Philatis* may show the greatest diversity of endemic species of any of the known Galapagos biota. Further data from other character sets are badly needed for these insects. In particular DNA and other biochemical data would be helpful. Most important would be field data on ecology and reproductive isolation for the determination of more certain species boundaries.

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