ACCOUNT OF TWO EXPEDITIONS TO SAO TOME AND PRINCIPE ISLANDS
JANUARY-MARCH 1989 & JULY-SEPTEMBER 1990
including a description of a new subspecies
of Acraea pharsalus Ward and Bematises alcinoe Felder

TOMASZ PYRKU

The present paper is the result of my two visits to Sao Tomé and Principe Islands. My main objective was the reduction of the first reasonably complete check-list of the Rhopalocera species (excluding Hesperidae) existing on the two islands. This task required intensive field work, followed by extensive bibliographical research and laboratory studies. The additional result of these studies was the description of two new endemic subspecies from the Principe Island belonging to the genera Acraea and Bematises. My field work included the realisation of a large photographic documentation of the butterflies and the insects. Most of the endemic species of butterflies from Sao Tomé and Principe were photographed for the first time in nature. I attempted to study some interesting aspects of the zoogeography of Sao Tomé and Principe Islands. A few ideas concerning the speciation and the migration process are given in this paper.

Acknowledgements

I’d like to thank Mr Janusz Wojcik, director of the Zoological Museum of the Jagiellonian University in Cracow for his invaluable help, for the laboratory facilities and his constant scientific assistance and supervision. Mr Jacques Pierru and Mr G. Bernard from the Museum National d’Histoire Naturelle in Paris for their precious advice and for their general interest in my studies. Mr Jean-Guy Canu for his absolutely unique informations concerning the Sao Tome and Principe fauna and Mr Hein Bornsma for helping me to publish the present article.

I’d like to thank the Sao Tomé and Prinçipe’s authorities, first of all the Ministry of Agriculture for providing special permits to carry out the field studies, the directions of the State Enterprises of Milagrosa and Porto Real for the accommodation facilities and the personnel of the Porto Station for the permission to consult their insect collection. I’d like to thank all my companions, the families Carneiro and Lislet, Mr Fernando from Angolares, the likable spanish doctors Gertrudis and Lourdes and all the others. Special thanks to my friend RATÔ. Finally I’d like to express my gratitude to Mr Juão RACAI without which my research on Sao Tome and Principe would end before it even started.

I will give only a very general outline of the physiography and the climate of the two islands needed to the correct understanding of the conditions affecting its butterfly fauna. Sao Tomé and Principe are situated about 200km from the african mainland, 150km one from the other, parallel to the continental coast. The surface of Sao Tomé (725 sqkm) is six times larger than that of Principe. The approximate length of Sao Tomé is 50km. Principe is three times smaller. There are high variations in the annual rainfall, especially on Sao Tomé, ranging from 5000mm in the south-west to 800mm in the north-east. The variations on Principe range from 4000mm and 1200mm respectively. The entire of Principe and nearly entire of Sao Tomé were originally covered with the tropical rain forest. The primary dry vegetation on Sao Tomé almost completely disappeared, excluding a tiny area in the north-western corner of the island. The primary humid zone vegetation persists in the southern and the south-central portion of both islands. The cultivated land and the rain forest overlap in a large transitional zone which was the principal area of my research.

My observation and collection sites were:

On Sao Tomé - 1. Agua Ize, on the eastern coast in the coco-palm and cocoa plantation area in a strongly deteriorated environment. It was my operational base. 2. Bomboim, in the north-centre of the island, in a valley surrounded by hills covered by secondary and primary vegetation. 3. Agua Jiaso, in the south-east, in the cocoa plantation area, on the foot of the Fico Maria Fernandez, a steep basaltic rock covered by secondary forest. 4. Lagoa Azul, in the north-west, in the dry forest and savana area. Fragmentary records have also been made in Lagoa Amelia, Trindade, Porto Alegre, Sao Miguel and Santo Antonio.

On Principe, my main research zone was the south-eastern portion of the island, between the localities of Terriero Velho, Bela Vista and Robeira Fria in the cocoa, coco-palm, abandoned coffee plantations, secondary and partly primary forest area. Fragmentary records have been made in Porto Real and Santo Antonio.

The inular fauna of the butterflies of Sao Tomé and Principe can be divided in two different ways: 1. species inhabiting the primary or the secondary vegetation area; 2. species inhabiting the humid or the dry zone (in the case of Sao Tomé only).

