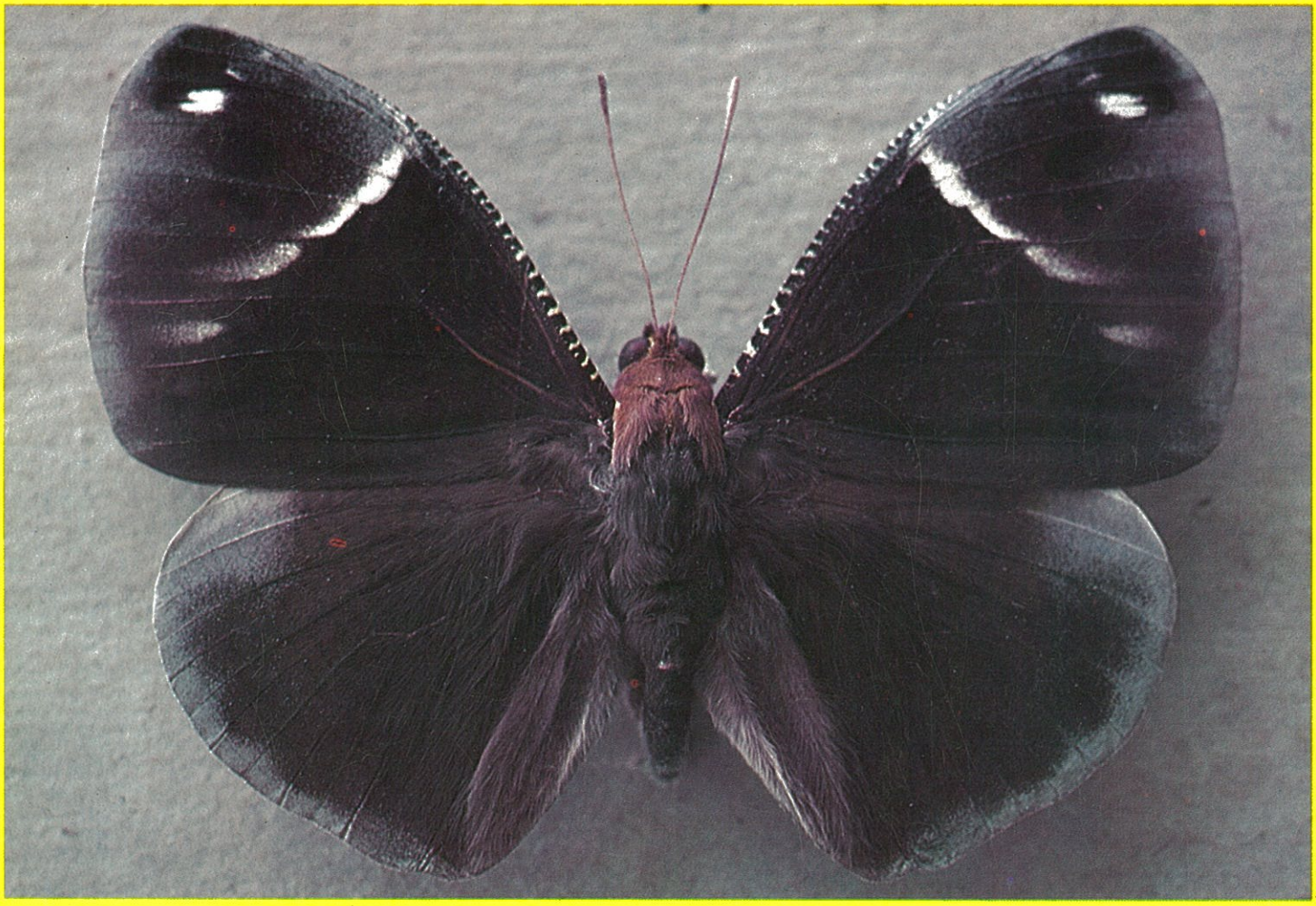
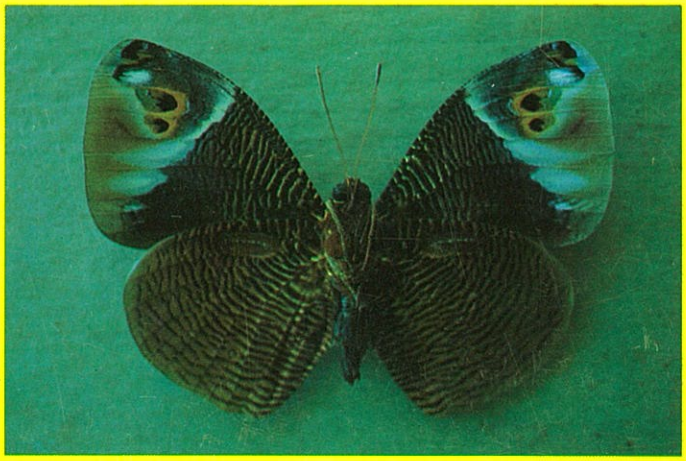
LIVING WORLD

Journal of the Trinidad and Tobago Field Naturalists' Club 1981 – 1982





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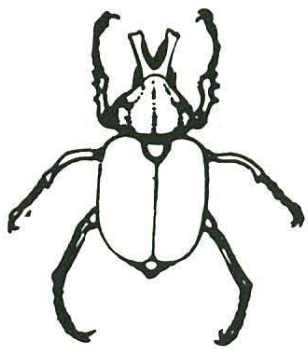


Natura Maxime Miranda in Minimis

LIVING WORLD is published biennially by the Trinidad and Tobago Field Naturalists' Club. This issue is dedicated to the president of the club, Mr. Ian Lambie. Type-setting, design and page mechanicals by Inprint Caribbean Ltd., 112 St. Vincent Street, Port of Spain, Trinidad.

Dedication

IAN LAMBIE joined the club as a young man shortly after it was revived in 1954. On the resignation of the secretary in 1960 he accepted the onerous duties of the post and faithfully discharged them for 20 years. On his resignation in 1980 he was elected President. During those 20 years the membership of the club trebled and the work with it. Much of the prestige and popularity of the club today can be attributed to his wise conduct of its affairs and though he obviously believes that the "soft answer turneth away wrath" this does not prevent him from fighting tenaciously for the things he believes to be right, e.g. the removal of the barge *Pelican* from the Caroni Swamp Nature Reserve.

In recognition of his tremendous contribution to the life of the club this issue of its journal is dedicated to him.

IAN LAMBIE President of the Club

CONTENTS

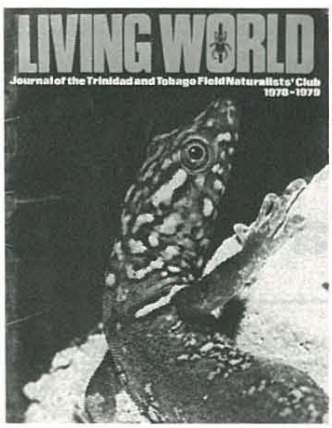
Editorial

WITH this issue we redeem two promises made in the previous issue. We publish an article on the guava especially for those biology students who study it as a part of their syllabus, and it will be followed by other articles similarly catering to the needs of biology teachers and students. We publish, too, an article *What is an endangered plant?* as a contribution to the conservation debate and a spur to action.

We are conscious of the need to publish material that will help local naturalists to identify the plants and animals of their native land and in this issue there are three such articles, one on chitons, and two on butterflies. The remaining articles cover a wide range of topics and there is surely something for everyone.

In the 1977 issue we published a photograph of Theodore Roosevelt and two companions in front of the Oropouche Cave in 1911 with a plea from Dr. Julian Kenny for information about the visit and the men. Subsequently, Dr. Peter Bacon was able to supply some details (published in the 1978-1979 issue) when he discovered an article by Roosevelt himself describing the trip and stating that his three companions were "F.W. Urich, the entomologist, G.B. Rorer, the mycologist, and the solicitor-general, Archer Warner". Roosevelt misspelt an unfamiliar name for the solicitor-general in question was Aucher Warner. We can now complete the story by stating that Urich took the photograph, Warner is the person standing to the right of Roosevelt and Rorer is the person kneeling on one knee in front of them.

Though we try to make each issue free from error, errors nevertheless occur and our preceding issue intended to span the years 1979-1980 masqueraded as 1978-1979. With this issue for the years 1981-1982 therefore we maintain our biennial publication schedule. However, articles from the preceding issue should be cited as from Living World 1978-1979.



Cover story

FRONT COVER: Three stages in the life history of the butterfly *Dynastor macrosiris*. Top: Adult. Bottom left: Fourth-instar larva. Bottom right: Pupa. See article by F.C. Urich and J.O. Boos, p. 34. (First published photographs of larva and pupa — Photos by Hans Boos.)

BACK COVER: *Heliconia hirsuta*, a common forest plant. See article on Flowering Behaviour of Trinidad plants by V.C. Quesnel, p. 48. (Photo by V.C. Quesnel.)

The Trinidad and Tobago Field Naturalists' Club

THE Trinidad Field Naturalists' Club was founded on the 10th July 1891. Its name was changed to the present one in 1974.

The objects of the club are to bring together persons interested in the study of natural history, the diffusion of the knowledge thereof and the conservation of nature.

At present the club has an enrolment of over four hundred members comprised of nature-lovers and professional and amateur naturalists.

Monthly lecture meetings are held at the St. Mary's College on the second Thursday of the month while field excursions are held on the last Sunday of each month, except December, when no official club activities are organized.

Membership is open to all residents of Trinidad and Tobago, of at least fifteen years of age, who subscribe to the objects of the club. The club also maintains an overseas mailing-list.

The club's management committee is: Ian Lambie, President; Frankie Farrell, Vice President; Victor Quesnel, Honorary Secretary; Mary Alkins, Honorary Assistant Secretary; John Hilton, Honorary Treasurer; David Rooks, John Seyjagat, Linda Ahwai. Its editorial committee is: Julian Duncan, Richard ffrench and Victor Quesnel.

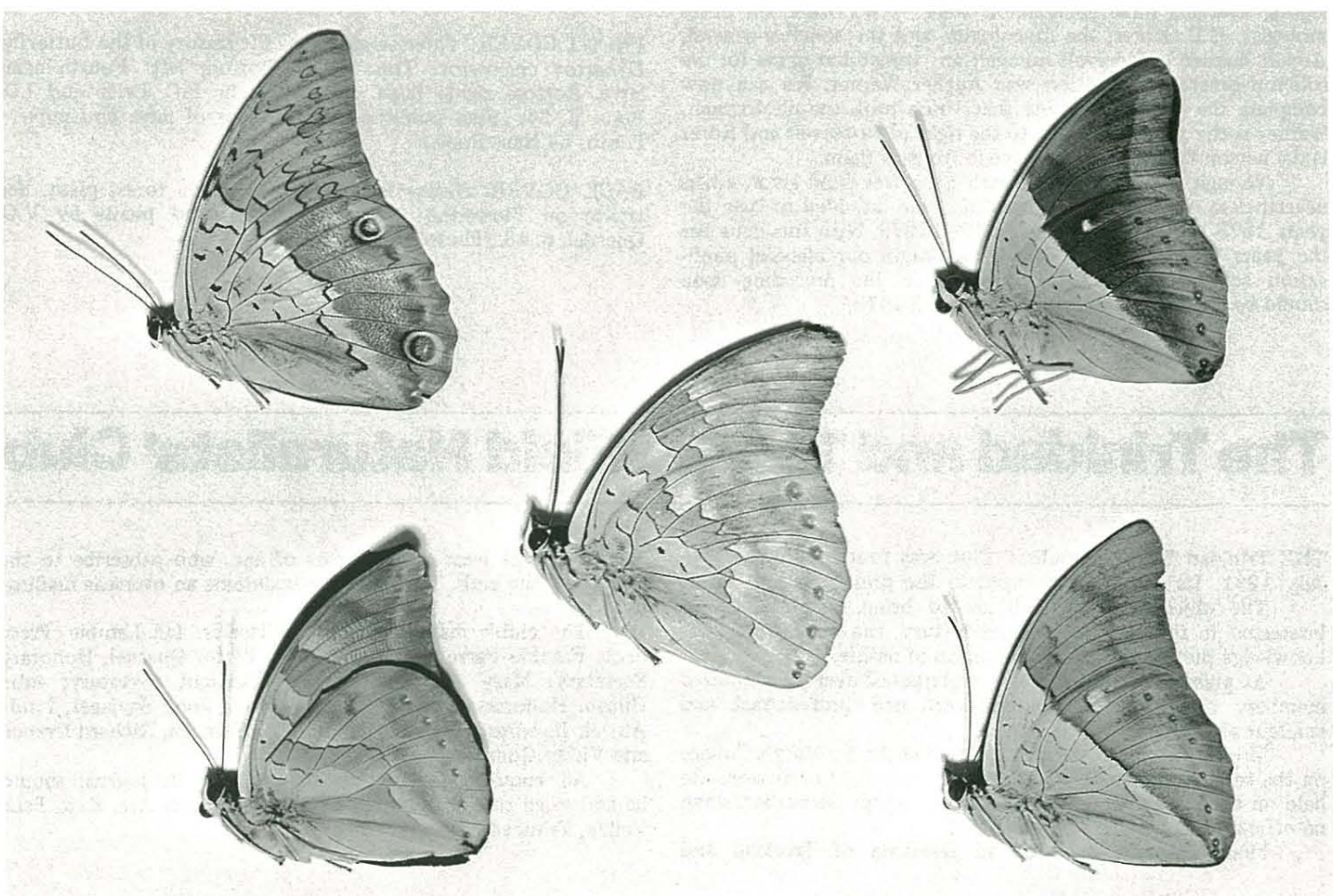
All enquiries concerning the club or its journal should be addressed to the Honorary Secretary, 1 Palm Ave. East, Petit Valley, Trinidad, W.I.

A review of the Trinidad butterflies hitherto placed in the genus *Prepona* (Lepidoptera : Nymphalidae)

By *Henry Papworth* Zoology Department, Science Laboratories, South Road,Durham, England

INTRODUCTION

Although the butterflies generally known as *Prepona* spp. are large and much collected, the relationships within the group and their nomenclature have been much confused (see e.g. Vane-Wright 1974). Five species are now known from Trinidad; four of these however, as shown below, must be transferred to the genus *Archaeoprepona.* Furthermore, of the four species listed by Kaye (1921) and Barcant (1970) only one specific name remains unchanged. It seems that the common names of these species are more stable than the scientific ones, and one aim of this paper is to provide a stable set of scientific names for future use.



TOP left: Prepona omphale Hbn. *ABOVE left: Archaeoprepona demophon* L. *CENTRE: Archaeoprepona demophoon* Hbn. ssp. *ilmatar. TOP right: Archaeoprepona meander* Cr. *ABOVE right: Archaeoprepona amphimachus* F.

The other aim is to draw attention to an additional Trinidad species recently captured: *Archaeoprepona meander* Cr. (not to be confused with the Banded King Shoemaker, *A. amphimachus* Fab. which until now was known as *P. meander).* Clive Urich has taken one specimen of this species, and there are two in the Angostura-Barcant collection. During the months of August and September 1980 Mr. D.I. Watkins and I took six examples of this species and saw several more.

The nomenclature used here is that suggested by Professor H. Descimon of Marseilles, France, the leading expert on this group who is preparing a revision of it.

METHODS

(a) Collection

Adult *Prepona* are among the most powerful flying butterflies. They are colloquially known in Trinidad as the 'King Shoemakers' and, together with the 'Blue Shoemakers' (*Anaea* sp.) and 'Grape Shoemaker' *(Historis odius orion* Fab.), are categorised by Barcant (1970) as 'Sap-suckers' because they are attracted to the exudates of wounded trees and fallen, rotting, fruit. Butterfly collectors utilise these habits to trap these otherwise elusive insects. About half of the specimens caught during the study period were obtained from fruit traps. These essentially consist of a cylindrical net suspended above a dish of rotting fruit such as mangoes or plantain. Sap-suckers, satyrids, brassolids and Morphos are attracted to the bait and, having fed, fly upwards into the net from which they seldom escape. The remaining specimens were netted in flight. On August 20, 1980 David Watkins and I chanced upon a fall of mangoes on Morne Catherine. At least fifteen *Prepona* butterflies of four species, including A. *meander* were feeding.

(b) Genitalia Preparations

Male genitalia are more diagnostic in structure, and easier to prepare, than those of females. The following procedure was used. For males the posterior third of the abdomen (three to four segments) was removed and transferred to 10% KOH 80° C for four hours. With fine forceps the hard chitinous genital armature was freed from the surrounding soft body tissue. Once cleared of surplus tissue the specimen was placed in weak acetic acid (2%) for five minutes. It was then washed in several changes of tap-water (slightly acidic). Gradual dehydration through a series of alcohols of increasing strength was followed by clearing in xylene. It was in this medium that the drawings were made. The specimens were finally stored in cedar-wood oil.

REVIEW OF TRINIDAD *PREPONA* AND *ARCHAEOPREPONA*

The old genus of *Prepona* is divided into two genera on the following characters:

Prepona

i. Male hindwing hair tufts light.
ii. Middle segment of labial palp four times length of basal segment.
iii. Antennae red at tip.
iv. Femur, tibia and tarsus of hindlegs about same length.
v. Mace-like sub-uncal projection of male genitalia.

Archaeoprepona

i. Male hindwing hair tufts black.
ii. Middle segment of labial palp three times length of basal segment.
iii. Antennae black at tip.
iv. Femur, tibia and tarsus of hindlegs unequal in length.
v. Lobed sub-uncal projection of male genitalia.

There is a variety of opinion as to what status to accord these two divisions. Rydon (1971) erected two new tribes the *Archaeopreponini* and the *Preponini* (the latter including the genus *Agrias).* On the other hand, recent synoptic works (e.g. Lewis 1974, Smart 1976) consider the differences subgeneric. Here, I follow Descimon and recognise the two genera, *Prepona* and *Archaeoprepona.*

Apart from the male of *P. omphale*, the uppersides of all species are very similar. The useful distinguishing characters are to be found on the underside (see plate).

1. *Prepona omphale* Hubner 'Purple King Shoemaker'

The name *omphale* is probably correct for this species. It is one of a group of five closely related species which Professor Descimon is revising, and specimens will be sent to him to confirm this identification. Kaye (1921) and Barcant (1970) list this species as *P. laertes demodice* Godt.

It is easily distinguished from the *Archaeoprepona* spp. by the eye-spots on the upper and undersides of the hindwing. These occur at the lower end of the wing towards the tornus, there being two on the underside and one on the upperside (see photograph). The male occurs in two colour morphs. In the more common morph there is an iridescent royal blue band running parallel to, but nearer the costa than, the usual turquoise band. The other male form is similar to the female and is a typical *Prepona.*

No males were caught and the genitalia are not figured. It is possible that the Trinidad specimens are a subspecies distinct from the mainland South American form. Le Moult (1932) described a subspecies *trinitensis* of *Prepona pseudojoyceyi* Le Moult from Trinidad. Since *pseudojoyceyi* is a synonym of *omphale*, the name *trinitensis* is available for a Trinidad subspecies of *omphale.* However, in view of the unconfirmed identity of *omphale* and the doubtful value of this (and many other of Le Moult's) subspecies, it would be best not to use this subspecific name at this time.

P. omphale has also been recorded from Tobago.

2. *Archaeoprepona demophon* Linnaeus 'King Shoemaker'

This is the same specific name as that used by Kaye and Barcant. The species is easily distinguished from similar Trinidadian species by the fairly uniform fawn-coloured underside, which in fresh specimens is marked with chestnut (see photograph). The male genitalia are quite different from closely allied species. The aedeagus is distinctive. Of the general armature the head of the uncus is dorsally covered with short spikes — see figures. There is no sub-species named from Trinidad.

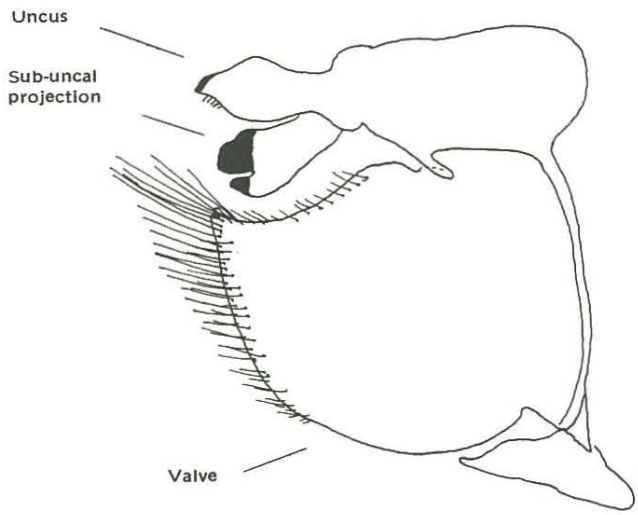
3. *Archaeoprepona demophoon* Hubner (ssp. *ilmatar* Fruhstorfer) 'Silver King Shoemaker'

Listed by Barcant as *Prepona antimache* Hbn. Certainly the most common species on the island during 1980, and the only one for which the subspecies has been definitely ascertained. It is, however, at best a weakly differentiated subspecies and probably best not used. The underside, which is similar to that of *Prepona omphale*, is silver-grey scalloped with narrow black markings, but lacks the eye-spots. In the male genitalia the sub-uncal projection is not bifid as it is in *A. meander;* the uncus itself has a small backwardly projecting hook and the aedeagus is distinctive. See Figs 1 — 2.

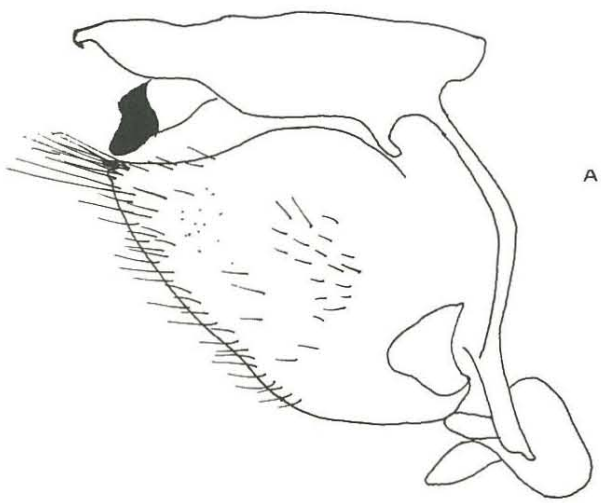
4. *Archaeoprepona amphimachus* Fabricius 'Banded King Shoemaker'

This is the correct name for the species previously known as *Prepona meander* Cr. (Kaye 1921) or *P. meander* Fruhst. (Barcant 1970). The underside is diagonally divided into a light brown and a dark brown area. The male genitalia of this and the following species are very similar. No differences could be found in the sub-uncal projections, valvular morphology or any of the general armature structure. However, on examination of the aedeagus

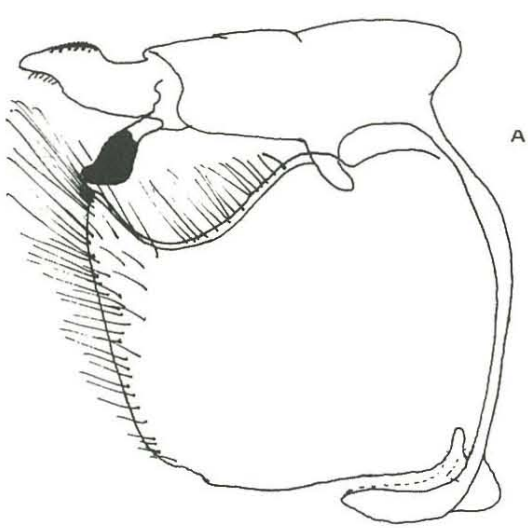
FIG. 1 MALE GENITALIA OF *Archaeoprepona* spp. in lateral view with right valve and aedeagus removed. (SCALE 1 cm = 0.5 mm)



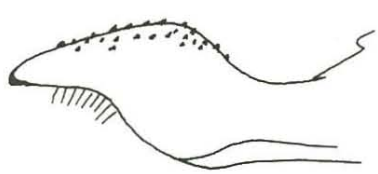
A. meander Cr. or
A. amphimachus F.
(there is no significant difference between these two species).



A *demophoon* Hbn.

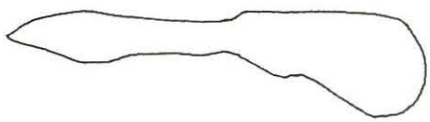


A *demophon* L.



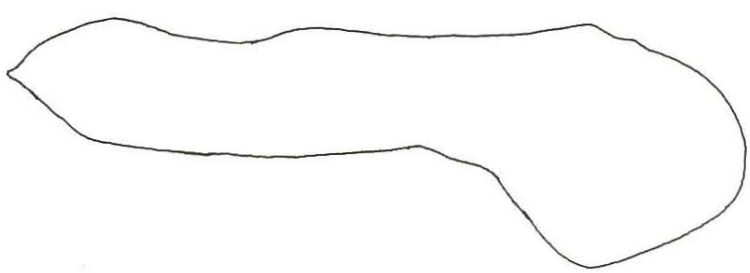
Head of uncus

FIG. 2. AEDEAGI of *Archaeoprepona* spp. in lateral view.

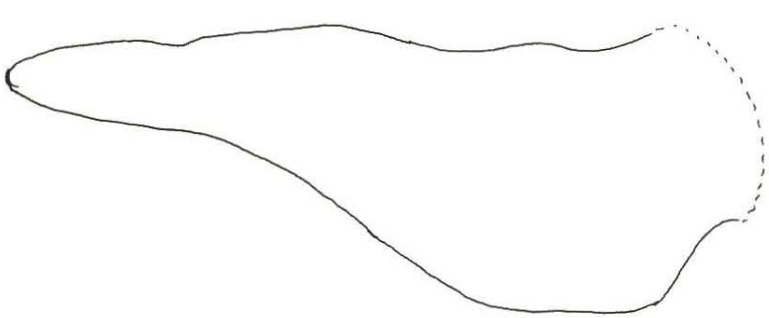


A. *amphimachus* Fab.
length 2.75 mm.
minimum width 0.25 mm.

A. *meander* Cram.
length 3.2 mm.
minimum width 0.35 mm.



A. *demophoon* Hbn.
length 5.0 mm.
minimum width 0.75 mm.



A. *demophon* L.
length 5.0 mm.
minimum width 0.5 mm

a distinct difference is apparent (see drawing). The minimum width in the pale form is smaller and the length shorter.

5. *Archaeoprepona meander* Cramer

This, it should be noted, is the name used in the past for the 'Banded King Shoemaker'. It is, however, a distinct species with more contrasting light and dark brown areas, the latter being a deep chocolate brown, with a smaller more distinct pale mark near the hindwing costa (see photograph). This recent find in Trinidad has, apart from one capture on the North Coast Road (see addendum), only been captured in the North-West Peninsula of Trinidad on Morne Catherine. It will be of interest to see if this species becomes more common or widespread in the future. This will give some indication as to whether it is a recent coloniser that is spreading, or a species confined to the North-West.

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ACKNOWLEDGMENTS

I would particularly like to thank Professor H. Descimon of the Faculté des Sciences, Zoologie Générale, Marseille, France, for elucidating the taxonomy of this group for me. I would also like to thank Dr. Paul Smart of the National Butterfly Museum, England and Dr. Matthew Cock of the Commonwealth Institute of Biological Control who gave taxonomic advice. Interest in this problem was first sparked off by discussions with Mr. Clive Urich of Sangre Grande and Matthew Cock. The laboratory work was carried out at the Zoology Department, Durham University, England.

