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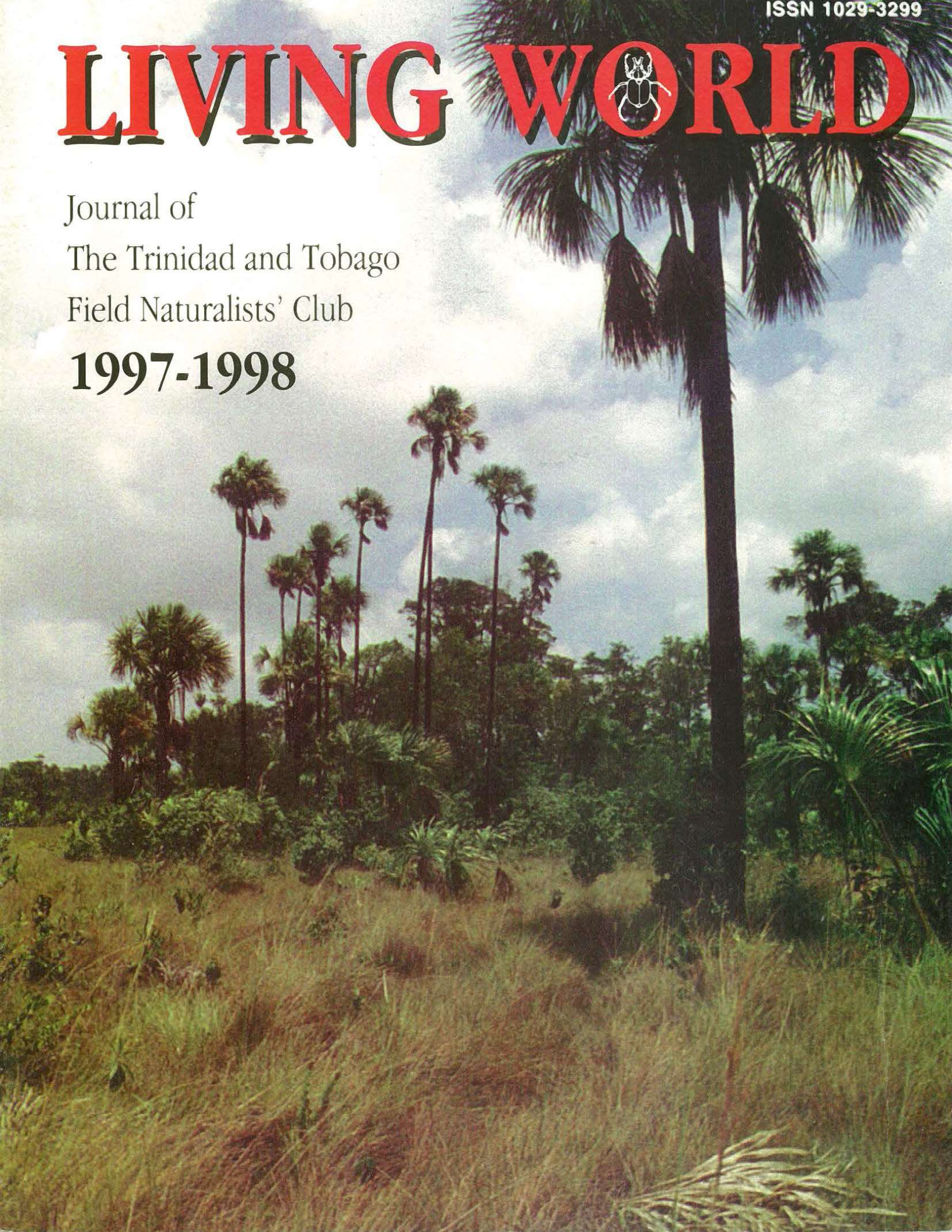

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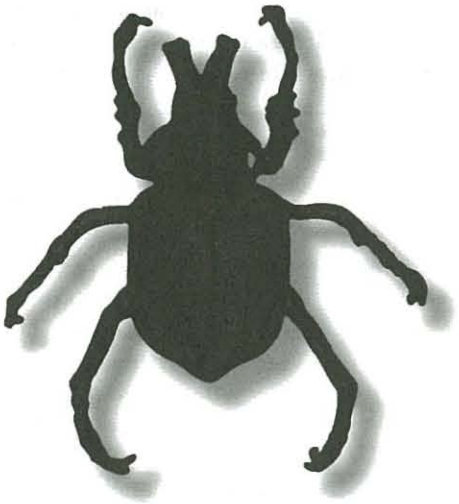

Natura Maxime Miranda in Minimis

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EDITORIAL

As new Editor of *Living World* I am conscious of the enormous effort the previous Editor, Dr. Victor Quesnel has put into the Journal in making it the success it has been over the years. He revived the journal in 1956 and was closely associated with the production of most of the issues published so far. There were other Editors of course, notably Richard ffrench and Peter Bacon, who kept the Journal going while maintaining high standards. The new Editor pledges to at least maintain the high standards set by previous Editors.

In this issue, we present a series of articles by Richard ffrench, one giving a brief history of ornithology in Trinidad and the others updating the status of certain bird species in Trinidad and Tobago. Ian Lambie and Vishnu Debie provided the data on bird counts for the years 1976 to 1981. Paul Comeau and C.C. Clubbe give an interesting account of savanna expansion following fires in the Aripo Savannas. An account on the food and feeding behaviour of the bat *Carollia perspicillata* is given by Victor Quesnel. Migratory patterns of butterflies are difficult to study, so we welcome the observations made by Dave Chadee on *Phoebis statira.* Matthew Cock continues with his series on the Hesperiidae butterflies. He describes a new species for Trinidad, *Clito trinidadensis.* He expects to complete the series of studies in our next issue and then begin a series of updates on these butterflies.

Our next issue, 1999 - 2000, might well be a special issue and it is hoped that we will have contributions from more members of the Club. Deadline for the next issue is December 1, 1998.

EST

THE TRINIDAD AND TOBAGO FIELD NATURALISTS' CLUB

The Trinidad and Tobago Field Naturalists' Club was founded on 10th July 1891. Its name was incorporated by an Act of Parliament (Act No.17 of 1991). The objects of the Club are to bring together persons interested in the study of natural history, the diffusion of knowledge thereof and the conservation of nature.

Monthly lecture meetings are held at St. Mary's College, on the second Thursday of every month, while field excursions are held on the last Sunday of every month except December.

Membership is open to all persons of at least fifteen years of age, who subscribe to the objects of the Club.
All enquiries concerning the Club or its Journal should be addressed to the Honorary Secretary, P.O. Box 642, Port of Spain, Republic of Trinidad and Tobago
email: *ttfnc@wow.net*

Cover Photo: Marginal vegetation at Aripo Savanna V. (See P.23) Photo by Paul Comeau

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A REVIEW OF THE ORNITHOLOGY OF TRINIDAD AND TOBAGO 1950-1985

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Introduction

In presenting this historical review of the progress of ornithology on Trinidad and Tobago over a 35-year period, I am conscious that I may have omitted mention of work unknown to me, or which I have been unable to remember. If so, I apologise to those concerned. Nevertheless, I was resident on Trinidad for nearly 30 of those years and actively involved in ornithology, so I met, corresponded or worked with the majority of those mentioned below. I hope I have done them justice.

The Fifties

In common with most neotropical countries at the mid-century, Trinidad and Tobago could produce little evidence of ornithological activity up to 1950 other than the work of collectors. Even the extraordinarily detailed and valuable work of Belcher and Smooker (1934-1937) was based solely on their collection of nests and eggs. The age of the collector was indeed not quite over, since sizeable collections of bird specimens were made on Trinidad and Tobago during 1950-1951 by A. Rasool and R. Plowden-Wardlaw for the Yale Peabody Museum in Massachusetts, and by G. F. Mees in 1953-54 for the Leiden Museum in Holland. During this decade a considerable number of bird skins were also obtained by Wilbur Downs and Thomas Aitken in the course of their work at the Trinidad Regional Virus Laboratory (TRVL), and deposited in the collection now held by the Caribbean Epidemiology Centre (CAREC) in Port of Spain. This should form the basis of a national collection, if such a project is ever contemplated.

Apart from Leotaud's work of 1866, written in French and now virtually unobtainable, there was up to 1950 no descriptive account of the birds of Trinidad and Tobago. James Bond's monumental study of West Indian birds, begun in the 1920s, pointedly drew a line between the Antilles and Tobago, in acknowledgement of the fact that the avifauna of Trinidad and Tobago were basically continental in nature, rather than oceanic, and his 1936 book omitted the birds of these islands. Thus anyone living in or visiting Trinidad to study birds could identify species only by using books on the birds of British Guiana, now Guyana, the Antilles, Panama, Mexico or even the U.S.A.; or alternatively, by relying on museum collections most of which were to be found in the metropolitan countries of the north. Naturally, this restriction tended to deter residents of Trinidad and Tobago from taking an interest in ornithology, for the basis of most studies depends on identification.

The first book to attempt to remedy this situation was produced locally in 1950, not by an ornithologist but by an elderly Catholic priest, Father Raymund Devas, who lived in Grenada. It contained virtually no illustrations, was very short and fairly inaccurate, but it did contain an almost complete list of species and it was a start. A similar attempt to enlighten interested visitors was made by Mrs. K. Alford with notes on birds in a Tobago guide-book at about this time. Popular articles illustrated by photographs and very inadequate paintings appeared in oil company magazines written by Johnson (1956-57) and Saunders (1956, 1957), and these may have helped to arouse the latent interest in birds among the people of Trinidad and Tobago. Two individuals, R.E. Johnson (1937) and E. Chenery, had indeed studied local birds since the 1930s, but there was little published work. The revival of the Trinidad and Tobago Field Naturalists' Club fortunately led to publication of a Club journal at varying intervals from 1956 up to 1965, and every two years after that. This led to early contributions on birds from Chenery (1956) on nesting toucans, and by Quesnel (1956) on the density of Great Kiskadees in Port of Spain.

It is perhaps not surprising, therefore, to find that the major contributions to ornithological science at this time emanated from expatriates, mainly British, for Trinidad and Tobago was then still a colony, or North American. First to appear was a useful volume by Junge and Mees (1958) giving an account of the taxonomic work arising from the latter's collections five years earlier. Brief descriptions of all species were included, but there were no illustrations. Next came a book from Geoffrey Herklots, principal of The Imperial College of Tropical Agriculture (ICTA) which preceded The University of the West Indies (U.W.I.) at St Augustine. Dr. Herklots was a British plant physiologist with an interest also in birds and painting. He attempted to fill the need for an illustrated field guide of local birds, but unfortunately the work (1961) was not a success. The descriptions were far too lengthy and detailed, being clearly based on specimens in the hand, and so were in many cases useless for field work; worse still, the author's own paintings were too often grotesque and inaccurate, usually depicting only the anterior half of the bird, and were well below the standard by now to be expected in an international market. Herklots' field experience also was far too limited to enable him to provide adequate treatment for the majority of the species accounts.

Probably the most significant development for local ornithology during this decade came about from the decision

of the famous American naturalist and explorer William Beebe to set up a tropical field research station for the New York Zoological Society at his property, "Simla", in the Arima Valley. Founded in 1950, it was to last over twenty years, and served mainly to attract researchers to study tropical biology in a setting that benefited from convenient access and modern facilities rarely available to field workers elsewhere in the neotropics at that time. Although Dr. Beebe was already of advanced years and produced little significant work himself at Simla, his paper on the ecology of the Arima Valley (1952) provided a useful base for future research.

A few years later, Beebe's far-sightedness was rewarded when Simla, and its neighbouring estate of St. Pat's, became the base for research conducted over five years by David and Barbara Snow, professional ornithologists from Britain, who soon became, along with Alexander Skutch in Costa Rica, some of the most outstanding personalities in the world of neotropical field ornithology. One of the great benefits of the Snows' situation was that, unlike the majority of visiting expatriate researchers, they were able to work over a lengthy and continuous period, and thus achieve an indepth understanding of the ecology and other biological aspects of the area. The principal subjects of their studies were the lek-forming manakins (1962a, 1962c, 1963, 1971), bellbirds (1970) and hummingbirds (1972, 1973, 1974) as well as the oilbird (1961, 1962), certain swifts (1962b) and thrushes (1963b); arising from the above came continued work on the significance of fruit-eating in tropical birds and its connection with the evolution of lek behaviour (1962a, 1962c). The Snows' work also embraced many other branches of ornithology, and provided extremely valuable primary data, meticulously collected, on breeding seasons (1963a, 1964, 1973, 1974), social organization (1971, 1973), feeding niches (1972) and ecology (1971), longevity (1974), and the general biology of species (1963a, 1964, 1985). To further their ecological studies they also collected plant material widely for identificafion purposes, since literature on neotropical plants was then as sparse as that on birds. Although the Snows' residence on Trinidad ended in 1961,their association with neotropical ornithology has endured for more than three decades to the present time, by many visits to continental countries. I myself benefited greatly from the Snows' generous sharing of primary data to assist my own studies, as well as through stimulating companionship in the field. For a young ornithologist starting out in the neotropics, the opportunity to learn as a kind of apprentice from such experts was a wonderful stroke of luck.

The Sixties

Since we were all disappointed by the inadequacy of Herklot's book, it is not surprising that in the early 1960s the Snows and I began to talk about a joint project to produce a publication worthy of the extraordinary avifauna of this country. To begin with, this consisted mainly of amassing data on the general biology of species, and the understanding was that I would concentrate my efforts on lowland areas, swamps and coasts, while the Snows would deal with hill forests.

Meanwhile, there had been brief visits to Trinidad and Tobago by scientists with specific interests, which resulted in publications in the international scientific press; these included Darnton (1958) on manakins, Gilliard (1958) on birds-of-paradise in Tobago, Tashian (1957) on oropendolas, and Gross (1958) on the sleeping habits of Bananaquits. During the 1960s the Simla station facilitated important research by Collins (1968-1974), mainly on various swifts, Lill (1974) on evolutionary aspects of manakin courting behaviour, and Drury (1962), on oropendola nestbuilding. Independent research led to the publication of papers by other workers, such as Lanyon (1963), on the obscure *Myiarchus* flycatchers, Gochfeld (1972,1973) on marshland and unusual species, and Nottebohm (1969), on parrot learning behaviour.

On the more popular front, two important books appeated which certainly put Trinidad and Tobago into the limelight to some extent. These were the work of Jan Lindblad, the Swedish naturalist and photographer, on the scarlet ibis in Caroni Swamp (1969), and Brooke Worth (1967), a scientist working with Wilbur Downs at the TRVL, whose perceptive and amusing book on his adventures in Trinidad is a classic of its kind.

One interesting development followed the destruction of Tobago's forests in 1963 by Hurricane Flora. Perhaps typically, the government of the day was less interested in the almost total extinction of several hill forest species there, including the White-tailed Sabrewing, than in the effect on the islands tourist trade of the similarly near annihilation of the introduced Greater Bird-of-Paradise on Little Tobago Island. Sensing an opportunity, I and some others were able to bring about the establishment on Little Tobago, for one year, of a graduate researcher from Wisconsin, Jim Dinsmore, whose work (1967-1972) not only dealt with the ecology of the island, and its doubtful suitability as a haven for birds-of-paradise, but also included the first comprehensive account of the main seabird islands off north-east Tobago.

During the 1960s I had not been idle. Following the precepts and example of the Snows, my wife and I began as early as 1958 to catch and band a variety of species, with particular emphasis on the Dickcissel (1967a), whose erratic winter irruptions into south Trinidad reached a peak at this time. We worked also on migrant shorebirds, which conveniently roosted and fed in great numbers on Pointe-a-Pierre mud-flats near our home, in the days before the oil company reclaimed that land for a tank farm, and on the scarlet ibis (1970), which still nested in Caroni Swamp up to 1969. We also paid a number of visits to offshore islands, principally Soldado Rock, where we banded and studied Sooty Terns and Brown Noddies (1989, 1991a), and the various Bocas islands in the course of Field Naturalists' Club expeditions (1965, 1967b, 1969).

In 1965 I finally began work on actually writing my guide to local birds. David Snow, who left the country in 1961, had decided he was too busy elsewhere to participate, but gave much-valued help. I was also fortunate enough to acquire the cooperation of Don Eckelberry and John 0'Neill,

two of the foremost bird artists in the U.S.A., and, crucially, financial backing for the publication from a friend. I must mention here that at no time did I aspire to write a field guide which exists principally or even solely to enable identification. Birds are far too interesting, indeed fascinating, to be relegated to the level of names or numbers to be collected by those with nothing better to do. Thus I determined to include and present in summary form all the information I could glean on the 400 odd species known to occur on Trinidad and Tobago. It took me eight years to complete (1973), and a further 18 years to update (1991b). Of course we had been collecting a wide variety of data for ten years before I began writing the text and this has continued right up to the present. The emphasis was on life history material, such as vocalisations, food, breeding and other behaviour. From the outset I aimed to provide a reference book which could be useful for residents and visitors on Trinidad and Tobago, but which would also provide a basis for field workers in neighbouring countries. Thus I included a wide-ranging bibliography of some 330 titles, which I had consulted in the course of my compilation. I believe it was all this information, collated for the first time in a general study of the birds of a neotropical country, which gave my book its main value.

Although it had always surprised me that few members of the Field Naturalists' Club had taken much interest in bird study, there had nevertheless been plenty of interest in other branches of natural history, and particularly in the conservation of wildlife. This latter concept was probably the principal motivator in the establishment in 1967 of the Asa Wright Nature Centre, the first of its kind in the neotropics, which was based largely on the initiative of Don Eckelberty, the American artist, who spear-headed the efforts to set it up. Shortly after this, the New York Zoological Society decided after the death of William Beebe to give up its field station, and the property was eventually taken over to be run on a limited budget by the Nature Centre. Thus the facilities remained in place to enable important work to be done there during the 1970s and beyond. By this time the University of the West Indies had established itself securely in various campuses, and support there had been available for visiting or resident field workers in ornithology.

The Seventies and early Eighties

Valuable work was done over a lengthy time by a team from Florida, led by Peter Feinsinger, mainly on the subject of the ecological relationships of hummingbirds and flowering plants (1978, 1982); also by the Wileys (1980) and Manolis (1982) on the breeding strategies of certain icterids, by Morris (1984) on breeding seabirds on Little Tobago, and by Williams and others on bird migration that had been monitored on radar (1977). One of the most useful pieces of research, from my personal point of view, was carried out by Keeler-Wolf (1982) on comparative avian ecology in the hill forests of Trinidad and Tobago, particularly as it related to the recovery of Tobago's hill forest after 1963.

I had followed up my more general work by concentrating on more specific topics, such as the life history of the pearl kite (1982), the bird-life of an abandoned estate at Grafton, Tobago (1978), and on a more sustained attempt to bring an interest in history into the lives of the wider public of Trinidad and Tobago through magazine and newspaper articles, and eventually a less costly illustrated booklet on the commoner birds of the country (1986).

Moving into the eighties, we find continuing work on migrant seabirds by a Canadian team led by Blokpoel and Morris (1982, 1984), a useful but far too brief study of the impact of chachalacas on crop predation in Tobago by Diamond (1983), and some interesting comparative work by Wunderle on the avifaunas of Tobago and Grenada (1985). In the later years of the decade, work was forthcoming on rare or threatened species such as the piping-guan, scarlet ibis and other wetland species, but I am reaching beyond the scope of this study.

It cannot have escaped notice that little ornithological research was produced during the period under review by native-born residents of Trinidad and Tobago. Exceptions to this rule include some members of the Trinidad and Tobago Field Naturalists' Club, such as Elisha Tikasingh and Clyde Crichlow; but no one in that Club would need to be reminded that one principal contributor, especially in latter days, has been that all-round naturalist of the "old school", Victor Quesnel, who followed up his original work from 1956 on the Kiskadee by articles on hummingbirds (1977), nightjars (1985), and in a hilarious if controversial work on the song of the peppershrike (1987).