These divisions are of a typological character, because in most occasions we can only speak in terms of species more likely to be found in the dry or in the humid zone, in the primary or in the secondary vegetation area. For instance, we can say that Hypolimnas misippus and Acraea zetes annebora are representatives of the dry zone as they are far more abundant in the northern and in the eastern part of Sao Tomé. They are however occasionally seen in the humid south-west. Lepidoptera occurs only in the humid zone but equally in the primary and the secondary vegetation area. Some species will much more likely be seen in the vicinity of the primary humid vegetation: Papilio bromius furous, Saliya bolbodavis insularis or Charaxes odysseus.
The only species apparently restricted to the dry primary vegetation is Graphium leonioides sanctithomae; therefore it should be considered as the most endangered butterfly species on the São Tomé Island. Most of the endemic insular species are linked to the primary vegetation zones, while the "recently" immigrated species are observed mostly in the secondary vegetation zones or in the cultivated land. The 'new' species tend to dominate the insular fauna as they are often polyphagous and much more resistant to the devastating human activity. They compete with the indigenous species when they breed on the same food plant or when they live in the same ecological niche. This can be observed in the case of Papilio bromius furvus and Papilio demodocus. P. h. furvus which breeds originally on Rutaucueae or Citrus in the remote areas (such as Bom Bom) where P. demodocus is rare, but does not appear in the areas densely populated by P. demodocus.

São Tomé and Príncipe islands are of volcanic origin and have never been connected to the mainland. Thus, from the zoogeographical point of view they are tropical oceanic islands. Their entire flora and fauna are of insular origin. The process of colonization of those volcanic islands was probably similar as in the well-known example of the Krakatau island. Nevertheless, no further analogies can be drawn between Krakatau and São Tomé/Príncipe. As the intensity, the scale, the rate of the process and the success of migration depends on a number of factors different in each case from the continent, the size of the island, the wind, etc.

The distance from the mainland is always the first obvious factor limiting the influx of immigrants to São Tomé and Príncipe islands are situated at a considerable distance of 200 km off the continental coast. Although we may imagine pupae or larvae reaching an island by sea, substantially the main stream of colonisation proceeds by air. Relatively few butterflies are able to undertake such a long flight across the sea (in September 1990 I observed two specimens of Pierides: Mylothris sp., one about 3 km and the other about 20 km off the coast of Gabon. They were flying vigorously heaving, while the wind was blowing north) 1.

In spite that the area of Príncipe is six times smaller than that of São Tomé both islands are inhabited by approximately the same number of the butterfly species. We may assume then, that the "size factor" was altered by other factors. Strong winds blowing during the rainy season in the Gulf of Guinea, predominantly from the south-west i.e. from the open sea direction, do not favour strong influx of butterflies from the continent on São Tomé and Príncipe.

The factor influencing the diversity of the insular butterfly fauna is the faunistic potential of the nearly mainland area, in the case of São Tomé and Príncipe - the Gabon and Cameroonian forests. The number of species and the density of the populations increases the chances of migrants if we consider the fact that more than 1000 species of butterflies live in the continental forests in front of São Tomé and Príncipe; the about 50 species on each of the islands seem to be a rather low number.

This simple induction may not correspond to reality. A significant part of the 1000 continental species consist of weak flying butterflies confined to a very limited area as Lycaenidae belonging to the large genera Pteris, Telipina, Lepida, Euphyia, Isolabes, etc. and species inhabiting the forest understorey belonging to such genera as Euphaedra, Beura, or Euriphene (comprising about 350 species) which cannot be considered as potential migrants. In fact, none of the above-mentioned genera are known to exist on São Tomé or Príncipe. There are also species whose population density is very low and the probability of their successful migration is merely theoretic. Consequently, the conclusion is that the colonisation potential of the Central African forest is much lower than expected if only the number of the insular species is taken into account.

Most butterflies existing on the São Tomé and Príncipe islands belong to strong flying and widespread genera such as Acraea, Jumelia, Charaxes, Hypolimnas. They are however few butterflies, such as the fragile Lepisia nupia, whose presence on both islands could be explained easily only assuming an artificial introduction. The human factor in dispersion cannot be neglected. 90% of the butterfly species existing now on the Hawaiian islands were brought accidentally or deliberately by men. Unfortunately, in the case of São Tomé and Príncipe we do not have any data concerning the introduction of the butterfly species due to human activity. Human presence of these islands began 500 years ago, a period long enough to transcribe the fauna of such a tiny area. Portuguese brought themselves hundreds of vegetal species and many of them are known to be host plants of the butterflies living on São Tomé and Príncipe. Even though it is impossible to say how many butterfly species were accidentally introduced by man, I estimate their number might approach one third of the total number of species on São Tomé and Príncipe.