ADDENDUM — List of *Prepona* and *Archaeoprepona* taken in August and September 1980 by D.I. Watkins and the author.

1. *Prepona omphale* Hbn.
   Morne Catherine, at mango, 20 August (1); Forest Reserve, 24 September (1)

2. *Archaeoprepona demophon* L.
   Grand Ravine (section of Morne L'Enfer Forest Reserve), fruit trap, 10 September (2); same locality, fruit trap; 23 September (1)

3. *A. demophoon* Hbn.
   Morne Catherine, at mango, 20 August (2); same locality, at mango, 24 August (1); same locality, fruit trap, 28 August (1); North Coast Road, milestone 3, flying; 13 September (1); Grande Ravine, flying, 13 September (1); Parrylands, fruit trap, 18 September (1); Forest Reserve, fruit trap, 18 September (1).

4. *A. amphimachus* F.
   Morne Catherine, feeding at mango, 20 August (1); Blanchisseuse, flying, 27 August (1).

5. *A. meander* Cr.
   Morne Catherine, feeding at mango, 20 August (3); same locality, fruit trap, 28 August (2); North Coast Road, milestone 3, flying, 13 September (1)

What is an endangered plant?

By *C. Dennis Adams* and *Yasmin S. Baksh* The National Herbarium, U.W.I., St. Augustine.

EXISTING KNOWLEDGE AND CURRENT AWARENESS

THE Threatened Plants Committee (TPC) of the International Union for Conservation of Nature and Natural Resources, is based at the Royal Botanic Gardens, Kew, England. In May and June 1979 the TPC Secretariat prepared and issued pro forma lists of Trinidad and Tobago flowering plants which should be considered for inclusion (or exclusion after study) in the Red Data Categories: extinct; endangered; vulnerable; rare; indeterminate; insufficiently known; see Appendix I. The source of the names of plants to be selected for the preliminary list was primarily the published parts of the definitive Flora of Trinidad and Tobago. The criteria were, other than that a species is endemic to one or both of our islands, that the flora indicated a limited distribution elsewhere or stated specifically or implied that the species is rare or uncommon in Trinidad and Tobago.

Unfortunately, the Flora is incomplete and also, through changes of style over the long period of its publication, inconsistent in the amount of detail included, especially on internal and external distributions. Over the many years since the first parts of the Flora were issued, several additions have been made and these are verified by specimens at St. Augustine and elsewhere of which the Kew Secretariat may not be aware.

In the TPC lists a number of species appear which were undoubtedly originally attributed to Trinidad in error. Some of Lockhart's 'unlocalised' plants came from Venezuela, and most of those included in the Flora based on Sieber numbers were collected in Martinique. In early parts of the Flora, many of these were given full entries; in later parts firmer judgments have been made with regard to their claim for inclusion and some have been relegated to footnotes or mentioned as 'doubtful records'. The true distribution status of some of these reported species may remain in doubt indefinitely and it is unrealistic to continue to regard them as belonging to the Flora, and wasteful of effort to consider them further in the conservation exercise. If they are rediscovered they can always be re-admitted and would then automatically have a high risk-rating. Plants included in a Flora which are known only in cultivation should also be omitted if the assessment is to deal primarily with the condition of native and naturalised species. Cultivated plants may warrant conservation in their own right as rare, useful or otherwise desirable introductions.

While the status of an endemic species is clearly that of a plant which by definition has a limited known distribution, it need not necessarily be rare or local within the circumscribed area. Study will show that some of the endemic species of Trinidad at least are common and not at risk; they must, however, all be included in preliminary lists for checking. *Ilex aripoensis* is an example of a common endemic species.

Whether accurate or not, the Kew lists are daunting. The numbers of flowering plants seeming to deserve some further consideration are 581 dicotyledons (158 being endemic) and 155 monocotyledons (29 being endemic), making a total of 736 out of an overall complement of 2281 species recently estimated for the two islands; see Appendix II. As we shall see, this proportion of 32.3 per cent is low, mainly because the Kew investigators did not have access to up-to-date statements about grasses, sedges and palms.

The TPC lists were sent to Trinidad for 'Red Data' categorisation. This means FIELD STUDY to determine the population statistics and, although that is a very big job indeed, it is an essential and ultimately unavoidable task to be undertaken. Existing procedures leading to categorisation decisions differ very widely in different countries. Perhaps this is only to be expected in view of the many circumstances that apply. Countries of different sizes, habitat variety, human population dispersal, with varied types and areas of agricultural and industrial activity, do not have the same bases for decisions, but all experience special difficulties in devising convincing comparative methods. Some features, such as the accessibility of sites and whether the plants are particularly attractive or desirable and encourage commercial collectors, are useful but none-the-less non-comparable as measures. Where there are old records and definite localities or rare or local plants are known, or where detailed mapping has been done, as in parts of Europe, a more objective methodology can be worked out; numbers of map squares in which a species no longer occurs can be used as a positive measure of threat.

NEW APPROACHES TO THREAT PREDICTION

In view of the discrepancies in the TPC lists, the demonstrated need for a plan leading to some positive investigative procedure, and the opportunity to work from a small but comprehensive herbarium comprising both classic and modern collections, the authors decided to use their local facilities to prepare an independent list. It was agreed that only factual information would be used in the first instance and any expression of opinion as to the presumed rarity of a plant would be ignored for the time being. Any arbitrary standards adopted would, as far as possible, be applied equally to all taxa.

Sources of Information

The selection of species meriting further study to establish their rare or threatened status was made by using the following sources: —

1. The collections in the National Herbarium of Trinidad and Tobago at St. Augustine; combined as appropriate with,
2. The collections cited in the published parts of the *Flora of Trinidad and Tobago;* combined as necessary with,
3. Collections mentioned in other available literature.

Criteria for Preliminary Selection

Species with three or fewer seen or recorded collections

were listed and any with four or more collections from three or fewer localities were also considered and listed if the locations were vague or general and in need of investigation. Species of non-endemic status but known only from the larger areas of more or less uniform distinct ecology, such as the Aripo Savanna, Chacachacare Island or the Nariva Swamp, were not listed if the number of collections indicated that the plants were, and still are, locally abundant in those places. Some very common species, poorly represented in the herbarium because collectors have stopped bringing them in, have been omitted. All endemic species have been included.

The results of this survey are as follows: — 524 dicotyledons (166 being endemic) and 339 monocotyledons (49 being endemic), making a total of 863 species, or 37.8 per cent of the flora. This total of possibly threatened species excludes specifically 86 'rare' species believed to have been reported erroneously, and all species known only in cultivation.

Criteria for Ranking the Selected Species

For each species listed, the localities where collections were made, the habitat characteristics of the sites, the dates of first and last collection and the regional distribution were noted as completely as possible. Species represented only by unlocalised undated specimens have almost all been excluded unless there is firm evidence to suggest that they should be included. These data were mustered because it was felt that they could be used to take a further step in the direction of determining the extent of the risk to the future existence of the species. To this end it is necessary to discuss the meaning and significance of each of these four elements before explaining a numerical method of representing them, leading to a relative assessment of Risk Index.

Local Distribution — Element 1

The proper representation of localities entails mapping. This must ultimately be done species by species. Areas delineated can be political (county, borough, parish, ward, etc.), physiographic (natural features, such as hills and valleys, or swamps, distinguished by contour lines) or by means of artificial grid. There will always be reinforcement between any kind of map position and ecological data so, for ease of handling and comparability, a regular grid system is probably preferable to any other. As physiography is often directly responsible for the basic characteristics of ecological habitats, the grid provides a more independent method of establishing locations. It remains to be seen what resources can be deployed to achieve the detailed mapping of the rare and threatened plants of Trinidad and Tobago.

Ecological Tolerance — Element 2

Enough is known about the general ecology of these islands for it to be feasible to make definite statements about species indicating their habitat preferences. Some species are so specialised that they can occupy only one main kind of biological niche; a clear example of this could be cited in the woody mangrove species, although *Rhizophora mangle* may grow naturally in freshwater swamps as well as in undiluted seawater. Most epiphytes grow on trees but some of them thrive equally on rocks. Comparison of the flora of the St. Joseph, Aripo and Piarco Savannas shows some quite remarkable differences and a high level of mutual exclusivity suggesting that the physical characteristics of these savannas are not the same. It is easy to appreciate in what ways the St. Joseph Savanna differs from the other two, but it is not so obvious how those two differ from one another. A species that can occupy all three savannas has a higher survival potential than a species limited, for whatever environmental reasons, to only one of them. The mountains of Trinidad are not high enough to provide totally exclusive habitats at highest and lowest elevations and many species can tolerate the whole range of temperature and humidity conditions pertaining. There are, however, some especially rare species which occupy only the highest and coolest places and seem not to be able to thrive in warmer ones. The point of ascertaining the ecological distribution and tolerance of a species is related to knowing the alternative niches it can occupy and hence to have another measure of its survival capability.

When were the Collections Made? — Element 3

Active and systematic collection of the native flora of Trinidad can be said to have begun with Herman Crueger in the early 1840s. With peaks of interest, displayed mainly by particularly dedicated individuals, from time to time, this collecting continues to the present. Some species collected by Crueger have not been seen since and these may be extinct; others found by him have been re-collected in natural areas for the second time quite recently; yet others have been brought in regularly over the intervening years. Allowing that accidents of chance and non-related events may influence collecting opportunity, dates of collection are taken to reflect the presence and availability of native plants — whether they were present and available or not at other times. With this information to indicate the commonness or rarity of a species, an early date of first collection and a late date of last collection suggest commonness; a late date of first collection and an early date of last collection indicate rarity; a narrow span of years between first and last collections points to a species possibly more rare than one collected over a wide span of years.

External Distribution — Element 4

Every non-endemic species has by definition a distribution outside the two islands to at least one other place. The further extension of range may be to any other place or places where suitable conditions for the growth of that species may exist. Given natural settings and influences, the present known range and distribution of a species is a measure of its ecological tolerance and its dispersal history. A species with a wider range can be assumed to possess attributes enhancing its survival potential more positively than those of a species with a narrow or limited range, accepting also that suitable habitats may vary greatly in number, size and distance from one another. It is safe to assume that no two species have exactly the same range and so a simplification is called for. As a working start, the geographical position of Trinidad and Tobago offers the use of the cardinal points singly or in combination to express distributions as follows: — North = Distribution includes the West Indian Islands (Antilles); South = Distribution includes South America; East = Distribution reaches any trans-Atlantic (Old World) country; West = Distribution extends to Central America (Panama to Mexico).

The distribution characteristics of 648 non-endemic species that are deemed to require further investigation are set out in Table I. The groups of species treated in Vols. I, II and III of the definitive Flora have been presented separately. Each group, which can be regarded as a random independent sample, shows a remarkably similar expression of the fifteen possible distribution patterns to each of the other two groups. It is not necessary to discuss these close approximations in detail at this time but some of the reasons for them are obviously geographical. The table can be condensed as total numbers of species, irrespective of their other associations, having distributional affinity with South America (512), West Indies (351), Central America (256) and the Old World (74). These sorts of proportions are, in terms of dispersal opportunity and distance, no more nor less than what one would expect.

All endemic species have been listed in the preliminary survey and this information is summarised in Table II. Following from the observation that some endemic species are common in Trinidad, it may be supposed that further exploration elsewhere, particularly in the north-eastern mainland areas of South America, will reveal the occurrence of some of these species there, in which case they automatically will cease to be endemic.

TABLE I

Distribution Patterns of 648 Non-endemic Species of Trinidad and Tobago possibly meriting threatened status.

Cardinal Directions of other distribution	Volume of Flora in which species is catalogued			Total	Per cent
	I	II	III		
ONE direction	(665)	(737)	(664)	(2066)	
South America only	51	56	78	185	28.5
Central America only	1	—	5	6	0.9
Antilles only	17	26	14	57	8.8
Old World only	3	3	1	7	1.1
TWO directions					
C.A. & S.A.	19	17	26	62	9.6
A & S.A.	25	24	40	89	13.7
S.A. & O.W.	—	—	—	—	—
C.A. & A.	2	5	8	15	2.3
C.A. & O.W.	—	—	—	—	—
A. & O.W.	6	1	8	15	2.3
THREE directions					
A., C.A. & S.A.	26	35	64	125	19.3
C.A., A. & O.W.	—	—	1	1	0.2
A., O.W. & S.A.	1	2	1	4	0.6
C.A., S.A. & O.W.	—	—	1	1	0.2
FOUR directions					
A., C.A., S.A. & O.W.	16	10	20	46	7.1
UNKNOWN	4	8	23	35	5.4
TOTAL in each Volume	171	187	290	648	
Per cent in each Volume	25.7	25.3	43.7	31.4	

TABLE II

Distribution Patterns of 215 Endemic Species of Trinidad and Tobago

Endemism Status	Volume of Flora in which species is catalogued			Total	Per cent
	I	II	III		
TRINIDAD only	57	53	36	146	67.9
TOBAGO only	8	19	5	32	14.9
TRINIDAD & TOBAGO	16	13	8	37	17.2
TOTAL endemics in Volume	81	85	49	215	

Future taxonomic revisions may also have the same effect of increasing the known area of distribution and thus, notionally through the amalgamation of taxa hitherto believed to be distinct, the survival potential. A species endemic to Tobago may be more at risk than a species confined to Trinidad because of the differences in size and ecological opportunities of the islands.

Assessment of Risk Index

By applying numerals to the various states and conditions of the foregoing data it is possible to formulate a Risk Index for each threatened species. This, if applied consistently, should be at least a relative measure if not an absolute one. By reason of the fact that the method entails entering numerals for diffferent types of data into the same total, and that the actuarial assessment depends on attributing negatives for states which diminish the risk and positives for states which increase the risk, different species may have the same numerical risk-rating for different reasons. Because of this, it is desirable to back up the total assessment with details of the individual scores.

Such a system, of which there could be many because the actual numerical values assigned are arbitrary, is offered here.

Because the number of collections was used in making the selection for the survey, this information is not used again.

Element I

Number of Distinct Localties (discussed on p. 10). (This could, when known, be a number of grid-squares or some other bounded area which separates one area of collection from another; obviously the comparative densities of locations as against squares or areas, must be taken into account). Because every species must have ONE locality, the total of localities minus ONE is entered negatively. If the species is in both Trinidad and Tobago deduct TWO from the total of localities.

Element II

Number of Ecological Niches (discussed on p. 10). Because every species must occupy ONE ecological niche, the total of niches minus ONE is entered negatively.

Element III

Dates of First and Last Collection and Span of these Dates (explained on p. 10). The numerals to be awarded in consideration of the earliest and latest known dates of collection in Trinidad and Tobago are set out in Table III.

TABLE III

DATES OF COLLECTION

First (A)		Last (B)	Span (B − A)	
+0	< 1880	+5	< 10	+4
+1	1880 − 1910	+3	11 − 20	+3
+2	1911 − 1940	+1	21 − 40	+2
+3	1941 − 1970	+0	41 − 80	+1
+4	> 1970	+0	> 80	+0

Element IV

External distribution is scored as follows: −

The species is ENDEMIC to TOBAGO	+7
The species is ENDEMIC to TRINIDAD	+5
The species is ENDEMIC to BOTH ISLANDS	+3
The species is distributed in: −	
ONE Cardinal direction	− 0
TWO Cardinal directions	− 2
THREE Cardinal directions	− 4
FOUR Cardinal directions	− 6

Application of this scheme to particular species will enable one to be distinguished from another on a relative basis and be a guide to future action. If one starts with a score of ten (10) and adds or subtracts the numerals indicated by each of the Elements above (there are THREE components to Element III), a score of ten (10) or more should suggest that the species is at some risk. The highest possible score is for an endemic to Tobago known from only one collection before 1910 (there were no collections from Tobago before 1880) − an accumulation of twenty-five points ɔ − 0 − 0 + (1 + 3 + 4) + 7). A recently collected non-endemic (collected say from two localities, in one kind of niche, in 1957 and 1969, and also known from Venezuela) would score 10 − 1 − 0 + (3 + 0 + 3) − 0 = 15. A commoner better-known non-endemic (collected from six localities, in two niches, first in 1875 and last in 1970, and also known from South and Central America and Cuba) scores 10 − 5 − 1 + (0 + 0 + 0) − 4 = 0. An even commoner species would have a negative total score and would be that much less at risk. A species endemic to both Trinidad and Tobago must have at least two localities, one in each island, and so an example (with two known localities in Trinidad and one in Tobago, one niche, the first collection in 1912 and a last in 1935) would accrue a total of 17, i.e. 10 − 1 − 0 + (2 + 1 + 2) + 3.

WHAT CAN BE DONE NOW?

As well as supporting any action serving to prevent or diminish the wanton or avoidable destruction of natural vegetation anywhere in these islands, the concerned member of the public can improve his awareness of the task involved in conserving the flora and fauna.

Plant collecting that has resulted in the recording of presence and distribution of native species has been haphazard and sporadic and, although many years have passed since the early collectors were active, some places have never been visited at all with a view to systematic appraisal. In fact, hardly a single area has been exhaustively combed and even the much explored Aripo Savannas may yet yield additional rare species. Information about

insufficiently worked areas and inadequately known species can be obtained from the National Herbarium in renewed steps towards completing a survey of the existing flora as a first priority. Two obvious localities are the Trinity Hills and the south-eastern concession lands, and the easternmost parts of the Northern Range above about 300 m of altitude. The remaining forested parts of the south-west peninsula and the Erin Savanna area also require more study. Chacachacare Island is relatively well known but the other Bocas islands, Monos and Huevos, have hardly been collected on at any time. Tobago is in need of systematic collecting especially along the Main Ridge.

The second priority is to review the state of the flora in areas of particularly localised ecological character. Some of these, such as the Heights of Aripo on the limestone geology have been searched in the past, but not at all times of the year. El Tucuche is rather better known but there are many rare species to become better acquainted with there. In recent years, more intensive activity in the Nariva Swamp area has lengthened the list of freshwater swamp species, or extended their known ranges, in Trinidad considerably. These places harbour species which, because of altitude (lower temperature/higher humidity) or swampiness respectively, are unlikely to occur elsewhere.

Conservation tasks present themselves as more knowledge is gained. As a species is mapped, expeditions can go to likely places whence it has not so far been reported. The known range may then indicate an area of special floristic or ecological interest where other species of limited habitat preference occur — it is always easier to formulate a case to preserve an area of vegetation of multifarious attributes rather than a single species.

A third need is to keep existing information in constant review and to incorporate new information so as to either bring the Risk Indexes up to date or to revise the methods of computing them. When a method has been tested, and shown to be realistic, then the promotion of conservation awareness, and possibly even positive action, will be that much easier to achieve.

Detailed information about some examples of native species, selected for their moderately or very high Risk Indexes, is set out in Appendix III. These summaries are based on existing facts and may imply the level of threat and possibly a clue as to how that might be averted or clarified.

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APPENDIX I. The Red Data Book Categories (Designated by the Survival Service Commission of IUCN — with some slightly modified wording).

Extinct: Requires no explanation.

Endangered: Survival is unlikely if the factors causing reduction of numbers continue to operate. Numbers have been reduced to a critical level or habitats have been so drastically reduced that the species (taxa) restricted to them are deemed to be in immediate danger of extinction.

Vulnerable: Taxa believed likely to move into the endangered category in the near future if the causal factors continue operating. Adverse factors have been or can be identified and continue to threaten populations.

Rare: Taxa with small world populations that are not at present endangered or vulnerable, but are at risk. These taxa are usually localised within restricted geographical areas or habitats.

Indeterminate: Taxa known to be endangered, vulnerable or rare but where there is not enough information to say which of the three categories is most appropriate.

Out of danger: Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken or the previous threat to their survival has been removed.

Insufficiently known: Taxa that are suspected but not definitely known to belong to any of the above categories because of lack of information.

APPENDIX II. Estimates of the number of species of flowering plants recorded for Trinidad and Tobago can be made from existing literature. At various times in the past the counts were: —

Author	Families	Genera	Species
Grisebach (1864)	—	—	1187
Hart (1908)	126	805	1866
Britton (1921)	162*	998*	2197*
Adams & Baksh (1980 unpub.)	158	959	2281

** Britton's list includes about 60 species attributed to Trinidad through probably erroneously localised Sieber collections.*

APPENDIX III. A Selection of Native Flowering Plants of Trinidad and Tobago with high Risk Indexes.

Dicotyledons (Vols. I and II of the Flora of Trinidad and Tobago)

Chimarrhis microcarpa Standley (Rubiaceae)

	Score
1. Known only from Maraval (1 locality)	0
2. Growing in forest (1 ecological niche)	0
3. i. First collected in 1904	+1
ii. Last collected in 1904	+3
iii. Span zero years	+4
4. Endemic to Trinidad	+5
	10 + 13 = 23

Justicia laevilinguis (Nees) Lindau (Acanthaceae)

1. Known from Nariva Swamp (1 locality)	0
2. Growing in freshwater swamp (1 ecological niche)	0
3. i. First collected in 1961	+3
ii. Last collected in 1977	0
iii. Span 16 years	+3
4. Northern South America (1 cardinal point)	0
	10 + 6 = 16

Odontonema brevipes Urb. (Acanthaceae)

	Score
1. Easterfield, Great Dog R., Pigeon Hill and Parlatuvier (4 localities)	−3
2. Growing in shady forest (1 ecological niche)	0
3. i. First collected in 1889	+1
ii. Last collected in 1959	0
iii. Span 70 years	+1
4. Endemic to Tobago	+7
	10 + 6 = 16

Omphalea megacarpa Hemsl. (Euphorbiaceae)

1. Tabaquite and Tobago (2 localities)	0
2. Climber (1 ecological niche)	0
3. i. First collected in 1892	+1
ii. Last collected in 1955	0
iii. Span 63 years	+1
4. Endemic to Trinidad and Tobago	+3
	10 + 5 = 15

Paullinia excisa Radlk. (Sapindaceae)

1. Bacolet R., Castara-Parlatuvier Trace (2 localities)	−1
2. Climber (1 ecological niche)	0
3. i. First collected in 1889	+1
ii. Last collected in 1937	+1
iii. Span 48 years	+1
4. Endemic to Tobago	+7
	10 + 9 = 19

Securidaca lophosoma (Blake) Cheesman (Polygalaceae)

1. Road to Maracas Bay (1 locality)	0
2. Climber (1 ecological niche)	0
3. i. First collected in 1924	+2
ii. Last collected in 1924	+1
iii. Span zero years	+4
4. Endemic to Trinidad	+5
	10 + 12 = 22

Tococa broadwayi Urb. (Melastomataceae)

1. Charlotteville to Parlatuvier (1 locality)	0
2. In shady damp wood (1 ecological niche)	0
3. i. First collected in about 1913	+2
ii. Last collected in about 1913	+1
iii. Span zero years	+4
4. Endemic to Tobago	+7
	10 + 14 = 24

Monocotyledons (Vol. III of the Flora of Trinidad and Tobago)

Dicranopygium insulare (Gleason) Harling (Cyclanthaceae)

	Score
1. 8 localites in Tobago	−7
2. Growing in woodlands (1 ecological niche)	0
3. i. First collected in 1889	+1
ii. Last collected in 1937	+1
iii. Span 48 years	+1
4. Endemic to Tobago	+7
	10 + 3 = 13

Eleocharis elegans (Kunth) Roem. & Schult. (Cyperaceae)

1. Caroni Swamp (1 locality)	0
2. Growing in ditch (1 ecological niche)	0
3. i. First collected in 1975	+4
ii. Last collected in 1975	0
iii. Span zero years	+4
4. West Indies, Central and South America (3 cardinal points)	−4
	10 + 4 = 14

Philodendron fendleri Krause (Araceae)

1. Mathura Forest, Sans Souci, St. Ann's, Valencia (4 localities)	−3
2. Climber on cliffs and trees (2 ecological niches)	−1
3. i. First collected in 1890	+1
ii. Last collected in 1947	0
iii. Span 57 years	+1
4. Endemic to Trinidad	+5
	10 + 3 = 13

N.W. Simmonds (J. Ecol. 38 (2): 289, 1949) reported this species as "frequent in the wetter forests . . . ".

Sacciolepis indica (L.) A. Chase (Gramineae)

1. Aripo Savanna (1 locality)	0
2. Roadside weed (1 ecological niche)	0
3. i. First collected in 1979	+4
ii. Last collected in 1980	0
iii. Span 1 year	+4
4. Old World tropics and Central America (2 cardinal points)	−2
	10 + 6 = 16

Omission of any specific examples of orchids and bromeliads is deliberate, the reason being that they are almost all at risk because of the special interest taken in them by collectors.

A note on *Belvosia formosa* Aldrich (Diptera Tachinidae), a parasite of *Automeris janus* Crans (Lepidoptera, Saturnidae)

By *Dave D. Chadee, Ashton Le Maitre* and *Robin C. Persad* Insect Vector Control Division, P.O. Box 556, Port of Spain, Trinidad.

BELVOSIA FORMOSA Aldrich is a widely distributed tachinid fly from Mexico, Panama and Costa Rica in Central America, from Brazil in South America and from St. Clair, West Indies, (Aldrich, 1928). Since the type specimens were collected by F.W. Urich who worked in Trinidad, it is felt that St. Clair, W.I., refers to St. Clair, Trinidad, West Indies.

Belvosia formosa is a known parasite of two moths *Rothchildia orizaba* Fab. and *Automeris* io Fab. (Aldrich, 1928, and Arnaud, 1978). This paper records the collection of specimens of *Belvosia formosa* from Monos Island, Trinidad, West Indies, an island from which it has not been reported before. Moreover, this study has revealed *Automeris janus* Crans as an additional host of the parasite.

Six larvae of *Automeris janus* were collected off partially defoliated *Cocos nucifera* L. (Coconut tree) on the 31st January, 1980, at Morris Bay, Monos Island. The larvae collected were transported to the laboratory at Insect Vector Control Division where they were reared to adults. At the laboratory the larvae pupated after 17 days. After 18 days of pupation 3 adult *Automeris janus* moths emerged.

From the other pupal stages no adult moth emerged. However, the adult parasite *Belvosia formosa* emerged after 16 days through an apical slit of the pupal case of *Automeris janus*. Seven adults of *B. formosa* emerged as follows: — 2 female, 23.111.1980 and 1 female, 24.111.1980 (D.D. Chadee, Collector); 3 male, 25.111.1980. and one male, 26.111.1980 (R.C. Persad, Collector).

Two specimens of *B. formosa* and the associated pupal case of *Automeris janus* were deposited in the U.S. National Museum of Natural History, Washington, D.C. Five specimens of *B. formosa* and the associated pupal cases are lodged in the Insect Reference collection at the Caribbean Epidemiology Centre (CAREC) P.O. Box 164, Port of Spain,Trinidad, W.I.

We wish to thank Dr. C. Sabrosky from the Smithsonian Institute, U.S. National Museum of Natural History, Washington D.C. for identifying *Belvosia formosa* Aldrich. In addition, we thank Mr. H. Wood from the Ministry of Agriculture, Land and Fisheries, Trinidad, W.I. for assisting in this study.

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A Study of the Aquatic Fauna of the Aripo Savannas

By *M. Alkins, G. de Souza, M. Julien, M. Koo, R. Lue Chee Lip* and *S. Shadid* **Department of Zoology, U.W.I., St. Augustine, Trinidad.**

INTRODUCTION

The Aripo Savannas are located within the Long Stretch Forest Reserve in east central Trinidad and are a number of open areas covered with grass-sedge vegetation amidst an extensive area of seasonal marsh forest.