I said earlier that William Beebe in his establishment of Simla laid down an important foundation; so I return finally to the Arima valley, and to the other highly successful venture of the Asa Wright Nature Centre, which has drawn onithological pilgrims from all parts of the world. This has led to a valuable tourist asset, and has contributed towards the awakening of an awareness, through education and publicity, of wildlife and especially birdlife in this country. In the ten years since I found myself unfortunately constrained to leave my residence of 30 years in the West Indies, I have seen the continued expansion of this process, not only at the Centre, but also in other areas of both islands, and into valuable and praiseworthy efforts by a number of individuals and organizations in the fields of eco-tourism, photography, publication and research. It is my hope that the latter field will now begin to be developed even more widely.

I am proud to have been part of the development of ornithology in Trinidad and Tobago over the last 40 years. I have made many fine friends and acquaintances during that time, and I would like to express my very sincere appreciation for all that they have done with me along the way.

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DOUBTFUL ORIGIN IN SOME BIRD SPECIES RECORDED FROM TRINIDAD & TOBAGO

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Introduction

The science of ornithology operates within certain recognised parameters. All wild species in a particular area are accorded individual status, such as resident, migrant visitor, vagrant, etc. But any species whose origins are suspected to be artificial, e.g. as a result of introduction or the product of captive breeding, usually is treated on a different level from truly wild birds in any study of the area's ornithology.

It is therefore valuable from time to time to examine as critically as possible the status of any species that might reasonably be suspected of dubious origin, so as to prevent these suspicions from being clouded and eventually forgotten with the passing of time. In most cases introduced species do not survive for long, because of ecological constraints or competition with indigenous species; but there are a few examples where such species have been successfully naturalized, so that they have now established sizeable populations that are likely to remain so. These include the House Sparrow *Passer domesticus* and the Common Starling *Sturnus vulgaris* in North America, and the Canada Goose *Branta canadensis* and the Ruddy Duck *Oxyura jamaicensis* in Britain (though the latter's position in Europe has recently come under threat from conservationists.

We should not be surprised that in nearly every case of successful naturalization serious objections have arisen, as negative impacts on the natural environment come to be recognised. Among the disadvantages are the effects of competition eliminating indigenous species, the over-abundance of the newcomer arising from the lack of natural predators, and the detrimental results suffered by farmers and others when crops, gardens, parks and even buildings are damaged by these birds.

The following account deals separately with more than 30 species that have occurred on Trinidad or Tobago over the last 50 years. The great majority are species known to be kept in captivity by aviculturists, zoos, or just as pets. Sometimes individuals escape, others are deliberately freed, and in a small number of cases this has led to the establishment of a viable feral population, breeding in the wild, but sometimes dependent to a varying extent on humans for survival. Obviously, without a considerable effort it would be impossible to be absolutely certain that a particular individual bird originated from an artificial background; but sometimes such a bird betrays its origins by such signs as unusual tameness or plumage that has faded in captivity or become abraded by contact with its cage. In other cases we can only surmise, taking into account aspects such as the distance from the bird's natural range, its normal tendency towards vagrancy or not, along with other known examples within the species, and any evidence relating to local captive collections.

Some groups of birds are often kept in captivity, so naturally they form the largest proportion of the following list. They include waterfowl, the parrots and the seed-eaters. Apart from well-known collections of such birds at the Emperor Valley Zoo in Port of Spain and at the Pointe-a-Pierre Wildfowl Trust, a large number of birds are kept in captivity (but rarely encouraged to breed) by individual enthusiasts on Trinidad and Tobago. Currently there exists no mechanism by which birds that escape, or are released into the wild, from the above sources are identified as such, and it seems unlikely that this situation will change. All the more need, therefore, for the ornithological community to be aware of the consequences.

Annotated List

(* Denotes a species considered here as not being wild or feral within Trinidad or Tobago).

1. **Ducks.** The avowed aim of the Pointe-a-Pierre Wildfowl Trust at its inception in January 1967, when I served as Honorary Secretary, was to breed in captivity various species of the indigenous wildfowl of the country, most of which were then extremely rare, and through careful re-introduction to restock the local population. Principally this applied to two species of *Dendrocygna: D. autumnalis* the Black-bellied Whistling-Duck, and *D. bicolor* the Fulvous Whistling-Duck. Although natural forces may also have played their part, there seems no doubt that the recovery of the former on both islands over the last 30 years is partly attributable to the fact that several hundred *D. autumnalis* ducklings were released into the wild. To a lesser extent this may have happened with *D. bicolor*. The third species, *D. viduata*, the White-faced Whistling-Duck proved harder to breed in captivity, but eventually this was successfully achieved, and may well have been the origin of records such as two of this species seen by myself and Graham White at the Caroni Rice Project on 6 July 1991; further records of four birds were seen by G. White on 8 June 1992 and 18 June 1995 (pers. comm.). Another species commonly bred in captivity, both at the Trust and by many a householder, is the Muscovy Duck *Cairina moschata*. Any record of this species in the wild state has therefore to be

viewed with great caution. Unfortunately, other non-native species of waterfowl have occasionally been bred in captivity, and it is not impossible that individuals emanating from such origins may have found their way to freedom.

2. **Black Vulture** *Coragyps atratus.* Though common throughout Trinidad, this species is rarely found on Tobago. Around 1959 a few were released by those filming "Swiss Family Robinson" on Tobago, remaining at large for several years. I saw three there in 1965, and single birds in April 1967 and August 1968. Isolated birds have continued to be seen up to April 1989 (D. Rooks). Perhaps we should not assume that all these Tobago records are attributable to Walt Disney! The species is commonly found at Toco, from where its keen eyesight and flying ability should not preclude a visit to Tobago. It is in fact surprising that this vulture is not more common on Tobago.

3. ***Crested Guan** *Penelope purpurascens.* In 1962 I was summoned to the Emperor Valley Zoo to examine a bird brought in from south Trinidad under questionable circumstances. The keepers thought it "might be a Pawi" (*Pipile*), but it turned out to be this much larger species. Although fairly widespread in northern Venezuela, including the Orinoco delta (Meyer de Schauensee & Phelps 1978), it seems highly unlikely that such a heavily-flying bird would be capable of undertaking a flight of several kilometres over the open sea to Trinidad. Guans are often kept captive by Amerindians on the mainland.

4. **Red Jungle-fowl** *Gallus gallus.* Apart from the vast numbers of this species reared in the course of the poultry trade, a small but interesting feral population exists on the island of Little Tobago. The species was introduced on the island by an early resident about 1875, going wild after his death (Ingram 1913). During most of the present century their descendants have flourished on Little Tobago, benefiting from the bananas and other fruits planted for the use of birds-of-paradise. Most individuals have reverted to a wild state, avoiding human contact since they were frequently hunted for food; recently, with the proliferation of tourist traffic, a few birds have become tame, taking advantage of the scraps provided at the landing-place. But the fine plumage and excellent condition of the wild "chickens" that I have seen on the island show that they have adapted well.

5. ***Crested Bobwhite** *Colinus cristatus.* About 20 years ago I was notified of the occurrence of a banded bird of this species which had been found wandering beside a railway track in central Trinidad. Its behaviour indicated captive origin, but I was never able to discover its previous owner. Quails are sometimes kept in captivity to provide both eggs and meat for the table.

6. ***Sunbittern** *Eurypyga helias.* Only known on Trinidad from one record at Icacos on 25 April 1985 (TTFNC Bulletin), when a bird was seen at a farm by members of the Club on an expedition to SW Trinidad. The bird's extreme tameness, combined with an injury to one foot, leads me to suspect that this individual is likely to have been captured or wounded; in Venezuela the species is normally quite sedentary and is rarely seen to fly far from its riverside habitat.

7. **Feral Pigeon** *Columba livia.* Probably the best known of all introduced species and common in most countries; it is descended from the Rock Dove, a truly wild bird which frequents cliffs, caves and islands in the more remote regions of the world. Domestication of this species began in the Middle East at least 5000 years ago, giving rise to the enormous variety of plumages found in the domestic bird; whereas the wild bird is uniformly bluish-grey with black wing-bars and a pale rump, with a glossy iridescent neck. Many birds are kept as free-flying pets or used for racing, while a great number of feral birds frequent the large grain-stores on the outskirts of Port of Spain and elsewhere. It seems unlikely that any individuals of this species on Trinidad and Tobago could be truly wild birds.

8. **Parrots**. This family, containing many popular cage-birds, provides the greatest source of controversy concerning the origin of individuals. Apart from the six species known to exist as truly wild birds on Trinidad or Tobago, there are several others whose origins are more obscure and which require individual treatment.

(a) **Blue-and-yellow Macaw** *Ara ararauna.* This magnificent large macaw maintained a precarious foothold in the Nariva Swamp area of Trinidad up to the 1960s. I saw a group of 13 at Caltoo Trace in 1959. There were still a few in the area of Bush-Bush, where F. and M. Nottebohm (1969) estimated the total population to be 15 in early 1968. But a destructive forest fire in 1970 and relentless encroachment by squatters into the Nariva area over the following 25 years have certainly wiped out that small remnant. Yet the species is regularly seen in back-yards, sometimes in a cage, but also as a wing-clipped individual hopping about in semi-freedom. In the 1970s and 1980s C. Turpin had several free-flying pet birds living in his garden at Charlotteville, Tobago. Others were released by R.S.W. Deane and E. Lau at Speyside in a misguided attempt to "re-introduce" these swamp-dwelling macaws into Tobago (where there is no evidence they ever actually lived as wild birds). Clearly there is much illegal traffic in and out of Trinidad, mainly via the Icacos and Cedros area, where fishing boats can easily ply their trade unobserved between Venezuela and Trinidad. During the nine months October 1979 to June 1980 more than 125 of these macaws were exported from Trinidad to the U.S.A. (Roet *et.al.* 1981), ostensibly as native-bred birds, even though by then the local population was undoubtedly extinct. With the high prices paid by U.S. traders, it is not surprising that such pressure on the remaining wild population in South America is hard to eradicate. There has been some local movement towards captive breeding and re-introduction into the wild,

but this could only work if a sufficiently large area of appropriate habitat in Nariva Swamp were to be reserved and effectively wardened for the macaws, an unlikely prospect.

(b) ***Scarlet Macaw** *Ara macao.* The few records of this large macaw are mostly unsatisfactory. Two birds reported from Nariva Swamp in October 1934 (Belcher and Smooker 1936) were seen by an un-named observer, not by the authors; other birds were only heard; a group of five were reported from Waller Field by Abbott (Herklots 1961) without details; more recently there have been isolated records of individuals from the SW peninsula. While it is not impossible for some of these records to have involved wild birds, we must again consider the likelihood of escapes from captivity, for the species is commonly kept as a pet and is traded like the previous species through Trinidad (Roet *et.al.* 1981).

(c) ***Red-shouldered Macaw** *Ara nobilis.* There is no confirmed local record of wild birds of this species also known as Hahn's Macaw. Belcher and Smooker (1936), who never personally recorded the locally common *A. manilata*, quote an extremely tenuous sight-record by J.G.Myers in October 1934, and also refer to a specimen of doubtful origin in the British Museum. I was therefore astonished when I was told by R.S.W. Deane during the 1970s of the intention of a British aviculturist, the late L. Hill, to "re-introduce" the species to Trinidad and Tobago by releasing captive-bred birds. Two birds were actually released at Pointe-a-Pierre, but seem not to have survived. A bird seen by G. White at Waterloo on 20 October 1994 was presumed also to be an escaped captive.

(d) **Brown-throated Parakeet** *Aratinga pertinax.* Small groups of this species began to be seen regularly from about 1986 by G. White (1987), mainly in suburban areas of north Trinidad, and in the Caura and Maracas Valleys (R. Neckles *in litt.*) at least up to 1994. The species is common in similar habitats throughout northern Venezuela (Meyer de Schauensee and Phelps 1978). Observers have reported these birds to be quite tame, allowing an approach to five metres. While this would normally indicate likely domesticated origin, it does seem in this case to be a characteristic of the species. In addition, this does not seem to be a species commonly kept in captivity and comparatively few are traded (Ridgely 1981, Niles 1981). Therefore, while one cannot rule out the possibility that these records involve feral birds that were originally introduced, I am inclined to consider records of this species within Trinidad to involve genuinely wild birds.

(e) **Green-rumped Parrotlet** *Forpus passerinus.* Although now a common resident of open habitats in Trinidad, the species appears not to have been known before 1916 and is not represented in any collections made before that time. This seems to indicate likely introduction from the mainland, where it is commonly kept as a pet. Introduction from Trinidad to Tobago certainly happened during the 1950s and 1960s, and the species is now widespread on Tobago in suitable habitats, e.g. Mount Irvine. It should be classed as feral, for while it is still frequently caged in both islands, it clearly holds its own in the wild state.

(f) ***Budgerigar** *Melopsittacus undulatus.* This well-known small Australian parrot is one of the most widely kept cagebirds in the world. Occasionally escaped individuals are found, but rarely survive for long in the wild.

(g) ***Sulphur-crested Cockatoo** *Cacatua galerita.* This large white cockatoo is also native to Australia. For some years between 1988 - 1993 an escaped individual was to be seen at Crown Point, Tobago, where it frequently associated with Cattle Egrets.

(h) **Yellow-crowned Parrot** *Amazona ochrocephala.* The precise status in Trinidad of this well-known species (also called Yellow-headed Parrot) is one of the more difficult assessments to make in this study. During the period 1956 to 1976 I searched assiduously for wild individuals without success. The only birds found were living in urban or suburban surroundings in Port of Spain, St Augustine or Pointe-a-Pierre, where captive or tame birds were frequently seen or heard. Occasional reports from the SW peninsula could not be properly substantiated, and on all visits I made to that area I could only find the native *A. amazonica.* Reports were further complicated by the propensity of some local bird-keepers to divide *amazonica* birds into either "Blue-heads" or "Yellow-heads" according to the variable amount of yellow each bird had on its head; but "Yellow-head" did not usually refer to *ochrocephala*, although sometimes it did! In 1995 I found a sizeable population of *ochrocephala* apparently living in a feral state at the U.W.I. campus, St Augustine. There is no doubt that many captive birds are traded through Trinidad, e.g. over 1000 of this species were exported from Trinidad to U.S.A. during the 9-month period October 1979 to June 1980 (Roet *et. al.* 1981). It is highly likely that these birds originated in Venezuela, where regulations forbid exportation, probably passing easily if illegally into Trinidad via the SW peninsula. I conclude therefore that whereas feral groups have become established in suburban districts of Trinidad, the species' origins as a wild bird cannot be satisfactorily proven, so long as large numbers of this highly popular pet bird are passing through the territory.

9. ***Red-billed Toucan** *Ramphastos tucanus.* During the 1960s a bird of this species was brought to the Emperor Valley Zoo in Port of Spain. It was said to have been "found" in south Trinidad by a hunter. Almost certainly it originated in its native country of Venezuela, where it is common in Bolivar (Meyer de Schauensee and Phelps 1978), and was probably kept in captivity after being taken from a nest. Toucans make popular pets.

10. **Great Kiskadee** *Pitangus sulphuratus.* Maybe the best-known locally of all Trinidad's birds, even though occasionally confused with the Boat-billed Flycatcher *Megarynchus* or the Tropical Kingbird *Tyrannus melancholicus.* Unfortunately, this very popularity may have led the species to be introduced to Tobago, where R.S.W. Deane and the late E. Lau released birds into the wild at Speyside about 1970. The species has now spread from Speyside as far as Louis d'Or, where D. Rooks has found nesting birds. The suc-

cess of these feral birds can be attributed to the notable aggressiveness of the species in defending its territory, and predictably may lead through competition to the demise of other species among the indigenous avifauna of Tobago. Thoughtless introductions of this nature are to be deplored.

11. **Greater Bird-of-Paradise** *Paradisaea apoda.* The well-known history of this species from its introduction in 1909 from Indonesia to the island of Little Tobago need not be repeated. After the 1963 hurricane a lengthy study on Little Tobago by J.J. Dinsmore (1967) found a maximum of seven individuals, which gradually dwindled, and the last confirmed sighting on the island was in February 1981, though some claims for later occurrence have been made. People with vested interests have attempted to import replacements from Indonesia for this "island zoo", in spite of opposition from the ornithological and conservationist community. It is to be hoped that those in authority will uphold the claims of the natural world against the interests of dollar-orientated entrepreneurism.

12. ***Red-winged Blackbird** *Agelaius phoeniceus.* A male of this species was found living in Caroni marshes between June 1980 and mid-1981 (ffrench and Manolis 1983). It associated with the native *A. icterocephalus* and established its own territory. Although the species is known to breed as far south as Costa Rica and Cuba, the populations of those areas are not known to migrate south, as do the northern forms breeding in the U.S.A., which reach no further than California and Texas. J. Bond (*in litt.*) pointed out the overwhelming likelihood that this isolated bird was transported to Trinidad by boat. Numerous documentation exists of such instances, and I am inclined to agree that this is the most likely explanation.

13. ***Troupial** *Icterus icterus.* There are quite a few records of this species occurring on Trinidad over the years (although some of them have turned out to be the migratory *I. galbula*). Because the great majority come from urban/suburban districts, and in view of the great popularity of this species as a cagebird in Venezuela, I am inclined to suspect that all refer to escaped cagebirds. Otherwise, why are there no records from the wilder areas of Trinidad ?

14. **Red-breasted Blackbird** *Sturnella militaris.* Fairly widespread in savannas on Trinidad, but not recorded from Tobago till November 1974 (ffrench 1991). Records of several birds continued in the Lowlands area up to about 1990, but have recently ceased (D. Rooks pers. comm.). Bearing in mind that there is no suitable habitat along the entire north coast of Trinidad, one wonders how such a movement of a normally sedentary species could have been initiated. J. Bond (*in litt.*) suggested that there might have been an artificial introduction, but I have never known instances of this species in captivity. However, its apparent disappearance from Tobago does lead me to wonder whether Bond may not have been correct.

15. **Purple Honeycreeper** *Cyanerpes caeruleus.* A common resident on Trinidad, frequenting forests and adjoining cultivation. In the 1960s I saw a few individuals near Charlotteville, Tobago, but the only records since then have been occasional sightings by David Rooks mainly in the area of Gilpin Trace. Since I know that the late M. Turpin kept this species captive at Charlotteville, where the 1963 hurricane destroyed her aviaries, I assume the above records relate to escaped cage-birds or their descendants. But it is of course possible that there is a small indigenous population of the species living in the Main Ridge forest on Tobago.

16. **Golden-rumped Euphonia** *Euphonia cyanocephala.* This small tanager, locally called "Tête Bleu", seems to be a rare resident, turning up here and there at various times in Trinidad's Northern Range. Although there is no reason to doubt any particular record, one has to beware of assuming that all occurrences are natural, owing to the existence of caged individuals which may well gain a temporary freedom.

17. ***Trinidad Euphonia** *Euphonia trinitatis.* More commonly found on Trinidad than the previous species. A single record in 1964 from Tobago, where the bird is not known to be indigenous, probably refers to an escaped cage-bird, as such pets are commonly carried by boat between the islands.

18. **Palm Tanager** *Thraupis palmarum.* One of the commonest birds on Trinidad, where it frequents a variety of habitats. First noticed in the Scarborough area of Tobago by D. Rooks and others about 1982, since when it has spread fairly rapidly through suitable areas of the island. Although hardly known as a pet bird, the sudden appearance of this sedentary species leads me again to suspect artificial introduction by some misguided person for an entirely inexplicable motive. It has been suggested that the species may have reached Tobago via a boat travelling from Trinidad, but I have no evidence that it has been observed on board any boat even in harbour.