The endemism rate of the two islands varies whether we consider only the endemic species or the subspecies or all the specific local forms without an established status (see table 2) as well the butterfly fauna of São Tomé is older than the fauna of the neighbouring Príncipe as most of the São Tomé's endemics are well established species with distinct external characters. However, differences between them and the continental species are not so well pronounced on the genitalia level. For example, Acraea nubia and Acraea insulana are very distinct morphologically from any continental species but their genitalia reveal their close relations with the species of the Acraea eginae and Acraea pharsalis group. The relations between the endemics of Príncipe and the continental forms are not clear. J. PERRIER (1988) treats Acraea mediae as a "prospecies" to demonstrate its status in relation to Acraea eginae.

From zoogeographical point of view we are not allowed to treat "en bloc" the islands of the Gulf of Guinea - Fernando Pó, Príncipe, São Tomé and Annobon as it was done by certain authors (see check-list's comment, São Tomé). São Tomé and Príncipe islands are situated parallel to the continental coast and almost as far from each other as from the continent.
Such a geographic position means that the butterfly fauna must have evolved on the two islands independently. It is confirmed by the species analysis. From among 65 species registered on Sao Tomé and Principe only about 21 (31%) exist on both islands. Some of them have been probably brought by man: Papilio demodocus, Leptosia nupia, etc. The cosmopolitan species such as Hypolimnas misippus, Junonia oenone, Leptotes pirothous etc. could have reached very easily the two islands independently. Some species exist on both islands but at different subspecies: Charaxes canidiope thomasius - Charaxes canidiope canidiope, Graphium leonidas sanctithomae - Graphium leonidas sanctamariae, etc. Only a couple of species could be an evidence of an interchange between the two islands: Neptis eltinghami (2), Fernando Pó’s fauna is an offshoot of the neighbouring Cameroon forest and highlands fauna. Unless the presence of Bicyclus dorotheae concolor (described from Fernando Pó) on Sao Tomé is confirmed (which I doubt), there is no reason to link this island to Sao Tomé nor to Principe. Only the fauna of Annobón is composed of species immigrated mostly from another island of the Gulf of Guinea - Sao Tomé. It is proved by the existence of Acraea zetes annobona confined to Sao Tomé and Annobon. Sao Tomé and Principe are not a zoogeographical archipelago, contrary to the Comoros or the Mascarenes. They are in fact two distinct areas within the Afrotropical Region.

The islands of Sao Tomé and Principe offer a multitude of opportunities to make interesting ecological or behavioural observations. For example, I found it very surprising to see butterflies belonging to the genera Hypolimnas, Precis or even Acraea (on Principe) visiting rotten banana bait. On the continent, these butterflies are usually not attracted by fermenting fruits. The change of their behaviour might be explained by insufficiency of their original nutritional needs found in animal dung or flowering plants.

When on Principe, I’ve noticed that females of Cyrestis camillus were ovipositing on Trecula africana, Saligna amilla on Cola sp. and Vatairea bimacula on Coffea sp. Unfortunately my stay in each place on Sao Tomé and Principe was not long enough to make successful breeding experiments. Many specimens of Charaxes canidiope thomasius have been observed by Mr Rato CARINDA gathering for the night on Vernonia amygdalina, whose flowers, on the other hand, attract very well the endemic Acracea species from Sao Tomé: A. niobe, A.insulatrix and A. newtoni. V. amygdalina originates from southeast Asia.

Further studies are needed to develop a more complete picture of the biology of the butterflies of Sao Tomé and Principe and a special account has to be made to evaluate the impact of man on this fragile biotope. Adequate measures are to be taken to preserve Sao Tomé and Principe’s flora and fauna against irreversible environmental changes which are likely to occur as a result of extensive human activity. Let’s hope that the case of the environment disaster that took place on the island of Mauritius will not be repeated on Sao Tomé and Principe.