This area has been proposed as a Scientific Reserve within the system of National Parks and Protected Areas in Trinidad and Tobago (Thelen and Faizool, 1980) since it has for a long time been recognised as being unusual, for example Kingsley (1871). However, research has concentrated largely on the flora rather than the fauna, for example Beard (1946, 1953) and Richardson (1963). Very limited information is available on the fauna, for example Quesnel (1979) and Thelen and Faizool (1980); and in particular the aquatic fauna has only briefly been reported since it is relatively limited and inconspicuous. Thelen and Faizool (1980) report the presence of small fish including sardines, guabin, cascorob and yaraw in ponds and waterways in the savannas, and occasional water boa in the ponds.

The nature of the aquatic fauna found in the savannas, however, is expected to be interesting because of the type of habitat supporting it. The savannas (lying about 30 to 45 metres above sea level) are very flat, and because of this, the impermeable clay or iron pan and lack of many natural streams and channels, drainage is very poor. In 1940, however, channels were excavated by the United States Armed Forces thus slightly improving drainage (Richardson, 1963).

The savannas lie mainly within the watershed of the Aripo River so that most of the water drains in a westerly direction via drainage channels and the Black River to the Aripo River. A small section drains towards the east to the Quare River (Fig. 1). The Black River is clear compared to the Aripo River which is laden with silt from upstream quarrying operations (Thelen and Faizool, 1980).

In the open savanna areas, the microtopography is either flat, undulating or composed or irregular hummocks with depressions between. These depressions and the drainage channels, both natural and man-made, hold water when the savanna floods during the rainy season but dry up in the dry season. They thus form temporary aquatic habitats and consequently this influences the nature of the fauna supported. Knowledge of the fauna found in these temporary systems is quite limited but observations by local naturalists have resulted in reports of fish such as *Cichlasoma bimaculatum*, *Hemigrammus unilineatus*, *Poecilia picta*, *Aphyocarax axelrodi*, *Odontostilbe pulcher* and *Rivulus hartii* (H. Boos, pers. comm.) and the amphibian *Leptodactylus sibilatrix* (J. S. Kenny, pers. comm.).

As a result of the lack of information on the aquatic fauna and the intrinsic interest of studying a temporary aquatic system, a small group of final-year zoology students of the University of the West Indies conducted a short survey of the aquatic fauna within a small section of the savannas as part of an exercise in community ecology.

RESULTS AND DISCUSSION

Eight sampling sites were studied in Savannas V, VI and VII, over a two-week period in November 1979 (Fig. 2). Sites A, F, G, and H were within the drainage channels and ditches while B, C, D and E were depressions in the savanna. Physical parameters such as depth, temperature and current speed were measured and a general collection of fauna was made including free-swimming and benthic fauna.

Table I summarises the physical data collected for the eight sites. No depth was measured at Site E since there was very dense plant growth and this also restricted faunal sampling. Water movement at Sites A and H could not be measured since flow was impeded by plant growth. The table shows the relatively high temperatures (29 – 33° C) associated with shallow stagnant pools except at Site G which was shaded by overhanging vegetation. The areas with flowing water were relatively cooler (26 – 27° C).

TABLE I:

PHYSICAL PARAMETERS OF SITES A – H

Location	Depth (cm)	Temperature (°C)	Current
A	59	27	very slow
B	5	32	stagnant
C	15	29	stagnant
D	15	33	stagnant
E	—	33	stagnant
F	30	27	0.2 m/sec.
G	7	26	stagnant
H	7	26	very slow

Table II summarises the fauna collected at all sites except Site E. Altogether 15 species were collected, nine of which were found at Site A which was also the deepest site and which in the height of the rainy season would be quite extensive and possibly continuous with the Aripo or Black Rivers. Sites A, F, G and H are also possibly continuous with each other and the main rivers during the rainy season hence the presence of fish in all of these sites.

The small ponds formed in the depressions in the savanna (Sites B, C and D) supported mainly arthropods such as pond

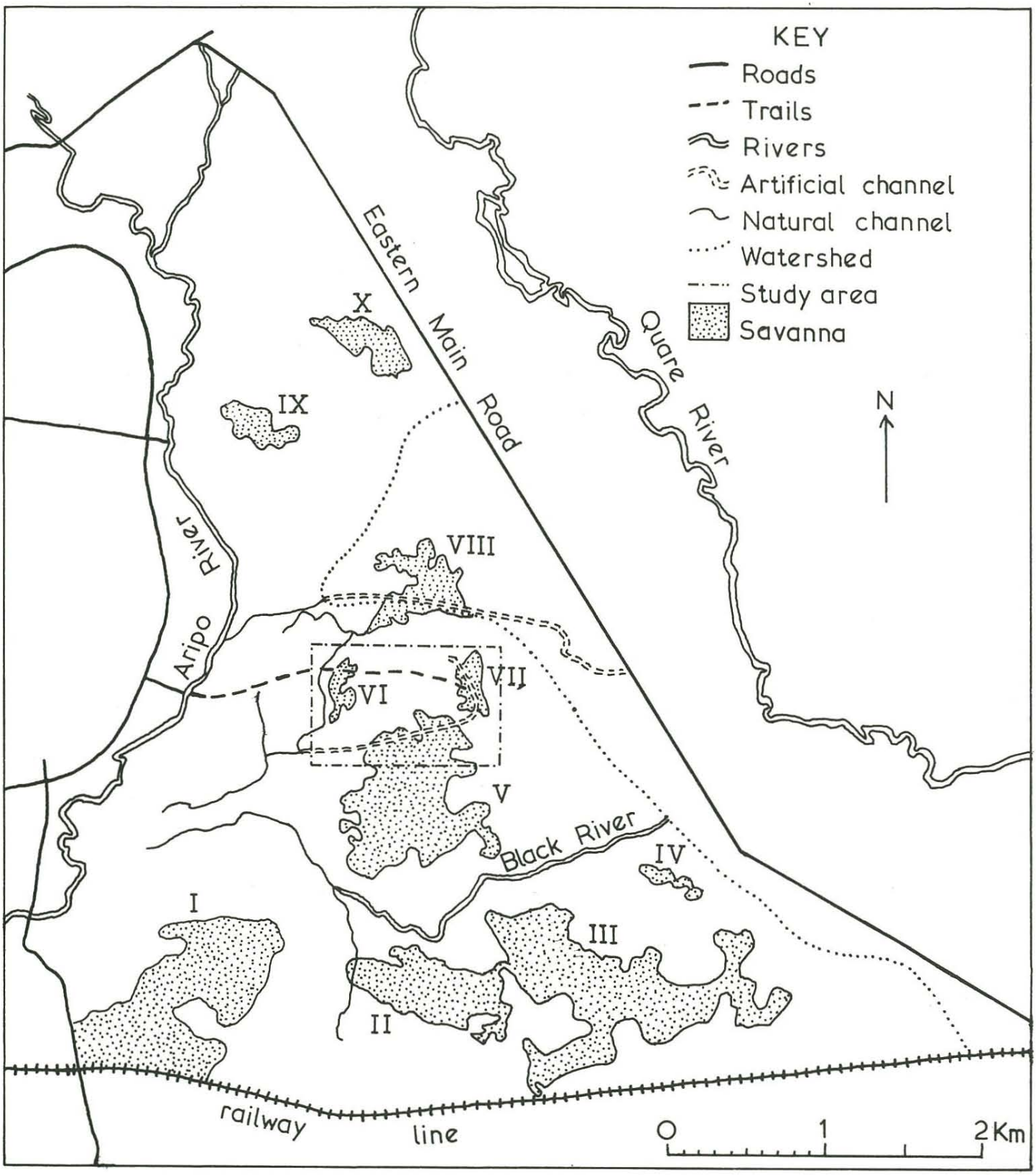

Fig. 1: Hydrography of the Aripo Savannas.

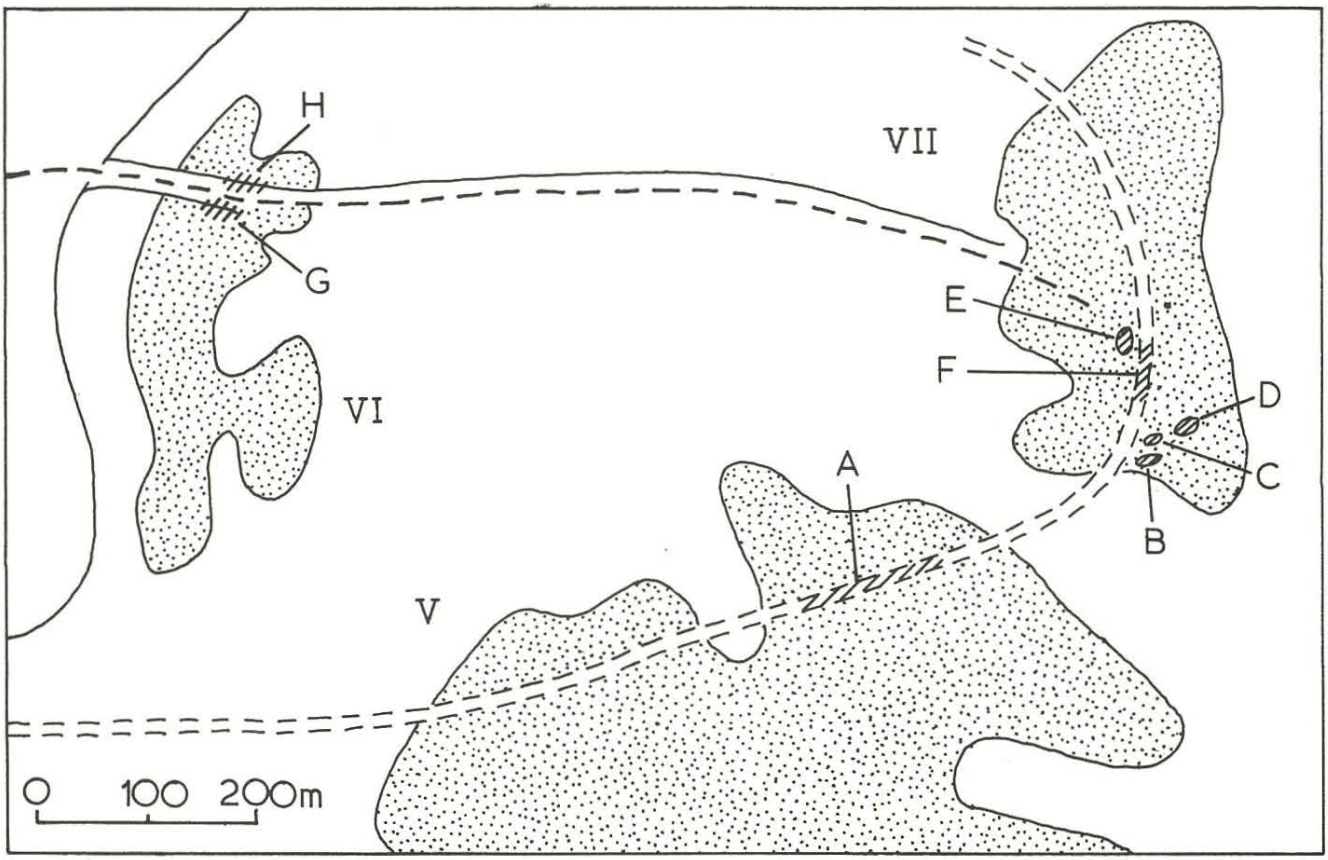

Fig. 2: Detail of study area showing sites A to H (key as in Fig. 1).

TABLE II

FAUNA COLLECTED AT SITES A – D AND F – H

Species	Sampling Site						
	A	B	C	D	F	G	H
Annelida:							
Oligochaeta						*	
Arthropoda:							
Odonata: Corduliidae (L)	*					*	
Aeshnidae (L)	*					*	
Lestidae (L)	*						
Ephemeroptera: Ephemerellidae (L)	*						
Hemiptera: Gerridae		*				*	
Notonectidae		*	*	*			
Coleoptera: Gyrinidae		*	*	*			
Vetebrata:							
Pisces: *Cichlasoma bimaculatum*	*				*		
Gymnotus carapo	*						
Hoplerythrinus unitaeniatus	*						
Hemigrammus unilineatus	*				*		*
Synbranchus marmoratus	*						
Callichthys callichthys						*	
Amphibia: *Bufo marinus* (L)		*					

* indicates presence of species

L Larval stage

skaters, water boatmen and whirligig beetles which are all capable of aerial dispersal so that colonisation of isolated pools of water is possible. Also, the *Bufo* tadpoles found at Site B would be temporary inhabitants.

Generally, the fauna is typical of that of a temporary system. For example, the dragonfly, damselfly and mayfly larvae are temporary inhabitants spending only their nymphal stages in the water, the adults being terrestrial. The odonatan nymphs require relatively long periods to develop (up to 2 years) and this could explain their presence only in Sites A and G and not the small pools. The fish in particular, are adapted to this type of environment. Distribution to and from isolated pools of water when the habitat is drying out in the dry season would be a major problem which is solved by species such as *Synbranchus* and *Callichthys* which are quite efficient at movement over land.

Also it is to be expected that in small isolated and stagnant aquatic habitats such as these, deoxygenation of the waters could be a major problem. This would be accentuated in the dry season when high temperatures increase the rates of consumption of oxygen by the inhabitants and decrease the solubility of the gas as well. Kramer *et al* (1978) discuss different respiratory strategies used by Amazonian fishes, many of these identical or similar to Trinidadian species. Among those mentioned is *Callichthys callichthys* which gulps air at the surface and uses the intestine as a site of oxygen uptake; *Hoplerythrinus unitaeniatus* which is capable of branchial as well as aerial respiration, the latter by using part of its gas bladder as a site for oxygen uptake; *Synbranchus marmoratus* which is amphibious, using the branchial chamber for aerial as well as aquatic respiration. This species can also aestivate in the dry season to avoid very harsh conditions. (Graham, 1978).

It is not confirmed whether *Cichlasoma bimaculatum* is an air-breather but Lowe-Mc Connell (1969) suggests that it may be since it can survive for a long time out of water and dissection reveals a well vascularised air-filled stomach. Although *Gymnotus carapo* is not a confirmed air breather either, it is related to the electric eel, *Electrophorus electricus* which uses its buccal cavity for air breathing.

It is also mentioned in Kramer *et al* (1978) that there is a possibility that fish with no special respiratory adaptations use the well oxygenated surface film and this may be the case with *Hemigrammus* and other sardines found in the savannas.

In summary then, the aquatic fauna of the Aripo Savannas is typical of that of a temporary aquatic system. The fauna is adapted for dispersal to new aquatic habitats and also for enduring harsh conditions associated with the small stagnant ponds. Other species are temporary inhabitants utilising the habitat when available for only parts of their life cycles.

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A Hesperiid Hitch-hiker

By *Raymond Manuel* Macdonald College, Montreal, Canada

IN THE course of unpacking a suitcase upon my family's return to Montreal in September 1977, following a visit to Trinidad, I was pleasantly surprised to find a live caterpillar among the damp towels and bathsuits. It was promptly secured and placed in an environmental chamber (LD 16:8, 60% RH, 80° C). Pupation occurred the following day (September 16, 1977) and an adult Hesperiid butterfly emerged eleven days later (September 27, 1977). It turned out to be *Pellicia bromias* G. & S. which occurs in Trinidad and Tobago (Barcant, 1970) and which is known also from Mexico, southwards to Panama (Godman and Salvin, 1887 — 1901; Draudt, 1921 — 1924). Klots (1951) records it as a casual species which strays into southern Texas.

I wish to thank Dr. J.D. Lafontaine, Biosystematics Research Institute, Ottawa, Canada, who confirmed the identification. The specimen is deposited in the Lyman Entomological Museum, Macdonald College of McGill University.

* *Pellicia bromias* G. & S. is a synonym of *Nisoniades rubescens* Moeschler — Ed.

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An early pest control measure in Trinidad

By *Raymond Manuel* Macdonald College, Montreal, Canada.

THE problems which can be caused to health and agriculture by the introduction, wilfully or accidentally, of foreign insect species, are well known today. To name but a few: *Aedes aegypti* (L.) the urban mosquito transmitter of yellow fever in Trinidad, the African race of the honey-bee in Brazil, and the gypsy moth *(Porthetria dispar* L.) which is ravaging deciduous forests in North America. This is not to say that all wilful introductions are bad since this is an important aspect in the biological control of pest insects and weeds.

Almost two hundred years ago there was some concern for Trinidad. It appears that there was fear of introducing an ant species which apparently was doing some damage in the Antilles. This resulted in the King of Spain commanding the Governor of Trinidad (Royal Cedula on Colonization of 1783, Article 26. vide Carmichael, 1961) [1] to appoint suitable subjects to search vessels and the effects of arriving settlers in order to prevent its introduction. Whether that fear was real or unfounded is beside the point, but the edict represents probably the earliest pest control regulation in the history of Trinidad, and is certainly one of the earliest in the New World.

To my daughter Anna I express my gratitude for turning up Carmichael's book in her school library and bringing it to my attention.

[1] Carmichael, G. 1961. *The History of the West Indian Islands of Trinidad and Tobago. 1498 — 1900.* Alvin Redman Limited, London, 463 pp.

Lepidoptera of Nariva Swamp

By *M.J.W. Cock* **Commonwealth Institute of Biological Control, Curepe, Trinidad**

RECENTLY, I examined the *Studies on the Biological Resources of Nariva Swamp, Trinidad* by Bacon et al. (1979) put out as Occasional Paper Number 4 of the Zoology Department, UWI. While the bulk of this work makes most interesting reading (and I recommend it to members of the Field Naturalists' Club), I was soon turning to the faunal list of Appendix 8, and examining the list of Lepidoptera (pp. 405 — 7) — this being one of my particular interests. I have to admit that I was disappointed, although the quality of this section gives no measure of the quality of the rest of the work.

Of the 36 species listed, eight are mis-spelt, one is a synonym, one is an old name no longer used, and five or six species and one aberration must be regarded as probable mis-identifications. Although left as a question mark, the family to which *Lycorea ceres* belongs is Danaidae, as is readily ascertainable. The order in which the families are listed appears to be random. The correct order for the families listed should approximate to Uraniidae, Hesperiidae, Papilionidae, Pieridae, Lycaenidae, Riodinidae, Nymphalidae, Heliconiidae, Morphidae, Brassolidae, Satyridae, Ithomiidae, Danaidae, as could have been found by consulting a text-book of entomology.

The incorrect spellings are: —

	Correct Spelling
HESPERIIDAE	
"Colocilopsis musa"	*Cobalopsis musa*
PIERIDAE	
"Eurema venarta"	*Eurema venusta*
NYMPHALIDAE	
"Anartia amalthea"	*Anartia amathea*
"Phepona meander"	*Prepona meander*
Branded king shoemaker	*Banded king shoemaker*
"Billis hypena"	*Biblis hyperia*
BRASSOLIDAE	
"Cutobelpia beucynthia"	*Catoblepia berecynthia*
"Dynastor mucrosiris"	*Dynastor macrosiris*
ITHOMIIDAE	
"Aecea eurymedia agna"	*Aeria eurimedia agna*

Cobalopsis musa is a synonym of *Arita arita* Schaus; while *Cystineura cana* is now known as *Mestra nypermestra cana* Erich.

The species needing confirmation which are probably mis-identified are: —

HESPERIIDAE	
Arita arita (=Cobalopsis musa)	One of a group of similar species.
PIERIDAE	
Eurema gratiosa	A forest species of the Northern Range.
RIODINIDAE	
Nymphidium onaeum	A rare species normally found in the south. Several similar species.
Calociasma lilina	A very rare species normally on hilltops of the Northern Range.
NYMPHALIDAE	
Metamorpha epaphus	First record outside Northern Range but this species is spreading.
Prepona meander	This is based on an error by Barcant (1970). The correct name for this species is *Prepona amphimachus* F. The true *P. meander* does occur, although rarely, in the NW of Trinidad.
HELICONIIDAE	
Heliconius ethillus	Not normally seen below 1,000 feet.
BRASSOLIDAE	
Dynastor macrosiris	A very rare species normally only taken at light.
ITHOMIIDAE	
Hypothyris euclea forbesi	An aberration in Trinidad only taken once previously.

In addition, I would like to include a list of butterflies which I have collected from the area to the west of milestone 46 of the Manzanilla-Mayaro Road extending to the Nariva River Bridge. The list makes no attempt at completeness (except for the Hesperiidae) since the records only reflect species taken owing to my interest in them.

HESPERIIDAE

Pyrrhopyge amycles amycles Cramer 1♂ September '79

Polythrix octomaculata octomaculata Sepp	1♀ June '79; Sept. '79
P. auginus Hewitson	1♂ March '79
Urbanus proteus proteus Linnaeus	1♀ September '79
U. esmeraldus Butler	1♀ February '80
U. simplicius Stoll	1♂ September '79
U. procne Plotz	2♂ March '79
Nisoniades rubescens Moschler	1♂ June '70
Pellicia dimidiata dimidiata Herrich-Shaeffer	1♂ March '79
Gorgythion begga pyralina Moschler	1♀ Sept. '79, 1♂ Feb. '80
Xenophanes tryxus Stoll	1♂ March '79, 2♂ Sept. '79
Timochares trifasciata trifasciata Hewitson	1♀ June '79
Chiomera asychis simon Evans	1♀ Oct. '78; 2♂ 1♀ Mar. '79; 2♂ 2♀ Sept. '79; 1♂ Feb. '80
Corticea corticea corticea Plotz	4♂ February '80
Mnasicles hicetaeon Godman	1♀ September '70
Papias sp. nr. *dictys* Godman	1♀ September '79
Lerema ancillaris ancillaris Butler	2♂ February '80
Enosis angularis angularis Moschler	1♂ February '80
Argon argus Moscher	1♀ February '80
Carystus phorcus phorcus Cramer	1♂ February '80
Phlebodes sp. nr. *torax* Evans	2♂ June '79; 4♂ 1♀ Feb. '80
Quinta cannae Herrich-Shaeffer	1♂ Sept. '79; 1♂ Feb. '80
Wallengrenia druryi curassavica Snellen	1♂ February '80
Panoquina ocola Edwards	1♂ Sept. '79; 1♂ Feb. '80
LYCAENIDAE	
"Thecla" hesperitis Butler	1♂ March '79
"Thecla" echion Linnaeus	1♀ March '79
"Thecla" marsyas Linnaeus	1♂ September '79
"Leptotes cassius Cramer	1♂ September '79
RIODINIDAE	
Nymphidium molpe Hubner	1♂ 1♀ February '80
HELICONIIDAE	
"Dryadula phaetusa Linnaeus	2♂ March '79

A number of comments are worth making on the above list of my captures of Lepidoptera.

1. It is massively incomplete. In particular no moths are included.

2. It is heavily biased towards Hesperiidae owing to my interest in this family.

3. *Dryadula phaetusa* (The Caroni Flambeau) — this is probably the furthest North this species now occurs in Trinidad.

4. The following species are additions to the list of Trinidad butterflies given by Barcant (1970) (based on that of Kaye (1921) for the Hesperiidae) although recorded by Evans (1951 — 55) from Trinidad. *U. esmeraldus, U. procne, M. hicetaceon, L. ancillaris.* The other species which do not appear in Barcant (1970) are the correct names of some of the species he lists.

5. The following species, although recorded by Kaye, are not in the British Museum collection as recorded by Evans (1951 — 55) and thus confirm the species as occuring in Trinidad. *P. octomaculata, E. angularis.*

6. I have not been able to identify with certainty the *Phlebodes* sp. and the *Papias* sp. They may well be new to science and if so, represent the only butterflies endemic to the Nariva Swamp, Trinidad.

A further record for Nariva Swamp is given in Barcant (1979, p. 124). Many who have read Barcant's *Butterflies of Trinidad and Tobago* will recall his account of a visit to Bush-Bush in which he describes the capture of nearly a hundred specimens of *Helicopis cupido* Linnaeus (Riodinidae). This is another record for Nariva Swamp of a very local, typical swamp butterfly. It is also a good example of the sort of collecting that is not required in a wildlife sanctuary.

The shortcomings of our knowledge of the butterflies of Nariva Swamp are all too apparent. Yet, for the Nariva Swamp, butterflies are comparatively well-known and our knowledge of most other insect groups is negligible. This makes only too clear the need for a long-term research programme on Nariva Swamp to include the insect fauna. To this end, the establishment of a field station on Bush-Bush by UWI is to be highly recommended. Assistance towards a more complete study of the flora and fauna is one area where perhaps the Trinidad and Tobago Field Naturalists' Club could be of assistance particularly where club members do have extensive knowledge of Trinidad's flora and fauna.

Let us hope that the Government of Trinidad and Tobago will heed this report and its lucid conclusions and recommendations and avert what could only be an ecological and conservation disaster if the alternative plan of the Overseas Technical Co-operation Agency of Japan should ever be put into operation.

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Notes on rare butterflies including two species new to Trinidad

By *M.J.W. Cock* Commonwealth Institute of Biological Control, Curepe, Trinidad.

1. *Mimocastnia rothschildi* Seitz "Rare Green Dragon" (Riodinidae)

The female of this rare Riodinid was taken for the first time in Trinidad by myself in April 1980 in the Parrylands oilfield. Males have previously only been found in the Inniss Field area of Cats Hill. The female flew down into a sunlit clearing amongst dense forest and settled under a leaf about 1 metre off the ground, with its wings spread. Barcant (1970, *Butterflies of Trinidad and Tobago*, Collins, London) suggests that the forewing bar is yellow but, as in the original description, in this specimen it is white.

2. *Argyrogramma occidentalis* G. & S. (Riodinidae)

I caught two males of this species new to Trinidad in April 1980. They were flying together, in a shaft of sunlight in the otherwise shady forest, just to the north of the road leading to the main Textel Station from milestone 9¾ on the Arima-Blanchisseuse Road. The altitude here is about 600 metres. This species superficially resembles *A. holosticta* G. & S. (the Shower of Gold) but differs in that it is smaller, the wings are more angular, the ground colour is orange and there is a narrow silvery submarginal band.

3. *Polystichtis (Lemonias) maeonides* Godart (Riodinidae)

In October 1979 I caught a male of this species feeding on flowers of *Eupatorium inulaefolium* by the road leading to the main Textel Station from milestone 9¾ on the Arima-Blanchisseuse Road. This species has not previously been recorded from Trinidad. Scott Alston-Smith has, however, drawn my attention to specimens in his own collection (1 ♀) and in those of Clive Urich (2 ♂ 1 ♀) and Malcolm Barcant (1 ♂ 1 ♀). In appearance, the male resembles the male of *P. zeanger* Stoll but without the dark apical shading and purplish spots of the forewing. The female has more rounded wings, with similar markings, but the ground colour is a much brighter yellow-orange and is more extensive on the forewing. It would appear to be an extremely rare species since the British Museum has only one specimen (the type, a male, from Guyana) and this may well be the first time the female has been described or illustrated. On the same occasion I also caught a male *Parcella amarynthina* Felder, a female *Mesene hya monostigma* Stich. (Orange Underwing) and a female *Syrmatia dorilas* Cramer (White-Spotted tadpole), three Riodinids which are seldom seen.

4. *Lemonias parthaon* Dalm. "Rare Yellow Underwing" (Riodinidae)

This appears to be another rare Riodinid in Trinidad. I know of two recent captures which seen worth recording. Scott Alston-Smith took a male at Fig Walk and I took one in the Guanapo Valley near the river crossing on the track from near milestone 3½ (February 1980).