19. **Finches and Seed-eaters.** One of the most regrettable developments for local ornithology over the last 40 years has been the progressive disappearance of nearly all the members of this group. There is little doubt that this is attributable to the depredations of the pet-trade, combined with the destruction of habitat and general ease of access to more remote areas, which previously served as a refuge and reservoir. As a result, so few wild birds are left of the formerly widespread *Sporophila / Oryzoborus* species that nowadays if an observer is lucky enough to find a bird, it is necessary to ask whether it may not be an escape from captivity.
(a) ***Blue-black Grosbeak** *Cyanocompsa cyanoides.* A male of this beautiful species was recorded near Port of Spain in July 1990 (R. Neckles *in litt.*). The circumstances and tameness of the individual indicate artificial origin, especially as

singing males are highly popular and valuable on the mainland.

(b) ***Lesser Seed-Finch** *Oryzoborus angolensis.* On at least two occasions, e.g. in September 1966 and August 1968, I encountered singing males of this species in the area of Gilpin Trace, Tobago. The species was hitherto unknown on Tobago, though still at that time present on Trinidad in small numbers. I regard the most likely explanation of these occurrences to be escapes from captivity, especially as I found the species in similar circumstances on Barbados in 1956.

(c) ***Java Sparrow** *Padda oryzivora.* This popular Asian seed-eater is a commonly kept pet, and this seems the most likely explanation for one seen at Turtle Beach, Tobago on 11 November 1980 (C.E.Keller *in litt*).

(d) ***Common Waxbill** *Estrilda astrild.* Another commonly kept cage-bird, native to Africa south of the Sahara. Small numbers appeared near the Caroni Rice Project as early as 18 September 1990 (G.White pers. comm.), and up to 40 have been seen in the area of Trincity water treatment plant as recently as January 1996 (D. Finch *in litt.*). It may now be establishing itself as a feral species.

(e) ***Saffron Finch** *Sicalis flaveola.* Although common locally in western Trinidad, it is not distributed generally throughout the country. The species was introduced to Charlotteville, Tobago by the late M. Turpin, and a few birds escaped after the hurricane, being later seen again in captivity. It is no longer extant on Tobago.

(f) ***Siskin sp.** *Carduelis sp.* A bird of this genus was seen by a British ornithologist at Mount St Benedict on 23 March 1992 (J. Hornbuckle *in litt.*). Not known formerly from Trinidad, though the Yellow-bellied Siskin *C. xanthogastra* ranges through northern Venezuela east to Paria peninsula. Possibly a vagrant, but just as likely to have been an escaped cage-bird.

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SOME OUTSTANDING PROBLEMS IN THE ORNITHOLOGY OF TRINIDAD AND TOBAGO

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Introduction. It is presumptuous to suppose that the ornithology of any area can be completely understood. Nevertheless, for an area as small as Trinidad and Tobago, one which has been fairly well studied over the last 40 years, it may be helpful if from time to time some of the outstanding problems are brought to the attention of the ornithological community, in order that perhaps they may be scrutinized under a more intense focus. To this end I examine here some thirty species, for which we need answers, mainly pertaining to their status in the country.

For several species I draw attention to cases of possible misidentification in the past, sometimes where very similar species are involved, and in other cases where the previous evidence may have been faulty. For instance, the series of generally excellent papers on the nesting of local birds by the late authors, Sir Charles Belcher and G. D. Smooker (1934 - 1937), were later found to have contained a few mistakes. They ascribed nests of the ant-tanager *Habia rubica* to the antbird *Myrmeciza longipes*, and those of the crake *Laterallus exilis* to another, larger rail. Furthermore, in a number of instances they admitted that their identification was based on the word of a third party, often "a hunter", who brought in eggs or a nest that he had found, but may well not have identified the parent bird correctly. Collectors not infrequently employ field assistants to find material, and there is no way of ensuring that all such material is properly named. It is therefore necessary to re-examine some of those records, in order to confirm or reject their authenticity.

For other species I merely remind readers that we require further data to corroborate what has previously been asserted or assumed. Sometimes ecological changes or persecution may have altered the status of species, and only sustained observation and serious effort can show what is now the true picture. It is my hope that the increased number of observers visiting or resident in the country will result in answers being found to many of the following problems.

Rufescent Tiger-Heron *Tigrisoma lineatum* Nowadays rarely seen in marshland (ffrench 1991). Both Leotaud (1866) and Belcher/Smooker considered it a resident species. But the set of eggs cited by the latter (and brought by someone to Smooker) are much too small for this species. Yet the species is not particularly known to migrate. Does it still breed on Trinidad ?

White-cheeked Pintail *Anas bahamensis.* Belcher / Smooker knew this as a resident of Trinidad and recorded clutches of up to 10 eggs from Caroni Swamp. More recently it has been recorded breeding on Tobago, as well as in captivity at Pointe-a-Pierre. Does it still breed in other parts of Trinidad?

Masked Duck *Nomonyx dominica.* Although it is clear that this species does breed on Trinidad - for groups of immature birds have been found, sometimes accompanied by an adult female - the egg size remains somewhat anomalous. Belcher/Smooker refer to two clutches of buffy white eggs, with granulated shells, 4 averaging 60 x 46 mm. In November 1967 a similar clutch of 4 was brought from Caroni marshes to John Cambridge at Pointe-a-Pierre, who was well experienced with the locally breeding ducks. He put the eggs into an incubator, where three ducklings hatched a day or so later. I saw the remains of the eggshells and verified their approximate size as matching the previous clutches.

Unfortunately the chicks soon died, but although I examined them carefully and preserved the specimens in alcohol for transhipment to an American museum, by some mischance the container was lost. James Bond (1978) challenged the identification of all these clutches on the grounds that they were too large by comparison with others from Cuba. More evidence is needed !

Gray-headed Kite *Leptodon cayanensis.* Although this species is fairly regularly seen over the Northern and Central Ranges, the only actual record of breeding comes from some eggs purportedly collected on Trinidad, which reached a collector in Europe (Schonwetter 1961). As egg-collectors are sometimes found to be unreliable for purposes of scientific authenticity, I feel we need firmer evidence that this species breeds on Trinidad.

Hook-billed Kite *Chondrohierax uncinatus.* After apparently escaping notice on Trinidad for over 75 years, this species again showed up in 1978, and has since been observed on a number of occasions. Sedentary and sluggish, it may well be breeding on Trinidad, but again we need direct evidence of this. Eggs, apparently from Trinidad, were described in the Schonwetter 1961 account, but they are suspiciously large, compared with authentic eggs from Suriname (ffrench 1991).

White-tailed Hawk *Buteo albicaudatus.* This savanna species is very rarely found on Trinidad nowadays, although I believe that some observers have mistakenly confused it

with a somewhat similar species, the far commoner Short-tailed Hawk *Buteo brachyurus*, which mainly frequents forested country. It is interesting that the latter species was never recorded at all by Belcher/Smooker; this makes me wonder about the authenticity of their two nests at Mount Hope, attributed to *albicaudatus*, a species they term "a resident of fairly frequent occurrence".

Broad-winged Hawk *Buteo platypterus*. Another species never recorded by Belcher/Smooker (!), but fairly common today, especially on Tobago. Known definitely as a winter visitor (nominate race) from the north, this species is found on Tobago in all months. Does it nest there, and if so, which subspecies is involved? A male specimen taken on Trinidad, now in the American Museum of Natural History, was identified as from the Antillean race *antillarum*, but this was challenged by James Bond (*in litt.*), who said it was from the nominate northern race. Clearly winter visitors from the north are also regularly seen, often flocking on migration; so it is possible that two separate populations are involved.

Ash-throated Crake *Porzana albicollis*. There are no recent authentic records of this species, which was collected on Trinidad in the 19th century. Belcher/Smooker considered it a rare resident, but the three nests they mention contained eggs that were clearly too small, probably belonging to the tiny crake *Laterallus exilis*. *P. albicollis* much resembles the immature form of the migratory Sora *P. carolina*, and this may have caused confusion. But is it still found on Trinidad?

Azure Gallinule *Porphyrula flavirostris*. This species was not recorded on Trinidad before 1978, and was unknown to field-workers from the Trinidad Regional Virus Laboratory (now the Caribbean Epidemiology Centre), who worked intensively during the 1960s in the area of Bush-Bush Forest in Nariva Swamp, where the species is now apparently resident. However, although it is regularly seen, no direct evidence of breeding is yet forthcoming. Observers should look out for this, especially in the Melon Patch area.

Collared Plover *Charadrius collaris*. This little plover is fairly commonly seen on both islands from May to November, and occasionally in other months. The only breeding records are those of Belcher/Smooker in June and July. Is this species just an off-season visitor from South America, or does it breed here? If the latter, where is it nesting, on beaches, reclaimed land, or possibly savanna edges at Piarco or Waller Field ?

Large-billed Tern *Phaetusa simplex*. This strikingly patterned bird is a familiar visitor to western coastal areas of Trinidad, as well as inland marshes and reservoirs. Recorded in almost every month but less common from November to February, when it returns to breed on the continent. One nest was recorded by Belcher/Smooker in May. Is it possible that it still breeds on Trinidad ?

Yellow-billed Tern *Sterna superciliaris*. This small river tern is fairly common on Trinidad during the same period of the year as *Phaetusa*, but it was not recorded by Belcher/Smooker, who may possibly have thought it was the migratory Least Tern *S. albifrons*. They considered the latter might have bred in June, and I suspect these observations might well have referred to *S. superciliaris*. It is well worth looking for nests of this species in Caroni marshes.

Lined Quail-Dove *Geotrygon linearis*. This secretive dove, usually found on or near the ground in high forest, has been recorded on Tobago, but to my knowledge there are no records since Hurricane Flora in 1963. Is it still extant on Tobago ?

Oilbird *Steatornis caripensis*. One of the most extraordinary records of the past few years was that of a group of these birds at Hillsborough Dam, Tobago in September 1988 (ffrench 1993). Although the species is known to roost in sea-caves on the north coast of Trinidad, and may well commute between Huevos and the mainland, it seems almost incredible that it should fly across 30 miles or more of open sea between Trinidad and Tobago. An alternative theory put forward by Hans Boos, one of the observers at Hillsborough, is that Oilbirds may be resident on Tobago, roosting in so far undiscovered caves on the sea coast or inland, an extremely unlikely hypothesis in my opinion. The small size of the island, coupled with the propensity of this species to attract human predation, and to excite the attention of folk-lorists, seems to me to rule out any possibility that it could have just not been noticed over the years. So pending further observations from Tobago, I have to assume that the 1988 record involved vagrants from Trinidad. Much remains to be discovered about the species' movements outside the breeding season, though it is known to migrate within the continent.

Ringed Kingfisher *Ceryle torquata*. A regular but fairly rare visitor to Trinidad from the mainland. The single breeding record at Caroni of Belcher/Smooker in June involved a single egg, unlikely to have been a full clutch. Similarly the Amazon Kingfisher *Chloroceryle amazona* was also found breeding once by Belcher/Smooker at Madamas in May, although it has hardly been recorded otherwise from Trinidad. Do either of these large kingfishers still breed locally? Or is it that river conditions are very different now from 60 odd years ago ?

Flycatchers. There are several problems involving correct identification in this difficult family, for which the best diagnostic feature is often the call-note or song. But often visitors to the islands have insufficient time or opportunity to become acquainted with the calls, and I believe some identifications on the basis of plumage only may have been mistaken.

Among the few species that visit from the south of the continent during the austral winter between April and

September is the Variegated Flycatcher *Empidonomus varius*, which is intermediate in size between two other flycatchers that are heavily streaked below, the Streaked Flycatcher *Myiodynastes maculatus* and the Piratic Flycatcher *Legatus leucophaius*. To make matters more complicated two different races of *E. varius* may be found on Trinidad, *rufinus* which is resident in north Venezuela, and the southern migrant race, which is slightly larger. Unlike *Myiodynastes* and *Legatus*, *E. varius* is very quiet and its weak, thin *psee* is of little help in identification. Observers should always consider calls if possible when distinguishing between these three species.

Another identification problem involves several members of the genus *Myiarchus*. I am usually a little doubtful when I hear of sight identifications of *M. swainsoni, venezuelensis, tyrannulus* or even *ferox* being made on the basis of plumage. Matters are complicated by differences in immature plumage. The exhaustive study of this genus by W. E. Lanyon (1963) showed that the birds themselves discriminated between the various sympatric species mainly on the basis of different call-notes. But again this does not help us in the case of *swainsoni*, the southern migrant that has rarely been recorded on Trinidad, since it is very quiet on its northern winter quarters. *M. venezuelensis*, on the other hand, can readily be distinguished on Tobago by its call from *tyrannulus*, but it is probably not safe to identify these two species by plumage, except maybe in the hand. Another possibility that has not yet been explored is that *ferox*, which James Bond and others mistakenly claimed to be locally resident (before Lanyon showed those records to pertain to *venezuelensis* or *swainsoni*), may turn up on the Bocas Islands, since it is known from the Paria peninsula. Observers should listen for its distinctive call-note, a short, rolling *prrrt*.

The other flycatcher problem relates to another difficult genus, *Elaenia*. While the common *flavogaster* presents no difficulty, it is quite difficult to tell apart in the field the smaller species, *chiriquensis* and *parvirostris*. The latter is a southern breeder, migrating mainly north to Amazonia, and very occasionally reaching Trinidad. Although it is somewhat larger than *chiriquensis*, it is probably unsafe to identify it in the field, especially as it is unlikely to call. Observers should look out for nests of *chiriquensis* in areas like Aripo Savanna; but again some members of this species may migrate into Trinidad from the mainland.

Blue-and-white Swallow *Notiochelidon cyanoleuca*. Another southern migrant that is usually found from June to September in suitable habitat in western Trinidad, this species was also found breeding by Belcher/Smooker in late March; this might possibly have referred to the resident nominate race, that ranges from Costa Rica south. It is probably impossible now to prove this, for no other nests have been found locally. Have they been looked for ?

Chivi Vireo *Vireo chivi*. In my book (1991) I set out the complex nature of this species' status in Trinidad and Tobago, with possibly as many as four separate forms resident in or visiting our islands. Once more, it is probably risky to differentiate between these in the field, but in the hand careful measurements and examination may suffice. Call-notes also vary slightly, but the birds are usually silent outside their breeding season. Although some authors merge all forms of chivi with the North American Red-eyed *Vireo olivaceus*, this is a matter of opinion. It would still be good to understand the local position of these vireos more clearly.

Yellow Warbler *Dendroica petechia* This common northern migrant is a familiar winter resident, but in various forms is known also to breed as far south as Peru, Venezuela and its offshore islands, as well as a number of West Indian islands, including Barbados. A few years ago David Rooks (*in litt.*) claimed a possible nest at Grafton, Tobago but adequate evidence was lacking. It is highly unlikely that the migratory form *aestiva* would breed on Tobago, and if the resident form *petechia* were to breed there, it would be sedentary and we should expect other records on Tobago between mid-April and August. It is also likely that males of such a local breeding form would be distinctive in plumage, e.g. with a chestnut cap. It is well worth keeping a look out for such an interesting occurrence. Note. A very recent record of a singing warbler on Tobago in July (Hayes, *in litt.*) may indeed throw more light on this situation.

Purple Honeycreeper *Cyanerpes caeruleus*. Soon after Hurricane Flora in early 1964 I found a few individuals at Pigeon Peak, Tobago, but have never seen them on Tobago since. I understood at the time that the late Mrs Mavis Turpin had kept some in captivity, and that the hurricane damage had released her birds. David Rooks (*in litt.*) has been seeing the species "regularly" in the Main Ridge forest, but I know of no other sightings. Observers should be on the look out for this species, which in good conditions can easily be distinguished from its congener, the resident Red-legged Honeycreeper *C. cyaneus*.

Golden-rumped Euphonia *Euphonia cyanocephala*. Originally known as the Blue-hooded *Euphonia*, and locally as Tete Bleu, this species is very elusive nowadays, possibly because of the depredations of bird-catchers. Although Belcher/Smooker recorded one nest in July, the irregular sightings on Trinidad point to the likelihood that this species is an off-season visitor from the mainland. All authentic sightings should be recorded.

Sooty Grassquit *Tiaris fuliginosa*. Fairly common on Trinidad nowadays, where it is subject to seasonal migration. Care must be taken not to confuse this species with its congener *T. bicolor*, which is common on Tobago and Chacachacare. No authentic records yet from Tobago, where slight variations in male plumage in *bicolor* may have led to mis-identification. Although *bicolor* is slightly larger than *fuliginosa*, the latter's wing averages 10 mm longer, which

should help identification for birds in the hand.

Orange-fronted Yellow-Finch *Sicalis columbiana.* Another oddity, in that the only records for Trinidad are those of Smooker, who collected this species near San Juan in September 1926 and recorded nesting at the same time. The species may easily be confused with the Saffron Finch S. *flaveola*, but the latter is noticeably larger. There seems no reason why *columbiana* should not occur on Trinidad, so observers should look out for it in ranch-land and savannas in the west.

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A RECONSIDERATION OF SOME CAPRIMULGIDS ON TRINIDAD AND TOBAGO

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Introduction. The Caprimulgidae, including the sub-groups nighthawks and nightjars, are difficult birds to study, largely because they are nocturnal or, in some cases, crepuscular. In addition, their mottled, cryptically patterned plumage creates problems of identification for many observers, especially in dim light.

The six (or seven) species known to occur on Trinidad and/or Tobago (ffrench 1991) include some for which details of status and distribution are far from clear. In this paper I am outlining some of the problems, in the hope that future observers may succeed in unravelling them. Two species, the Pauraque *Nyctidromus albicollis* and the White-tailed Nightjar *Caprimulgus cayennensis* are comparatively well-known, the former having been the subject of recent papers in this journal (Quesnel 1985, 1989, 1993). I shall deal mainly with the other species.

1. Short-tailed Nighthawk *Lurocalis semitorquatus.*
This small nighthawk, formerly known as Semicollared Nighthawk or (erroneously) Nightjar, is widely distributed on Trinidad but cannot be called common. It is regularly seen over forest in the Arima valley at altitudes up to 450m, but also at sea-level in the Oropouche Lagoon, where I found small bands hawking at dusk over small rivers near mangroves. It is characterised by its small size, generally dark colour with whitish crescent-shaped markings on the secondaries and coverts, but *no pale bar on the primaries*, (which all other locally occurring nighthawks have). Another diagnostic feature is the short, square-ended tail, so that at rest its long wings protrude beyond the tail. In flight it is characterised by its erratic, bat-like movement above the trees or over water. I have never heard a song, though I have heard its flight call, a light, hissing *whick-whick* or *wee-it*. In Venezuela it has apparently been recorded calling a repeated *cu-ick* or *che-wit* (though these calls may possibly have come from a different species).

The status of this species in Trinidad is made uncertain by recent doubts over the only breeding record, that of Herklots (1961) at Aripo Savannah on 28 March 1954. An egg measuring 23.5 x 16.0 mm was being incubated on the ground, but Herklots, as usual, did not state whether or not he collected the adult (and in fact it seems he rarely preserved his specimens). Recently Seutin and Letzer (1995) found a nest of this species (subsp. *noctivagus*) in Panama. It was on a horizontal branch 6m up in an *Erythrina* tree, where the authors observed the development of a chick over several days. This nest location matched those of three other nests of *L. semitorquatus nattereri* (which itself may be a separate, closely related species) in Argentina (Straneck *et al.* 1987). Pending further evidence, we should maintain an open mind on Herklots' record, but it seems likely that this species is an arboreal nester, and observers would do well to look for nests in trees.

