B O C A G I A N A

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ON THE ORIGIN OF TWO FLATIDS (HOMOPTERA AUCHENORRHYNCHA) OF THE SALVAGE ISLANDS (1)

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With 6 figures

In the summer of 1971 (September 15 to 23), the author took part in the IXth Ornithological Expedition to the Salvages (see Santos Júnior, 1971) and did entomological field-work on two of these islands. The expedition was made possible largely due to the courtesy of the Portuguese National Navy by offering for the voyage the oceanographic ship «S. Jorge». The stay in Selvagem Grande (Great Salvage) lasted from September 16 to 22 with Mr. Zino's house as headquarters. A very short visit to Selvagem Pequena (Small Salvage; formerly called Pitão Grande — Grand Piton) proved to be only possible in the morning of September 17 and disembarking on Ilhéu de Fora (Outer Islet) was completely impossible on account of the very rough sea.

In spite of the shortness of the visit paid to Selvagem Pequena compared with that to Selvagem Grande, only in the former was the author able to take Hemiptera. Reasons for no Hemiptera having been collected at Selvagem Grande (with 52 more known species of Spermatophyta than in Selvagem Pequena — see Pickering & Hansen, 1969) may have been due to its already scorched vegetation and chiefly to

(1) Comprising in part a communication presented by the author to the Auchenorrhyncha Meeting, University College of Cardiff, U. K. (27th-29th September, 1973).

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the significantly disrupted state of its natural communities. The bare aspect of Selvagem Grande (Fig. 1) was mainly brought about by the introduction of goats and rabbits in the 15th century, the former being now extinct. In this island, only the following Spermatophyta were easily recognizable: *Nicotiana glauca* Grah. (Fig. 2), *Frankenia laevis* L. (in Fig. 3, with nest of Cory's shearwater — *Calonectris diomedea borealis* (Cory), *Mesembryanthemum nodiflorum* L. and *M. cristallinum* L.

As opposed to this, Selvagem Pequena provides evidence of the original spontaneous natural communities as it was not subjected to

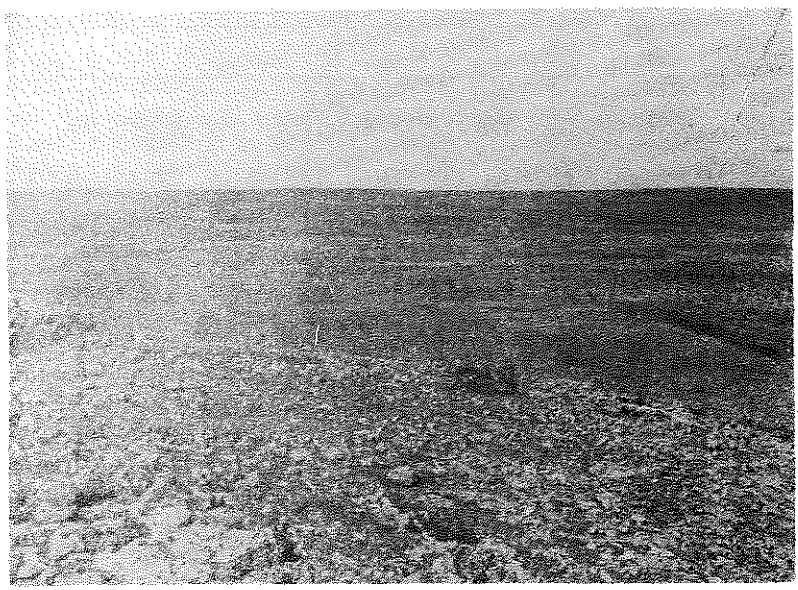

Fig. 1. — Selvagem Grande: View of the plateau (author's photograph)

artificial introduction of plants and animals. At this island, in the sandy shore area of halophytes surrounding Pico do Veado (Fig. 4), a rich insect fauna of the three following Hemiptera occurred in association with *Suaeda vera* J. F. Gmel. and *Agropyron junceiforme* (A. & D. Loeve) A. & D. Loeve: *Nysius cymoides* (Spinola, 1848), a lygaeid and two endemic flatids (Homoptera Auchenorrhyncha) — *Cyphopterum salvagensis* Lindberg, 1959 and *C. quartaui* Linnavuori, 1974 [3] (Figs. 5 and 6).