5. *Pyrrhogyra crameri* Auriv. (Nymphalidae)

Barcant (1970), regards this as a doubtful Trinidad species. There are two records — one from Moruga (E.E. Fabian, March 1922) and one from Erin (F. Birch, February 1905). As reported in the Field Naturalist (March 1980) I took one on the field trip to Moruga Bouffe in February 1980. Since then, Clive Urich and Scott Alston-Smith have revisited this area and caught this species, confirming that it is breeding there.

My thanks to Dr. Jeremy Holloway of the Commonwealth Institute of Entomology who determined the *A. occidentalis* and *P. maeonides*, and to Scott Alston-Smith who drew my attention to the previous captures of *P. maeonides* and lent me the female shown in the plate.

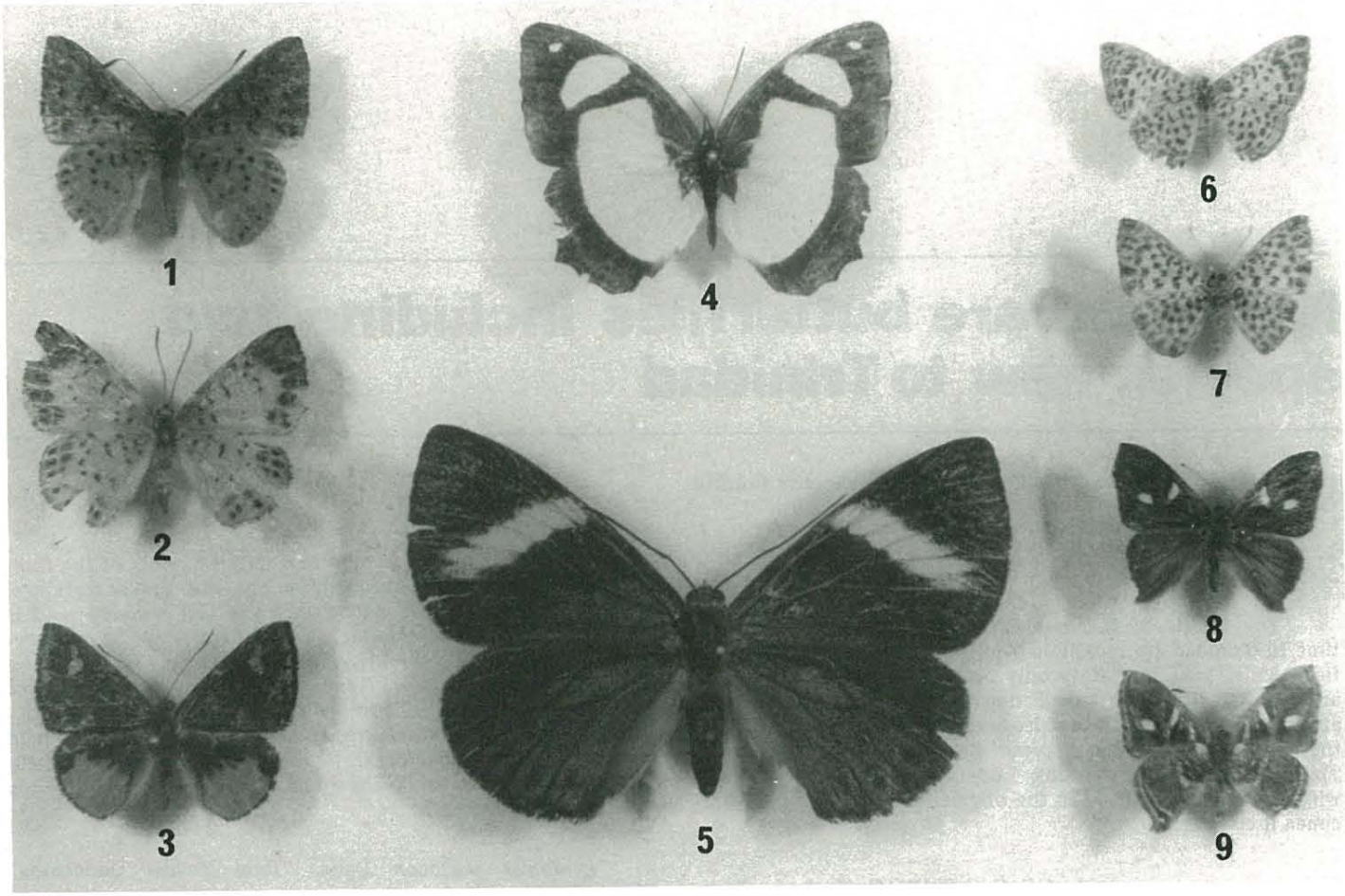


Plate 1. Some new or rare Trinidad butterflies not illustrated by Barcant (1970).

1.	*Polystichtis maeonides* ♂	Arima-Blanchisseuse Road, milestone 9¾. Textel Road, *Eupatorium* flowers. October 1979.
2.	*P. maeonides* ♀	Rio Seco, Matura, January 1978. S. Alston-Smith.
3.	*Polystichtis parthaon* ♂	Guanapo Valley, February 1980.
4.	*Pyrrhogyra crameri*	Nr. Moruga Bouffe, February 1980.
5.	*Mimocastnia rothschildi* ♀	Parrylands, March 1980.
6.	*Argyrogramma occidentalis* ♂	Arima-Blanchisseuse Road, milestone 9¾. In forest to north of Textel Road. March 1980.
7.	" " ♂ Underside	— do —
8.	*Anteros carausius* ♂	Chacachacare Island, *Eupatorium* flowers. January 1980.
9.	" " ♂ Underside	— do —

A. carausius is recorded as a new species for Trinidad in the account of butterfles from Chacachacare Island elsewhere in this issue.

Butterflies from Chacachacare Island including three species new to Trinidad

By *Matthew J.W. Cock* Commonwealth Institute of Biological Control, Curepe, Trinidad.

ON THE 15th January 1980, Julius Boos took Ken Preston-Mafham, a visiting nature photographer, and myself to Chacachacare Island. Although Julius Boos is well known as a butterfly enthusiast, on this occasion he managed to forget his butterfly net! However, sharing the one net we managed to make some interesting captures. These included three species of butterfly not previously recorded from Trinidad and Tobago. These were the Riodinid *Anteros carausius* Westwood and two Hesperids *Heliopetes domicella* Erichson and *Staphylus azteca* Scudder ssp. *tyro* Mabille.

I caught two males of *A. carausius*, feeding on flowers of *Chromolaena (= Eupatorium) odorata* L., about a third of the way up the track to the lighthouse. A week later Scott Alston-Smith also visited Chacachacare and managed to catch seven specimens all on one bush of *C. odorata.* This, however, does not end the records from Trinidad, for I have since found another specimen in Sir Norman Lamont's collection at UWI, labelled as *A. renaldus* Stoll (the Blue Brushfoot). This specimen was caught on Gaspar Grande in March 1928, presumably by Lamont himself.

Two other species of the genus *Anteros* are found in Trinidad and are illustrated in Malcolm Barcant's *Butterflies of Trinidad and Tobago* (Collins 1970). These are *A. formosanus* Cramer (the Gold Drop) which is obviously different, and *A. renaldus* which is superficially similar to *A. carausius. A. renaldus* is, however, larger (male forewing *A. renaldus* 15mm; *A. carausius* 12 mm) and the two undersides have distinct colour patterns. This species is illustrated together with other new or rare butterflies elsewhere in this issue.

Judging from the collection of the British Museum, *A. carausius* is widespread in the American tropics and varies considerably from locality to locality. The Chacachacare specimens are a good match with material from Venezuela. Since Malcolm Barcant has proposed common names for most of the Trinidad Riodinids, I would suggest the name "Bocas Brushfoot" for this species.

As the Hesperiidae are unfamiliar to naturalists in Trinidad and not covered by Malcolm Barcant's book, I merely record the capture (by Julius Boos and myself) of a pair of each of *H. domicella* and *S. azteca.* One specimen of each pair was taken at the bottom of the track to the lighthouse while the other was taken at Rust's Bay.

The commonest species of butterfly we saw on that day was *Ascia menciae janeta* Dixey (Pieridae). This is the species recorded by Barcant as *Pieris sevanta janeta,* a doubtful Trinidad species based on one record from Teteron Bay in 1904 and recently rediscovered by Clive Urich on Gaspar Grande *(Living World, 1977 — 8,* p. 15). The subspecies *menciae* Ramsden is known from Cuba and Saint Lucia, while the mainland subspecies *janeta,* was previously only known from Venezuela (Riley, N.D. (1975) *A field guide to the butterflies of the West Indies,* Collins, London). Apart from this species, the most interesting captures were *"Thecla"* (= Calliscista) faunalia* Hewitson and a specimen of *"T." (= Strymon) bazochii* Godart with white apical markings on the forewing which Scott Alston-Smith caught. This specimen matches that illustrated by Lewis (Lewis, H.L. (1973), *Butterflies of the World,* Harrap, plate 67, fig. 28). The normal form in Trinidad that was mis-named as *T. thius* by Kaye and Barcant (and illustrated by the latter) was also present.

The Bocas islands of Trinidad and Tobago provide an interesting opportunity to study the zoogeography of animals and to this end a complete list of butterflies caught and seen follows. Although a comparatively short list, perhaps the Field Naturalists' trip in August will extend this and trips to the other Bocas islands (and ideally Patos Island and the Venezuelan coast) will provide lists for interesting comparisons.

A. carausius, T. faunalia and *T. bazochii* were determined by Dr. Jeremy Holloway of the Commonwealth Institute of Entomology and I would like to thank him for this assistance. My thanks also go to Scott Alston-Smith for letting me include his records.

Checklist of the butterflies of Chacachacare Island

Hesperiidae	*Urbanus dorantes dorantes* Stoll, *U. viterboana alva* Evans, *Staphylus azteca tyro* Mabille, *Callimormus saturnus* *Callimormus saturnus* Herrich-Shaeffer, *Pyrgus oileus orcus* Stoll, *Heliopetes domicella* Erichson, *Mellana eulogius* Plotz
Riodinidae	*Anteros carausius* Westwood, *Emesis lucinda parvissima* Kaye, *Calepheles laverna* G. & S., *Nymula calyce* Felder
Lycaenidae	*"Thecla" (Callicista) albata faunalia "T." (C.) faunali* Hewitson, *"T." (C.) bazochii* Godart, *"T." (C.) bubastus* Cramer, *"T." myrtillus* Cramer *(= Rekoa palegon* Carmer auct. Barcant)
Pieridae	*Phoebis sennae* L. *Ascia monuste L. A. menciae janeta* Dixey, *Eurema albula* Cramer
Nymphalidae	*Mestra hypermestra cana* Erichson, *Anartia amathea* L.
Heliconiidae	*Colaenis iulia* Fab. *Heliconius melpomene* L.

**I put Thecla in inverted commas since the Neotropical Lycaenidae, although almost entirely put in the genus Thecla, badly need revision and none really belongs to this genus since it is restricted to the Old World.*

A preliminary survey of the coral reefs in Man-o-War Bay, Tobago

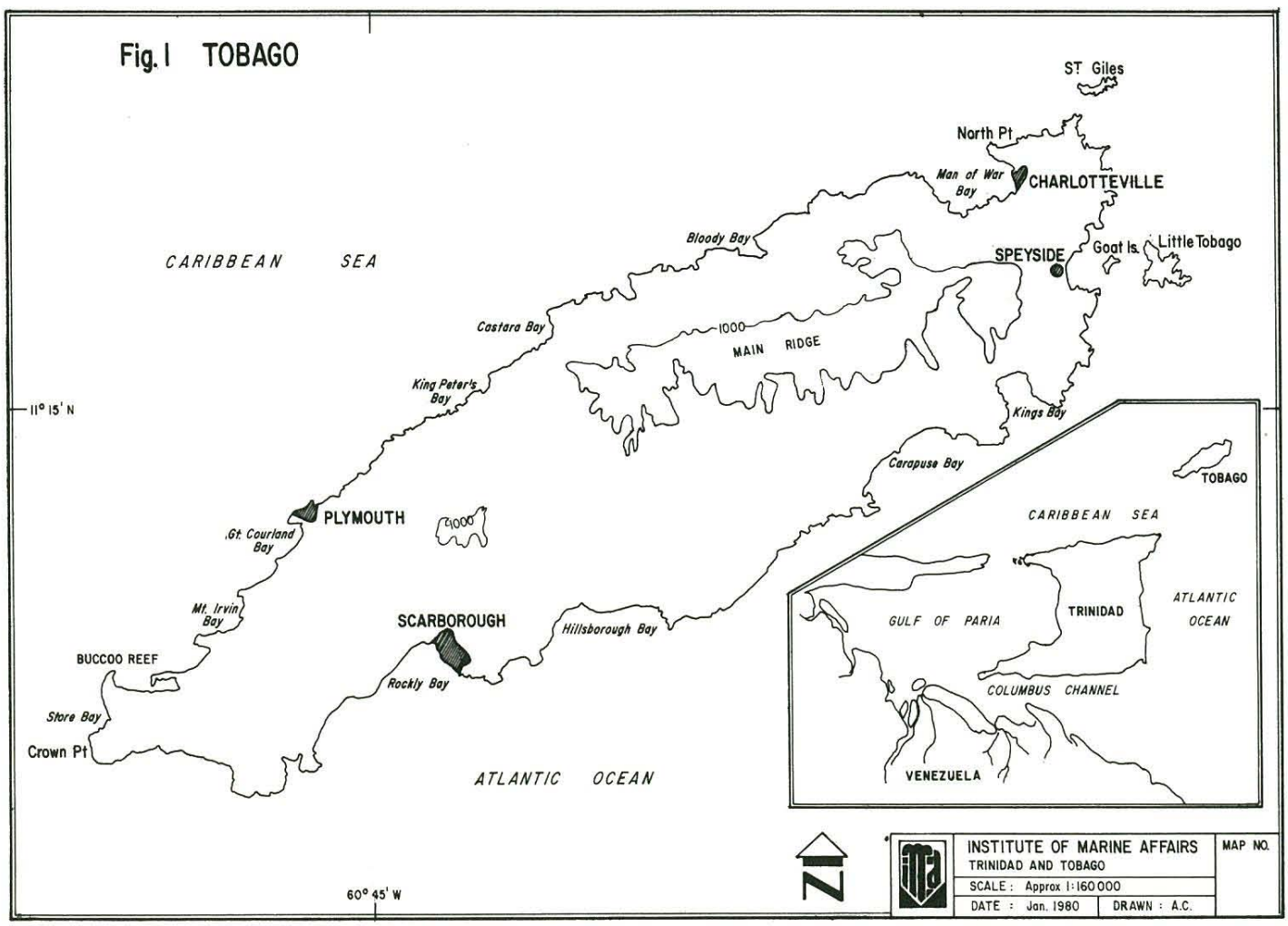
By *D. Ramsaroop* Institute of Marine Affairs, Chaguaramas

INTRODUCTION

There are many coral formations around the island of Tobago, with Buccoo Reef being by far the largest and best known. However, there are several smaller reefs, especially at Kilgwyn, Speyside and Man-o-War Bay (Fig. I) which possess communities that rival those of Buccoo Reef in beauty and diversity.

Studies on the coral reefs of Tobago have been confined primarily to Buccoo Reef (Goreau, 1967; Kenny, 1976). However, there has also been a preliminary study on the composition of the octocoral fauna on reefs at Speyside, Man-o-War Bay, Kilgwyn and Buccoo (Ramsaroop, 1976).

The reefs of Tobago comprise a prime resource. Coral reefs in general play a critical role in coastal protection, are spawning and feeding grounds for many commercial species of fish, are tourist attractions, and are useful for educational purposes. They are also extremely fragile ecosystems, which are increasingly



being exposed to critical impacts from man's activities. There is an urgent need, therefore, for proper and effective management of these threatened ecosystems. At present, Buccoo Reef is in a state of deterioration, partially because of the dragging of anchors of the reef guide-boats, the trampling and souvenir collecting by visitors, the frequent and illegal removal of commercial species, and increased sedimentation induced by on-shore developments.

One possible way of decreasing the harmful human impacts on Buccoo Reef, is to encourage the use of other reef areas in Tobago. However, before this is done, prudent management strategies must be developed to avoid a recurrence of the problems affecting Buccoo Reef. For this to be accomplished, there must be studies to gather relevant data. Some of the basic data needed would relate to location and size of reefs, species composition and zonation.

This study is an attempt to collect the above data on the reefs of Man-o-War Bay. It is the first in a series of similar studies which would eventually allow for the location and characterization of most of the coral reefs of Tobago.

MAN-O-WAR BAY

Man-o-War Bay (Fig. 2) is situated in the northernmost part of Tobago, and faces north. It is one of the larger bays in the island, being just under 2.5 kilometres wide at the mouth and extending as far as two kilometres inland.

The bottom of the bay is covered by sand and mud, except where coral formations occur in shallow water. The seafloor slopes towards the mouth of the bay where depths of around 80 metres are found. Circulation appears to be in the form of a clockwise eddy and the waters are relatively calm, except during November and January when large ground swells are common.

The bay is surrounded by hills which effectively shield it from the prevailing easterly winds. The coastline is precipitous, except where sandy beaches occur. The longest of these beaches extends between the villages of Charlotteville and Cambleton, a distance of approximately 0.5 kilometres. However, smaller beaches are found at Pirate's Bay on the east and Hermitage on the west (Fig. 2).

METHODS

Observations were carried out using SCUBA in November, 1977. Most corals and fishes were identified underwater. A waterproof fish-watcher's guide (Chaplin & Scott, 1972) proved most useful for identifying fishes in their natural habitat. Fish and invertebrate specimens not easily ascertained underwater, were collected by hand, fish pots and hook and line, and subsequently named. Various texts (Bayer, 1961; Warmke & Abbot, 1961; Bohlke & Chaplin, 1968; Randall, 1968; Smith, 1971; Kenny et al, 1974; Zeiller, 1974; Zeiller, 1975; Ramsaroop, 1976; Voss, 1976) were used to identify the specimens during the study.

Size and location of reefs were determined from aerial photographs supplied by the Mapping & Control Section of the Division of Lands & Surveys.

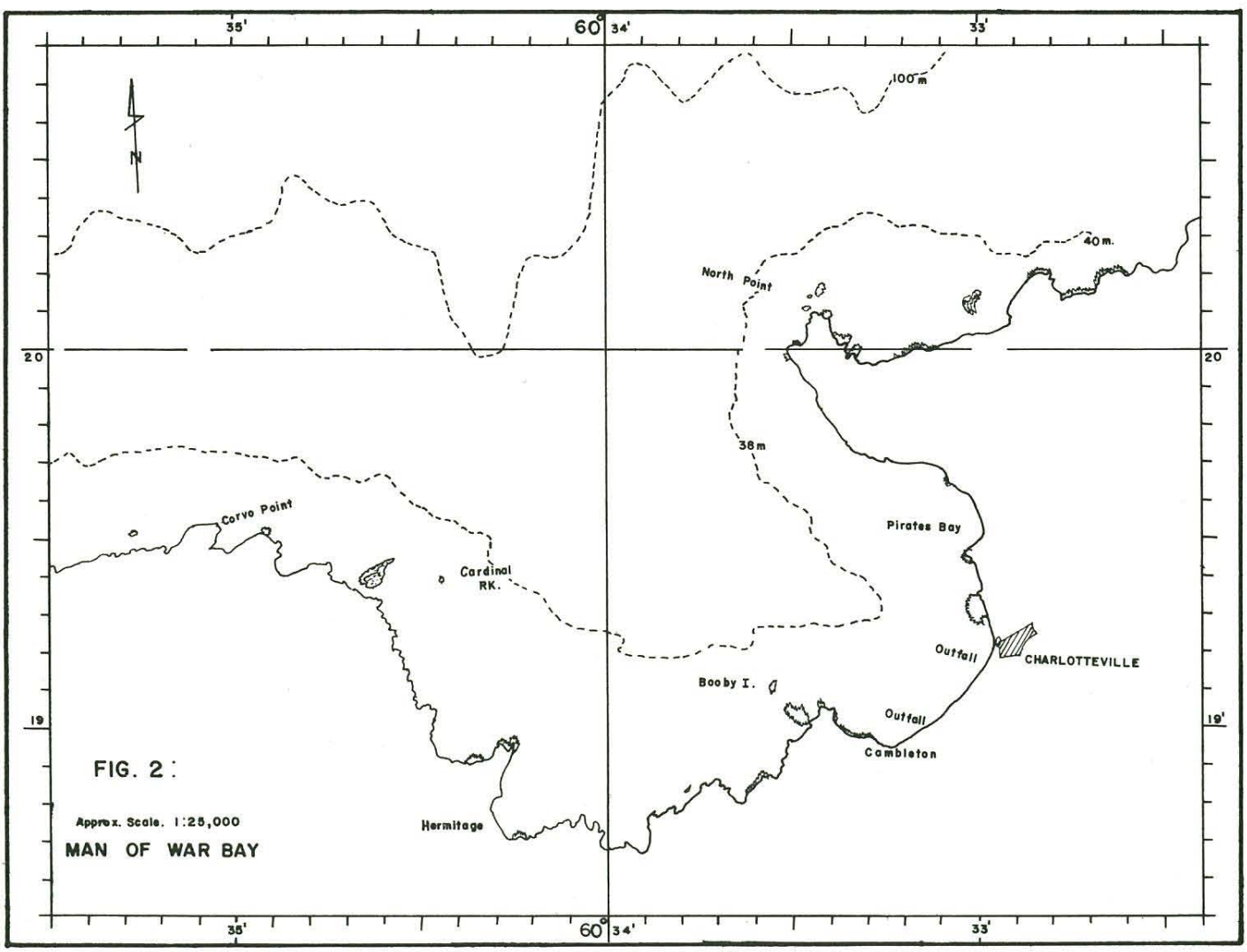


FIG. 2:
Approx. Scale. 1:25,000
MAN OF WAR BAY

RESULTS

There are several coral formations in Man-o-War Bay (Fig. 3). Two of the largest are found at Booby Island and Pirates'

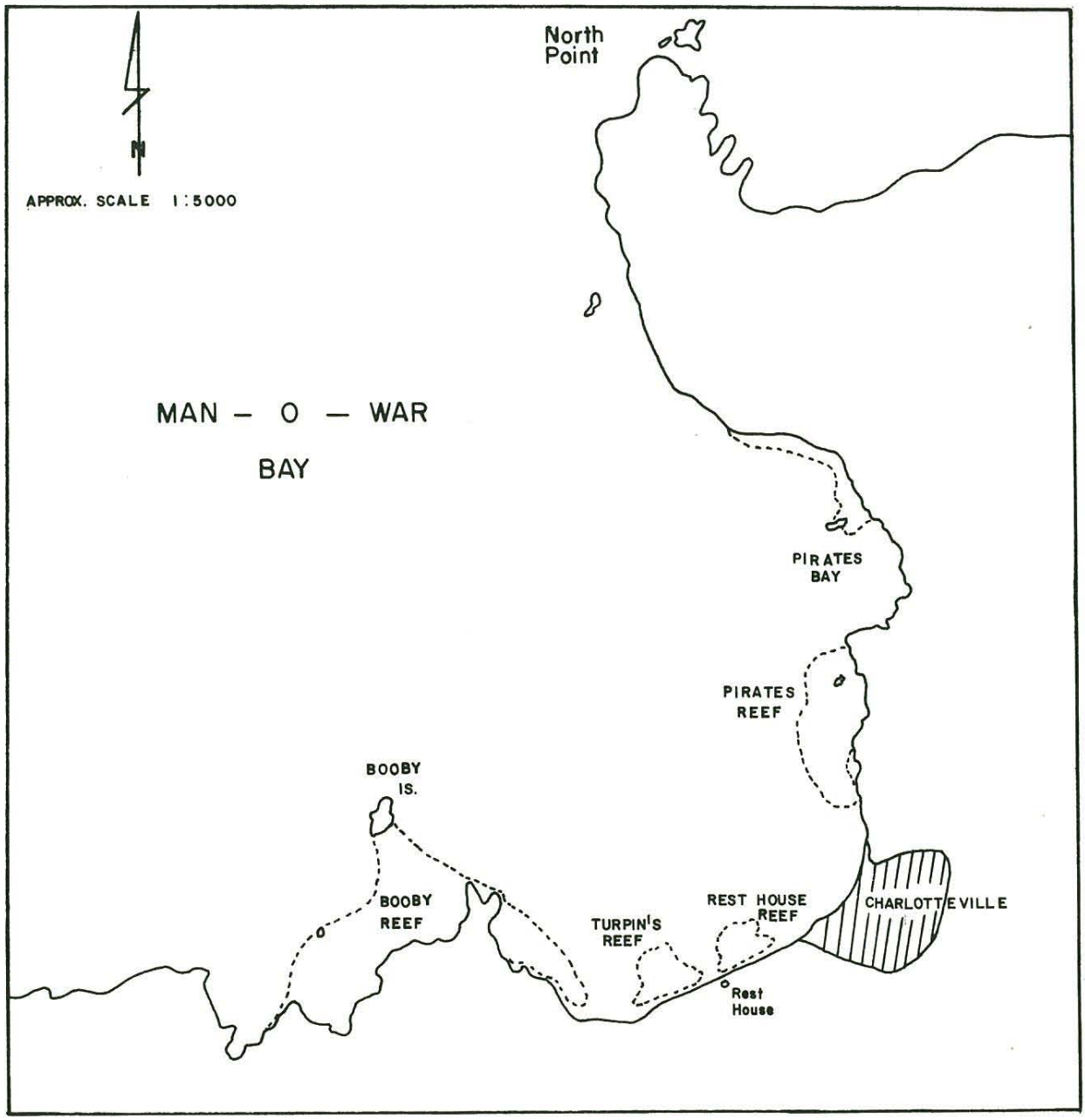


FIG. 3: REEFS IN THE EASTERN PART OF MAN-O-WAR BAY

Bay. Smaller formations occur north of Pirates' Bay, opposite the Government's Rest House, and opposite Charles Turpin's house (Fig. 3). For purposes of convenience, these reefs are referred to in this study as Bobby Reef, Pirates' Reef, Turpin's Reef and Rest House Reef.

BOOBY REEF

Booby Reef is triangular in shape, the base of this triangle being at the shoreline and approximately 150 metres wide, while the apex is at Booby Island, a distance of approximately 85 — 90 metres from the shore.

The reef top is generally less than one metre below the surface near shore, and gradually deepens as it extends seawards to depths of between 2 and 3 metres near Booby Island. The dominant coral species is the elk's horn coral, *Acropora palmata*, which appears as an impressive, though monotonous, formation. However, occasional small colonies of the octo-corals *Gorgonia ventalina* and *Briareum asbestinum*, and the stony corals, *Diploria sp.*, *Agaricia sp.*, *Favia fragrum* and *Montastrea annularis* occur among the *A. palmata*. The long-spined sea urchin, *Diadema antillarum*, was common in the area. Several species of reef fishes, specifically parrotfishes *(Sparisoma sp., Scarus sp.)*, surgeonfish *(Acanthurus sp.)* harlequin bass *(Serranus tigrinus)* and damselfishes *(Eupomacentrus sp., Abudefduf saxatilis, Chromis cyanea)*, were seen in these shallow waters.