In Venezuela Paul Schwartz (pers. comm.) reported that three different-sized *Lurocalis* nighthawks occurred in cloud forest at Rancho Grande. He considered them different subspecies, including the nominate race (which occurs on Trinidad), *schaeferi* and the southern migrant *nattereri* (occurring in July and August). A fourth, larger race *rufiventris* is found in the Venezuelan Andes. Seutin and Letzer (1995) remarked that known egg sizes of the above *Lurocalis* varied significantly, but pointed out that the egg found by Herklots was smaller than would be expected. If it was not a *Lurocalis* egg, it could only have come from *Caprimulgus cayennensis*, which is a common breeding resident in the Waller Field area.

L. semitorquatus has been observed in every month of the year on Trinidad, but it is certainly not clear whether the same race is involved all the time. Migrants from the south would be expected between May and October, and I would expect breeding (if any) to occur between February and June. Regular observations of this species in its known haunts should reveal any significant seasonal movements.

2. **Common Nighthawk** *Chordeiles minor.*
The only local record is that of Kirk from Tobago (1883), but his comment that it occurred "from July to October" prompts speculation that Kirk may have confused this northern migrant with its congener *C. acutipennis* (see below). Certainly the North American *C. minor* does migrate south into the Antillean islands (where I saw it on Barbados) and South America, so could be expected on Trinidad and Tobago. I have seen birds of this genus flying over Crown Point, but at the time was never able to identify it adequately. The most likely month for sightings is October, and the time during the last hour or so of daylight. Its close similarity to the slightly smaller *C. acutipennis* means that identification may well necessitate a bird in the hand.

3. **Lesser Nighthawk** *Chordeiles acutipennis.*
This is the species that is commonly seen in Trinidad during August to October, feeding high over the Caroni savannas and marshes during the last hour of daylight (unless some of these are *C. minor* !). At such a time one can see as many as fifty in

the sky at once, twisting and turning as they feed up to 30m above ground. After dark they can be seen along tracks and side-roads in the savannas, their eyes gleaming in the reflection of car head-lights. All specimens of *Chordeiles* so far collected on Trinidad and Tobago have been *acutipennis*. Discrimination of the two *Chordeiles* species should be reasonably easy in good conditions, but of course mostly they are seen in the last hours of daylight or after dark.

The nesting of *acutipennis* on Trinidad has been recorded only by Belcher and Smooker (1936), who found four nests from February to mid-May, a time when I personally have found the species scarce, to say the least. I wonder therefore if the nesting (and the eggs) attributed by these authors to this species may not have been those of *Caprimulgus cayennensis*, as suggested earlier for *Lurocalis*. It is perhaps significant that Smooker had spent quite a few years collecting on Trinidad without ever encountering *cayennensis*; he eventually found out from Roberts (1934) that it was resident. The eggs and nests of the two species are very similar.

If I am wrong in my suspicions, then we should regard *C. acutipennis* as a rare resident. In that case, why does one never hear its call? This might be described as a churring trill lasting about 10 seconds and often repeated. It must be admitted that such a sound at night in marsh or savannah country might be interpreted as coming from an amphibian; but the songs of the various species of frogs and toads in Trinidad have been intensively studied (e.g. Kenny 1969, 1971), so that any similar song coming from a nightjar would almost certainly have been noticed. I am therefore inclined to believe that *C. acutipennis* is a common, regular migrant to Trinidad (and less common on Tobago), but is unlikely to be a resident at all.

4. **Nacunda Nighthawk** *Podager nacunda.*

The status of this considerably larger nighthawk is similar to that of the previous species but different! Like *C. acutipennis* it is most commonly found between June and October, and rarely at other times. Belcher and Smooker (1936) recorded three nests with eggs in Caroni marshes during April. In this case the large size of the eggs precludes any mistake. But again there are few sightings of this species except during the period when most south temperate migrants move to the north of the continent.

The smaller race of this species, *minor*, breeds in the northern part of South America, so one assumes that Smooker's observations of breeding birds refer to this race. Certainly most of the collected specimens are small enough, although two birds have wing chords measuring 236 and 238 mm, large enough to fit the migratory nominate race. The latter is known to reach Venezuela from late May (Friedmann and Smith 1950). There are no specimens available from Tobago, and to my knowledge no records from this century, but Kirk (1883) claimed to have collected two in September and October; it seems unlikely that he was mistaken in the identity of this strikingly large nighthawk.

One solution to the puzzle as to why Smooker found these two nighthawks nesting, but no-one else has, could be ecological changes - drainage, agricultural and economic development - that have occurred in the Caroni marshes over six or seven decades. But large numbers of both species still occur during the migratory period, when we should expect that most birds visiting Trinidad (or Tobago) from South America would be southern breeders. On balance I believe that both these nighthawks are non-breeding visitors.

5. **Rufous Nightjar** *Caprimulgus rufus.*

One of the mysteries about this large nightjar is that it has so rarely been seen. Yet it seems to be not uncommon in its habitat of deciduous scrub and light woodland in NW Trinidad. During 1965 - 1969 on a number of overnight visits to the Bocas Islands I heard many calling birds between April and June, and the species has been heard in the Northern Range foothills as far east as St Augustine. Yet no calls are heard outside the breeding season, and the species is certainly difficult to find when it is not calling. In spite of considerable efforts (even including attempts at mist-netting) we never actually located a single Rufous Nightjar on those Bocas visits, and no specimen has ever been collected there.

Belcher and Smooker (1936) recorded four nests (February to May), and one bird was actually seen. There is indeed no mistaking the breeding song of the species, which resembles that of its congener the Chuck-wills-widow, but can safely be separated from that species. David Rooks (pers. comm.) claimed to have found this species nesting on Tobago, identifying it only by its plumage. He did not "notice" any call, and I believe that confirmation can only follow if this diagnostic feature can be safely identified.

Identification of Caprimulgids.

It is a common feature amongst birds of cryptic plumage (e.g. nightjars, some antbirds and flycatchers) that they communicate with each other quite effectively in conditions of thick undergrowth or in darkness, largely by distinctive call-notes, rather than by distinctions of plumage. Human observers of these groups of birds might do well to emulate the birds themselves, and rely for secure identification on satisfactory understanding and appreciation of their songs or calls. Of the three commonly breeding species of caprimulgids on Trinidad and Tobago, all the calls are quite distinct, even with their slight variations.

Although Victor Quesnel (1993) has distinguished up to seven separate "calls" for the Pauraque *Nyctidromus albicollis*, by far the commonest is the far-carrying whistle, resembling *wee-oo*, which may be preceded by one or two preliminary notes that are occasionally added. Its other calls are mostly similar.

The White-tailed Nightjar *Caprimulgus cayennensis* found on both islands, mainly calls an extremely high-pitched double note - *chi-peeer*, quite unlike the lower-pitched song of *Nyctidromus*. But both these species make a whistling call.

The Rufous Nightjar *C. rufus* has a completely different breeding call from the above two species, being a rhythmical,

but not at all musical, series of four or five notes, *chuck-wit-wit-wee-oo*, repeated every few seconds. I would never describe this sound as a whistle, and I cannot understand Belcher's description of it (1936) as a "characteristic hiss". Once heard, it can hardly be forgotten, for during the breeding season males seem to call constantly through the hours of darkness.

Note. Most nightjar species also use their wings in courtship to create a drumming or whirring sound, quite separately from their calls.

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SPECIES AND INDIVIDUALS RECORDED ON CHRISTMAS BIRD COUNTS 1976 - 1980

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In the 1985-1986 issue of Living World magazine, the results of the Annual "Christmas Bird Counts" for the years 1969-1975 and 1981-1983 were published by Richard ffrench.

The results of the "Christmas Bird Counts" for the years 1976-1980, which were also conducted under the rules laid down by the National Audubon Society are now supplied in the accompanying table.

Similarly to those previously and subsequently conducted, the counts were done within a circular area, 15 miles in diameter and having Arouca as its centre, as described by ffrench in his article.

The compiler of the "Christmas Bird Counts" for the years 1976-1980 was Manny Levine of South Hempstead, New York.

	SPECIES / YEAR	1976	1977	1978	1979	1980
1	Little Tinamou	3	1	1	4	8
2	Least Grebe					
3	Pied-Billed Grebe		1	2	3	6
4	Olivaceous Cormorant					
5	Anhinga	1			4	1
6	Magnificent Frigatebird	3	5	6		
7	Stripe-Backed Bittern					
8	White-Necked Heron				1	5
9	Great Egret	300	100	33	20	20
10	Snowy Egret	150	50	30	60	24
11	Green-Backed Heron		1			
12	Great Blue Heron					4
13	Little Blue Heron	40	400	16	30	52
14	Tricoloured Heron	70	400	250	200	40
15	Striated Heron			3	7	10
16	Cattle Egret	1500	6000	4900	2000	10180
17	Black-Crowned Night-Heron			5		2
18	Yellow-Crowned Night-Heron					22
19	Boat-Billed Heron					18
20	Least bittern					
21	Pinnated Bittern					
22	Scarlet Ibis	5000	8000	6500	8400	8000
23	Fulvous Whistling-Duck					
24	Snow Goose					
25	American Wigeon					
26	Blue-Winged Teal			2	20	3
27	King Vulture					
28	Black Vulture	122	446	330	612	344
29	Turkey Vulture	63	110	52	8	21
30	Gray-Headed Kite			2	1	
31	Hook-Billed Kite					
32	Pearl Kite					
33	White-Tailed Kite					
34	Double-Toothed Kite					
35	Short-Tailed Hawk					
36	Zone-Tailed hawk					
37	Gray Hawk		1		3	1
38	White Hawk		2	4		2
39	Savanna Hawk		6	3	3	5
40	Broad -Winged Hawk	2	6	5		1
41	Common Black Hawk	13	6	7	3	4
42	Great Black Hawk					
43	Ornate Hawk-Eagle	2	3	2	2	1
44	Long-Winged Harrier			2	1	
45	Osprey	5	4	7	2	9
46	Crested Caracara					
47	Yellow-Headed Caracara					
48	Peregrine Falcon	1	1	1	2	
49	Bat Falcon	2		3		2
50	Merlin		1			3
51	Gray-Breasted Crake					
52	Clapper Rail	4	6		1	4
53	Gray-Necked Rail					
54	Sora		1			
55	Common Moorhen		20	8	8	8
56	Purple Gallinule			4		10
57	Azure Gallinule					
58	Limpkin					
59	Wattled Jacana	4	50	39	8	49
60	Southern Lapwing	3	16	33	10	37
61	Semipalmated Plover	1				80
62	Black-Bellied Plover	52	75			60
63	Collared Plover					
64	Solitary Sandpiper	3	6	5	8	
65	Lesser Yellowlegs	96	100	17	3	34
66	Greater Yellowlegs	14	50	1	1	9
67	Spotted Sandpiper	12	30	55	51	50
68	Willet					5
69	Black-Necked Stilt					
70	Wimbrel					
71	Sanderling					
72	Western sandpiper					
73	Least Sandpiper	1		9		150
74	Pectoral Sandpiper					

	SPECIES / YEAR	1976	1977	1978	1979	1980
75	Ruddy Turnstone					
76	Semipalmated Sandpiper					150
77	Common Snipe	2	1			
78	Short-Billed Dowitcher		35			
79	Yellow-billed tern					
80	Rock Dove	12	14	24	15	
81	Scaled Pigeon	25	4	6	9	8
82	Pale-Vented Pigeon		4			4
83	Eared Dove		24	2		5
84	Common Ground-Dove			12		19
85	Plain Breasted Ground Dove	10	3	2		
86	Ruddy Ground-dove	40	100	48		30
87	White-Tipped Dove	2				10
88	Gray-Fronted Dove	2	3	1	5	3
89	Red-Bellied Macaw					
90	Brown-Throated Parakeet					
91	Green-Rumped Parrotlet		10	8	12	28
92	Lilac-Tailed Parrotlet	8	27	29	13	12
93	Blue-Headed Parrot	13	9		7	7
94	Yellow-Crowned Parrot					
95	Orange-Winged Parrot	8	63	5	39	137
96	Mangrove Cuckoo					5
97	Squirrel Cuckoo	1			2	5
98	Little Cuckoo					2
99	Greater Ani		1			7
100	Smooth-Billed Ani	56	64	66	47	39
101	Striped Cuckoo		2		3	1
102	Barn Owl					
103	Tropical Screech owl					1
104	Spectacled Owl					
105	Ferruginous Pygmy-Owl	3	8	5	7	13
106	Mottled Owl					
107	Oilbirds	102	118	129	147	152
108	Common Potoo		1	1	1	5
109	Semicollared Nighthawk					1
110	Pauraque					1
111	White-Tailed Nightjar					
112	White-Collared Swift					
113	Chestnut-Collared Swift	1	6		4	
114	Gray-Rumped Swift	26	50	19	5	41
115	Band-Rumped Swift	66	12	24	7	
116	Chaetura spp.	40				
117	Short-Tailed Swift		49	16	3	18
118	Lesser Swallow-Tailed Swift		1			
119	Forked-Tailed Palm Swift		20	22	12	4
120	Rufous-Breasted Hermit	1	3	4	1	5
121	Green Hermit	3	5	6	2	5
122	Little Hermit	1	7	1	2	7
123	White-Necked Jacobin		1	2		
124	Brown Violetear			3		1

	SPECIES / YEAR	1976	1977	1978	1979	1980
125	Green-Throated Mango	1			1	
126	Black-Throated Mango	2	6	14	3	16
127	Ruby Topaz	1	2	1		1
128	Tufted Coquette	3	4	3	1	
129	Blue-Chinned Sapphire	3	2	1	1	4
130	White-Tailed Goldernthroat					
131	White-Chested Emerald	4	6	3	5	7
132	Copper Rumped Hummingbird	29	9	13	6	25
133	Long-Billed Starthroat	3	2		2	3
134	White-Tailed Trogon	1	1	3	3	2
135	Collared Trogon		4		5	2
136	Violaceous Trogon	2	1	2	2	10
137	Ringed Kingfisher					
138	Green Kingfisher	1				
139	Belted Kingfisher					
140	Pygmy Kingfisher			1		1
141	Blue-Crowned Motmot				1	6
142	Rufous-Tailed Jacamar					2
143	Channel-Billed Toucan	4	11	10	11	15
144	Goldern-Olive Woodpecker	3	8	3	6	9
145	Red-Rumped Woodpecker	1			2	
146	Chestnut Woodpecker			1	2	1
147	Lineated Woodpecker		6		3	6
148	Crimpson-Crested Woodpecker	1				1
149	Plain-Brown Woodcreeper	4			2	3
150	Straight-Billed Woodcreeper		1			
151	Buff-Throated Woodcreeper	3	2	1	4	2
152	Streak Headed Woodcreeper					
153	Pale-Breasted Spinetail		2	1	2	5
154	Stripe-Breasted Spinetail			1		
155	Yellow-Chinned Spinetail	4	10	3	5	13
156	Gray-Throated Leaftosser	2				
157	Streaked Xenops				2	1
158	Great Antshrike	2	2		6	4
159	Black-Crested Antshrike		2	8	1	5
160	Barred Antshrike	2	2	4	9	4
161	Plain Antvireo				1	
162	White-Flanked Antwren	2	1	2	5	
163	White-Bellied Antbird		3	1	1	2
164	Black-Faced Antthrush	2	1	2	4	5
165	Bright-Rumped Attila					
166	Black-Tailed Tityra		2	5		2
167	Bearded Bellbird	7	10	10	6	28
168	Goldern-Headed Manakin	10	17	20	16	19
169	White-Bearded Manakin	18	4	7	2	92
170	Fork-Tailed Flycatcher			1		
171	Pied-Water Tyrant	4	12	8	5	9
172	White-Headed Marsh-Tyrant	3	12	6	14	12
173	Tropical Kingbird	41	33	47	61	22
174	Gray Kingbird	1			1	

	SPECIES / YEAR	1976	1977	1978	1979	1980
175	White-Winged Becard					
176	Sulphury flycatcher		2		1	
177	Piratic Flycatcher			1		2
178	Boat-Billed Flycatcher	2	7	6	4	16
179	Streaked Flycatcher		3	2		9
180	Varigated Flycatcher					
181	Great Kiskadee	22	25	30	35	61
182	Dusky-Capped Flycatcher		1	3	1	
183	Olive-Sided Flycatcher	1		3		1
184	Tropical Pewee	4	4	5	2	7
185	Euler's Flycatcher	2	1		1	6
186	Fuscous Flycatcher					
187	Bran-Colored Flycatcher		1	3	1	
188	Yellow-Olive Flycatcher					
189	White-Throated Spadebill	3				
190	Yellow-Breasted Flycatcher	1	2	2	4	6
191	Yellow-Bellied Elaenia	2	4	3	11	7
192	Small-Billed Elaenia					
193	Forest Elaenia				1	
194	Short-Tailed Pygmy Tyrant					
195	Scrub Flycatcher			1		
196	Southern Beardless Tyrannulet		3	4	6	3
197	Slaty-Capped Flycatcher	3	1		3	6
198	Ochre-Bellied Flycatcher	5		6	4	1
199	White-Winged Swallow					
200	White Wagtail					
201	Gray-Breasted Martin	6	206	3		
202	S.Rough-Winged Swallow	13	6	4	4	2
203	Barn Swallow	12	2	12		83
204	Rufous-breasted Wren	3	3	13	11	14
205	House Wren	4	9	15	35	19
206	Long-Billed Gnatwren	2	6	5	12	9
207	Tropical Mockingbird	25	27	25	27	24
208	Yellow-Legged Thrush					
209	Cocoa Thrush	14	19	8	10	21
210	Bare-Eyed Thrush	2	3	6	2	2
211	White-Necked Thrush	4	4	9	8	14
212	Rufous-Browed Peppershrike	6	20	14	18	28
213	Red-Eyed Vireo					
214	Golden-Fronted Greenlet	10	10	13	20	10
215	Black-And-White Warbler					
216	Prothonotory Warbler					1
217	Tropical Parula	3	4	1	4	2
218	Yellow Warbler	1	3	1	9	11
219	Blackpoll Warbler	1				16
220	Canada Warbler					
221	Northern Waterthrush	6	20	9	4	
222	Masked Yellowthroat					
223	American Redstart	4	1	3	1	
224	Bay-Breasted Warbler					

	SPECIES / YEAR	1976	1977	1978	1979	1980
225	Goldern-Crowned Warbler	2	4	4	5	
226	Blackburnian Warbler	1				
227	Bicolored Conebill		3	8	4	19
228	Bananaquit	76	60	59	54	78
229	Purple Honeycreeper	62	19	29	8	2
230	Red-Legged Honeycreeper					
231	Green Honeycreeper	15	10	14	17	13
232	Blue Dacnis	10	5	4	2	1
233	Trinidad Euphonia	2	1	3	1	5
234	Violaceous Euphonia	14	19	14	21	21
235	Speckled Tanager	2	2	3	5	1
236	Turquoise Tanager	12	9	7	11	44
237	Bay-Headed Tanager	31	34	10	13	64
238	Blue-Gray Tanager	70	59	18	34	53
239	Blue-Capped Tanager					
240	Palm Tanager	66	40	23	26	62
241	Silver-Beaked Tanager	12	26	14	16	45
242	Hepatic Tanager	3	1	1	1	1
243	Summer Tanager	1				
244	Red-Crowned Ant-Tanager	1				4
245	White-Lined Tanager	12	38	16	11	29
246	Swallow Tanager					
247	White-Shouldered Tanager	1	3	2		3
248	Grayish Saltator		2	3	1	3
249	Streaked saltator					
250	Red-Capped Cardinal					
251	Dickcissel					
252	Blue-Black Grassquit	12	100	26	32	28
253	Sooty Grassquit					
254	Yellow-Bellied Seedeater					
255	Ruddy-Breasted Seedeater	4	6	6	6	11
256	Grey Seedeater					
257	Shiny Cowbird	6	100	11	4	28
258	Giant Cowbird		27	6	2	7
259	Crested Oropendola	75	51	40	44	207
260	Yellow-Rumped Cacique		20	1	3	32
261	Carib Grackle	50	500	20	46	3000
262	Yellow-Hooded Blackbird		1	3	2	12
263	Moriche Oriole					
264	Yellow Oriole	3	3	3	4	9
265	Red-Breasted Blackbird	2	20	3	6	17

Year	1976	1977	1978	1979	1980
Total Number	8759	18281	13515	12638	24529
Total Species	131	146	142	140	159

Number of different species for years 1969 to 1996 = 265

CW = Count Week

SAVANNA EXPANSION IN TRINIDAD, W.I.