Table 1: Number of species recorded from Sao Tomé and Principe and percentage of the families as compared with the entire Afrotropical Region.

<table>
<thead>
<tr>
<th>Families</th>
<th>Sao Tomé</th>
<th>Principe</th>
<th>Afrotrop. Reg.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sps</td>
<td>%</td>
<td>sps</td>
</tr>
<tr>
<td>Papilionidae</td>
<td>3</td>
<td>6.37</td>
<td>2</td>
</tr>
<tr>
<td>Phriidae</td>
<td>5</td>
<td>10.63</td>
<td>5</td>
</tr>
<tr>
<td>Sathiyidae</td>
<td>1</td>
<td>2.12</td>
<td>2</td>
</tr>
<tr>
<td>Acraeidae</td>
<td>9</td>
<td>19.14</td>
<td>7</td>
</tr>
<tr>
<td>Damaidae</td>
<td>1</td>
<td>2.12</td>
<td>1</td>
</tr>
<tr>
<td>Libytheidae</td>
<td>1</td>
<td>2.12</td>
<td>0</td>
</tr>
<tr>
<td>Nymphalidae</td>
<td>14</td>
<td>29.76</td>
<td>16</td>
</tr>
<tr>
<td>Lycaenidae</td>
<td>13</td>
<td>27.65</td>
<td>9</td>
</tr>
<tr>
<td>Tot. n. of sps</td>
<td>47</td>
<td>100</td>
<td>42</td>
</tr>
</tbody>
</table>

* Source: D.E. Owen, Tropical Butterflies.

Table 2: Endemicy rate of Sao Tomé and Principe’s butterfly fauna.

<table>
<thead>
<tr>
<th>Status</th>
<th>Sao Tomé</th>
<th>Principe</th>
</tr>
</thead>
<tbody>
<tr>
<td>endemic species</td>
<td>11</td>
<td>23.40</td>
</tr>
<tr>
<td>endemic subspecies</td>
<td>7</td>
<td>4.89</td>
</tr>
<tr>
<td>undescribed forms</td>
<td>3</td>
<td>6.37</td>
</tr>
<tr>
<td>continental forms</td>
<td>26</td>
<td>55.30</td>
</tr>
<tr>
<td>Tot. n. of species</td>
<td>47</td>
<td>100</td>
</tr>
</tbody>
</table>

Remark: Only the species whose records from Sao Tomé and Principe are confirmed were included in tables 1 and 2.
DESCRIPTION OF A NEW SUBSPECIES
OF ACREA PHARSALUS WARD FROM PRINCIPE ISLAND

(Lepidoptera Acraciidae)

T. PYRZ.

Introduction

Acrea pharsalus is one of the 7 (to 9) species of Acraciidae existing on the island of Principe. It is, indeed, one of the most common representatives of this family, together with Acrea lycaea and Acrea jodutia. When in March 1989 A. pharsalus was in the peak of its abundance, A. lycaea was rarely observed. In August 1990 the situation was reversed. A. jodutia was equally common in March and in August.

Acrea pharsalus is a widespread species occurring from Mozambique and Kenya in the east to Sierra Leone in the west. Three subspecies have been described: A. pharsalus rodina Rothschild from the Ethiopian highlands, A. pharsalus pharsaloides Holland from eastern and south-central Africa and A. pharsalus pharsalus from the equatorial forests. I examined a large sample of specimens from Nigeria, Gabon, Cameroon, Tanzania and Principe.

A. pharsalus shows considerable individual variation. There are, however specific features in wing pattern and colour, particular to subspecific races or local forms. I've noticed, that specimens from Okomu (Nigeria, west of Niger bank) are slightly different than the specimens from Gabon and southern Cameroon, while the specimens from Obudu (southeastern Nigeria) are transitional between the two other populations. Specimens from Yankari (north-central Nigeria) are quite distinct and could represent a separate race, but the material I studied was not sufficient to be conclusive.

The size seems to be an important feature in the considerations on A. pharsalus. Tanzanian specimens are by far the largest, central African are smaller but larger than the Nigerian, while those from Principe are the smallest of all.

The description of the new subspecies from the island of Principe is based on the comparison of the external morphological characters of insular and continental-Central African specimens.