To the east, the reef extends at its deepest to depths of approximately 25 metres near Booby Island. However, the lower limits of the reef become progressively shallower moving shorewards. Below the reef's lower limit, the substratum is generally sandy. On the east slope, communities were distributed into three major zones, apart from the *A. palmata* zone at the reef top. The first of these zones occurred at depths approximately between 3 and 7 metres. Here, the soft coral, *Palythoa mammillosa*, the fire coral, *Millepora alcicornis* and the elk's horn coral, were codominants. Other common species found in this zone were the gorgonians *Plexaura flexuosa, Muricea elongata* and *Eunicea tourneforti*, the stony corals, *Eusmilia fastigiata, Acropora cervi-*

TABLE I

CORALS OF MAN-O-WAR BAY, CHARLOTTEVILLE

Scientific Name	Common Name	Booby Is. Reef	Rest House Reef	Pirate's Bay Reef
SCLERACTINIA (Stony Corals)				
Eusmilia fastigiata		X		
Madracis asperula			X	X
Acropora cervicornis	Stag's horn coral	X		X
Acropora palmata	Elk's horn coral	X	X	X
Agaricia agaricites	Leaf coral	X	X	X
A. fragilis	Hat coral	X		X
Siderastrea radians	Starlet coral	X	X	X
S. siderea	Starlet coral	X	X	X
Porites asteroides	Porous coral	X	X	X
P. branneri	Porous coral	X		X
P. porites	Finger coral	X	X	X
Favia fragrum	Star coral	X	X	X
Diploria clivosa	Brain coral	X	X	X
D. labyrinthiformis	Brain coral	X	X	X
D. strigosa	Common brain coral	X	X	X
Colpohyllia natans	Brain coral	X		X
Solenastrea bournoni	Star coral	X		X
Montastrea annularis	Common star coral	X	X	X
M. cavernosa	Large star coral	X	X	X
Meandrina meandrites	Brain coral	X	X	X
Dichocoenia stokesii	Star coral	X		X
Mussa angulosa	Large flower coral	X	X	X
Scolymia cubensis	Mushroom coral	X	X	X
Mycetophyllia lamarkana		X		
HYDROCORALLINAE (Hydrocorals)				
Millepora alcicornis	Fire coral	X	X	X
M. complanata	Fire coral	X	X	X
* *Macrorhyncia phillipina*	Stinging feather hydroid	X		
OCTOCORALLIA (Horny Corals)				
Briareum asbestinum		X	X	X
* *Iciligorgia schrammi*	Black sea fan	X		X
Erythropodium caribaeorum		X	X	X
Plexaura flexuosa	Bent Plexaura	X	X	X
P. homomalla	Black sea rod	X		X
Psuedoplexaura porosa		X		X
Eunicea tourneforti		X	X	X
E. clavigera				X
Muriceopsis flavida		X	X	X
Plexaurella dichotoma	Double forked Plexaurella	X		X
P. nutans		X	X	X
P. grisea	Grey Plexaurella			X
Muricea elongata		X	X	X
*Lophogorgia punicea		X		
Pseudopterogorgia acerosa	Dry sea feather	X	X	X
P. americana	Slimy sea feather	X		X
Gorgonia ventalina	Common sea fan	X	X	X
G. flabellum	Sea fan	X		X
Pterogorgia citrina		X	X	X
Ellisella elongata	Sea whip	X		
Nicella schmitti		X		
ANTIPATHARIA (Black Coral)				
*Antipathes sp.	Bottle brush coral	X		
*Antipathes sp.	Black sea fan	X		
ZOANTHIDEA (Soft Corals)				
Zoanthus sociatus	Green sea mat	X	X	X
Palythoa mammillosa	Knobby zoanthidean	X	X	X

**Ahermatypic species or species without zooxanthellae*

TABLE 2

REEF ORGANISMS OBSERVED AT MAN-O-WAR BAY APART FROM CORALS AND FISHES

	Scientific Name	Common Name
SPONGES	*Oligoceras sp.*	Bleeding sponge
	Iricinia sp.	Vase sponge
	Dysidea sp.	Heavenly sponge
	Callyspongia sp.	Tube sponge
ANNELIDS	*Hermodice carunculata*	Green bristle worm or fire worm
MOLLUSCS	*Lima scabra*	Flame clam
	Spondylus americanus	Atlantic thorny oyster
	Tridachia crispata	Ribbon nudibranch
	Strombus gigas	Queen conch
	S. costatus	Milk conch
	Cyphoma gibbosum	Sea leopard
	C. signatum	Fingerprint cyphoma
	**Chiton marmoratus*	Marbled chiton
ECHINODERMS	*Astichopus multifidus*	Fissured sea cucumber
	Isostichopus badionotus	Sea cucumber
	Diadema antillarum	Long-spined urchin
	Nemaster grandis	Giant sea lily
	Tropiometra sp.	Black sea lily
	Ophiocoma echinata	Spiny ophiocoma (Brittlestar)
	Ophioderma brevispinum	Short-spined Ophioderma (Brittlestar)
CRUSTACEANS	*Panulirus argus*	Spiny lobster
	P. guttatus	Spotted lobster
	Grapsus grapsus	Sally lightfoot or rock crab
	Stenorhynchus seticornis	Arrow crab

**For a drawing of this species see* Studies on the Trinidad Chitons *by Baboolal et al — Ed.*

TABLE 3

FISHES OF MAN-O-WAR BAY

Family Name	Specific Name	Common Name
Carcharhinidae (Requiem sharks)	*Carcharhinus springeri*	Reef shark
Elopidae	*Megalops atlanticus*	Tarpon
Synodontidae (Lizard fishes)	*Synodus intermedius*	Sand diver
Muraenidae (Moray eels)	*Gymnothorax moringa*	Spotted moray
	G. funebris	Green moray
Belonidae (needle fishes)	*Strongylura timucu*	Atlantic needle fish
Fistulariidae (Cornet fishes)	*Fistularia tabacaria*	Cornet fish
Aulostomidae (Trumpet fishes)	*Aulostomus maculatus*	Trumpet fish
Syngnathidae (Pipe fishes and sea horses)	*Syngnathus rousseau*	Caribbean pipe fish
Holocentridae (Squirrel fishes)	*Holocentrus rufus*	Squirrel fish
	H. ascensionis	Long-jaw squirrel fish, Marianne
	Myripristis jacobus	Blackbar soldier fish
Sphyraenidae (Barracudas)	*Sphyraena barracuda*	Great barracuda
Trichiuridae (Cutlass fishes)	*Trichiurus lepturus*	Aluminium fish, machete
Serranidae (Groupers and Sea bases)	*Epinephelus guttatus*	Red hind
	E. adscensionis	Rock hind
	E. striatus	Nassau grouper
	Cephalopholis fulva	Coney
	Petrometopon cruentatum	Graysby
	Mycteroperca tigris	Tiger grouper

	Serranus tigrinus	Harlequin bass
Grammidae (Fairy Basslets)	*Gramma loreto*	Royal gramma
Priacanthidae (Big eyes)	*Priacanthus cruentatus*	Glass eye
	P. arenatus	Big eye
Apogonidae (Cardinal fishes)	*Apogon maculatus*	Flame fish
Echeneidae (Remoras)	*Echeneis naucrates*	Sharksucker
Carangidae (Jacks)	*Caranx hippos*	Crevelle jack
	**Caranx lugubris*	Black jack
	**Decapterus punctatus*	Round Scad
		Round Robin
	**Selar crumenophthalmus*	Big eye Scad Goggle eye jack
	**Seriola dumerili*	Greater amberjack
	**Trachinotus palometa*	Pompano
	**T. falcatus*	Permit
	**Oligoplites saurus*	Leather jacket, Sapate
Scombridae (Tunas and Mackerels)	**Scomberomorus maculatus*	Spanish mackerel, carite
	**S. cavalla*	King mackerel
		King fish
	* *Sarda sarda*	Common bonito
	**Thunnus atlanticus*	Blackfin tuna
	**T. albacares*	Albacore tuna
Lutjanidae (Snappers)	**Lutjanus jocu*	Dog snapper
	**L. synagris*	Lane snapper
	**Ocyurus chrysurus*	Yellow tail snapper
Pomadasydae (Grunts)	*Haemulon striatum*	Striped grunt
	H. carbonarium	Caesar grunt
	H. macrostomum	Spanish grunt
	H. steindachneri	Latin grunt
	H. chrysargyreum	Small-mouth grunt
	Anisotremus virginicus	Pork fish
Sparidae (Porgies)	*Archosargus rhomboidalis*	Sea bream
Sciaenidae (Croakers and Drums)	*Equetus acuminatus*	Cubbyu
	E. punctatus	Spotted drum
Bothidae (Left eye flounders)	*Bothus lunatus*	Peacock flounder
Scorpaenidae (Scorpion fishes)	*Scorpaena plumieri*	Spotted scorpion fish
Chaetodontidae (Butterfly fishes and Angel fishes)	*Chaetodon capistratus)*	Foureye butterfly fish
	C. striatus	Banded butterfly fish
	C. ocellatus	Spotfin butterfly fish
	Pomacanthus arcuatus	Grey angel fish
	P. paru	French angel fish
	Holacanthus tricolor	Rock beauty
	H. ciliaris	Queen angel fish
Pomacentridae (Damsel fishes)	*Eupomacentrus fuscus*	Dusky damsel fish
	E. leucostictus	Beau gregory
	E. partitus	Bicolor damsel fish
	Abudefduf saxatilis	Sergeant major
	Chromis cyanea	Blue chromis
Labridae (Wrasses)	*Halichoeres bivittatus*	Slippery dick
	H. garnoti	Yellow-head wrasse
	H. maculipinna	Clown wrasse
	Thalossoma bifasciatum	Bluehead
Scaridae (Parrot fishes)	*Sparisoma viride*	Spotlight parrot fish
	S. radians	Bucktooth parrot fish
	Scarus vetula	Queen parrot fish
	S. taeniopterus	Princess parrot fish
	S. coeruleus	Blue parrrot fish
Blennidae (Combtooth blennies)	*Ophioblennius atlanticus*	Redlip blenny
Gobbidae (Gobies)	*Gnatholepis thompsoni*	Goldspot goby
	Coryphopterus glaucofraenum	Bridled goby
Acanthuridae (Surgeon fishes)	*Acanthurus coeruleus*	Blue tang
	A. bahianus	Surgeon fish
	A. chirurgus	Doctor fish
Balistidae (Trigger fishes)	*Balistes vetula*	Queen trigger fish
	Melichthys niger	Black durgon
Monacanthidae (File fishes)	*Cantherhines pullus*	Tail light file fish
Ostracionthidae (Trunk fishes)	*Lactophrys triqueter*	Smooth trunk fish
	L. bicaudalis	Spotted trunk fish
	Acanthostracion quadricornis	Scrawled cowfish
Tetraodontidae (Puffer fish)	*Sphaeroides greeleyi*	Caribbean puffer
Canthigasteridae (Sharpnose puffers)	*Canthigaster rostrata*	Sharpnose puffer
Diodontidae (Porcupine fishes and burrfishes)	*Diodon hystrix*	Porcupine fish

Commercial species generally caught outside Man-o-War Bay.

cornis, Porites porites and *Millepora complanata.*

Fishes were most numerous in this zone, and in addition to the species commonly found in the *A. palmata* zone, moray eels *(Gymnothorax sp)* squirrelfishes *(Holocentrus sp.)*, groupers *(Epinephelus sp., Cephalopholis sp., Petrometopon sp.)*, flame fishes *(Apogon maculatus)*, grunts *(Haemulon sp.)*, drums *(Equetus sp.)*, butterflyfishes *(Chaetodon sp.)*, angelfishes *(Pomacanthus sp.)*, were all common in this zone.

The long-spined sea urchin was also observed, while the ovulid gastropod, *Cyphoma gibbosum* (sea leopard), was occasionally found, generally in pairs, feeding on gorgonians.

The next major zone occurred at depths approximately between 7 and 15 metres. This zone could easily be referred to as the *Pseudopterogorgia* zone. Large and numerous colonies of the gorgonian sea feathers, *Pseudopterogorgia acerosa* and *P. americana*, appeared to be the dominant forms here. Some colonies were up to 2 metres high. This zone had the most diverse coral fauna, including the stony corals *Diploria clivosa, Montastrea cavernosa, A. palmata, Siderastrea radians, M. alcicornis, Mycetophyllia sp., Agaricia sp., Mussa angulosa, Porites branneri, P. porites;* the soft corals, *P. mammillosa;* and the gorgonians *E. tourneforti, Pseudoplexaura porosa, Plexaura flexuosa,* and *Muriceopsis flavida.*

All the fishes observed in the previous zones were also seen in this zone. In addition, green morays *(G. funebris)*, trumpetfishes *(Aulostomus maculatus)*, the big eyes *(Priacanthus cruentatus* and *P. arenatus)*, porkfishes *(Anisotremus virginicus)*, scorpionfishes *(Scorpaena plumieri)*, queen triggerfishes *(Balistes vetula)*, black durgons *(Melichthys niger)*, trunkfishes *(Lactophyrs sp.)*, puffers *(Sphaeroides sp.* and *Canthigaster sp.)*, and porcupine fishes *(Diodon hystrix)* were also encountered.

C. gibbosum was common in this zone, and was mostly found feeding on polyps of the sea feather, *P. acerosa.* This mollusc was usually found in single or multiple pairs, at times numbering as many as a dozen individuals on one gorgonian colony. The giant crinoid, *Nemaster grandis*, occurred frequently in this zone, while the flame clam, *Lima scabra*, was found in narrow crevasses. The arrow crab, *Stenorynthus seticornis*, was seen both in this zone and the zone immediately above. Sponges were also numerous, and these included the bleeding sponge *(Oligoceras sp.)*, the vase sponge *(Iricinia sp.)*, the heavenly sponge *(Dysidea sp.)*, and the tube sponge *(Callyspongia sp.)*.

The last zone was found to occur at depths between 15 metres and the lower limit of the reef. Here the seafloor was covered by large boulders, and was quite rugged and irregular. Gorgonians were more sparsely distributed, with the most common being small colonies of *P. acerosa* and *P. americana.* Most of the stony corals found above also occur at these depths. Other species found here include *Mycetophyllia lamarkana, Meandrina meandrites, Scolymia cubensis* and *Dichocoenia stokesii.* Most fish and sponge species found in the shallower zones were also seen here, but in lesser numbers. The spiny lobster, *Panulirus argus*, and the spotted lobster, *P. guttatus*, were also observed in this area.

The queen conch, *Strombus gigas*, the milk conch, *S. costatus* and the sea cucumbers *(Astichopus sp.*, and *Isostichopus sp.)* were found on the sandy substrate at the lower edge of the reef.

The west slope of Booby Reef was similar to the east slope and was characterized by the same general zonation pattern. On this slope the reef also ended at a sandy bottom, at depths varying between 20 and 25 metres. The sea floor was extremely rugged and irregular. The species found on the east slope were also found on the west slope.

On the northern side of Booby Island, the sea floor dropped precipitously down to depths varying between 20 and 25 metres. Below this the sea floor dropped less rapidly, and was composed primarily of sand, coral fragments and occasional patches of rock. Above 20 metres, stony corals and gorgonians abounded. Here also were found the only ahermatypic corals of the reef. These include the octocorals, *Ellisella elongata* (white sea whip), *Lophogorgia punicea* (orange sea fan), *Iciligorgia schrammi* (black sea fan), *Nicella schmitti* and two antipatharians (black corals) of the genus *Antipathes*, commonly referred to as the bottlebrush coral and the black sea fan. Large specimens of tube and vase sponges and feather hydroids were also observed. Extremely large specimens of the Atlantic thorny oyster *(Spondylus americanus)* were found at depths below 13 metres, together with large specimens of sea cucumbers *(Astichopus sp.* and *Isostichopus sp.)* and the giant crinoid, *Nemaster grandis.*

PIRATES' REEF

Pirates' Reef extends southwards from the southern end of Pirates' Bay to the northern limit of the village of Charlotteville (Fig. 3). This reef extends from the shoreline to about 50 or 60 metres offshore, its lower limits varying at depths between 12 and 15 metres. At greater depths, the substratum is composed of sand and coral rubble. The communities on this reef also follow a vertical zonation pattern similar to that of Booby Reef.

The reef top occurs at depths between 0.5 and 2.0 metres. *A. palmata* was common, but unlike the reef top at Booby Reef, there were large patches of the soft coral, *P. mammillosa* and many colonies of the stony corals, *M. complanata, M. annularis* and *Diploria sp.* Occasional colonies of the gorgonians *G. flabellum* and *G. ventalina* were also observed.

At depths between 2 and 5 metres, the community was more diverse than at the reef top. Gorgonians were sparse, except for the common seafan *(G. ventalina)*, while the stony corals, *M. annularis, A. palmata* and *S. radians*, and the soft coral, *P. mammillosa*, were common. Also occurring among these were occasional colonies of *P. porites, Agaricia sp., E. caribaeorum, D. clivosa, P. asteroides, M. complanata* and *M. alcicornis.*

At depths between 5 and 15 metres, the seafloor community was similar to that found at corresponding depths on the east and west slopes of Booby Reef. Here also, the gorgonians, *P. americana* and *P. acerosa* were the dominant species. The fish communities were also similar in species composition to those on the west and east slopes of Booby Reef.

REST HOUSE REEF

The Rest House Reef lies opposite the Government's Rest House (Fig. 3), and extends to distances varying between 25 and 30 metres offshore. This reef is approximately 40 metres at its widest and terminates seaward at depths between 6 and 7 metres. Below this depth, the substratum is sandy. Only 30 species of corals were observed as compared with 48 species and 42 species noted for Booby Reef and Pirates' Reef respectively. At depths above three metres, *A. palmata* and *Madracis asperula* predominate, while below this depth gorgonians, especially *P. americana, P. acerosa, Plexaura spp., Pseudoplexaura spp.* and the stony corals, *M. meandrites, Diploria spp. and Millepora spp.*, were abundant.

TURPIN'S REEF

Turpin's Reef lies to the West of the Rest House Reef, and is similar in size. Insufficient observations were made on community composition and species distribution to allow for a description at this time.

All species observed in this study are listed in Tables 1-3.

DISCUSSION

The reefs of Man-o-War Bay are considerably smaller than those at Speyside, Kilgwyn and Buccoo. While a lagoon separates Buccoo Reef from the mainland, the reefs of Man-o-War Bay extend to the shoreline which may suggest that the latter are geologically younger than Buccoo Reef.

Being further removed from the effects of Orinoco River effluent, especially lower salinity and higher turbidity levels, it is reasonable to expect that there will be a larger number of species on the reefs of Man-o-War Bay than at Buccoo Reef. Although preliminary indications are that there are more stony

coral, octocoral and fish species in the former area, a definite statement cannot be made for all groups until more comprehensive collections are made in both areas.

Booby Reef is the largest and most diverse of the reefs studied. The vertical zonation of the communities on this reef is the most distinctive, and this is probably related to the fact that this reef extends to greater depths than the other reefs. The reef top, for instance, was the most striking, being comprised almost entirely of the elk horn coral, *Acropora palmata*, while the reef tops on the other reefs consisted not only of *A. palmata* but significant numbers of other coral species.

While Booby Reef is the most diverse, and would offer the best snorkelling and SCUBA diving, it is the most inaccessible, being backed by a shoreline which is precipitous. The shoreline at Pirates' Reef is also precipitous, but this reef can easily be approached from Pirates' Bay. Rest House and Turpin's Reef are the most accessible, lying next to a beach with road access. This could easily develop into a disadvantage, in that the reefs could eventually fall prey to souvenir collectors.

Further biological studies of these reefs are needed, supported by physical oceanographic and geological information, if we are to develop prudent management strategies.

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Metamorphosis of *Dynastor macrosiris* Westw. (Lepidoptera Brassolidae)

By *F.C. Urich* Sans Souci Estate, Sangre Grande, Trinidad and *Julius O. Boos* c/o Bridas, S.A., Apartado Postal 105, Talara, Peru, South America

ON December 20, 1979, an exciting event in the butterfly world occurred at the home of the senior author, F.C. (Clive) Urich at Sangre Grande — the emergence of a male specimen of the extremely rare Brassolid butterfly, *Dynastor macrosiris* Westw. Approximately two months before, a female attracted to the lights of his home was caught and killed for his collection, but before committing the specimen to the setting board, one egg was carefully squeezed from her abdomen. The ovum was remarkably large for a butterfly, 3.50 mm in diameter as compared to .75 mm for the genus *Caligo*, and ribbed as is normal in the family Brassolidae. It was white at first, turning to pink as the larva developed.

A brief history of this species is in order. The genus *Dynastor* consists of only three known species. Two of these, *macrosiris* and *darius* Fab. are known from our Island; the other, *napoleon* Westw., plus the two other species previously mentioned occur in South America. Of the three, *macrosiris* is the least known. As far as can be ascertained, international museums have very few specimens. Books have very little to say on the genus, except that they are primitive and rare, especially *macrosiris*, which we have found to be crepuscular with only the females attracted to light. In addition to the dozen or so females collected in Trinidad in the last 100 years, we know of only one previous male being collected by Gordon Govia at Fondes Amandes flying rapidly along the trail at dusk so much so that at first he thought he had netted a bat! Two specimens are pictured in Barcant's *Butterflies of Trinidad and Tobago*. The one identified as a male is an error as can be seen by comparing the illustration with the photograph of the male in this article. The males are smaller than the females and have much more angular wings. Also of interest is the discovery that the adults have a rudimentary probosis like that of the genus *Brassolis* ("coconut bark" *B. sophorae* L.) and, like this species and some moths, do not feed during their adult lives, making it impossible to bait them to traps with rotting fruit.

After a few days it became apparent that the egg might be fertile, because of the gradual change of colour, and a frantic search in the literature for possible larval foodplants was started, help being sought from all the local enthusiasts. Finally, at the Commonwealth Institute of Biological Control, Drs. Fred Bennett and Matthew Cock produced a reference to the breeding of *D. darius* on bromiliads ("wild pines") in a book written in Portuguese on foodplants of insects in Brazil. With this clear, we felt we had a chance to raise the larva. We had failed twice before with another Brassolid *Catoblepia berecynthia* Cr. by not knowing the larval foodplant. (Subsequently this species was successfully raised.) Naturally, we were rather anxious not to miss this once-in-a-lifetime opportunity.

On 23rd October, 1979 (after 13 days incubation), the egg hatched, and the larva, after causing much consternation by refusing to feed on offerings of fresh banana and palm leaves, settled down and fed on a species of Bromeliaceae, *Aechmea nudicaulis* L. consuming to our surprise, leaves, spins and all! The larva fed and grew without further problems, shedding its skin three times before pupation. The perfect protective colouration makes a description of the larva next to impossible. Of interest is that contrary to Barcant's description, the larva, as can be seen in the photograph, has two "tails" and is quite different from the tailless larva of *B. sophorae* L. The pupa was quite remarkable, resembling a snake poised to strike or a swallow about to take off.

The figures below are the important dates:

Eggs deposited — 11th October 1979
Hatched — 23rd October 1979
First moult — 2nd November 1979
Second moult — 10th November 1979
Third moult — 19th November 1979
Ceased feeding on — 30th November 1979
Pupated on — 4th December 1979
Adult ♂ emerged — 20th December 1979
Time from deposition of ovum to emergence — 70 days

Thanks are due to Mrs. F.C. Urich for putting up with the frequent telephone calls, intrusion on her privacy for inspection and photography of the "baby"; to Mr. Hans Boos for the photography; to Mrs. J. Boos for typing and re-typing the manuscript; to Drs. Bennett and Cock for their invaluable help in locating references to the foodplants of this genus and to Dr. C.D. Adams and Mr. Bhorai Kalloo of the National Herbarium housed at the University of the West Indies, St. Augustine, for their service in identifying the larval foodplant.

A further article for an international magazine is planned when more information currently being sought on this species is obtained. The specimen is housed in the collection of the senior author at Sangre Grande.

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• *See front cover for illustrations.*

Some recent additions to the Avifauna of Trinidad and Tobago

By *Richard ffrench* St. Peter's School, Pointe-a-Pierre

THE latest edition (1980) of my book on local birds contains most of the records of new and unusual species up to late 1978; but for reasons of economy it was not possible to add full accounts of new records in our islands. Two of these, the **Lesser Black-backed Gull** and **Indigo Bunting**, were mentioned in the last issue (1978 — 1979) of this journal.

I here present further data collected during 1979 — 1980, including one species new to Trinidad and three new to Tobago, with additional notes on the status of eight others.

American Flamingo *Phoenicopterus ruber.* There have been occasional reports during the last 20 years of sightings of this species. However, none has to my knowledge been documented and confusion with the Scarlet Ibis, *Eudocimus ruber*, locally known also as Flamingo, has led me to be wary of any but properly authenticated records. Such has now come to hand in an extremely careful and well-produced account sent to me by a teenager, Louise White of Tunapuna, who saw the bird while in company with five other people, all of whom knew well the distinction between a flamingo and an ibis.

This was evidently an immature bird, seen at Balandra Bay at midday on April 12, 1980. There had been much rain earlier in the morning, and the bird looked exhausted and attempted to land on the beach without, however, actually doing so. It was observed over a period of ten minutes. This is the first record in Trinidad of this species, which is known along the coasts of western Venezuela and Guyana, as well as the offshore Venezuelan islands of Los Roques and La Orchilla. It is not very surprising that the occasional bird should occur here, situated as we are between the Venezuelan and Guyanese populations. But there is no evidence that these two populations do in fact mingle. Incidentally, no escapes have been reported from the Port of Spain Zoo, where a small group of this species is kept captive.

Southern Lapwing *Vanellus chilensis.* This spectacular plover continues to thrive in Trinidad, and is evidently now well established since its first record in 1961. In addition to the sizeable breeding colony at Waller Field, birds are now occurring on a regular basis at Pointe-a-Pierre and in the marshes adjoining the Caroni and Nariva swamps, especially during the middle months of the year. As the call-note is so noticeable, I should add to the description in my book by saying "it is a penetrating, high-pitched series of similar notes, *tew-tew-tew*, etc. repeated sometimes for long periods in an excitable fashion."

Marbled Godwit *Limosa fedoa.* Four individuals of this large shorebird species were seen at Pointe-a-Pierre on September, 25 and 27, 1980. Observers included myself, my wife Margaret, and two visiting Swedish ornithologists. The birds were resting at high tide on the mud-flats in company with large numbers of other shorebirds and seabirds; they associated mostly with **Whimbrels** *Numenius phaeopus.* This species can be distinguished from its congener *L. haemastica* by its larger size, generally buffy brown appearance, cinnamon underwings, and the absence of contrasting black and white patterning on the wings and tail. The bill is also very long, appearing straight in the field, with the basal half pinkish. These birds were examined from a 50-metre distance through x 10 binoculars, and were seen well as they walked about on the mud, and also in flight.

Though the congeneric **Hudsonian Godwit** has been found occasionally in Trinidad in recent years, occurring in the course of its migration to southern South America, usually in September/October, the Marbled Godwit has not been reliably recorded here during this century. Leotaud (1866) collected a specimen in Trinidad, and it was also reported by Kirk (1883) from Tobago; however, the latter record's authenticity was doubted by me in a previous article in this journal (1973). Bond (1978) states that the species winters mainly on the west of the continent and in Central America. It is a rare transient in the West Indies, with records from the Greater Antilles and from Grenada and Carriacou. The above records of this striking species are therefore of exceptional interest to students of shorebird migration, being the furthest south on the eastern side of South America.