(3) Hemiptera identified and one described by Dr. Linnavuori (1974), to whom we thank for his cooperation and kindness .

The finding of two *Cyphopterum* species in this island is very interesting as it raises amazing zoogeographical problems. This genus includes about 35 species which are flightless and have rudimentary hind-wings, all with a very restricted distribution; about 29 of these are endemics to the Macaronesian islands and mostly limited to a single island; the remaining occur in the W. Mediterranean countries (Algeria, South of France and Morocco) and in the NW African region (Spanish Sahara). Distribution of this genus is thus very curious as

Fig. 2. — Selvagem Grande: *Nicotiana glauca,* an exogenous plant.

«possibility of active dispersal is slight, nor is the relatively plump body of the *Cyphopterum* species adapted for wind dispersal» (Lindberg, 1959).

As regards the two endemic flatids of Selvagem Pequena and on the basis of our present knowledge about the genus, the following question arises: are *C. salvagensis* and *C. quartaui* two continental species (remnants of a continuous pre-Macaronesian territory fauna) or do they belong to an oceanic fauna (arisen in oceanic isolation

through two distinct and successful immigrations arriving there by anemochorous dispersal from the Euro-African mainland) ?

In the continental hypothesis, *C. salvagensis* [4] as well as its closest relatives — a group of about 17 species inhabiting nowadays the Azores, Madeira, some of the Canaries, part of the W Mediterranean countries (South of France, Algeria and Morocco) and part of the NW African region (Spanish Sahara) (See Lindberg, 1962 and 1965;

Fig. 3. — Selvagem Grande: *Frankenia laevis* with nest of Cory's Shearwater (author's photograph).

Linnavuori, 1965) — would be actual representatives of a primitive stock of the pre-Macaronesian territory formerly connected with the Euro-African mainland and today disrupted. Also on this assumption, *C. quartaui,* a species with quite distinctive genitalia and of which «it is difficult to name its closest relative» [5] (Linnavuori, personal

(4) This species resembles most closely *C. maroccanum* Lindb. (Morocco), *C. aguaense* Lv. (Spanish Sahara) and *C. eremicum* (Fuerteventura, Lanzarote) which are part of a group of 18 related species.

(5) However, *C. quartaui* resembles *C. psammophilum* Ldb. (Fuerteventura, Morocco) in the shape of frons and to some extent also in the shape of the anal tube and the robust penis (Linnavuori, 1974 and personal communication). Considering this resemblance *C. quartaui* would be of a younger stock than *C. salvagensis,* as, according to Lindberg (1962), *C. psammophilum* belongs to a group of species of a more recent origin than the group to which *C. salvagensis* belongs.

communication), would be another survivor of the pre-Macaronesian land and probably of an older stock than *C. salvagensis*.

In the oceanic hypothesis, to the contrary, these flatids would be the result of two distinct invasions of long-winged ancestors from the adjacent mainland. The isolated Selvagem Pequena was first colonized by a single group of long-winged immigrants (or even by a single fertilized female) from a parental population on the W Euro-African mainland; this isolated population then diverged genetically and morphologically from the parental population to form *C. quartaui,* if definitely proved to be the older species. Only after the acquirement of sexual isolating mechanisms by these immigrants, a second set of colonists would have reached this island, apparently from Morocco or from the Spanish Sahara and also diverged from the parental population to form *C. salvagensis* — the probably younger species of the Small Sal-