Male genitalia of specimens from Okomu and Yankari (Nigeria), Gabon, Tanzania and Principe have been compared. There was no features particular to any of the population found.

Acrea pharsalus carmen n.sp. (fig. 1)

Male: Forewing: average length 27-28 mm (in the type series there are smaller specimens, 25 mm), less elongated than the nominal. The size of A. pharsalus carmen never approaches that of the nominal sp.: 31-33 mm.

Upperside: Ground color reddish-rufous generally, always richer than in the nominal. Deep greyish suffusion in the basal and the postbasal area darker than in the nominal. Spots in the medial and the postmedial area darker. The distance between the discal cell spots shorter than the width of the spots. Second spot from the base rounded or square, not elongated as in the nominal. Spot between Cu1 and M3 always rounded. Subapical bar of the same color as the ground color, or only lighter, never white or nearly transparent as in the nominal, broader than in the nominal.

Underside: wing pattern similar to that of the upperside.

Hind wing. Upperside: Ground color same as on the forewing. Greyish suffusion of the basal area darker than the nominal, reaching the submedial area. Medial spots larger than in the nominal, almost touching each other. The distance between spots 20 and 19 same as between 19 and 18 (based on spot pattern of A. encedon and A. nutallia, from Owen, 1971). The anal 7 and 13 spots always fused.

Underside: wing pattern similar to that of the upperside.

Female: Forewing average length 25-29 mm shorter than in the nominal (32 mm) and not as elongated as in the nominal.

Upperside: Ground color rufous orange with a greyish suffusion. Wing pattern similar to that of the male. Subapical bar pinkish white, different from the ground color of the wing.

Underside: wing pattern similar to that of the upperside.

Hind wing. Upperside: ground color similar to the forewing. Spot pattern similar to that of the male.

Underside: wing pattern similar to that of the upperside.

Type material:


Distribution: Principe Island.
DESCRIPTION OF A NEW SUBSPECIES
OF BEMATISTES ALCINOE FELDER FROM PRINCIPE ISLAND
(Lepidoptera Acraeidae)
T. Pyrcz

Introduction

Bematises alcinoe is the only representative of this genus on the island of Principe. This species is rarely observed, usually flying high, at the edge of the rain forest. Males have been observed in August, females in March.

Three subspecies are described: B. alcinoe nado Ungemach from south-western Ethiopia, B. alcinoe camerunica Aurivillius, from Central Africa and B. alcinoe alcinoe Felder ranging from Guinea Bissau and possibly Senegal to Nigeria. Morphological characters of specimens from Thai (Ivory Coast), Nsukka (Nigeria), Emounou (Gabon) and Principe have been compared. Male genitalia of specimens from Nsukka (south-east Nigeria) transitional between the subspecies B. alcinoe alcinoe, occurring west of the Niger bank and B. alcinoe camerunica, from Central Africa have been compared with those of the specimens from Principe.

Bematises alcinoe racaji n.sp. (fig. 2)

Male. Fore wing: average length 36-37 mm (same as the nominal ssp.), but wings more elongated than in the continental subspecies alcinoe and camerunica.
Fig. 2. Male genitalia of *Bemisia* ascites *racca* c. spp. (prep. genit. No 1008). Principe Isl. Terreiro Velho 22 VIII 1990, leg. T. Peace. a. dorsal aspect; b.vedegus; c. valva.

Fig. 3. Male genitalia of *Bemisia* ascites (prep. genit. No 1009). Nigeria, Anamba state, Nsukka 5 IX 1982, leg. J. Wurtsman. a. dorsal aspect; b.vedegus; c. valva.

Première colonne, de haut en bas: *Acræa pharsalus carmen* Pyr. AT & HT; *A. cedrutis F. pyrus* (Terreiro Velho, Principe Isl.); *Bem. ascites racca* Pyr. HT & AT. Deuxième colonne, de haut en bas: *Acræa insularis* Sh. on *Vernonia amygdalina* flowers in Bombay (VII 1990); *Hypolimnas salmuca* Thomenii Aur. on the Cantagalus trail (Nan Tomb, VII 1990); *Acræa niobe* Sh. in Bombay (VII 1990). Photos T. Peace.
Références

2. CONDAMIN M., Monographie du genre Bicyclus (Lepidoptera Satyrinae). Mémoires IFAN (Djak) 88.