Parasitic Jaeger *Stercorarius parasiticus.* This seabird has been reliably recorded off Trinidad several times. The first record for Tobago came when Chip and Linda Weseloh from Canada saw and photographed an adult bird at Pigeon Point on January 8, 1980. The bird landed on the beach and allowed a close approach.

Lesser Black-backed Gull *Larus fuscus.* I recorded in the last issue (1978 — 1979) of this journal a bird seen in August and September 1978 at Claxton Bay. Two similar birds were seen in September and October 1979 at Pointe-a-Pierre in company with **Laughing Gulls** *L. atricilla* and terns. However, in a letter James Bond, the eminent American authority on West Indian birds, has warned me against assuming that these birds are in fact *L. fuscus*, which has rarely been found in the western hemisphere. He says there may be confusion with the **Band-tailed Gull** *L. belcheri*, a South American species which resembles *fuscus* in many ways; this latter has been recorded in Florida and so might turn up here. I am, nevertheless, inclined to believe that our birds are *fuscus* for the following reasons:— (a) all our birds have been adults and have *not* shown the broad subterminal black tail band of adult *belcheri*. (b) *belcheri* is not recorded on the eastern coast of South America north of Uruguay. The Pacific race breeds north to Peru and wanders up to Panama, so the Florida records probably pertain to this race. (c) Apart from the Trinidad records *fuscus* has been reported four times from Aruba during 1973 — 75, and a specimen was taken on St. Martin in 1966 (Voous 1977).

Black Tern *Chlidonias niger.* On May 14, 1980 Tim Manolis of the U.S.A. noticed a few individuals of this species at Waterloo, in company with other terns. There are no other "spring" records for Trinidad of this northern breeding species.

Striped Owl *Asio clamator*. Following the recent discovery at Prospect of the first recorded nest of the endemic Tobago race, it is gratifying to discover that this owl is known from more than one area of Tobago. Reports have come in of owls in the scrubby hill country near Hillsborough Dam. As this habitat is not uncommon on Tobago, the bird may be less rare than has been feared.

White Bellbird *(Procnias alba)*. The unmistakable call of this species was heard by myself and my wife over a period of six hours on September 1, 1980 in the Caura Valley. The male bird was calling from a patch of thick forest on the west side of the valley near La Plata. It was not seen, but the musical two-syllabled call, resembling *aahn — king*, is well known to both of us.

This is only the fourth record for Trinidad, and the first since 1969, of this spectacular cotinga. The species is known in the tropical rain-forests of Venezuela, the Guianas and northern Brazil, but it has not yet been recorded from that part of Venezuela adjacent to Trinidad. This fact has led James Bond (in litt.) to query my statement (1980) that the species is a rare visitor to Trinidad. He feels that it is more likely to be a rare resident. However, my discussions on the subject with David and Barbara Snow, probably the world's experts on the cotinga family, tend to confirm my theory. It seems most unlikely that such a conspicuous bird — both as regards appearance and sound — if resident, should have escaped the notice of interested observers in Trinidad, who since 1965 have numbered many hundreds. Moreover, our knowledge of bird dispersal within the South American continent is still extremely sketchy. All recent evidence leads us to believe that dispersal, both local and international, is much more extensive than was hitherto thought.

Piratic Flycatcher *Legatus leucophaius*. This flycatcher is quite a common breeding bird in Trinidad, probably migrating to the mainland between September and February. Its habit of stealing the nests of icterids, especially the "cornbirds", is well known. It has not yet been authentically recorded from Tobago, though I did hear the characteristic call once near Charlotteville in April 1963; the record lacked corroboration. Again I heard the call, this time of two birds answering each other, near Hillsborough Dam, Tobago on April 16, 1980. My wife and I scanned the area for nearly half an hour, but were unable to locate the singers. However, the habitat was right for this species, and several Yellowtails *Psarocolius* were about.

Crested Doradito *Pseudocolopteryx sclateri*. Birds seen in June and July 1979 by Tim Manolis appear to be of this species, very rarely recorded in Trinidad. I have never seen it. Manolis, in a carefully documented account, reports that this tiny flycatcher resembles the northern kinglet *Regulus*. It frequents low vegetation in freshwater marshes bordering Caroni Swamp; all records are from the mid-year months, suggesting migration from southern South America.

Red-breasted Blackbird *Leistes militaris*. This species, first recorded from Lowlands, Tobago in November 1974, seems to be holding its own. A recent report mentions one seen at Crown Point Airport in February 1980. Black-and-White Warbler *Mniotilta varia*. Sharon Goldwasser of the U.S.A. saw an immature bird of this species in forested country by the Roxborough — Bloody Bay road on January 31, 1980. This is the first record for Tobago of a species that might have been expected before, since there are now about a dozen records for Trinidad where, however, observers in the area of the Asa Wright Nature Centre are much more numerous than in Tobago.

Additional note. I will also briefly allude to three other first records for species in Trinidad and Tobago, which have already been fully documented in international publications. These are:—

Azure Gallinule *Porphyrula flavirostris*. An adult bird seen at the edge of Nariva Swamp on July 2, 1978 (S. Quinn, F. Sibley et al.).

Greenshank *Tringa nebularia*. J. Bull (1978) reported the first occurrence in Tobago (and the whole Caribbean region) of this Old World wader on July 7, 1977. In the same article Bull reported a first record, also from Tobago, of the nominate Eurasian subspecies of the Whimbrel *Numenius phaeopus*.

Prairie Warbler *Dendroica discolor*. An immature seen at the edge of Caroni Swamp on March 21, 1978 (A. Keith).

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The Guava

By *E. Julian Duncan* Dept. of Biological Sciences, U.W.I. St. Augustine, Trinidad

THE gauva *(Psidium guajava L.)* is native to tropical America. It is reported to have been taken at an early date by the Spaniards to the Philippines and by the Portuguese to India. It is now grown throughout the tropics where in places it has been naturalised having been spread by birds.

Guava is a member of the large dicotyledonous family Myrtaceae to which the clove, cinnamon and eucalyptus also belong. These plants, as is characteristic of members of the family, possess essential oils in some of their tissues.

The guava is a large shrub or small tree that may attain a height of 10m. It is a shallow rooter and possesses a thin trunk that is covered with a scaly, multicoloured bark. From the base of the trunk several more or less erect branches may arise. These branches repeatedly spreading laterally, Suckers are often produced from roots near to the base of the trunk.

Young twigs and suckers are green, 4-angled and winged (figure 1d), and are covered with soft hair. They bear opposite, simple oval leaves. The paired leaves are so arranged that every other pair lies in the same horizontal plane; intervening pairs lie in a plane at right angles to the former. With age a twisting of the twig takes place so that all leaves come to lie in the same plane. The angular nature of the stem is also lost with age.

The leaves — dark green and smooth above, pale green and finely hairy below — may be up to 15 cm in length. The lateral veins arise pinnately from the midrib and curve forward to join the vein immediately infront. They are raised and prominent on the lower surface (figure 1e) but are depressed on the upper surface. The petiole is short.

Trees reach maturity at about 2 — 4 years at which time they begin to flower. In Trinidad two flowering periods are observed: December — January and July — August. Flowers are borne singly on slender peduncles (flower stalks) in the axils of the leaves on younger branches (figure 1f). Sometimes they are produced in cymes of two or three. At the junction of peduncle and flower two small bracteoles positioned opposite each other are found.

In the unopened flower the sepals form a tube which completely encloses the bud. When the flower is mature, the tube (calyx-tube) bursts into 4 — 6 irregular lobes allowing the 4 — 5 white petals to spread widely. Each petal is concave and reflexed (figure 1i). The stamens are numerous and are inserted in rows on a disc. The filaments are long (1 — 2 cm) and white; the anthers are pale yellow and dehisce longitudinally. The style is long and capitate (figure 1i).

The ovary is inferior, that is, all other floral parts are inserted at a level above it, and consists of 4 — 5 fused carpels each containing numerous ovules in axile placentation (figure 1b). Sometimes 6 loculi (compartments of the ovary) are seen (figure 1c).

The floral formula may be represented thus:

$$\oplus \; ♀ \; K(5) \quad C5 \quad A \quad G(\underline{5})$$

A half flower drawing and floral diagram are seen in figure 1a and b respectively. Both self and cross pollination are known to occur. Bees and other insects have been seen visiting the flowers.

Fruits are set twice per year; February — March and August — September. Some plants are reported to fruit all year round. The fruit is a berry which is variable in shape, being either globose, ovoid or pear-shaped. At the free end the persistent calyx is seen (figure 1, g and h). The outermost portion of the fruit (the exocarp) is pale green to yellow in colour; the interior (mesocarp) is fleshy and forms a pulp of varying thickness and colour (white, yellow, pink or red) in which the numerous seeds are embedded. The embryo within the seed is curved.

The seeds remain viable for about a year. Germination takes about 2 — 3 weeks.

The plants grow from sea level to 5,000 ft. and are capable of growth over a wide range of both climatic and soil conditions. The plants may be attacked by fungi which cause blackening of the immature fruits. In Trinidad the gauva flies *Anastrepha* spp. are so prevalent that it is difficult to find a fruit which is devoid of the larvae of the species.

The fruits which are rich in vitamin C are used for the preparation of jellies, jams and a sweetmeat known in the Caribbean as guava cheese. An infusion of the leaves is reported to be used in some areas for the cure of diarrhoea.

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Explanation of floral formula:

⊕ flower is radially symmetrical

♀ flower is hermaphrodite, i.e. possesses both male (stamens) and female (carpels) parts

K = calyx (5) consists of five fused petals

C - corolla 4 — 5 consists of four to five petals. Absence of brackets ( ) indicates the petals are free

A = androecium (male organ) consists of an infinite number of stamens. Absence of brackets ( ) again indicates that there is no fusion of the stamens

G = gynaecium (female organ). (5) indicates that there are five fused carpels; the line above the bracketted figure signifies that the ovary is inferior. Had the ovary been superior, the line would have been below the figure thus: (5)

APPENDIX

Suggested exercise for school children

Collect a ripe guava fruit and remove the seeds from within the pulpy mesocarp. Clean the seeds carefully and soak overnight in water. Place a cylinder of blotting paper in a jam jar so that the paper makes contact with the sides of the jar. Pour sufficient water into the jar so that the paper is well moistened. Place some of the seeds between the paper and the walls of the jar. Stand the jar on a shelf and observe it daily. Make notes and drawings of the changes seen, recording the length of time (in days) taken for each successive change to take place. Note whether the cotyledons are pushed upwards or remain roughly where the seed was originally positioned. A mark with a felt pen on the outer surface of the bottle at the time at which the seeds are placed to germinate will facilitate you in this observation. If the cotyledons are borne aloft, germination is said to be epigeal (brought above the soil level); if they remain below it is said to be hypogeal.

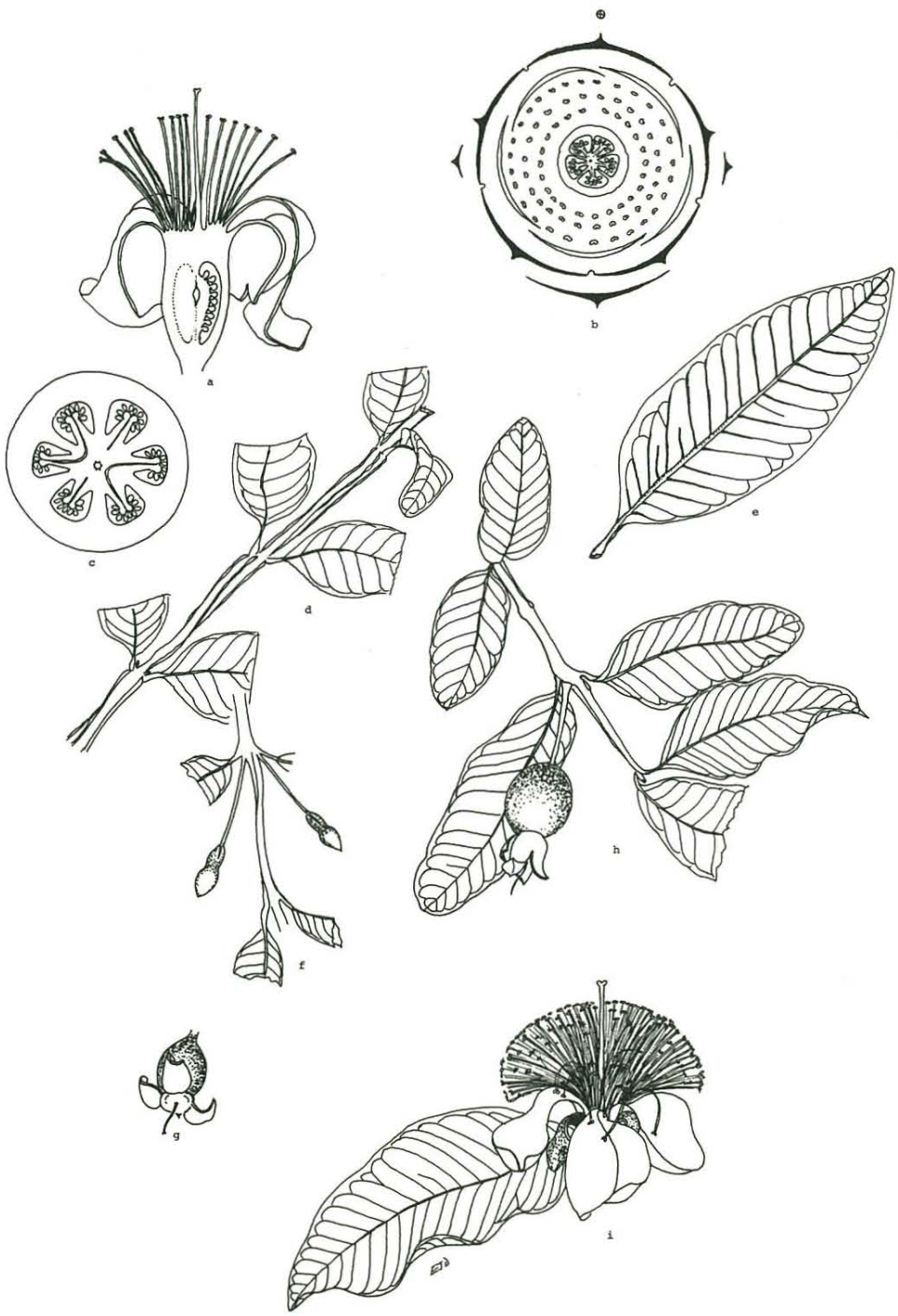


FIGURE 1. *Psidium guajava* L.

Studies on the Trinidad Chitons

By *Sucilla Baboolal, Sharon Johnatty & Zenora Ali* Department of Zoology, U.W.I., St. Augustine, Trinidad

INTRODUCTION

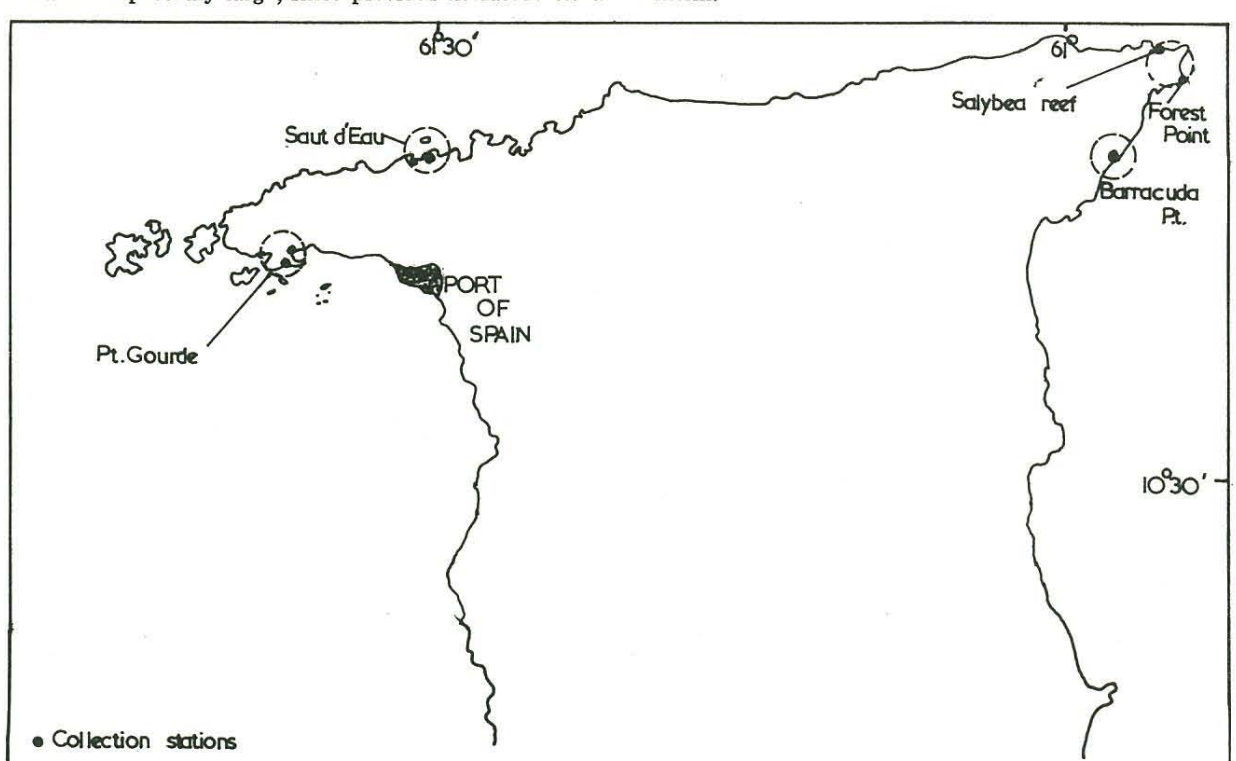
This project began as part of a field course in ecological studies on the rocky shore fauna at Barracuda Point, Balandra, undertaken by undergraduate students in the Department of Zoology, U.W.I., St. Augustine. A study of chiton zonation and behaviour was attempted. We found the animals very abundant but heavily exploited by the inhabitants of this area. From our research however, we realised that the available literature was inadequate: references on Trinidad chitons were limited, and some of the species collected may have been misidentified.

As a follow-up to the field course report (Mutunhu, 1978) and with the guidance of Dr. P.R. Bacon, Senior Lecturer in Zoology at U.W.I., St. Augustine, we decided to study these interesting animals in greater detail, and subsequently composed the present report. Collection was done at several sites on the north-east, north, and north-west coasts and the specimens were sent for identification by Robert C. Bullock, Associate Professor of Zoology, University of Rhode Island, U.S.A. The number of species identified was unexpectedly large, since previous literature cited only two or three species in Trinidad.

This report is only a beginning, since only a few areas were chosen for collection, but it reveals a little of the wealth of our fauna yet to be uncovered.

LITERATURE REVIEW

Most of the literature on local chitons is based on studies done in the Northern Caribbean. Warmke and Abbott (1961) list twenty-one species of chitons in five families. These were from South-east Florida, west Florida, some of the West Indian islands, Puerto Rico, and Central America. There is no direct mention of Trinidad. The families described were Lepidochitonidae (7 species); Mopalidae (1 sp.); Cryptoplacidae (5 species); Ischnochitonidae (7 species); Chitonidae (5 species) and sub-family Acanthopleurinae (2 species). The first recorded work from Trinidad (Bacon, 1970) was an introductory study of chitons carried out at Cumana. The two species identified were *Chiton marmoratus* Gmelin, and *Acanthopleura granulata* Gmelin.



COLLECTING SITES OF TRINIDAD CHITONS

FIG. 1

An extensive study which examined the chitons of the Caribbean in detail, was published by P. Kaas (1972). Thirty-two species of the thirty-four known in this region are described by the author, including five new species and a new variety. Humphrey (1975), dealing with marine molluscs of the Caribbean, devoted a few pages to the order Chitonida. As in other published works, the locations are given generally as 'West Indies', although the chitons found in Jamaica are dealt with in some detail. Eight species were described from southern Florida, the Florida Keys, Central America, Brazil and Peru. Eight other species from Jamaica are listed.

Only recently have any more attempts been made to study chitons of Trinidad. One of these includes a study of the zonation and behaviour of chitons on the rocky shores of the north-east coast (Mutunhu, 1978). The most recent contribution to the study of these animals in the Trinidad fauna was made by Cooper and Bacon (in press), and lists *Chiton marmoratus* Gmelin, *Chiton tuberculatus* Linne and *Acanthopleura granulata* Gmelin among edible molluscs, under their common names of "pachro" and "sea cockroach."

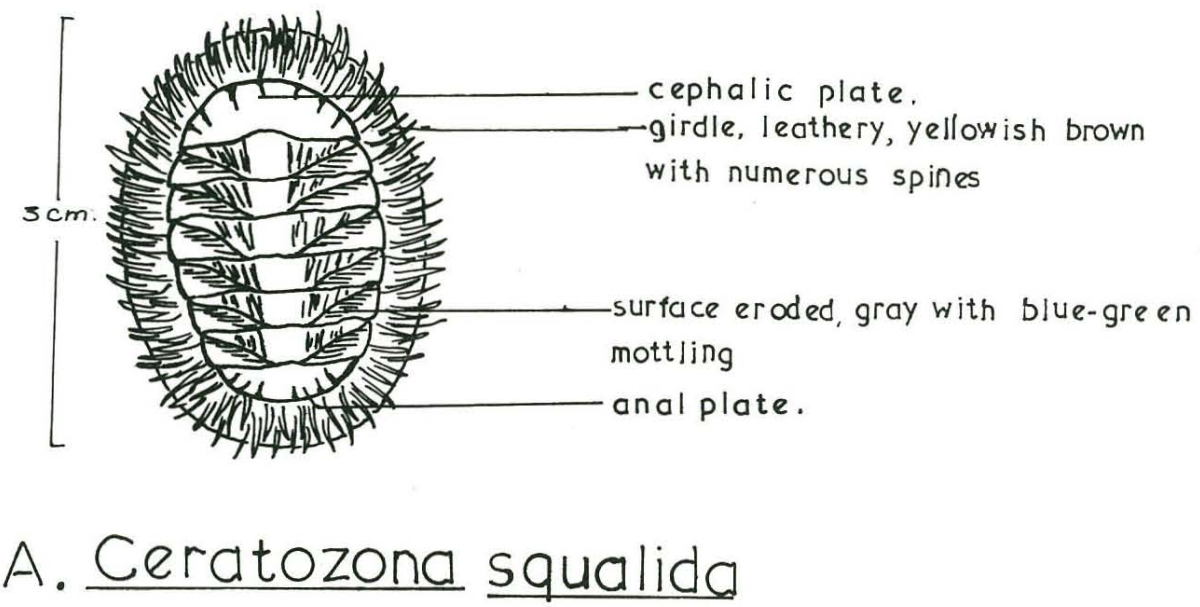


FIG. 2

COLLECTING SITES

All the sites studied were rocky shore formations although differing in degree of exposure (Fig. 1). These sites were chosen since the chitons were more abundant on such shores. Most of the collecting was done during the low tide and the water marks indicated that collecting areas were almost completely covered at high tide.

The rocky coast at Barracuda Point consisted of a few enclosed bays, with boulder beaches and wave cut platforms. These bays were bordered by steep-sided, deeply creviced rocks jutting out into the sea. There was also a boulder beach at Forest Point, but not many specimens were found there. Most of the collecting at this site was done on the rocky headland where wave action was intense.

At Salybia, collection was concentrated on the coral rubble, and boulder-strewn areas east of the reef, again, where there was heavy wave action.

The main collecting sites at Point Gourde were greatly eroded rock faces in a dredged area, and a fairly calm enclosed bay with large boulders and stones. The collecting sites at Saut d'Eau were limited to a few very deep crevices in the rocky coastline, since the area was extremely jagged and steep and subject to heavy wave action.

SPECIES DESCRIPTIONS

A. *Ceratozona spualida* (C. B. Adams) (Fig. 2)

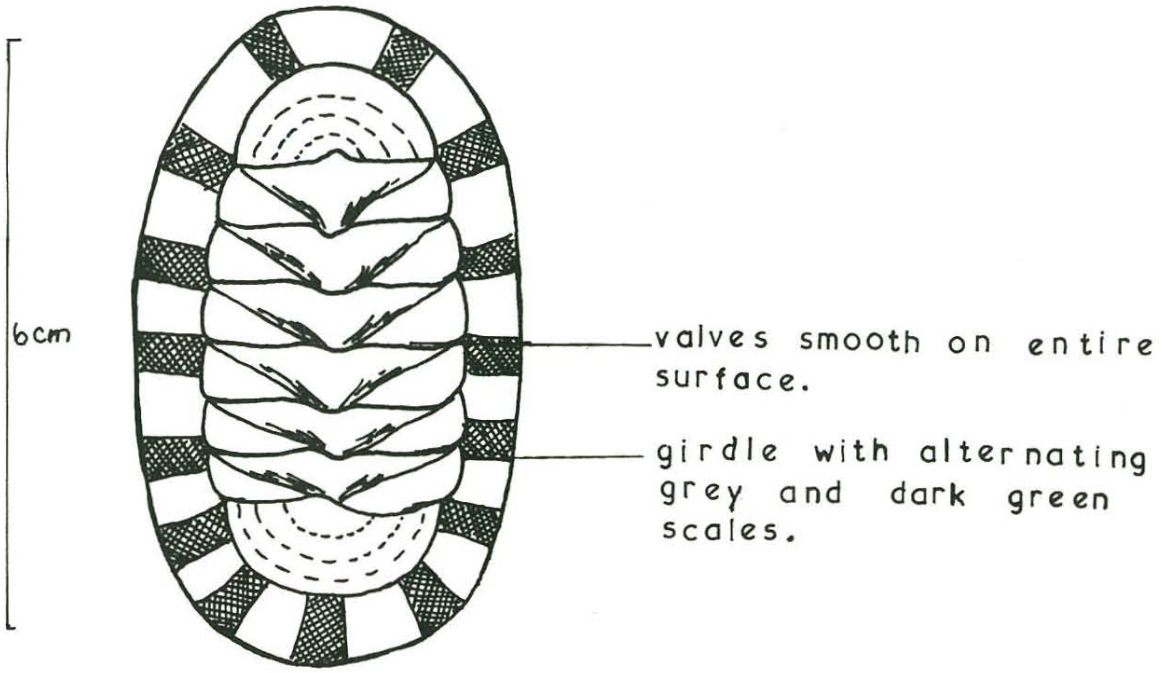
Length 3 — 4 cm. Colour, grey with blue-green mottling. Girdle is leathery and greenish brown in colour bearing numerous spines. The surface of the valves is roughly sculptured and frequently eroded or with dense algal growth. When alive, the animal's foot is bright orange in colour. This species is fairly common at Forest Point and is found in smaller numbers at Pt. Gourde and Barracuda Pt. It shows a preference for the more exposed rock faces subjected to intense wave action.

B. *Chiton marmoratus* Gmelin (Fig. 3)

Length 4 — 6 cm. Colour, dark brown or grey, with blotches on longitudinal lines of a lighter colour. The girdle consists of distinct alternating areas of dark green and white scales. The surface of the valves is smooth and devoid of algal growth. This helps to distinguish the species from *C. tuberculatus*. This species is very common at Barracuda Pt., and Forest Pt., where it was seen in large numbers. It also seems to prefer more exposed areas and was found far above the water level at low tide, but in areas splashed intermittently by the waves.