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Introduction

Neotropical savannas have received considerable attention over the years because of their ecology, specially adapted plants and unusual soil conditions (Myers 1933, Beard 1953, Blydenstein 1967, Ahmad and Jones 1969a, 1969b, Eiten 1972, Sarmiento and Monasterio 1975, Medina 1982, Sarmiento 1984). In Trinidad, most of the published work on this unique ecosystem (Beard 1946, 1953, Richardson 1963, Quesnel 1979) has concentrated on the vegetation dynamics of the open savannas with recent studies focusing on the role fire plays in altering species composition (Schwab 1988, Comeau 1990). As a result, little attention has been directed towards the marginal or ecotonal areas (Leotaud 1992) except to point out the sharp boundaries that exist between forest and savanna (Marshall 1934, Beard 1946, 1953). The frequent burning of savanna margins is mentioned by Richardson (1963) but no evidence is presented to indicate that savanna plants are colonizing these damaged areas. Recent field work by the authors at the Aripo Savannas has shown that few sharp ecotonal boundaries remain, that a lot of the marginal area has been damaged by fire and that evidence exists which supports savanna expansion.

Background

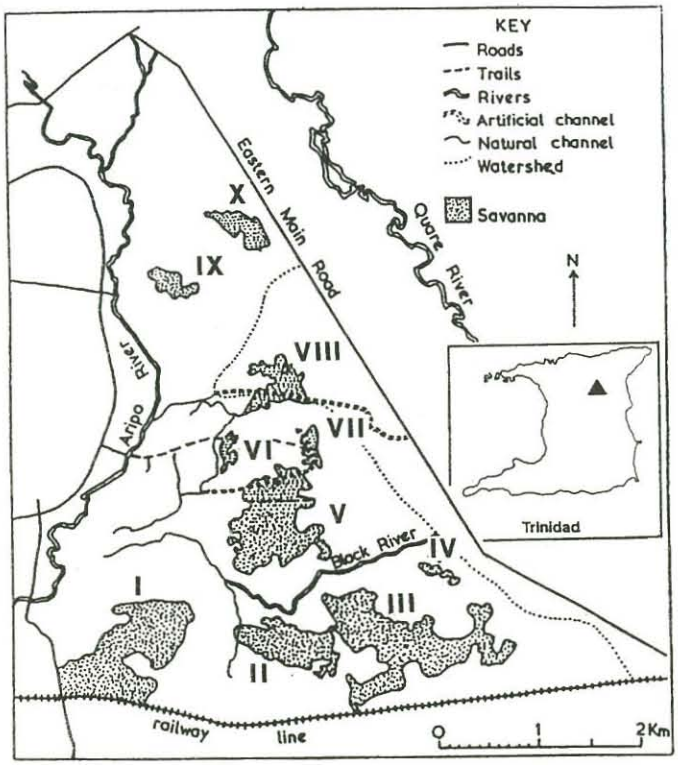

Figure 1: The ten savanas at the Long Stretch Forest Reserve Map Adapted from Schwab (1988)

The ten savannas at Aripo, covering 267 ha, are situated in the Northern Basin or Caroni Syncline of Trinidad. They are located within the Long Stretch Forest Reserve (Fig. 1), elevation 38 m, which contains the *Manicaria-Jessenia-Euterpe* association, *Calophyllum* faciation (Galba-Palm) of Marsh Forest (Beard 1946) or the *Calophyllum-Palmae* (Galba-Palm) type (Marshall 1934). The savannas include palm islands and open treeless expanses covered by sedges, grasses and other herbaceous plants. The surrounding forest, dominated by palms in the understory, together with the savannas form a vegetation mosaic that occurs on flat topography with rainfall ranging between 250 to 280 cm per annum. The savanna soil belongs to the Order: Ultisol, Suborder: Aquults, Great Group: Plinthaquults (Ahmad and Jones 1969b) which has a fragipan i.e., ironpan, restricting drainage.

Methods

Surveys were carried out along the marginal areas of the largest savannas at Aripo (I, II, III, V, VIII) as well as Savannas VI and VII. The sampling was done over a seven year period (1986-1993) during the months of November, December and January - end of wet to beginning of dry season; April, May, and June - end of dry to beginning of wet season; plus July and August - middle of wet season. All species growing around the perimeter of these savannas were recorded and notations made on abundance, habit, morphology, phenology and habitat. Those plants that could not be identified *in situ* were later keyed out using the Flora (Williams et al.1928-) and reference collection of the National Herbarium. Occasional forays were made into the forest during the marginal survey to determine the extent of the ecotone whenever it became diffuse.

Six 10 x 10 metre square plots were established to obtain quantitative data (Fig. 2). Three of these plots were controls located in stable communities, one from the open savanna of V, designated OS5, and two from sharp forest/savanna ecotones on the east and west sides of Savanna VI, namely FS6E and FS6W. These two plots were then divided into CFP6 for the combined forest phases and CSP6 for the combined savanna phases. The remaining three plots were located in diffuse unstable transition zones between savanna and forest, one in Savanna VI, designated TS6, and two in Savanna V, one located in the south-east section and the other in the north-west section of that savanna, designated TS5S and TS5N respectively. All species inside the plots were noted and visual estimates were made on occurrence, whether abundant, common or rare, as well as life-form, i.e. tree, shrub, herb, epiphyte, or climber.

Observations on marginal variability

A wide variety of marginal conditions occur with respect to species composition and habitat features. Amidst this variation,

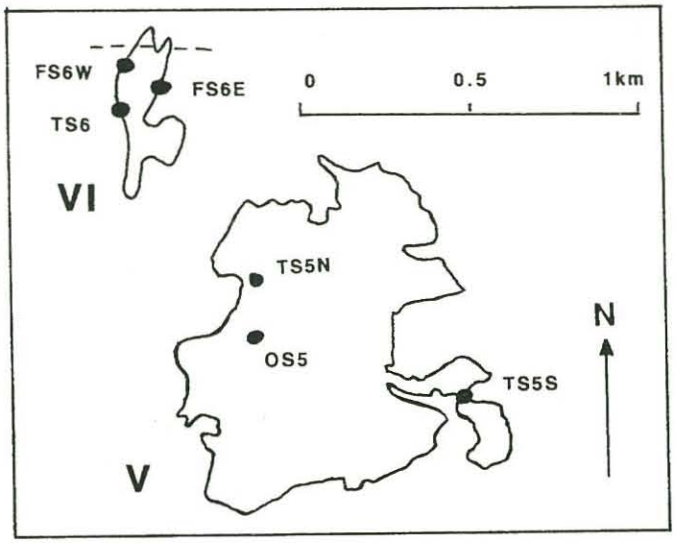

Figure 2: The positions of the sampling plots in Savannas V and VI at the Long Stretch Forest Reserve
Legend:
FS6W= Forest/Savanna 6 west
FS6E=Forest/Savanna 6 east
TS6=Transition Savana 6
TS5N=Transition Savanna 5 north-west
OS5=Open Savanna 5
TS5S=Transition Savanna 5 south-east

repeated patterns were observed and these formed the basis for establishing three succession hypotheses and comparing them with the stable communities which served as control sites. To understand the dynamics of savanna expansion and/or contraction it is necessary to first clearly define what are the more stable communities in the savanna/forest complex.

The most stable communities encountered during the survey were the marginal areas where the sharpest ecotones occur between forest and savanna, and the open savanna away from marginal disturbance. Sharp ecotones are not a common feature around any of the Aripo savannas reflecting the high degree of fire disturbance that occurs on a periodic basis (Schwab 1988). Some of the best sharp-boundary examples are found in Savanna VI (Plate 1) where two plots were set up. In the absence of disturbance, eg. fire and cutting, common mature forest trees near savanna margins include *Ilex arimensis* (Biscuitwood), *Isertia parviflora* (Wild ixora) and *Parinari campestris* (Bois bandé) together with all the dominant palms listed by Beard (1946) for Marsh Forest except *Attalea maripa* (Cocorite palm) which may be absent because edaphic conditions are too wet in ecotonal areas. Mature trees of the marsh forest reach an average height of 15m, the tallest being *Mauritia flexuosa* (Moriche palm), *Symphonia globulifera* (Yellow mangue), *Terminalia amazonia* (White olivier) and *Parinari.* Along some forest margins *Chrysobalanus icaco* (Fat pork) is the dominant tree. As these trees mature they lean toward the light, become top heavy and topple over which could explain their absence in some areas.

Plate 1: The sharp ecotonal boundary between mature marsh and savanna on the western side of Savanna VI

In the open treeless savanna (Plate 2), which represents the other stable community, the ground cover is dominated by the sedges *Rhynchospora curvula* and *R. barbata*, the grass *Paspalum puchellum* and the insectivorous *Drosera capillaris* (Sundew). Although these species are the most abundant, the vegetation does not form a continuous cover but is patchy with up to 40% of the ground surface being devoid of plants, except for algae, attesting to competition for limited nutrients and moisture extremes. The only shrubs present in open savanna are *Chrysobalanus icaco* (Fat pork) and *Byrsonima crassifolia* (Savanna serrette).

Plate 2: Treeless open expanse of Savanna V with stable ground cover dominated by grasses and sedges

The next step was to compare these communities with the unstable assemblages along savanna margins in order to gauge deviation away from or progression towards stability. In the transition plot in Savanna VI which appears to be reverting back to forest, the most abundant plants are the composite *Wedelia caracasana*, the sedge *Scleria bracteata*, the melastome *Miconia ciliata*, and *Heliconia psittacorum*. The former two are agressive competitors taking advantage of increased light when the margin gets opened up by fire

Plate 3: A diffuse margin on the western side of Savanna VI where relict Moriche palms are the only marsh forest trees to have survived the fire damaged habitat. Shrubs beneath the palms, such as *Ilex arimensis* (Biscuitwood) and *Isertia parviflora* (Wild ixora) are good indicators of the re-establishment of forest.

disturbance while the *Heliconia* is an invasive weed. *Mauritia flexuosa* (Moriche palm) was the only mature tree (Plate 3) indicating its ability to withstand fire as there was evidence of burning in and around the plot. Once the canopy is opened up by fire, the increased light produces a dense mid-story herbaceous layer made up mainly of sedges (*Diplacrum longifolium*, *Lagenocarpus guianensis* and *Scleria*) that allow little light penetration to the ground. In well-shaded areas, beneath shrubs and immature trees, forest species such as the woody vine *Rourea surinamensis*, and *Maprounea guianensis* (Petite-feuille) gain a foothold.

The two transition plots in Savanna V are composed of plants that show strong affinity with savanna vegetation. In the plot in the south-east sector, the most abundant plants are the marginal melastome *Comolia veronicaefolia*, the grass *Paspalum pulchellum* and the sedge *Rhynchospora filiformis*, the latter two being open savanna species. The melastome appears to be in decline being replaced by the grass and sedge. The microtopography, in this and other marginal areas, is hummocky due to worm and termite activity and possibly soil creep (Comeau 1990). Relicts of the forest persist with species such as *Tabebuia stenocalyx* (Wild calabash), *Chrysobalanus icaco* (Fat pork) and *Mauritia flexuosa* (Moriche palm), the latter producing pneumatophores i.e., spike-like aerial roots at ground level, within the plot.

The other transition plot in Savanna V, which is located in the north-west sector, has two abundant plants, *Paspalum pulchellum* and *Rhynchospora globosa* both of which are true savanna species. In addition to *Paspalum*, several tall grasses form a dominant herbaceous cover, *Panicum cyanescens*, *P. parvifolium*, *Andropogon virgatus* and *A. leucostachyus*, which seems to have slowed succession towards savanna. Hummocky microtopography characteristic of marginal areas, combined with high water tables, creates wet hollows where algae flourishes. The relict forest tree *Mauritia flexuosa* (Moriche palm) adapts to this wetness by producing pneumatophores.

Plate 4: The north-west corner of Savanna V where expansion is taking place

Plate 5: The gap between the Moriche palms in the foreground once contained trees which were destroyed by repeated fires. Grasses and sedges such as *Paspalum pulchellum, Rhynchospora barbarta* and *Lagenocarpus rigidus*, once established, favour the development of savanna.

Both the transition plots in Savanna V occur in areas where forest once extended in a narrow band across the landscape isolating smaller pockets of savanna from larger ones. Recurring fires eliminated the forest trees and opened a permanent gap, allowing the isolated pockets of savanna to coalesce with the main savanna (Plates 4 and 5).

Marginal stability versus savanna expansion

Repeated observations along marginal areas at the Aripo Savannas showed a great variety of successional or retrogressional stages that deviated from the sharply defined ecotone that characterizes a stable climax for the forest/savanna complex (Plate 1). These deviations are a result of fire disturbance (Schwab 1988, Comeau 1990). From this variety, three general patterns emerged. First, transition areas that are reverting back to forest (Plate 3); second, transition areas that are becoming more savanna-like (Plates 4 and 5); and third, transition areas that are leaning in the direction of savanna but have become arrested in their development by species dominance and pronounced micro-relief (Plate 6).

To test this pattern hypothesis, the plots set up in the

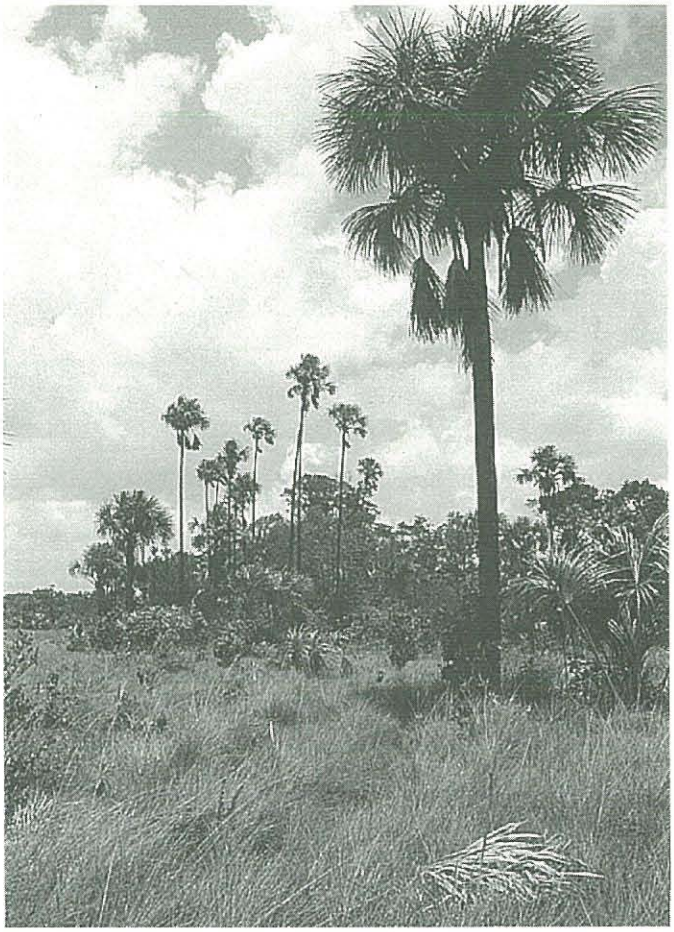

Plate 6: Savanna expansion has been slowed by the dominance of the tall grasses in the foreground, such as *Panicum cyanescens, P. parviforum, Andropogon virgatus* and *A. leucostachyus.*

transition zones were compared with the control plots (see Table I). The transition plot in Savanna VI (TS6) which represents re-establishment of forest has 41% forest species and only 4.5% savanna species while the transition plot in the SE section of Savanna V (TS5S) which represents establishment of savanna has 9.5% forest species and 40.5% savanna species, a reversal of the trend in TS6. The transition plot in the NW section of Savanna V (TS5N) which represents arrested development of savanna has 14% forest species and 42% savanna species, percentages which show similarities to those for TS5S. The trends are what would be expected from the observed general patterns. The three transition plots (TS6, TS5S, TS5N) also have the highest percentages of marginal and disturbance species compared with the control plots, namely FS6E, FS6W and OS5 (see Table I). In fact, the two forest/savanna control plots of VI have no disturbance species while the open savanna plot of V has no marginal species. This reinforces the validity of the controls.

If we look at the Sørensen similarity matrix (Sørensen 1948) for the various plots (seeTable II), the least similarity (index 2) occurs between the combined forest phase of the control plots in Savanna VI (CFP6) and the open savanna control plot in V (OS5). This result is expected as these plots represent the extreme opposites of stable vegetation and are,

Table 1 - Total species numbers and species percentages within the plots; duplicate species are excluded.

Species Plots	FS6E	FS6W	TS6	TS5S	TS5N	OS5
Total	63	67	44	42	36	22
Total F	35	36	18	4	5	1
Total F+S	9	10	8	10	6	2
Total M	8	8	9	8	6	0
Total S	11	13	2	17	15	18
Total D	0	0	7	3	4	1
% F	55.6	53.7	40.9	9.5	13.9	4.5
% F+S	14.3	14.9	18.2	23.8	16.7	9.1
% M	12.7	11.9	20.5	19.0	16.7	0.0
%S	17.5	19.4	4.5	40.5	41.7	81.8
% D	0.0	0.0	15.9	7.1	11.1	4.5

Legend: Species category
F = forest species
S = savanna species
M = marginal species
F+S = forest and savanna species
D = disturbance species

Plot designation
FS6E = Forest/savanna 6 east
FS6W = Forest/savanna 6 west
TS6 = Transition Savanna 6
TS5S = Transition Savanna 5 south-east
TS5N = Transition Savanna 5 north-west
OS5 = Open Savanna 5

therefore, the least similar in species composition. Conversely, OS5 has the greatest similarity (index 41) with the combined savanna phase of the control plots in VI (CSP6), again what would be expected. What is significant is the wide discrepancy, i.e., difference, between the low similarity (index 6) of OS5 and the transition plot in Savanna VI (TS6), and the higher similarities (31 and 34) between OS5 and the transition plots in the SE and NW sections of Savanna V, TS5S and TS5N respectively. This substantiates the contention that TS6 is reverting back to forest and that TS5S and TS5N and becoming more savanna-like in their species composition. To further reinforce this contention, a similar discrepancy exists between the low similarity (index 11) of CSP6 and TS6, and the much higher similarities (46 and 43) between CSP6 and TS5S and TS5N respectively.

Table II - Sørensen Similarity Matrix

Plots	CFP6	TS6	TS5S	TS5N	CSP6	OS5
CFP6						
TS6	47					
TS5S	24	35				
TS5N	19	32	52			
CSP6	28	11	46	43		
OS5	2	6	31	34	41	

Legend:
CFP6 = Combined Forest Phase 6
TS6 = Transition Savanna 6
TS5S = Transition Savanna 5 south-east
TS5N = Transition Savanna 5 north-west
CSP6 = Combined Savanna Phase 6
OS5 = Open Savanna 5

Key species in the transition process

There are several good indicator species that once well established in ecotonal areas affect the direction in which succession will proceed. These include *Ilex arimensis* (Biscuitwood) and *Isertia parviflora* (Wild ixora) which favour the re-establishment of forest while the grass *Paspalum pulchellum*, and the sedges *Rhynchospora barbarta* and *Lagenocarpus rigidus* would influence succession to proceed toward savanna-like conditions.