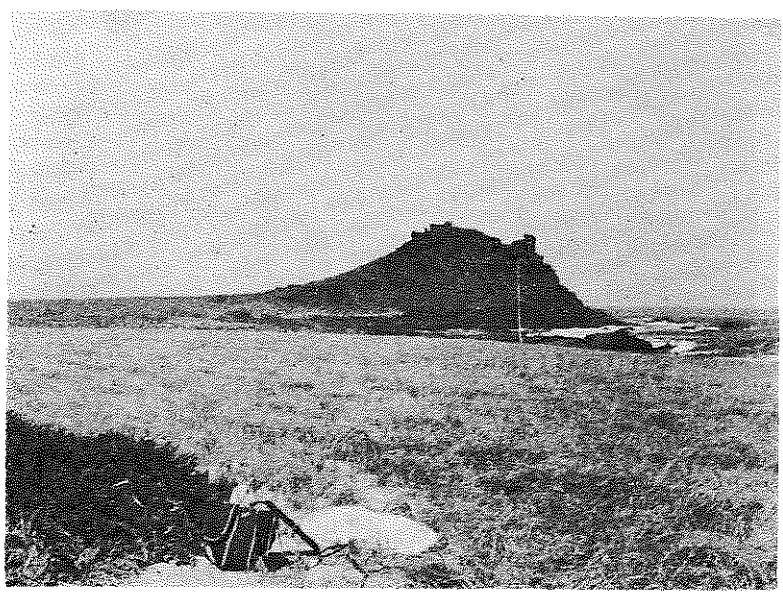

Fig. 4. — Selvagem Pequena: *Suaeda vera* (at left) and clumps of the grass *Agropyron junceiforme*. Note Pico do Veado in center background, the highest point (49 m.) of this island (author's photograph).

vage *Cyphopterum*. In this oceanic scheme it is necessary to admit the occurrence of an evolutionary adaptation in the successful immigrants as well as in their ancestors, i. e., the atrophy of hind-wings with the consequent loss of ability to fly and reduction of dispersability.

Lindberg (e. g., 1958 and 1962) explained the distribution of the majority of the *Cyphopterum* species by a continental hypothesis. On the other hand, Lindroth (1960) when treating a similar subject (distribution of the endemic ground-beetles or carabids of the Azores), followed an oceanic scheme. This author stresses that «absence of functioning wings is always something secondary in Carabid beetles, that is, they are all descendants of full-winged ancestors» and that «The Azoren fauna in itself, at least as far as Carabids are concerned,

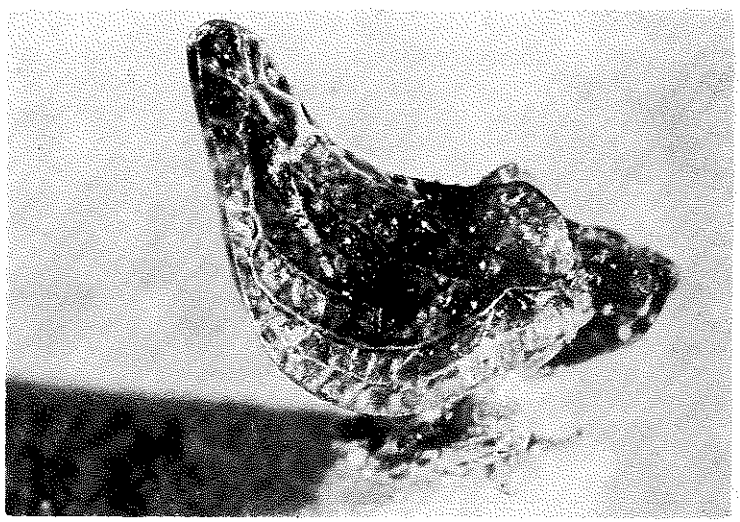

Fig. 5. — *Cyphopterum salvagensis* (male, length 2.90 mm.).

does not seem to make the hypothesis of a former land-connection with other Macaronesian islands or with the adjacent mainland necessary».

A third hypothesis concerning the Salvage flatids is also possible. *C. quartaui* or the species that definitely proves to be the older one, could be a survivor species from the pre-Macaronesian territory and *C. salvagensis* a younger element spread to Selvagem Pequena by long-winged ancestors from NW Africa and since the island was separated from the mainland.