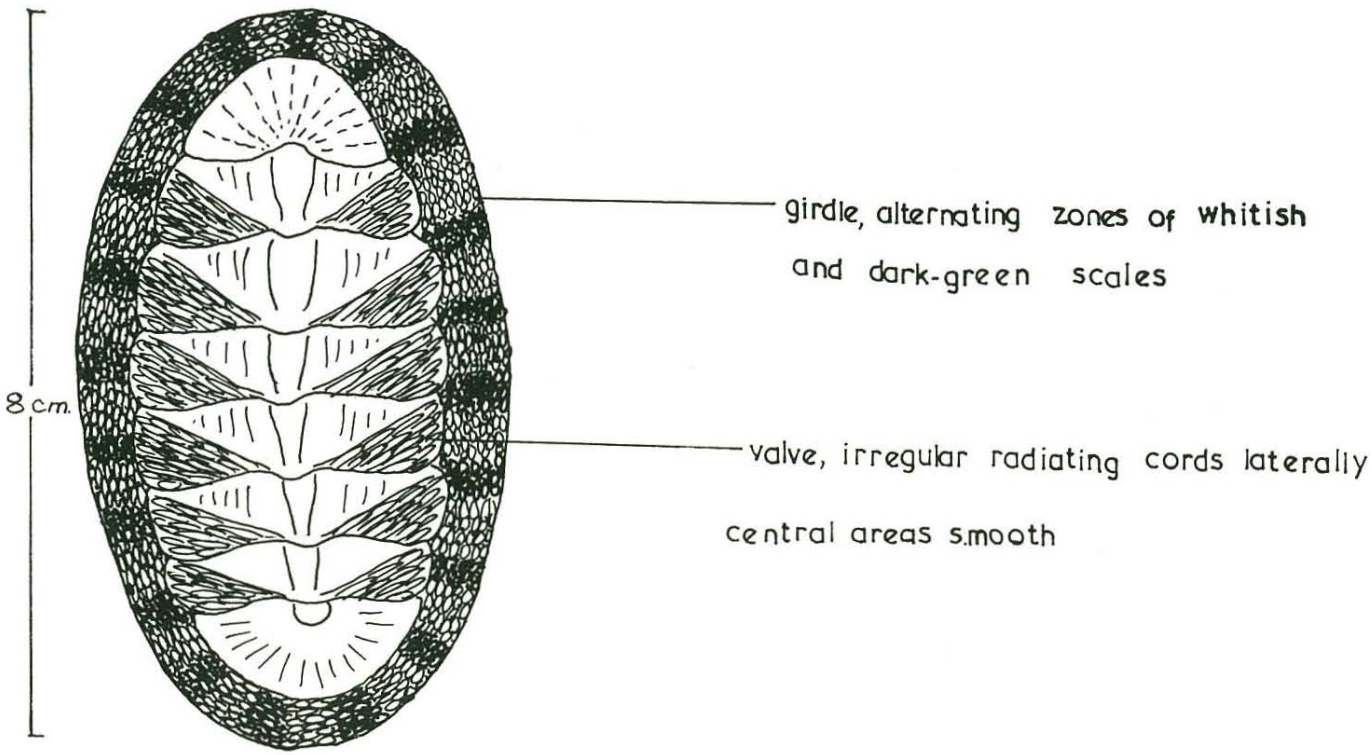
C. *Chiton tuberculatus* Linné (Fig. 4)

Length 6 — 8 cm. Colour, greyish green to dark brown. The girdle consists of alternating areas of dark green and whitish scales. The lateral area has about five irregular radiating cords. The central areas of the valves are smooth at the top, with wavy longitudinal ribs on the sides. This species can be distinguished from *C. marmoratus* by the ridge on the central area of the valves. The other specimens have eroded dorsal surfaces, usually covered with algae. This species is fairly common at Barracuda Point. It was usually found either in deep crevices in rocks which were exposed at low tide; or permanently submerged in rock pools. Its habitat preference is related to its low tolerance to desiccation and its photonegativity as compared with other species.



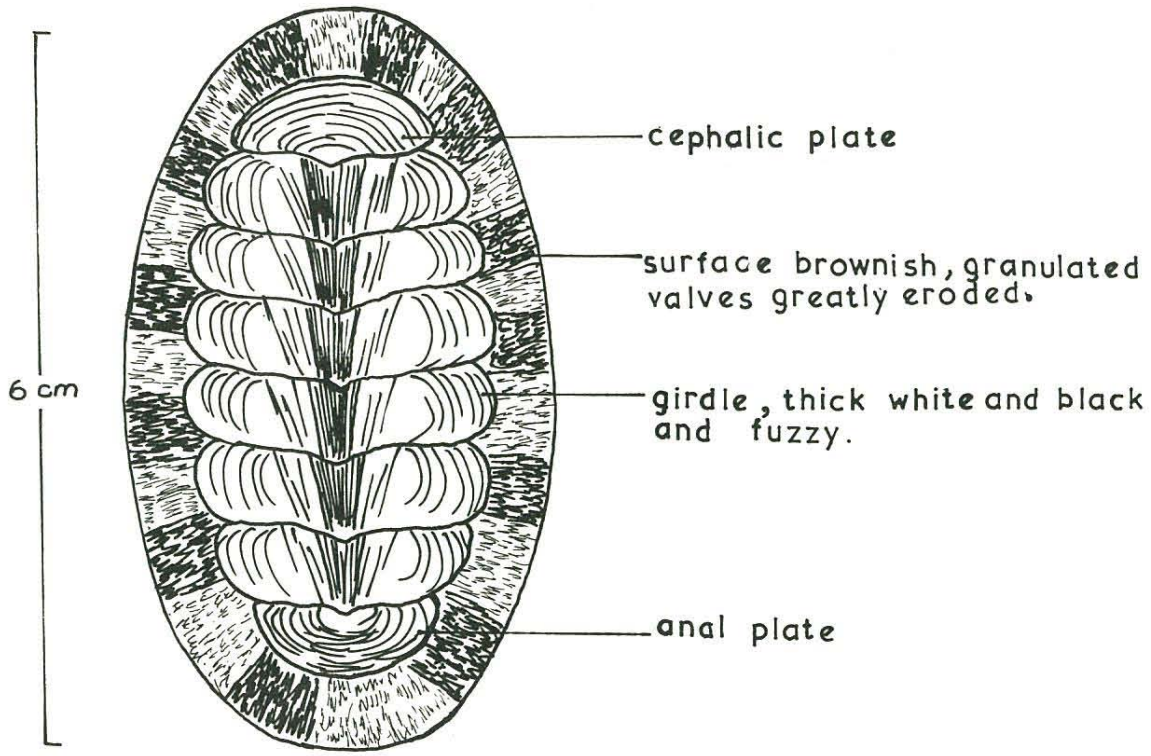
B. Chiton marmoratus.

FIG. 3



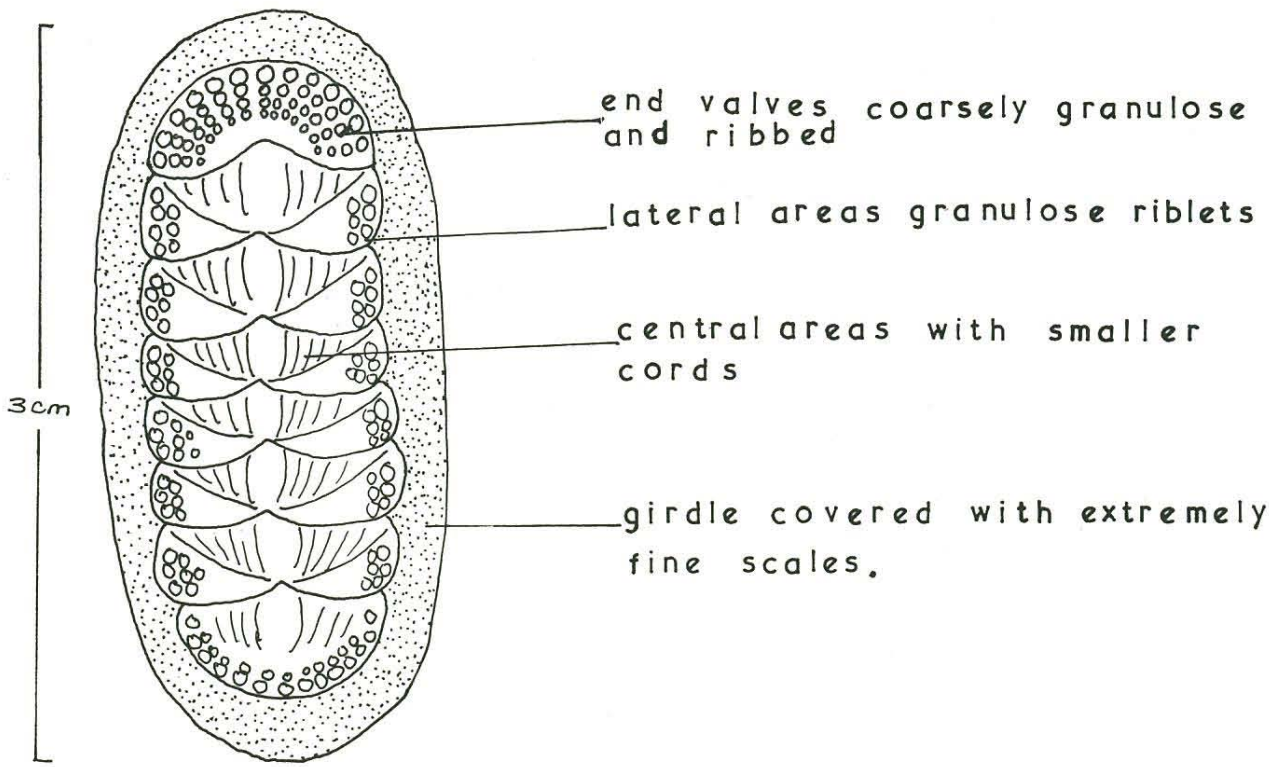
C. Chiton tuberculatus

FIG. 4



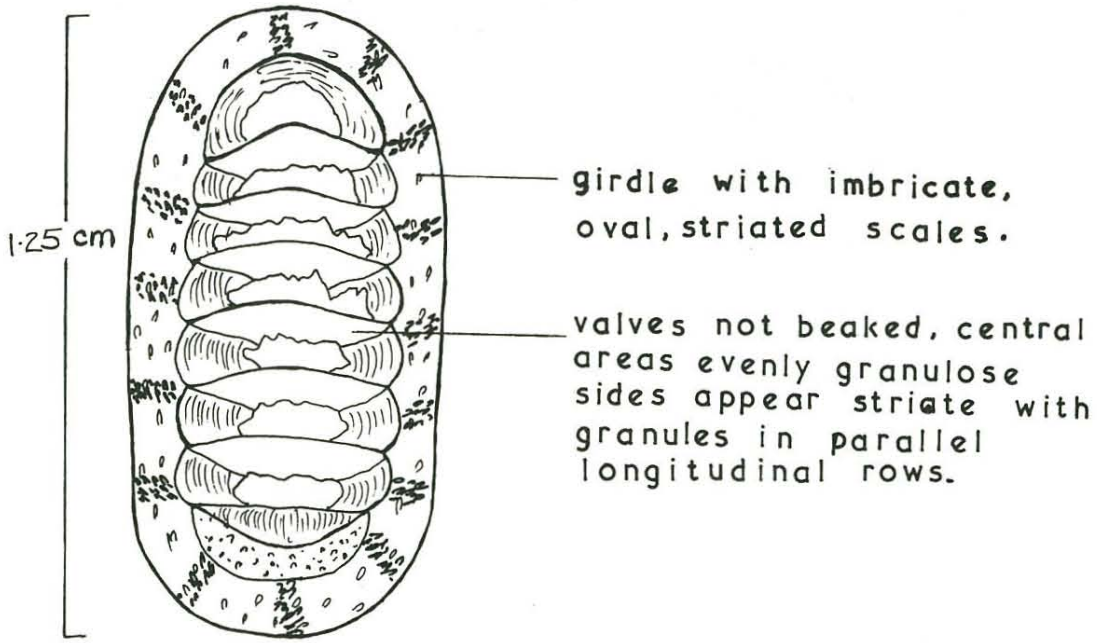
D. Acanthopleura granulata

FIG. 5



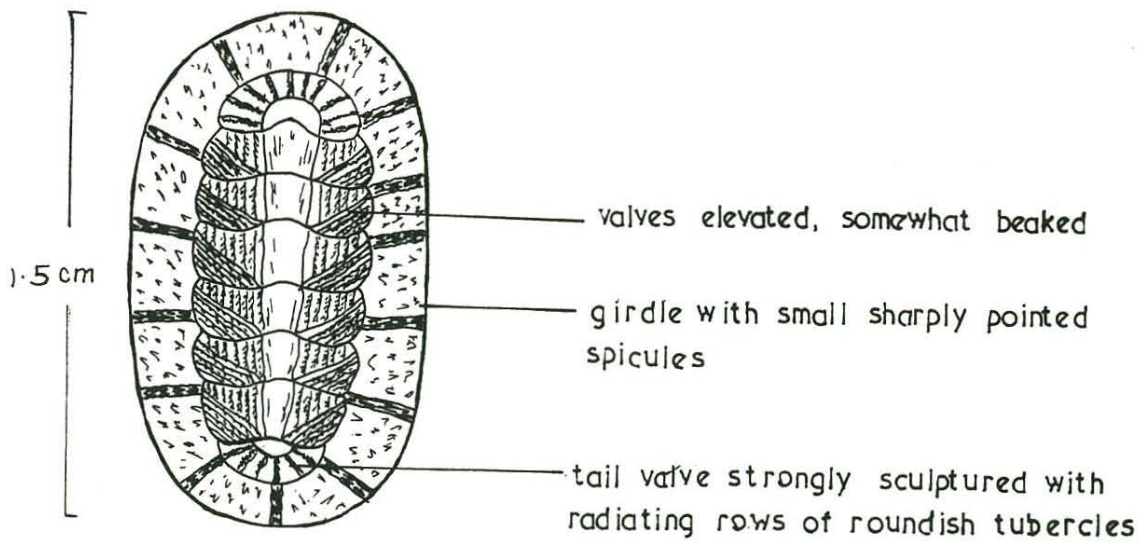
E. Ischnochiton pectinatus.

FIG. 6



F. Ischnochiton striolatus.

FIG. 7



G. Calloplax janeirensis.

FIG. 8

D. *Acanthopleura granulata* Gmelin (Fig. 5)

Length 4 — 6 cm. Colour, brownish green. This species is easily recognised by its thick, fuzzy girdle with alternating areas of black and greenish white. The surface of the valves is commonly eroded. This species is common at Salybia Reef, Pt. Gourde and Saut d'Eau. It was found deeply wedged in rock crevices and under ledges at higher levels on the shore.

E. *Ischnochiton pectinatus* Sowerby (Fig. 6)

Length 2 — 4 cm. The animal is narrow and elongate. Colour, mottled grey with black. The surface is granulose with longitudinal ridges on the central area. The cephalic valve has radiating granulose riblets. The girdle is covered with extremely fine scales among larger long flat scales which are irregularly scattered. This species was found at Salybia only, and may be common in coral

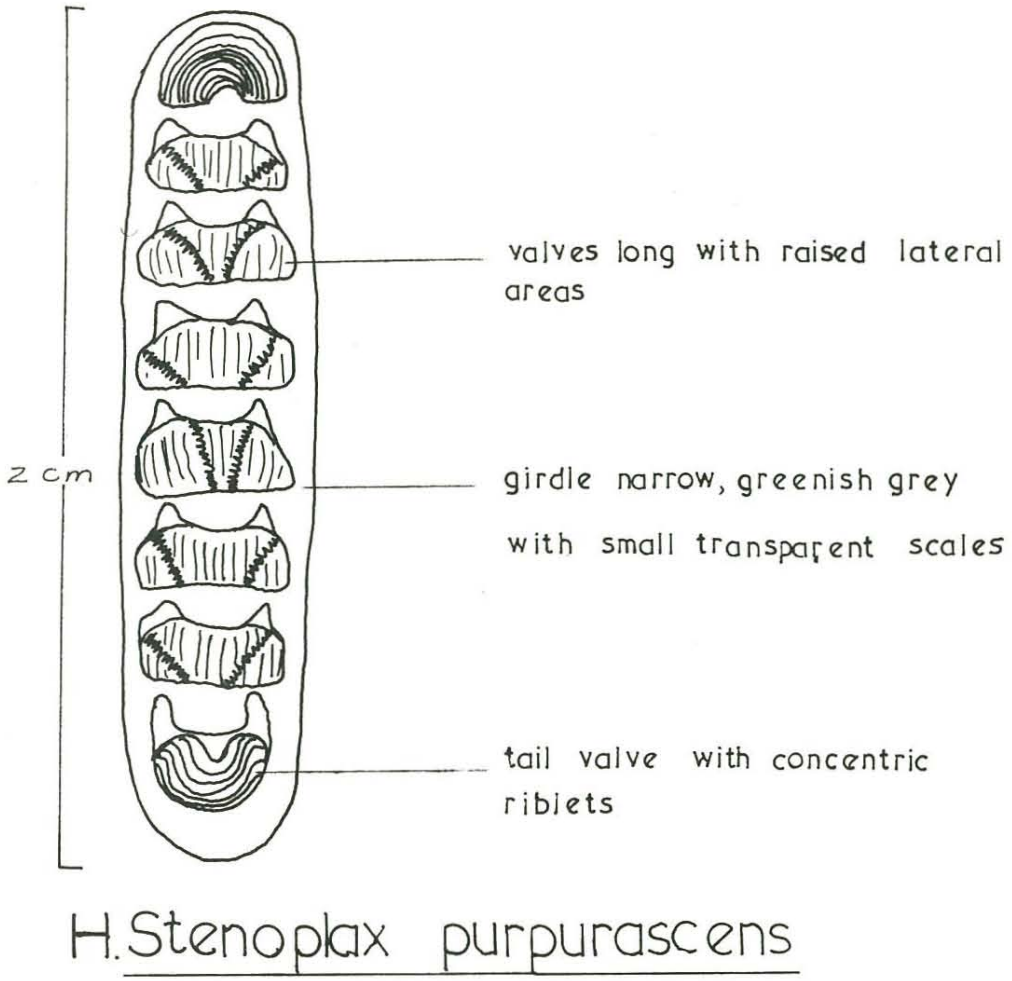


FIG. 9

reef areas. It was found attached to the under surface of boulders and stones.

F. *Ischnochiton striolatus* Gray Fig. 7

Length 0.5 — 1 cm. Colour, light orange to yellow brown. The animal is oblong to oval-shaped. The girdle is moderately wide, covered with scales, and is generally variegated with alternating light and dark patches. The central areas are evenly granulose. Before the diagonal ridge, the granules are arranged in parallel longitudinal rows, so that the lateral areas appear striated. Head and tail valves are sculptured with close shallow concentric grooves. This species also seems restricted to coral reefs and was found attached under boulders and stones.

G. *Calloplax janeirensis* Gray (Fig. 8)

Length 1 — 1.5 cm. Colour, grey to yellowish brown. The animal is elongate, oval and rather narrow. The girdle consists of strongly ribbed scales among which may be found sharply pointed spicules. The lateral areas of the valves are sculptured with large beaded ribs. The head valve and tail valve bear radiating rows of roundish tubercles. The central area of valve is ridged with the apex being elevated, smooth and rounded. This species is also relatively common in the coral reef area at Salybia, and found in habitats similar to *Ischnochiton pectinatus*, and *I. striolatus*.

H. *Stenoplax purpurascens* Adams (Fig. 9)

Length 1 — 2 cm. The animal is elongated and narrow, only slightly elevated. The girdle is greenish grey with small groups of dark scales among small transparent scales. Head and tail valves bear concentric riblets. The tail valve is large and slightly concave. Intermediate valves bear raised lateral areas. This species is uncommon but found under boulders at Salybia Reef.

GENERAL DISCUSSION

Of the eight species identified, the more common ones were *Chiton marmoratus*, *Chiton tuberculatus*, *Acanthopleura granulata*, and *Ceratozona squalida*. These were found in large numbers, but their presence was restricted to certain areas of the coast. *Chiton marmoratus* was found both at Barracuda Point and at Forest Point, and seemed to be the dominant species in these areas. *Chiton tuberculatus* was found in lesser numbers, only at Barracuda Point. *Acanthopleura granulata* dominated the rock faces at Point Gourde and Saut d'Eau, but was found in lesser numbers at Salybia reef. *Ceratozona squalida* was abundant both at Staubles Bay and at Forest Point.

The rare species were *Calloplax janeirensis*, *Stenoplax purpurascens*, *Ischnochiton striolatus*, and *Ischnochiton pectinatus*. Their presence was restricted to the coral reef area at Salybia reef, where they were found clinging to the undersurfaces of boulders and stones which were permanently submerged.

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Brief notes on birds

By *Richard ffrench* St. Peter's School, Pointe-a-Pierre

1. **What is the relationship between the Blue-gray Tanager and the Palm Tanager?**

These two species, the Blue-gray Tanager *Thraupis episcopus* and the Palm Tanager *T. palmarum*, are extremely common and well-known in suburban gardens and around human habitation. They are evidently closely related in form, voice and behaviour; but in appearance one is not likely to confuse them. The vivid blue of the wing coverts of the "Blue Jean" is a sight few naturalists would mistake. The duller "Palmiste" is generally olive green and has blackish outer wing feathers, contrasting with the pale yellowish green inner feathers, showing up as a pale wing-bar in flight.

Both species habitually feed at rotten bananas on my garden feeding-table. Often as many as ten individuals of the two species congregate there. Recently I have noticed one bird which resembles the Palmiste in general pattern, with the wing-bar and the blackish outer primaries. But it is distinctly *blue* in tinge, not olive green like the other Palmistes with which it associates. I am assuming that this individual is a hybrid, as such have been known to occur in the wild between the two species in Suriname (Haverschmidt). But for hybrids to occur in the wild an extremely close relationship must obtain. Could it be that we have here *one* species, in spite of the apparent morphological difference? It would be most interesting to follow up the life-history of a known hybrid, to see, for example, whether it was fertile.

Certainly the two species are ecologically close. Food, and breeding habits are almost identical. Their squeaky songs, too, are very similar; I certainly find it difficult to identify them correctly, though sometimes I can pick out the Palmiste's notes as shorter and more staccato. I believe also that the latter's toes have longer claws, which help to control movement on the slippery surfaces of palm leaves which they frequent.

There does seem to be enough evidence to support an investigation into the relationship of these two common species. Maybe someone at U.W.I. will attempt it one day.

2. **The success of the Mockingbird in Trinidad.**

The Tropical Mockingbird *Mimus gilvus* is a comparatively recent arrival in Trinidad; or at least it has spread remarkably since 1931 when apparently it was restricted to the St. Augustine area (R. Roberts). The bird evidently thrives in suburban gardens and near human habitation, for it is now one of the most abundant and successful species around Port of Spain, San Fernando and my own home at Pointe-a-Pierre.

One reason for its success may be its aggressive attitude towards other species; at the feeding table it usually drives away the other, mostly smaller, species. But it also seems to breed with remarkable success; possibly this too can be attributed to the zeal with which it defends its territory, nest and young.

In my garden a pair built a nest in a small mango tree in March 1980. The three eggs produced two flying young; by late May the pair had another clutch of eggs under incubation, and again two young successfully fledged. The main adult moulting process must have followed at this stage, during which few species breed. But by early October in the same year another three eggs had been laid. Although I cannot prove that the same pair used the nest, I have no reason to believe any change had taken place. Certainly if another mate had intervened there would have been no end of chasing and squabbling, possibly even ending in the death of one bird. But I saw none of this.

Thus the pair produced at least six young that successfully flew during one year. I doubt if this is an isolated instance; indeed similar cases have been reported before. Maybe the favourable environment of a housing estate provides protection from some predators (but not from cats or mongooses), also an assured food supply from fruit-bearing trees and well-cut lawns. A conservative estimate would grant to the Mockingbird an adult reproductive period of three or four years. Thus this pair of mine could reproduce themselves ten times over. No wonder the species is doing well!

3. **The recovery of Tobago forest birds from Hurricane Flora.**

It happened that I spent some time in Tobago's rain forest in the Pigeon Peak area in April 1963, some five months before Hurricane Flora struck the island and devastated the Main Ridge. Thus I was able to make suitable comparisons when I returned in January 1964 to examine the hurricane's effect on the bird life of the forest.

At that time destruction seemed comprehensive. On Pigeon Peak hardly a tree remained standing, and those that did were mutilated seemingly beyond recovery. It was difficult to walk on the ground, covered as it was with fallen tree trunks, already beginning after three months to be covered with vine creepers. The typical bird life of the Tobago rain forest was sadly depleted. I saw no Collared Trogons, Yellow-legged or White-necked Thrushes, no Plain Antvireos or Blue-backed Manakins. But perhaps the most disturbing disappearance was that of the White-tailed Sabrewing, a typically montane hummingbird not known in Trinidad. I wondered whether the species had been able to withstand the effects of the desiccating blast of the wind, which would have removed for a time all the blossom and other sources of nectar in the area.

A series of visits and studies carried out at intervals between 1964 and 1979 revealed a very gradual recovery of most of these species. Some, like the manakin, are equally at home in second growth, so did not take long to recover their numbers. The others remained rare for years. One problem was that the forest regenerated very slowly. On the top of the ridge new growth of

the most adaptable trees reached a height of ten metres within 15 years, but the isolated skeletons of partially stricken trees soaring ten metres higher bore eloquent witness of what the original forest had been. And nowhere could I find a sizeable patch of forest which had escaped the devastation of the hurricane.

It was not until 1974 that Sabrewing hummingbirds were seen again, and then in very small numbers, at one locality on the Main Ridge. But at least it proved that the species had survived. Over the last six years a few more individuals have been seen.

Then in April 1980 I was fortunate enough to accompany Todd Keeler-Wolf to one of his study sites on the Main Ridge, where he and his wife have been carrying out comparative ecological studies. Here at last I came across an almost untouched patch of rain-forest. In the deep ravines and valleys large trees growing to 30 metres could still be found; the undergrowth was comparatively sparse, with a mainly unbroken canopy above, as I had known 17 years earlier on Pigeon Peak. And here, appropriately, I found Sabrewings, Trogons, Antvireos and White-necked Thrushes, along with most of the other forest species. Todd, whose comprehensive survey will be published elsewhere in due course, said that this was the best patch of rain-forest he had located in a thorough search of Tobago.

The rest of the Tobago Main Ridge forest may take a long time to recover to the pre-1963 stage — 100 years was the estimate of some foresters — but at least an element of the original has remained. I hope it is allowed to survive.

The flowering behaviour of some Trinidad plants

By *V. C. Quesnel* 1 Palm Ave. East, Petit Valley, Trinidad

SINCE hummingbirds feed mainly on nectar, their distribution and abundance must bear some relation to the distribution and abundance of the plants at which they feed. Moreover, the flowering behaviour of the plants must influence the hummingbirds in some way. It was with the object of learning something about this interaction that this study was begun. As the work progressed, this aspect began to recede into the background and an understanding of flowering behaviour as an important part of each plant's life history came increasingly to the fore. In other words, the emphasis began to shift from the birds to the plants. This preliminary study has produced information that can be followed up in both directions, towards a fuller understanding of the plants on the one hand and towards the hummingbirds on the other hand.