Conclusions

Strong floristic evidence exists for savanna expansion following repeated disturbance in marginal communities at the Aripo Savannas. The frequency of fire seems to be one of the determining factors that control the direction succession will take. Time-lapse aerial photography would provide additional support for this evidence.

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FOOD AND FEEDING HABITS OF THE FRUIT-EATING BAT *CAROLLIA PERSPICILLATA*

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Introduction

On 16 July 1992 I realised that a small group of bats, perhaps three or four, had been hanging up in a corner of my bedroom to feed. They did not roost there during the day but used the spot as a temporary roost for feeding only. Getting rid of them I thought might be difficult so I decided to study their feeding behaviour instead. To do that I simply put a sheet of newspaper below the roost to collect the discarded food and faeces and examined the collection later. At first I did this the next day; later the collections accumulated over several days. My interest at the start of the project was simply the food they ate, but when casual obserations suggested that feeding activity was much greater after mid-night than before, I changed the paper at mid-night so I could separate the collections into one before mid-night and one after. At first I could not identify all the fruit or eliminated seeds I found, but by comparing them with fruit I could pick on nearby trees and by growing plants from the seeds, I eventually identified almost all of the species involved.

All the observations were made at this one site at Haven Hill Farm, Talparo. On 16 May 1993 the bat was identified as *Carrollia perspicillata* by April Allgaier.

The food

Most of the food consists of fruit, and Table 1 records the species, and their monthly distribution throughout the study. The droppings consisted of whole green fruit, portions of uneaten fruit, fruit skins that were more or less complete, bits of skin, calyces, seeds, pulp, and faeces containing seeds and pulp. Some fruit were comparatively easy to recognise, some were not.

There were two species of *Vismia* and two of *Piper*. *Vismia cayennensis* has slightly larger fruit than *Vismia falcata* . However, I could not absolutely identify the two species by the sizes of the discarded fruit skins, so I decided on the species collected by looking at the species in fruit at the time. The two species of *Piper* were identified from plants grown from the seeds of discarded fruit and faeces, as well as from recognisable portions of discarded fruits. I could not reliably identify the species from the appearance of the seeds alone so in Table 1 the two species were not separated. *Pothomorphe* seeds also could not be reliably distinguished from *Piper* so I relied on the examination of full- grown plants for ripe fruit when deciding presence or absence. A single spat, dark blue in colour, contained seeds resembling those in the family Melastomataceae and this is entered in Table 1 with a question mark.

The "white pulp" referred to in Table 1 sometimes contained seeds, sometimes not. Four plants were grown from the seeds and later identified as *Philodendron acutatum.* It is probable that this pulp at different times contains the fruit of other monocot species such as *Monstera spp* and *Musa spp*; I have seen the bats eat ripe plantains. I have also seen the bats collect the fruit of *Passiflora tuberosa* and *Pothomorphe peltata* which aided the identification of some of the droppings.

Not all the food is fruit. Partly-eaten leaves of *Cassia bacillaris* turned up so frequently that it is hard not to think of them as deliberately sought rather than accidently gathered. *C. bacillaris* flowers, though not so frequent as the leaves, also seem to be deliberately sought. There were at times other leaves, which remain unidentified. During May and June when beetles are usually common, wings, elytra and legs of a fairly large reddish brown beetle were frequently found and again it is hard to think of these beetles as not deliberately sought.

The condition of the uneaten parts of the fruit sometimes gave

Table I. Foods eaten by *Carollia perspicillata* from 1992 to 1994

Year	92						93												94					
Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Vismia falcata **b**	●	●	●									●	●	●	●									
Piper spp **c**				●		●		●	●	●	●	●	●			●	●	●		●	●	●	●	●
Banara guianensis **b**		●	●												●									
Pothomorphe peltata **c**																		●			●			
Cecropia peltata **c**			●	●	●				●	●	●				●	●	●				●	●	●	
Rollinia exsucca **c**			●	●	●	●	●	●	●						●	●	●	●	●	●	●			
Vismia cayennensis **b**				●	●	●	●	●	●	●	●	●				●	●	●	●	●	●		●	●
Cassia bacillaris **l**							●	●	●	●	●								●	●	●	●	●	
"White pulp" P. acutatum **c**							●	●	●	●						●	●	●	●	●		●	●	
Castilla elastica **p**										●	●	●										●	●	
Passiflora tuberosa **b**																	●	●	●					
Melastome ? **b**																●			●					
Ficus trigonata **f**											●													
Psidium guajava **b**				●																				
Acnistus arborescens **b**												●											●	
Cassia bacillaris leaf, **fl**		●	●	●	●		●			●	●		●	●	●	●	●	●	●	●	●	●		
Insect parts											●	●						●					●	●

b = berry, **c** = composite fruit, **f** = fig, **l** = legume, **p** = fruit of partially fused carpels, **fl** = flower

information about the bats' manner of feeding. The uneaten parts of the *Vismia* fruits consisted of the skins with perhaps the calyx and stalk attached; the bats evidently squeeze the fruits, suck out the contents and spit out the skins. The fruits of *Banara guianenesis* were treated in the same way but because the fruit skin is not so tough as that of *Vismia* the skin was often torn into several pieces. On the other hand, the berry of *Acnistus arborescens* seems as a rule to be swallowed whole because I have never found discarded skins. The fruits of *Rollinia exsucca* were bitten open, the soft central parts with the seeds consumed and the harder material discarded. Although the entire fruit of *Cecropia peltata* seemed to be eaten sometimes, at other times the central columns (rhachides) were discarded. The difference in treatment may be due to the difference in size of the bats in the group for it seemed to consist of a mother and juveniles. The rhachides of *Piper* and *Pothomorphe* were regularly discarded. The seeds of *Cassia bacillaris* with adhering pulp were swallowed but the seeds of *Castilla elastica*, being somewhat larger, were sucked clean of pulp and discarded.

The time of feeding

Quite early in the study I realised that feeding after midnight seemed to be much more common than feeding before midnight. By changing the sheet of paper below the roost at midnight I collected two samples per night for 23 nights during the period from 24 July to 24 August 1992. At this time the bats were feeding almost exclusively on *Vismia falcata* fruit and by counting the discarded skins from which the contents had ben sucked out I could get a quantitative measure of feeding before and after midnight. Nights where there was something additional on the sheets were simply excluded from the count as were nights when I forgot to record the results.

There were 145 skins before midnight and 516 skins after midnight so the bats consumed significantly more food ($\chi^2 = 208$, $P<0.001$; all statistical treatments are as given in Moroney 1956) after midnight than before, 3.56 times more. Dividing these figures by 23 (the number of nights) the average number of fruits eaten per night was 6.3 before midnight and 22.4 after midnight. However, it was clear from examination of all the figures that counts on individual nights might differ greatly from the mean. Furthermore, it seemed that the higher figures occurred on nights when there was moonlight and lower ones when there was no moon. This suggested that moonlight helped the bats to find their food. Unfortunately, in July 1993 I was not collecting the droppings in two lots per night so I cannot check these results with results from the 1993 observations.

The influence of moonlight

For the examination of this topic a slightly different set of results was used i.e. the counts for the period 30 July (new moon) - 24 August (three days before new noon), Table II. The counts for 5, 8 and 12 August, which had been omitted from the analysis in the previous section because of tiny amounts of *Cecropia* fruit in the droppings, were now included. This allowed me to have eleven days of records before the full moon of 13 August and eleven days from 13 August to 24 August. In the first set of 11 days 348 fruits were eaten and in the second set 310, a non-significant difference when tested by χ^2 .

However, when the 11 days around full moon (7-19 August, Table II) were compared with the 11 days near new moon (30 July - 5 August plus 20 August-24 August, Table II) there was a great difference, with

Table II Numbers and distribution of *V. falcata* fruit eaten by *C. perspicillata* in the period 30 July-24 Aug. 1992 NM 30 July, FQ 5 August, FM 13 August, LQ 21 August

Period	Before midnight	After midnight
30 July - 6 August*	26	111
7 August - 12 August+	48	163
13 August - 19 August#	57	161
20 August - 24 August	13	79

*Excluding 1 Aug., 2 Aug.; +Excluding 10 Aug.; #Excluding 16 Aug.

429 fruits consumed in the first period and 229 in the second. Tested by χ^2 ($\chi^2 = 60.8$) they were significatly different at $P<0.001$.The bats consumed about twice as much food per night around full moon as around new moon.

Using the same figures in Table II, I did a further test of the influence of moonlight on the bats' behaviour. The ratio of fruits consumed before midnight to after midnight for the period 30 July-12 August is 74:274 or 1:3.70. The ratio for the period 13 August-24 August is 70:240 or 1:3.43. By the χ^2 test the difference between these two ratios was not significant. However, the same ratio for the eleven days around full moon (7 August-19 August) is 105:324 or 1:3.09 and for the eleven days near new moon (30 July-6 August plus 20 August-24 August) is 39:190 or 1:4.87. Tested by χ^2 this difference is significant ($\chi^2 = 4.42$, $P<0.05$). During the period of bright moonlight the bats increased their early feeding proportionally more (2.69 times) than they did their late feeding (1.71 times) and this difference is caused by the moonlight.

Discussion

Looking at the foods listed in Table 1 we can see that some of the foods were eaten for very long periods (*Vismia, Cecropia, Piper* and *Rollinia*) whereas others were eaten for short periods only. This is a reflection of their availability. In fact *Vismia* can be regarded as a staple food since it was eaten for all but one of the months in the two year period. The two species have virtually identical seeds, and although the fruits of *V.cayennensis* are slightly larger, determining which is which after the bats have discarded them is difficult. I determined which was present in the food at any one time by examining the trees around the farm for ripe fruit rather than by trying to distinguish the fruit in the droppings. *V. falcata* flowers for only about two months between May and July and the fruits are available from July to September. *V. cayennensis* fruits virtually throughout the year. It may be noted in passing that the various fruit consumed are almost all berries or compound fruit, since figs and the fruit of *Castilla* are also compound fruit though slightly different from the others. The odd one is the legume of *Cassia bacillaris*.

The only other similar study with which I am familiar is that of Greenhall (1956, 1957). He studied three species of bat, of which one was *C. perspicillata*, over the years 1954-1956 in various parts of Trinidad. Comparing the two lists of food plants it is immediately obvious that only a few species are common to both lists: *Cecropia peltata, Piper spp* and *Psidium guajava*. There are twenty other species on Greenhall's list so together the two studies record 36 food plants. From the presence of many ornamental and cultivated plants in Greenhall's

list I conclude that at least some of the localities studied were in Port of Spain and Greenhall (pers. comm. 1997) has confirmed this. Yet it is very strange that neither of the two *Vismia* species, nor *Rollinia,* so prominent in my list turns up in his and hogplum (*Spondias mombin*) common around Haven Hill Farm, does not turn up in mine though it appears in his.

There is every indication that the list can be further extended if studies were conducted in new areas. Furthemore, by separating the species lumped together, *Piper spp* for example, the list can again be lengthened. Thus *C. perspicillata* conforms with the expectation of Freeland and Janzen (1974) that as a generalist herbivore it consumes a wide range of plants. However, I am not at all sure that the term generalist herbivore should be appplied to a basically fruit-eating animal rather than a leaf-eating one; fruits have evolved to make themselves attractive to herbivores whereas leaves have evolved mechanisms to discourage herbivory.

The finding that more food was consumed in the six hours after midnight than the six hours before came as a surprise. I draw attention to the fact that I did not actually watch the bats feed. More bats may have come to the roost after midnight than before, and thus account for the difference, but I think this unlikely. Goodwin and Greenhall (1961) state that "*Carollia perspicillata* probably feeds twice during each night." The present results may be regarded as giving some support to this supposition though there is nothing in them to rule out the possibility of more or less continuous feeding. But even so, they don't give any clue as to why they should feed in two bouts, or why there should be more feeding in the second bout than the first. How do the bats spend their "free" time in the period before midnight? In increased searching for food or in some other entirely unrelated behaviour? In a population feeding night after night on the same food as these bats were doing, it would seem that the bats should know where to find their food and should have to spend relatively little time on searching for new sources. So my belief is that they spend most of the "extra" time in searching their surroundings for new roosts, in dominance rivalries and in sexual behaviour.

The increase in the amount of food taken at full moon compared with new moon also came as a surprise. The authors of two popular books (Peterson 1964, Schober 1984) mention that the eyes of the fruit-eating bats of the Old World tropics have special adaptations for seeing in the dark and that these adaptations help the bats to find their food. There is no mention of anything similar in the fruit-eating bats of the New World, but the present results show that they too use their eyesight. By the χ^2 test the increase in feeding near full moon as compard with that near new moon is significant and related to the presence of moonlight. From first quarter to full moon the moon is visible during the whole period of darkness up to midnight and with each passing night becomes visible for an increasingly long time in the period from midnight to dawn until at full moon it is visible all night long. From full moon to last quarter the moon is visble during the whole period from midnight to dawn but is visible in the period from dusk to midnight for decreasing lengths of time. During the whole period from first quarter to last quarter there is much more moonlight than in the period from last quarter to first quarter (Fig. 1) and the bats increase their feeding significantly in this period. The conclusion must be drawn that the moonlight helped the bats to find their food through the use of their eyes.

Figure 1 shows that in the period of moonlight from first quarter to last quarter there is as much light available from midnight to dawn as from dusk to midnight; yet, at this period around full moon as compared with that around new moon the bats increased their feeding in the first bout before midnight more than they increased their feeding in the second bout after midight. The χ^2 test clearly indicates that the difference is real and related to the moonlight. Why should it be so? I suggest that it is a case of striking while the iron is hot, making the best use of existing good conditions rather than waiting for later ones. With appetite at least partly sated in the first bout feeding in the second bout would not increase proportionally.

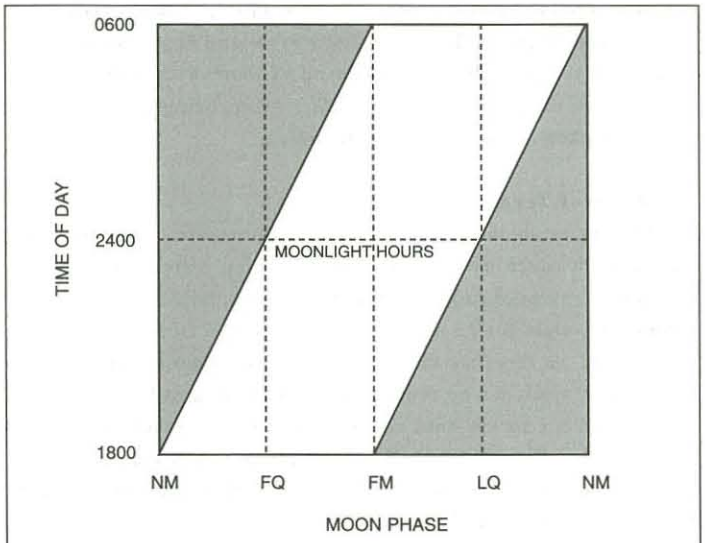

Figure 1: Idealised diagram to show the relationship between moon phase and the number of hours of moonlight between dusk and dawn.
NM - New Moon FQ - First Quarter FM - Full Moon
LQ - Last Quarter

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OBSERVATIONS ON THE MIGRATORY PATTERNS OF THE BUTTERFLY *PHOEBIS STATIRA* (CRAM) IN NORTH AND SOUTH TRINIDAD

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The yellow migrant, *Phoebis statira* (Cram) is distributed throughout Latin America and the Caribbean region, including the Guianas, Brazil, Venezuela, Ecuador, Peru, Panama and Trinidad and Tobago (Barcant, 1970). *Phoebis statira* usually are greatly attracted to flowers and are found generally in open areas with sunshine. In addition, they usually migrate each year with the onset of the rainy season and this migratory behaviour has been documented in 1918, 1919, 1926, 1932, 1947, 1954, 1962 (Quesnel 1971) and in 1960 in Rio Claro (Barcant 1970). In 1969, observations were made at Nariva, Petit Valley, Valsayn Park, Sangre Grande, Manzanilla, and Mayaro (Quesnel 1971). This paper describes the migratory patterns of *P. statira* observed over three days in August 1995 in the small village of Tableland, located east of San Fernando on the Naparima-Mayaro Road and at Champ Fleurs, a town located along the Eastern Main Road in north Trinidad (Fig. 1).

From 10.40 a.m. on Saturday 19 August, 1995 a swarm of *P. statira* first appeared in a band or column approximately 50 metres wide and from approximately four meters above ground level to just below the tree tops circa 25 m. The sunshine was brilliant and their characteristic bright yellow green coloration was very evident. Swarms of five to 10 butterflies were seen while many were scattered in the moving column, with a definite lead group and frequent changing of positions as individuals moved in a zigzag pattern within the group. It is estimated that over 9,000 *P. statira* butterflies were observed migrating in an easterly direction with numerous pairs observed copulating on the wing. At noon rain began falling which resulted in the complete cessation of flight. As the rains subsided at 12:45 p.m. the swarming activity re-emerged until 2.05 p.m. after which only a few stragglers could be observed.

On Sunday 20 August, 1995 activity began at 10.00 a.m. but the density of the swarm was considerably reduced. On both days numerous butterflies were observed feeding on the nectar of both ornamental and wild flowers along the roadside. The column of *P. statira* was followed by car along the Naparima Mayaro Road and numerous clusters were observed drinking from puddles and pools of water at Poole and San Pedro. In addition, many *P. statira* were seen as far east as Mayaro, located on the south eastern coast of Trinidad. (Fig.1).

In addition, on Monday 22 August 1995 while driving along the Eastern Main Road at Champ Fleurs I observed a small swarm flying from west to east. The time of this activity was 11.45 a.m. Figure 1 shows the flight patterns observed for *P. statira* at Tableland and at Champs Fleurs, Trinidad, West Indies.

Based on the observations of these three days it would appear that this annual migration of *P. statira* followed the west to east direction (Fig.1) but occurred in August (1995) rather than in June, the month rainy season begins, as reported by Barcant (1970). It is clear that the migration of this butterfly population must be advantageous to the species. For example, migration provides a means of avoiding adverse environmental conditions and thus may enhance finding alternative habitats, thereby increasing the butterfly's life-history options. However, migration carries costs as well as benefits.