In order to discover the scheme which fits best to reality an intensive ecological-taxonomical study and eventually a laboratorial genetic one are required. If such studies show that macropterous and brachypterous forms occur as polymorphism among the *Cyphopterum* species, good circumstancial evidence is then demonstrated for an oceanic hypothesis.

SUMMARY

During a recent scientific expedition to the Salvages, two islands were visited by the author. In the Selvagem Grande, an island with its natural communities in a somewhat disrupted state, very few Spermatophyta could be recognized and no Hemiptera at all were taken. In the Selvagem Pequena, on the other hand, rich populations of three Hemiptera proved to occur: *Nysius cymoides* (Spin.), a lygaeid, and

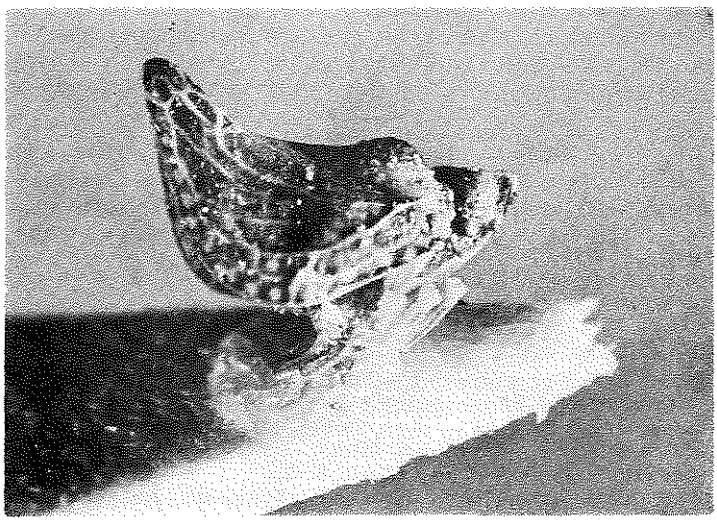

Fig. 6. — *Cyphopterum quartaui* (male, length 2.06 mm.) (photograph by Mr. Barradas).

two endemic flatids (Homoptera Auchenorrhyncha) — *Cyphopterum salvagensis* Lindb., 1959 and *C. quartaui* Linnavuori, 1974. Special importance is paid to the zoogeographical problem of the genus *Cyphopterum* A. & S. (with about 35 flightless species, all with a very restricted distribution in the Macaronesian, W. Mediterranean and NW African regions) with emphasis on the two Salvage endemics. Are *C. salvagensis* and *C. quartaui* two continental species — remnants of a continuous pre-Macaronesian territory fauna — or an oceanic fauna — originated by oceanic isolation by two distinct and successful immigrations arrived there by anemochore dispersal from the Euro-African mainland? Both possibilities are analized and, finally, a third hypothesis overlapping the two former is referred to.

RÉSUMÉ

Lors d'une récente expédition scientifique à l'Archipel des Salvages, l'auteur visita deux de ses îles. Les communautés naturelles de la Selva-

gem Grande étaient assez dégradées, l'auteur n'ayant pu parvenir à récolter aucun Hémiptère dans cette petite île. Contrairement à cela, dans la Selvagem Pequena, on a trouvé en abondance trois espèces d'Hémiptères: *Nysius cymoides* (Spin.), un Lygaeidé, et deux Flatidés endémiques — *Cyphopterum salvagensis* Lindb., 1959 et *C. quartaui* Linnavuori, 1974. On a donné une importance toute particulière au problème zoogeographique du genre *Cyphopterum* A. & S. (avec à peu près trente cinq espèces de vol limité, chacune avec une distribution assez réduite c'est à dire, en Macaronésie, en Méditerranée Occidentale et dans le Nord-Ouest Africain), en mettant l'accent sur les deux espèces endémiques des îles Salvages. Se sont *C. salvagensis* et *C. quartaui,* deux espèces continentales — espèces qui laissent apparaitre les vestiges d'une faune pré-Macaronésienne — ou une faune océanique — qui provient de l'isolement océanique à travers de deux immigrations couronnés de souccès à partir du continent Euro-Africain? Ces deux possibilités sont analysées et une troisième hypothèse d'entente est enfin présentée.

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