METHODS

The plants selected for study were those native plants that had been recorded by Snow and Snow (1972) as being visited by hummingbirds, together with some others at which I had observed hummingbirds feeding at least once. Plants were listed down the left-hand margin of sheets of paper and the dates and places of observation were recorded along the top. Flowering behaviour was recorded opposite each plant on a simple 4-point scale in which a negative sign indicated no flowering and one to three plus signs indicated different degrees of flowering from slight to abundant. A zero sign was used to indicate that the plant had not been seen at that particular time and place. Observations were made on the monthly field trips of the club, on other occasions as opportunity presented and also on short trips made expressly for the purpose of the survey. Most of the sites were in the Northern Range. The period of observation was from January 1976 to December 1978 and from June 1979 to May 1980.

Difficulties in scoring soon became evident. Where plants were clustered together (e.g. *Heliconia psittacorum*)* the score tended to represent the number of flowering plants as a proportion of the total; where plants were encountered singly and only a few were seen on any one trip the scoring tended to reflect the extent of flowering *per plant* as well. No attempt was made to mark individual plants and to count flowers on them as this would have required far more time than was available for the project. Thus, the method is to a considerable extent subjective.

The results for the four years of observation were summarized on histograms. In constructing the histograms, if observations had been made on any one species more than once in any one month the highest level of flowering for that month was recorded. Thus, for the four years of the study the highest score that could be attained for any one month would be twelve plus signs i.e. 4 x 3.

* *See Appendix for common names.*

Nomenclature follows the Flora of Trinidad and Tobago although the names of some of the plants have been changed since publication. It differs from the nomenclature used by Snow and Snow (1972) as follows:

	Name used by Snow & Snow	Name used here
a) Change in specific epithet	*Heliconia bihai*	*H. wagneriana*
	Costus spiralis	*C. cylindricus*
	Erythrina corallodendrum	*E. pallida*
	Cephaelis muscosa	*C. tomentosa*
b) Specific epithet determined	*Justicia* sp.	*J. secunda*
	Heliconia sp.	*H.* aff. *tortuosa*
	Costus sp.	*C. niveo-purpureus*

The plant called *Cephaelis muscosa* by the Snows is stated to have red flowers and since *C. muscosa* has white flowers it is clearly mis-identified. I assume the correct identification to be *C. tomentosa* which has yellow flowers in a compact head subtented by two scarlet bracts. The complete identification of the partly identified plants is based principally on the fact that these three are all known to be common in the Arima Valley where the Snows worked.

RESULTS

At the start of the survey I did not know all the plants in the Snow's list but I optimistically thought I could get to know them. This hope was not realized for some I never saw and others I learned to recognize too late to be of value. Thus, several plants (including all the bromeliads) were eliminated from the survey. Other plants that I knew well were seen too infrequently for the records to be meaningful. Thus, the report is concerned with a total of 38 plants for which adequate records were obtained.

After one year it was apparent that some plants were always in flower and recording of their behaviour was discontinued then or after one further year. Though no systematic recording of their behaviour was continued, further casual observations support the original assessment of continuous flowering at a fairly constant level. Six plants are on this list: *Lisianthus chelonoides*, *Stachytarpheta jamaicensis*, *Asclepias curassavica*, *Lantana camara*, *Cordia curassavica* and *Isotoma longiflora*. The last-named, included in the study on the strength of one visit by the Copper-rumped Hummingbird, is probably not

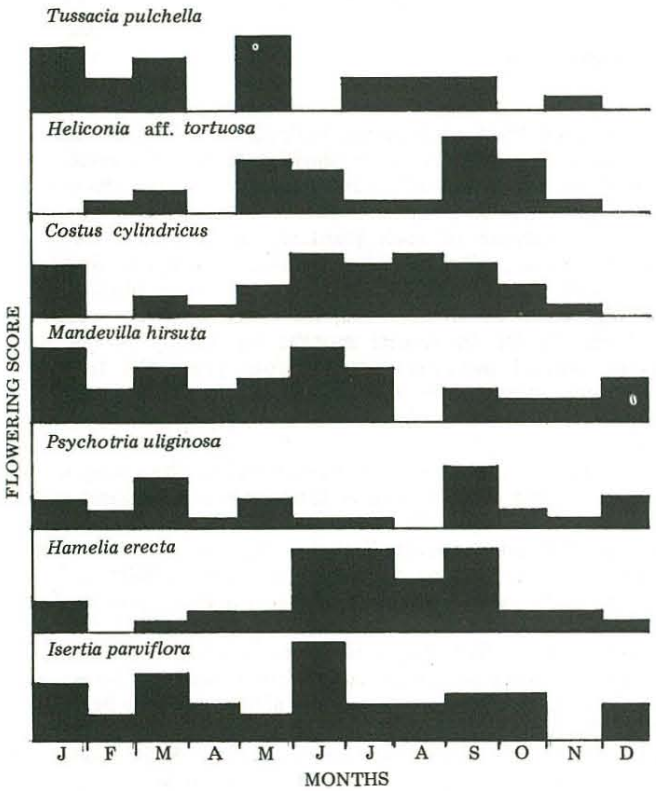


FIG.1. PLANTS that flowered year-round.

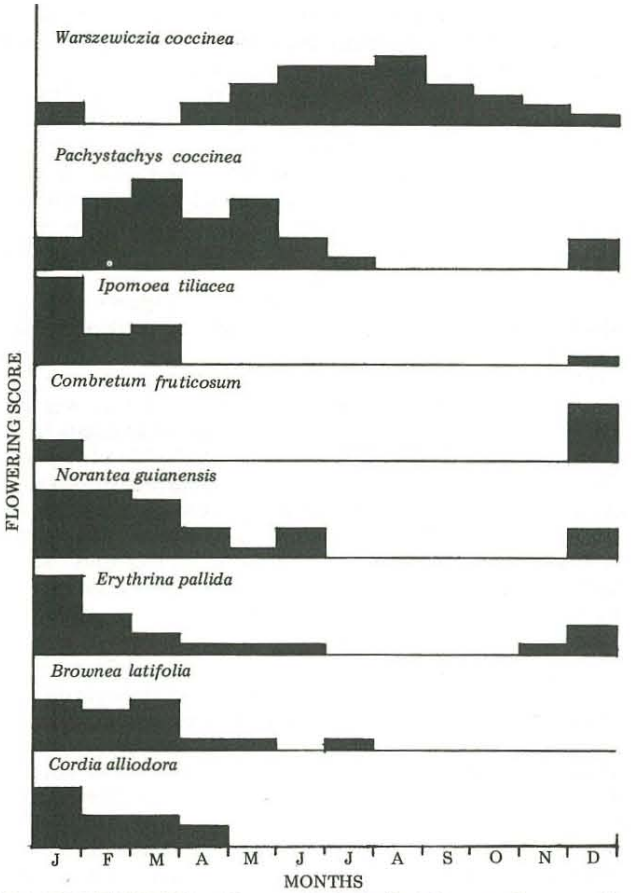


FIG. 2. FLOWERING patterns of plants that flowered seasonally.

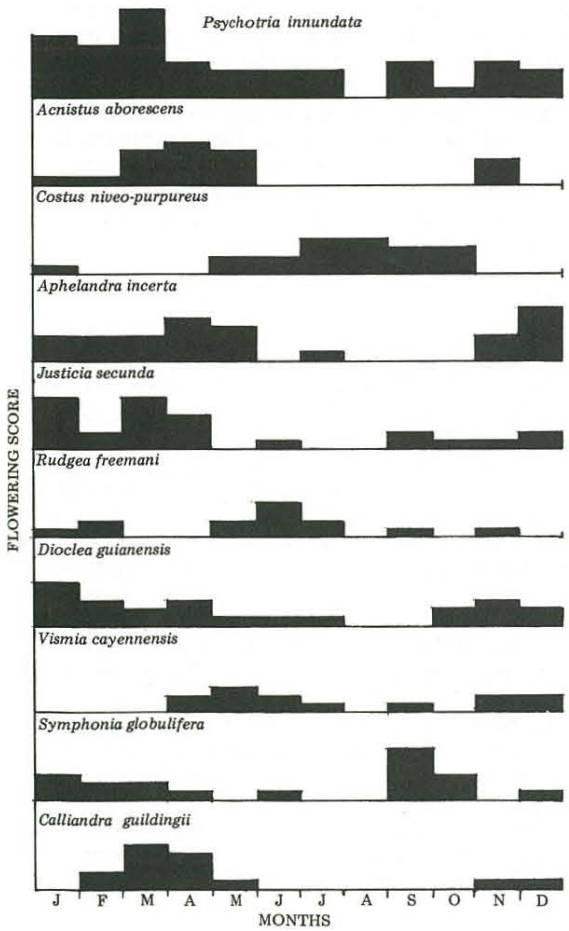


FIG. 3. FLOWERING behaviour of the plants that flowered neither seasonally nor year-round.

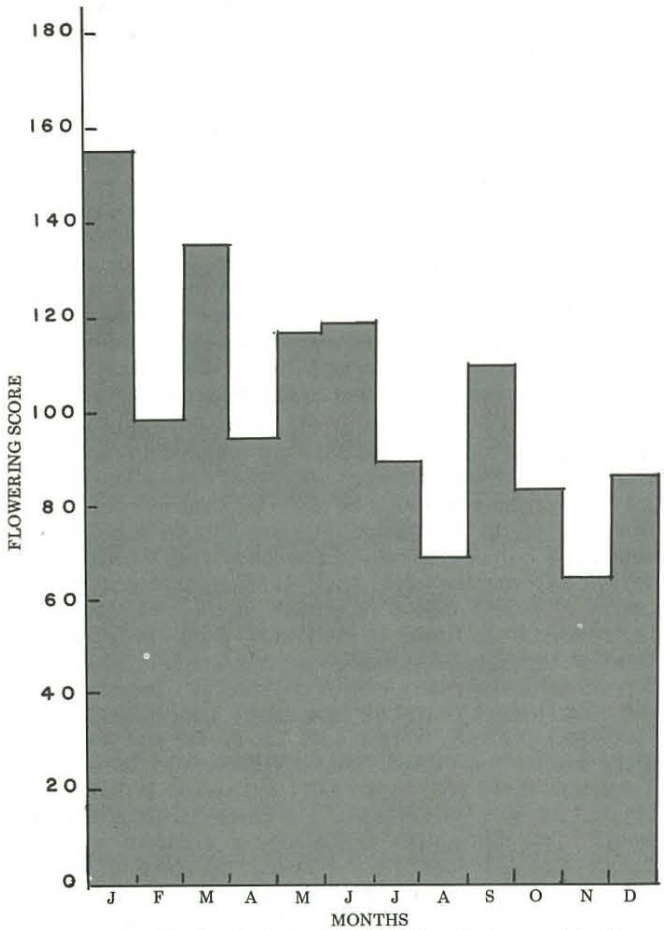


FIG. 4. FLOWERING behaviour of all the plants combined.

seen this behaviour in Trinidad it may well occur.

Pyrrhopyge phidias phidias Linnaeus 1758

The subspecies *phidias* is widespread in northern South America (Colombia to Suriname including northern Brazil). There are ten other subspecies ranging from southern Brazil to Mexico.

Although he himself had not seen it, Kaye included *P. phidias* in all his catalogues of the Trinidad butterflies on the basis of its inclusion by Crowfoot in the original list of Trinidad butterflies. Seitz describes *P. phidias* as having a large white basal patch on the underside of the hindwing, i.e., it is one of the *bixae* forms. No specimens of the *bixae* form are recorded from Trinidad, nor in view of the discussion on geographic variation above, are they likely to be. Accordingly, I suggest that although *P. phidias* occurs in Trinidad, the name used by Crowfoot and Kaye refers to a different species (or subspecies) which does not occur here. *P. phidias* and the next two species are in Kaye's catalogue under *P. charybdis* which does not in fact occur outside Brazil and Bolivia.

The ground colour of this species is a very dark blue-green. The cilia of both wings are white, changing to the ground colour at the apex. The head (excluding the collar and eyes) and the tip of the abdomen are bright red. There is a narrow fringe of white cilia behind the eye. Forewing length ♂:24mm.

This species appears to be widespread in Trinidad although not common. There are nine males and five females in the British Museum; I have two males from the summit of El Tucuche (June 1979); one male caught feeding on *Eupatorium* flowers in Parrylands oilfield (January 1980, J. Boos) and I have seen a male and a female from Morne Catherine (December 1976, S. Alston-Smith).

The males will sun themselves resting with their wings spread, the leading edges nearly making a straight line. On the summit of El Tucuche *P. phidias* and *P. thericles* flew together. The males seemed to be defending territories; whether the aggression was purely intra-specific or, more likely inter-specific, I could not tell owing to the great similarity of these two species.

The larvae of this species feed on *Vismia cayennensis* Pers (Hypericaceae). Initially, feeding in a small folded over-flap of leaf, as they grow the larvae change to a leaf roll in which they pupate. The mature larva is about 4cm long, it is red with a narrow, yellow transverse band across the middle of each segment. It is thickly hairy with short red hairs and longer white ones. The head is brown and hairy with narrow, dark, vertical lines anteriorly. The pupa is reddish brown with short red hairs which are absent from the elytra and appendage covers. A vertical stripe through the eye and the intersegmental areas of the abdomen are yellowish orange. It would be most interesting to know the life histories of the other similar species of *Pyrrhopyge*.

Pyrrhopyge proculus proculus Hopffer 1874

The subspecies *proculus* is found from Colombia to Guyana. There are four other subspecies in South America. Evans reports one male in the British Museum from Trinidad and it is the only record of which I am aware. This species can be distinguished from *P. phidias* and *P. thericles* since the termen of the hindwing is narrowly white before the cilia, whereas this white is absent from the other two species. Further captures are desirable to confirm this species as breeding in Trinidad.

Pyrrhopyge thericles ronda Evans 1953

This subspecies is endemic to Trinidad. Seven other subspecies occur in South America from Brazil northwards. All the records I have of this species are from hilltops of the Northern Range: El Tucuche (March, June 1979), Morne Catherine (August 1979) and Morne Bleu (January 1928, Sir Norman Lamont). Its behaviour and resting position are similar to those of *P. phidias*. To distinguish this species from *P. phidias* it is necessary to examine the underside of the head. As can be seen in Figure 3, two patches of red scales extend centrally down the neck in *P. thericles*, which are not present in *P. phidias*. This difference holds good for all the male Trinidad specimens I have examined. I have not seen the female of *P. thericles*, so do not know if this difference holds good in that sex.

Pyrrhopyge amyclas amyclas Cramer 1779

This species is incorrectly spelt as *P. amycles* by Kaye and Barcant. The subspecies *amyclas* is from Venezuela and the Guianas. There is one other subspecies, *denticulata* Herrich-Schaeffer 1869 which has a narrower yellow band and is found in Ecuador, Peru and the upper Amazons. The ground colour is a very dark brown, almost black. The underside of the forewing is narrowly yellow before the termen. There is a broad yellow band (expanding apically) at the termen of the hindwing on both the upper and underside. The head and tip of the abdomen are bright red. Forewing length ♂: 22mm.

Kaye records one specimen taken by Sir Norman Lamont at Bellevue (January 1915) but incorrectly gives the species range as Central America. I can record one capture (September 1979) and one sighting (February 1980) both on the edge of the Nariva Swamp. The capture was of a male feeding with its wings spread on *Cordia* (black sage) flowers.

Mysoria barcastus alta Evans 1951

The names previously used for this species are somewhat confused. In his 1914 list Kaye lists *M. venezuelae* Scudder saying it is "Not rare. St. Ann's Valley, behind Botanic Gardens; Ariapita Road (Several)". In the 1940s supplement Kaye adds *M. barcastus* Mabille & Boullet saying "It is very doubtful if this insect is distinct from *M. venezuelae*. The characters are not constant". Barcant omits *M. barcastus* from his list. It is now considered that *venezuelae* is a subspecies of *barcastus* found from Panama to the Guianas and Tobago. A different subspecies named *alta* is found in Trinidad which differs from *venezuelae* in being smaller and darker, owing to the cilia of the forewing being entirely dusky, and more or less darkened on the hindwings. Four other subspecies are found from Mexico to Argentina.

The wings are dark blue-green, giving way to iridescent dark green towards the bases. The cilia match the ground colour except for a short section on the termen of the hindwing, near the tornus. On the underside of the hindwing there is a red streak along the costa (more pronounced in the male) and a broad yellow band along the termen, narrowing to terminate at the tornus. The termen is narrowly white in the tornal half. The body has red spots at the base of the wings (underside), laterally on the abdomen, on the underside of the head and the collar. The tip of the abdomen is mauve above and red below. Forewing length ♂: 21mm; ♀: 25mm.

This species is widespread in Trinidad but seldom common. It can be taken feeding at flowers (e.g., avocado, *Eupatorium)* and rests either with its wings spread or with them above its head. On the Field Naturalists' trip to Moruga Bouffe (February 1980) the males were common in the Bouffe clearing.

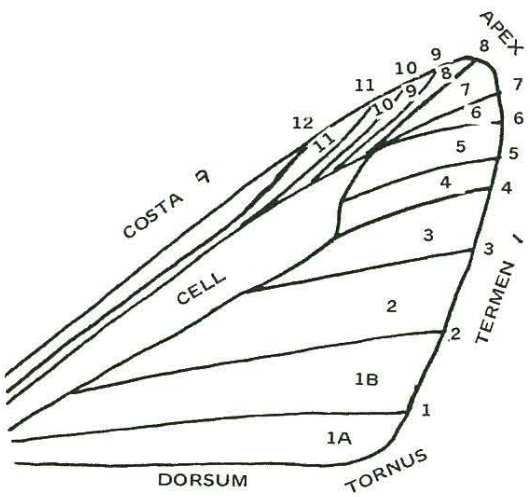
Moss (1949) records finding "half a dozen mauve larvae, rather hairy and prettily belted with lemon-yellow. They were feeding on small bushes of *Casearia minima* (Flacourtaceae) on waste ground". Likely host plants in Trinidad are Wild Coffee, *C. sylvestris* Sw., and Pipe Wood, *C. guianensis* (Aubl.) Vrb.

Myscelus amystis amystis Hewitson 1867

In Kaye's 1914 and 1928 catalogues the male of this species is given as *M. hages* Godman and Salvin while the female is described as a new species *M. rogersi* Kaye. In the 1940 supplement Kaye deletes *M. rogersi*, realizing his error; *hages* is a subspecies of *M. amystis* from Central America. The subspecies *amystis* is from Colombia, Venezuela and Trinidad. A further four subspecies of this species extend its range to Argentina.

Figure 1

Venation of *Pyrrhopyge phidias*. The numbering of the veins (around periphery) and the spaces (between veins) follows the system used by Evans (1951 et seq.). Forewing length 24 mm.



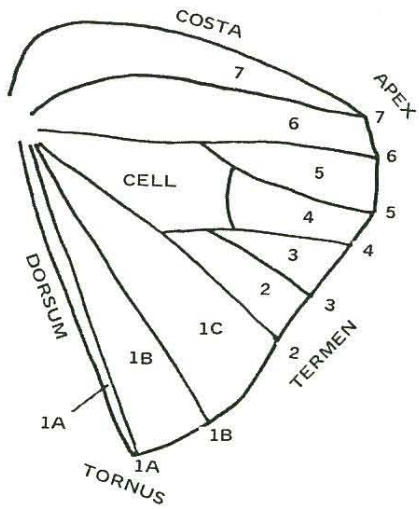


Figure 2 The claspers of skipper butterflies.

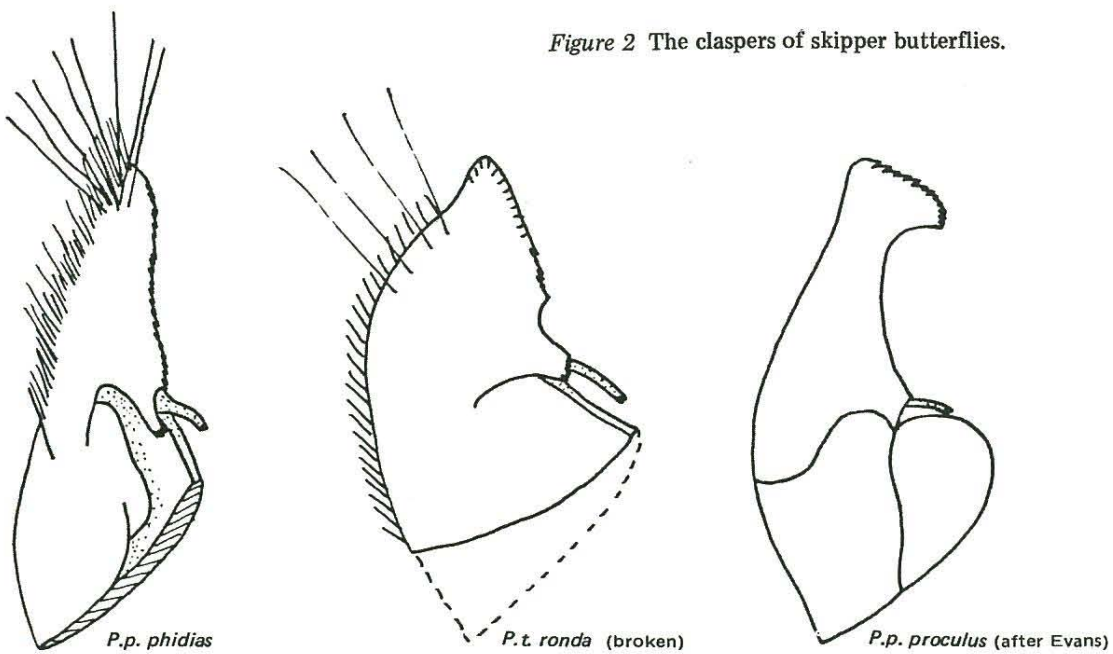
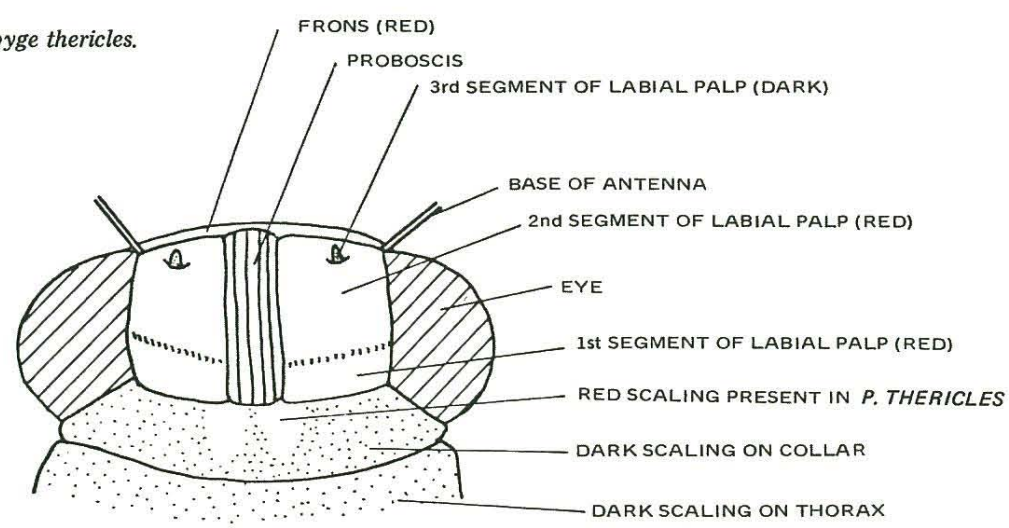


Figure 3 Head of *Pyrrhopyge thericles*.



The male above is yellow brown with black-edged hyaline spots on the forewing in spaces 1 — 9 and the cell. The veins, termen and costa are darkened. The hindwing has a hyaline spot in the cell and three dark bands of which only the outer is clearly defined. The veins, termen and costa are darkened. The cilia are dark at the veins and white in between. The underside ground colour is yellow, the veins are not darkened and the hindwing bands are clear. Forewing length ♂: 21mm.

The female is similar in general appearance to the male, but it is larger, the wings are more rounded and the ground colour is chestnut brown. The underside basally is yellow while the outer half is dull grey brown. Forewing length ♀: 25mm.

This species was thought to be restricted to the central southern part of Trinidad (west Moreau to Parrylands) where it is sometimes quite common; however, Scott Alston-Smith has recently taken a male at the Blue Basin falls, Diego Martin (March 1979).

A related species *M. pardalina guarea* Evans has been reared from *Guarea trichiliodes* L. (Meliaceae) by Moss (1949). The larva is "olive brown to greenish, ventrally pink with pinkish extremities and the head is warm brown, all being thinly adorned by long and very fine hairs . . .The pupa is dull brown and rather hairy." Redwood, *G. trichilioides* occurs in Trinidad, as does *G. glabra* Vahl. — both are possible food plants.

Aspitha aspitha parima Plotz 1886

Kaye, in the 1940 supplement, records one capture of this species (Morne Diable, January 1922, E.E. Fabian) under the name of *Yanguna rufescens* Riley; *rufescens* is now considered to be a subspecies of *A. aspitha* found in Brazil, while *parima* is also known from Suriname. There are no specimens of this species from Trinidad in the British Museum.

The ground colour is dark blue, almost black. There is a broad hyaline band on the forewing in the cell and spaces 2 and 1 (where it is narrower). The forewing cilia of space 1B are white, the remainder dark. The uppersurface hindwing has basal red markings in the cell and spaces 1B, IC and 2. The termen is jagged (not readily apparent in plate) and at least part of the cilia are white . The underside of the head and the forefemurs are conspicuously white. Forewing length ♂: 20mm.

I know of one recent capture of this species in Parrylands oilfield on *Eupatorium* flowers (January 1980, Julius Boos) where I also saw one a week later. This species would seem to be resident but rare in the south of Trinidad, and most easily caught at *Eupatorium* flowers. The larvae have been recorded as feeding on what may have been *Sapindus frutescens* Aubl. (Sapindaceae) in Brazil (Moss 1949). Moss records that "the larva is plentifully clothed with light pink hair on a deep maroon ground, including to bright crimson at the extremities. The head is ridged with curved lines and it is darker towards the mouth. The body is adorned laterally with six wedge-shaped marks of a very faint milky green hue on the central segments", (i.e., segments 5 — 10). *S. frutescens* does not occur in Trinidad, although the Soap berry or Soap tree, *S. saponaria* L. does and this may be the food plant here.

CHECKLIST PYRRHOPYGINAE OF TRINIDAD

1.+ *Pyrrhopyge phidias phidias* Linnaeus 1758
(=*P. charybdis* Hewitson; auct. Kaye partim)

2.* *P. proculus proculus* Hopffer 1874
(=*P. charybdis* Hewitson; auct. Kaye partim)

3. *P. thericles* Mabille 1871 *ronda* Evans 1951
(=*P. charybdis* Hewitson; auct. Kaye partim)

4. *P. amyclas amyclas* Cramer 1779
(=*P. amyles* Cramer; Kaye mis-spelling)

5. *Mysoria barcastus* Mabille & Boullet *alta* Evans
(=*M. venezuelae* Scudder; auct. Kaye)

6. *Myscelus amystis amystis* Hewitson 1867
(=*M. hages* Godman & Salvin; auct. Kaye)
(=*M. rogersi* Kaye)

7. *Aspitha aspitha* Hewitson 1866 *parima* Plotz 1886
(=*Yanguna rufescens* Riley; auct. Kaye)

Notes: species indented can be consided as synonyms from the Trinidad lists. auct. = as used by
partim = part of that species
* needs confirmation
+ since Hesperiidae are usually considered a separate superfamily, I start the numbering at 1 rather than continue from Barcant's list of the rest of the butterflies.

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