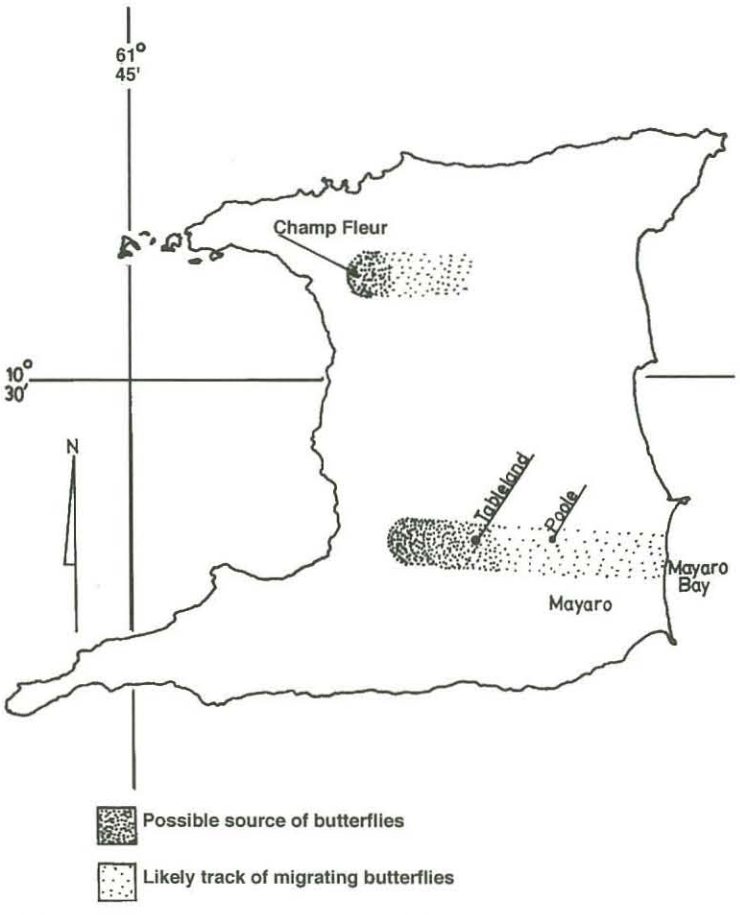

Figure 1. Map of Trinidad showing path of migration of *Phoebis statira* butterflies in August, 1995.

These include:

a. the actual metabolic cost which involves the utilization of energy to support flight;

b. risks of increased predation and not finding a suitable habitat, and

c. potential reproductive cost owing to increased time to first oviposition, decreased energy reserves available for reproduction, shortened lifespan, and/or a decrease in overall fecundity.

However, the observations of copulating pairs of *P. statira* at Tableland and Champ Fleurs suggest an oogenesis-flight syndrome which also has been observed among many insects (Rankin and Burchsted 1992). This behaviour activity (copulation) suggests that swarming increases or enhances male-female contact and thus provides better copulating opportunities. In addition, with migration, the weak and genetically inferior individuals usually die, or fail to successfully join the swarm or mate, thus, leaving only robust males with reproductive vigour to copulate with females, thereby improving the *P. statira* genetic constitution.

It should be noted that *P. statira* butterflies were observed migrating and copulating at the same, time thus providing an evolved advantage, for in most populations flight and reproduction are physiologically antagonistic (Rankin and Burchsted 1992). Thus, when the *P. statira* migrants arrive at their new habitat they are ready to begin reproduction immediately and any reproductive delay due to migration are minimized. In addition, based on these three observations we are unable to determine the exact breeding habitats of *P. statira* but their eastward migration suggest that new habitats are found. However, it is unlikely that the next generation would migrate further eastward because this would take the butterfly population over the Atlantic Ocean (Fig.1). There is a possibility that following the eastward migration and copulation the *P. statira* population may migrate westwards but this migration event has never been recorded and no literature is currently available on this unique migration pattern.

It is recommended that further observations be conducted on the *P. statira* migration patterns, population dynamics and kinetics to examine further the oogenesis-flight syndrome, the body size requirements for migration, metabolic costs, flight fuels and the reproductive cost of flight.

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THE SKIPPER BUTTERFLIES (HESPERIIDAE) OF TRINIDAD PART 9, GENERA GROUP E CONCLUDED (THIRD SECTION) WITH A DESCRIPTION OF A NEW SPECIES OF *CLITO*

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Introduction

This is the ninth in a continuing series on the identification and biology of the Trinidad Hesperiidae. It continues directly from part 8 (Cock 1996). In the next part I plan to treat the remaining Pyrginae, comprising Evans' (1953) genera groups F and G.

I reiterate my thanks to Dr C. Dennis Adams, Mrs Yasmin Comeau, Bhorai Kalloo and Winston Johnson of the National Herbarium who identified the plants from which I reared Hesperiidae in Trinidad. Mr Carlos Lopez-Vaamonde kindly checked my translation of the description of the biology of *Antigonus erosus* from Comstock and Vazquez (1961). The following have very kindly assisted in providing access to the collections in their care: Dr George McGavin of the Hope Entomological Collections, Oxford University Museum (HEC), Dr Phillip Ackery of the Natural History Museum (NHM) (formerly British Museum (Natural History)), Dr Mark Shaw of the Royal Scottish Museum (RSM), Mr Scott Alston-Smith to his private collection (SAS), Professor Julian Kenny and Dr Gene Pollard of the University of the West Indies, St. Augustine (UWI).

I especially thank Scott Alston-Smith who has read and commented on this paper, and provided additional records from his collecting, and observations and food plant records which have not previously been published (indicated as SAS in text).

107. E46/1 *Milanion hemes hemes* Cramer 1777 Plates 1-5

This subspecies occurs in Venezuela, Trinidad, the Guianas (TL Surinam) and at the mouth of the Amazon. Kaye (1914) records two Trinidad specimens in the collection of H J Adams; subsequently (Kaye 1921) he records additional specimens from Fondes Amandes (E J Patterson) and Ariapita Road (W J Kaye).

The sexes are similar. This species is dark brown above with white markings; below it is a lighter shade of brown, but the markings are similar apart from an expanded white spot in space 1B UNF, and the bases of both wings are slightly paler. Illustrations in Barcant (1970, Fig.4, No. 2) and Lewis (1973, Plate 83, No. 38). No costal fold; F ♂ 13 mm, ♀ 12-13 mm.

This seems to be an occasional, but widespread species, although perhaps over-represented in collections since it is so distinctive. It is perhaps more common in the north than in the south. Most records are from forests at intermediate altitude, the highest altitude from which I have seen a specimen being 518 m or 1700 ft. Almost all captures are of isolated

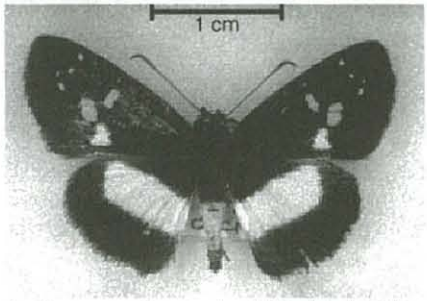


Plate 1 *Milanion hemes* ♂, Cumberland Hill, 14.xii.1978

specimens, and all 24 specimens for which I have data were captured between late November and mid-April, suggesting that it flies predominantly during the dry season.

At Belem, Moss (1949) records the food plant to be *Rollinia orthopetala* and other Annonaceae, but gives no other details. In Trinidad, SAS and I have the food plant to be *R. multiflora*, known locally as wild cashimar or wild sugar apple (Freeman and Williams 1928). In February 1994 I collected larvae and pupae on this food plant above Mount St Benedict's and above Fort George, and reared out several specimens. The plants used were all saplings growing beside paths; they were no more than a metre tall, with leaves 25-35 mm wide and 80-150 mm long. The details of the larval and pupal shelters are noteworthy and distinctive.

The eggs are small with about 14 ribs; they are laid on the leaf lamina UNS, towards the base, 1-2 per leaf. The final larval instar (Plate 2) is about 20 mm long; the head is chordate in shape, and rounded; the surface is covered with rugose dark projections; the head is light brown, with the posterior margin dark brown; the face is covered with pale speckles, and the most conspicuous feature is a white, vertical streak near the apex on each side of the face. The body is dull green with a heavy overlay of white speckles. The pupa is 14 mm long, rounded with a short, blunt frontal spike; cremaster long (1 mm) and slender; colour yellowish white, except abdominal spiracles, proboscis sheath distally, and three inter-segmental areas are black.

The stage I shelter (Plate 3) is a 6 mm diameter circular flap cut from the middle of the leaf lamina and folded under as a convex cup; all of the flap and the corresponding leaf UPS area except the line along which the larva rests are skeletonised. There is little or no feeding associated with the stage I shelter apart from the skeletonising of the shelter, suggesting that during this stage the larva may not leave the shelter, and only feeds within it.

The stage II shelter (Plate 4) is normally made upon the same leaf as the stage I shelter. It is about 15 mm x 7 mm; a wide flap is cut from the edge of the lamina to the leaf mid-

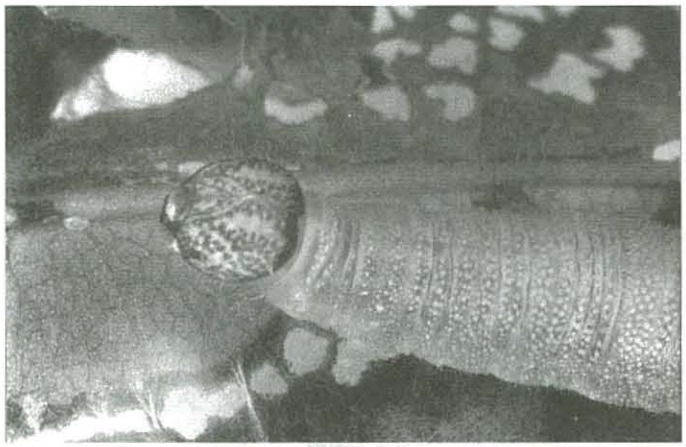


Plate 2. *Milanion hemes* fifth instar larva collected on *Rollinia* multiflora, behind Mount St. Benedict's on Mt. Tabor Track, 28.ii.1994

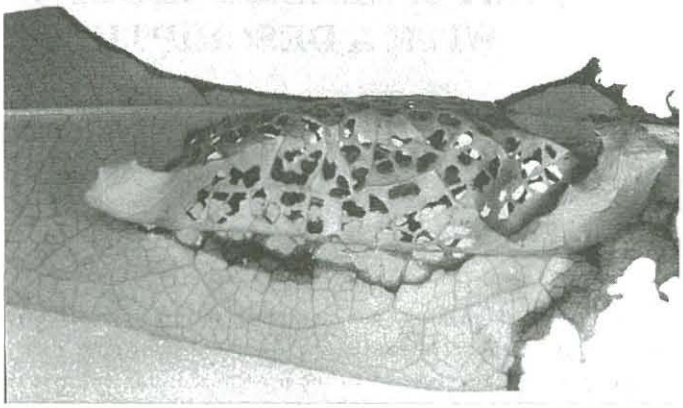


Plate 4. *Milanion hemes* stage II shelter on *Rollinia* multiflora, behind Mount St. Benedict's on Mt. Tabor Track, 28.ii.1994

rib and is folded under along a short join incorporating a main vein, and then shaped by the larva as follows. At the distal end a notch about 3 mm long is cut into the end, parallel to the mid rib, and the sides pulled together to form a keel, usually with the leaf-flap on one side of the notch projecting, which causes the shelter to be raised from the leaf UPS. At the basal end an arc is cut from the side away from the shelter hinge, about 3 mm short of the basal end of the

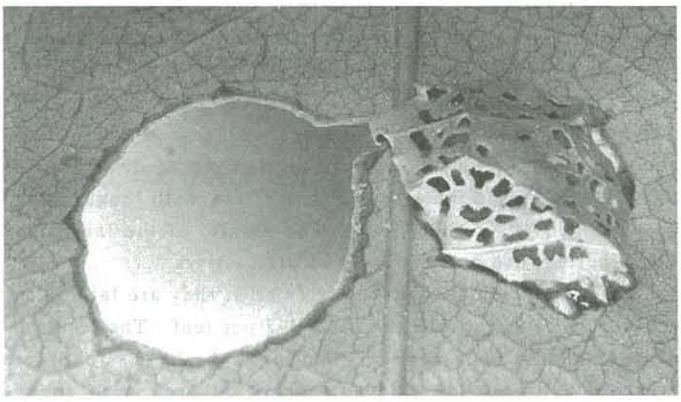


Plate 3. *Milanion hemes* stage I shelter on *Rollinia* multiflora, behind Mount St. Benedict's on Mt. Tabor Track, 28.ii.1994

shelter; the shelter is attached to the leaf UPS along this arc, leaving the basal portion of the flap free. The larva skeletonises the shelter flap and the leaf UPS except for a central line under which it rests; there is additional feeding nearby on the same leaf.

The stage III shelter (Plate 5) is formed on a different leaf, and it is also used for pupation. A large flap about 35 mm long is cut from the margin to the mid-rib, and folded under joined along most of its length along the mid-rib, old shelters may split along the mid-rib. The flap and leaf are consumed to the extent that both are about 10 mm wide; an arc is cut from about 5 mm from each end of the flap, curved from near the flap outer margin to the mid-rib; the shelter is then formed by attaching the inner edge of each arc to the leaf UPS, leaving the remainder of the flap loose at each end of the shelter, but joined to the shelter at each side. The whole of the shelter flap is skeletonised apart from the two loose bits of leaf at each end; the shelter leaf UPS is skeletonised in irregular patches along each margin of the shelter, leaving the central area under which the larva rests and the pupa is formed. Further feeding distal and basal to the shelter leaves only the basal portion of the leaf intact, so that the shelter then looks like a skeletonised fragment attached to the mid-rib. At pupation the inside of the shelter, but not the pupa, is lined with a loose white waxy powder.

I have examined Moss's material in the NHM. The pupa is formed in a globular shelter up to 3 cm long, with a fine lattice-work of small holes except over the area where the pupa occurs. Thus, there seems to be differences between the pupal shelters from the two areas, perhaps associated with the different food plant species.

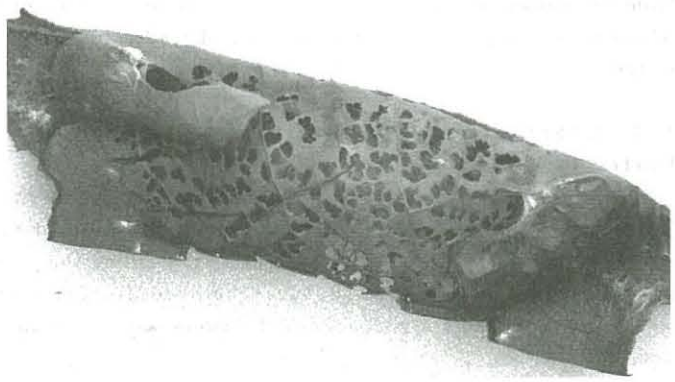


Plate 5. *Milanion hemes* stage III shelter on *Rollinia multiflora*, behind Mount St. Benedict's on Mt. Tabor Track, 28.ii.1994

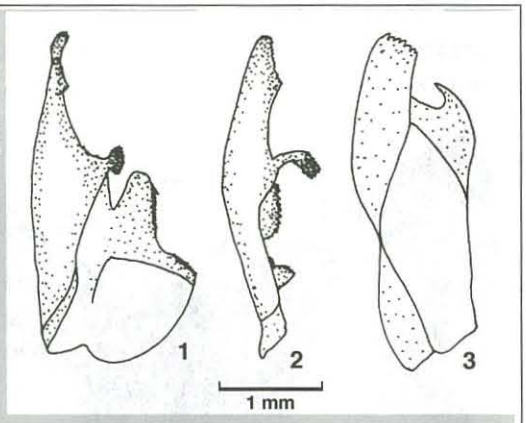
Mylon

All members of this genus are predominantly white with varying diffuse brown markings. Two species, *lassia* and *ander* have white hyaline apical spots in F spaces 6-9, while the remaining three, *menippus*, *pelopidas* and *jason* do not. *M. lassia* is smaller than *M. ander* and has a relatively clearly defined white discal band which extends to the costa. In *M.*

ander, which is a darker species, the discal band is shaded brown towards the costa. *M. menippus* is similar in size to *M. ander*, but not as dark. It has a more or less clear white discal band UPF, whereas in *M. pelopidas* and *M. jason* the band is filled with diffuse brown markings.

M. pelopidas and *M. jason* are very similar, although the genitalia are different: the cuiller of *M. pelopidas* is long, narrow and tapered, while that of *M. jason* is short broad and rounded. The character given by Evans (1953) seems effective: the dark bar at end of the F cell is directed to the outer edge of the discal spot in space 1B in *M. pelopidas*, and towards the middle or inner edge of this spot in *M. jason*.

The life history does not seem to have been recorded for



Figures 1-2, Left valve of male genitalia of *Mylon pelopidas* Fabricius, Chacachacare Is., nr lighthouse on flowers of *Chromolaena odorata*, 7.i. 1982 M.J.W.Cock. **1**, Internal view. **2**, Ventral view.

3, Male genitalia of *Mylon jason* Ehrmann (redrawn from Evans 1953, not to scale. (left valve, internal view, diagrammatic).

any member of this genus, and so the observations recorded here are of particular interest. The food plants found thus far in Trinidad are all Malpighiaceae or Combretaceae.

108. E50/1 *Mylon lassia* Hewitson 1868
Plates 6, 7

No subspecies are recognised of *M. lassia*, which is found

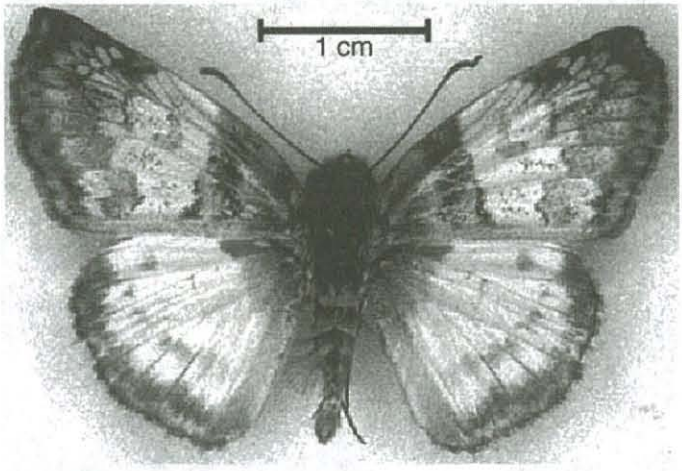


Plate 6 *Mylon lassia* ♂, Brigand Hill, 19.viii.1981

from Mexico to Ecuador (TL) and Trinidad. *Mylon pulcherius* Felder is a synonym described from Mexico which Crowfoot

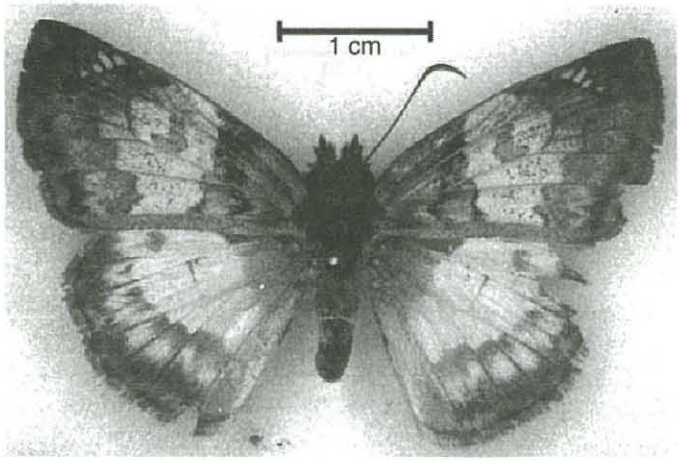


Plate 7 *Mylon lassia* ♀, Curepe, 9.xi.1980

(1893) recorded from Trinidad and Kaye (1904, 1921) lists without further comment. Kaye (1940) recorded *M. lassia* under its correct name as "rather a common species" with several records.

The female of this species is larger than the male and more heavily marked in brown. The colours are white and brown as shown. Illustration in Lewis (1973, Plate 83, No. 60, as *M. pulcherius*, a synonym). No costal fold; F ♂ 18 mm, ♀ 21 mm.

I have relatively few records of this species, and consider it scarce, contrary to Kaye's opinion above. Most specimens are from the Northern Range where I have records from Morne Bleu, Maupertuis, Hololo Mountain Road, Fort George, St Ann's, Symonds Valley and Calvary (near Arima). Away from the Northern Range, I have specimens from Curepe and Brigand Hill; Kaye (1940) records a specimen from Tabaquite (9.iv.1922 F.W. Jackson) and there are two males from Caparo in the NHM.

SAS has reared this species from Andrew's Trace on an as yet un-named plant, where it feeds on the light yellow-green flush leaves. Pupation takes place in the final larval shelter.

109. E50/7 *Mylon ander andrea* Evans 1953
Plates 8, 9

Judging by the specimens in the NHM, this is a very rare subspecies, represented by a male from Colombia and a female, perhaps mis-labelled, from Brazil. The nominate subspecies, *ander* Evans, is more common and found in the Upper Amazon, Peru, Bolivia and south Brazil (Evans 1953). This species was recently added to the Trinidad list (Cock 1982b).

Another white and brown species, with the female larger and more heavily marked. No costal fold; F ♂ 21 mm, ♀ 24 mm.

As recorded in Cock (1982b), I took a male and a female on the summit of Cumberland Hill (2.viii.1981). S Alston-Smith has since taken more specimens at the same locality (xi.1993), and it has also been taken on Morne Catherine (Charles De Gannes) and Rio Claro-Guayaguayare Road (x.1993, SAS).

SAS tells me that Charles De Gannes observed a female oviposit on *Brysonimia coriacea* var. *spicata* (Malpighiaceae)

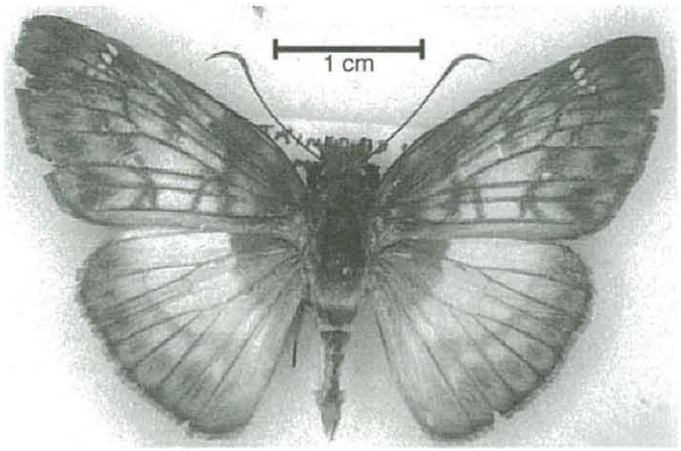


Plate 8. *Mylon ander andrea* ♂, Cumberland Hill, 2.viii.1981

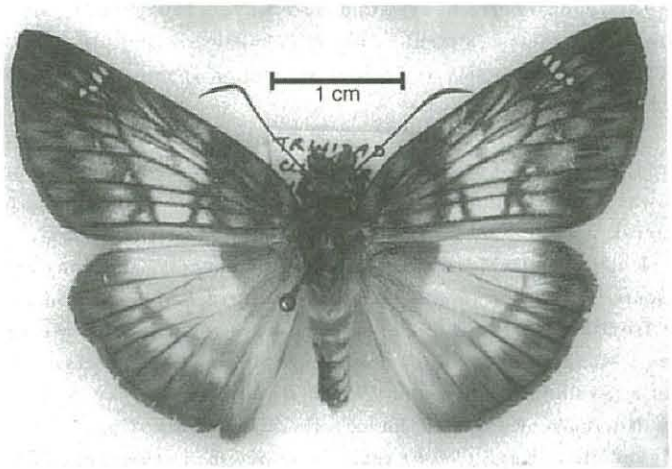


Plate 9. *Mylon ander andrea* ♀, Cumberland Hill, 2.viii.1981

on Morne Catherine (vii.1992). The young larvae are yellow green with a brown head. According to Williams (1929), "*B. spicata*" is widespread on poor soils.

110. E50/8 *Mylon menippus* Fabricius 1776 Plates 10-14

This common and widespread species is found from Mexico to Argentina (TL Surinam). Kaye (1940) records it, under its synonym *Eudamidas melander* Cramer, as "a fairly common species", with records from the south of Trinidad.

A third white and brown species, and once again the female is larger and more heavily marked than the male. Illustration in Lewis (1973, Plate 83, No. 59, as *M. melander*, a synonym). No costal fold; F ♂ 21 mm, ♀ 22-23 mm.

This species seems to be more common in the south of Trinidad than in the north: I have 11 records from the south, one from Central and three from the north. Six of my seven specimens were taken at *Eupatorium* flowers, and I suspect from the dates of capture of the earlier collectors that they had similar experiences. All records are from relatively undisturbed forest areas.

In October 1988, SAS reared this species from two Malpighiaceae on Morne Catherine: *Hiraea fagifolia* and

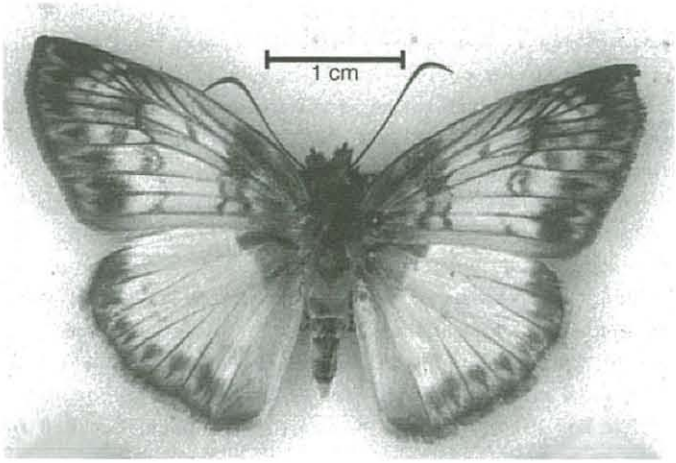


Plate 10. *Mylon menippus* ♂, Rio Claro-Guayaguayare Road, milestone 4-5, 17.ix.1978

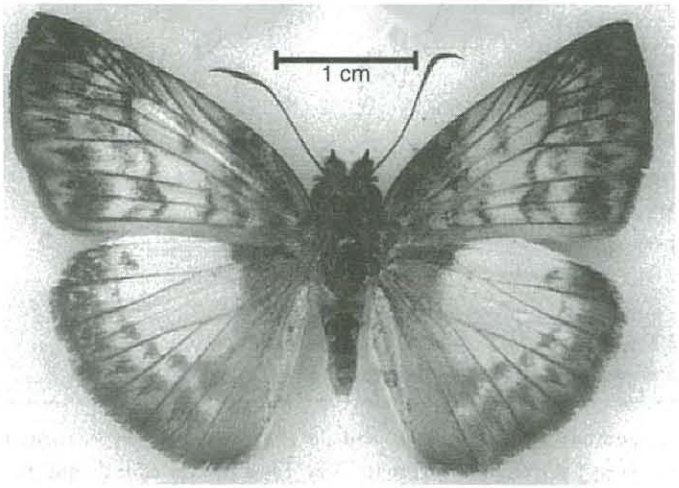


Plate 11. *Mylon menippus* ♀, Arima-Blanchisseuse Road, 19.iv.1982

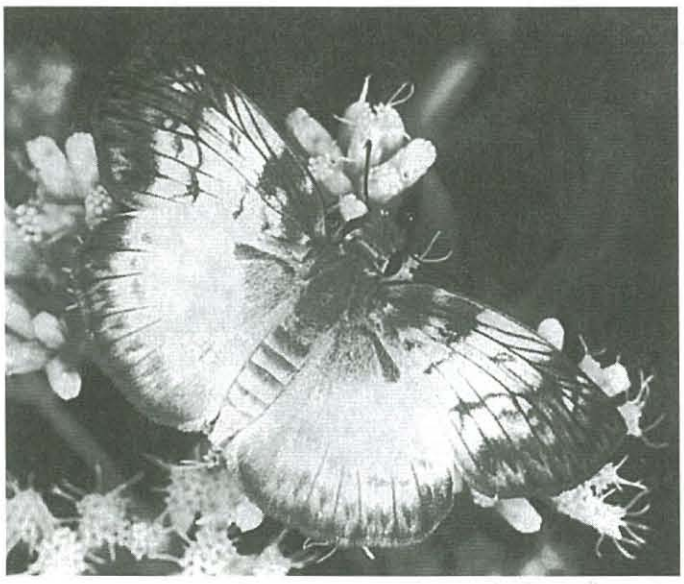


Plate 12. *Mylon menippus* male at flowers of *Austroeupatorium inulaefolium*, Brasso, 11.x.1993

Stigmaphyllon convolvulifolium, while I have reared a specimen collected on *H. fagifolia* on Mt. Tamana (14.x.1995). *S. convolvulifolium* is widespread in dry places in Trinidad, while *H. fagifolia* seems more localised (Williams 1929). The following account is based upon the specimen which I reared.

The final larval shelter was an elongate triangle cut diagonally from the edge of the leaf lamina and folded over upwards with the short side adjacent to the lamina edge; it was hinged along a major leaf vein, and held over the leaf with several strands of silk extending from the margins of the flap over the leaf surface.

The final instar larva (Plate 28) measured 22 mm. Head chordate, broadly indent at vertex and flattened dorsally; rugose, shiny; black, strikingly marked in white: a broad white band across face, extending along epicranial suture to vertex, and laterally with dorsal and ventral extensions towards the posterior margin of the head; within the white band is a black band across the frons, extending laterally across the epicranium, this lateral portion deeply divided by a white projection towards the frons. T1 concolorous with body. Body dull, translucent green; dorsal line slightly darker due to absence of underlying fat bodies; broad, yellow dorso-lateral line composed of vertical marks on anterior half of T2-A8, a typical segment having one quadrate mark and four narrow vertical bars. Spiracles pale, at centre of star of trachea, and linked by weak line of trachea visible through cuticle. Legs and prolegs concolorous.

The pupa (Plate 14) measures 18 mm and is supported at the cremaster and with a Y-shaped silk girdle. It is smoothly contoured, the eyes slightly protuberant; a few weak setae on eyes. The cuticle is transparent showing the underlying green colour; black markings as follows: a thin line along the costa F; spot at base of F; spot dorsally on frons; row of three spots across front of head, the central one displaced ventrally; faint spot posterior and ventral to eye. Spiracle T1 projecting, conspicuous; black posteriorly and laterally, pale anteriorly. Abdomen spiracles concolorous. Pupation lasted 18 days.

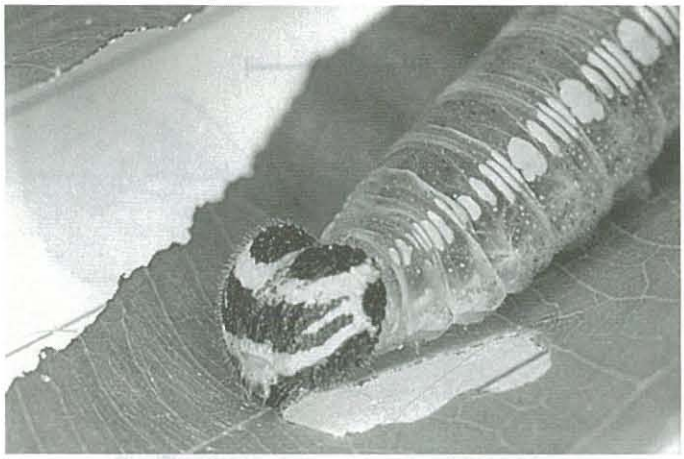


Plate 13. *Mylon menippus* fifth instar larva collected on *Hiraea fagifolia*, Mt. Tamana, 14.x.1995

111. E50/10 *Mylon pelopidas* Fabricius 1793
Plates 15, 16

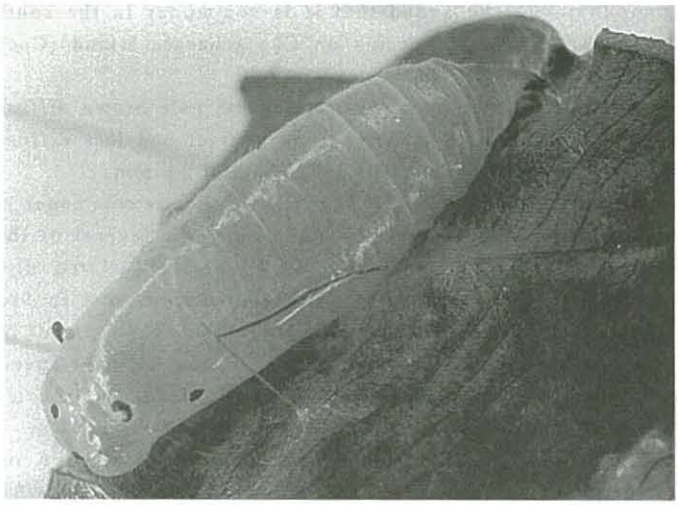


Plate 14. *Mylon menippus* pupa, collected as larva on *Hiraea fagifolia*, Mt. Tamana, 14.x.1995

This is another common and widespread species, found from Mexico to Paraguay (TL "Indiis"). Kaye (1904) lists this species under its synonym *Eudamidas ozema* Butler and records a capture by WE Broadway, and another from

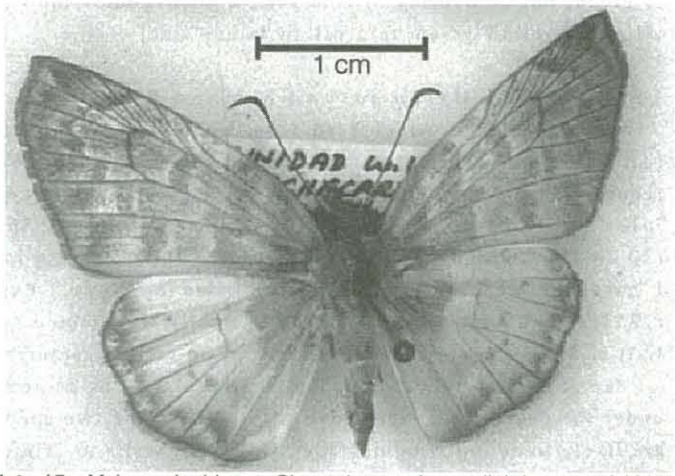


Plate 15. *Mylon pelopidas* ♂, Chacachacare Is., nr. lighthouse, 7.i.1982

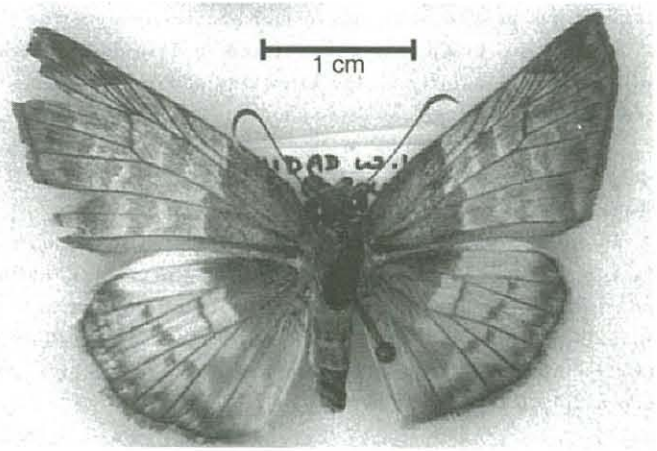


Plate 16. *Mylon pelopidas* ♀, Moruga Bouffe, 23.v.1982

Tunapuna; later he added that it is commoner in the south (Kaye 1921). It also occurs on Chacachacare Island (Cock 1982a).

This is a white species, overlaid with pale brown diffuse markings; the female is larger with heavier and less diffuse markings. No costal fold; F ♂ 19-21 mm, ♀ 21 mm.

I agree with Kaye (1921) that this species is commoner in the south, but even there it is not common. Several of the locality records suggest this species is more associated with disturbed forest than the last, e.g. secondary forest in San Miguel Valley, Arima, Maraval, Waller Field, near summit of Chacachacare Island, Moruga Bouffe. Although I have specimens taken at flowers of *Eupatorium* and *Cordia*, this species does not seem to be so closely tied with flowers as the last.

SAS has reared this species from larvae collected on *Combretum fruticosum* (Combretaceae) at Los Bajos (ii.1990). *C. fruticosum* occurs on hillsides and in thickets in moist and dry districts (Williams 1932). The larvae of *M. pelopidas* have the head chordate, light brown, with the vertex dark brown and five streaks, one centrally, and two laterally, angled inwards towards mouth parts; the body ground colour is green, but an overlay of fine yellow dots renders the overall effect yellow-green; thin yellow lateral line.

112. E50/11 *Mylon jason* Ehrmann 1907

This species is widespread from Guatemala to Paraguay (TL Venezuela), but not common in collections. Kaye (1940) records it from Trinidad, under the name *Eudamidas macaira jason*, on the basis of specimens collected from Port of Spain (10.vii.1927, Forbes) and St. Ann's (27.iii.1929, Huntingdon). I have not seen the two specimens listed by Kaye. Evans (1953) lists a female from Trinidad in the NHM collected by A Hall at St Ann's, xi-xii.1931. I know of no further captures.

Very similar to the last, but distinguished as indicated under the generic account above. In the field the two species are likely to be indistinguishable. On recent visits to Trinidad I have made a point of collecting specimens that appear to be *M. pelopidas* in the hope of finding *M. jason*, but thus far all material has proved to be the former species, suggesting that *M. jason* is not commonly encountered in Trinidad. Further collecting, particularly on the hills around Port of Spain may lead to the rediscovery of this species.

113. E52/1 *Clito trinidadensis*, n. sp.
Plates 17, 18

In Cock (1982b), I listed this species as *C. littera littera* Mabille, a new record for Trinidad. On closer examination, and in light of de Jong's recent description of *C. jonkersi* from Surinam (de Jong 1983), I am now of the opinion that the material from Trinidad also represents a new species, and accordingly I describe it here.

Description. Male. Plates 10-11. F 16-17 mm. UPF brown; diffuse dark brown pre-discal fascia in space 1; similar sub-marginal fascia; margin slightly paler, crossed by dark brown veins; white hyaline spots in spaces 1-8 and cell: space 1 a

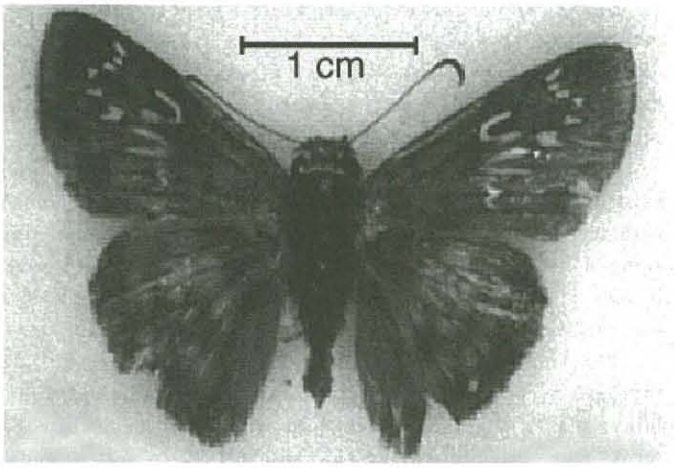


Plate 17. *Clito trinidadensis* **n. sp.** paratype ♂, La Laja Ridge, 17.iii.1982

double arc spot at centre, space 2 a basal **V**-shaped spot, space 3 a basal quadrate spot, spaces 4-8 a row of spots except that of space 5 displaced distally, a **U** shaped spot at end cell. UPH brown; discal area, consisting of a patch in space 1C at about 1/3, distal half of cell, spot near base of space 2, base of spaces 3-6, and quadrate spot across space 7 at 1/2, pale, semi-hyaline, tinted violet-blue with brown veins; pale brown marginal and sub-marginal fascias. UNF light brown; brown sub-marginal fascia; margin crossed by brown veins; space 1A to 4/5 near white; space 1B distal to hyaline spot pale brown except submarginal line and vein 1B which are brown. UNH

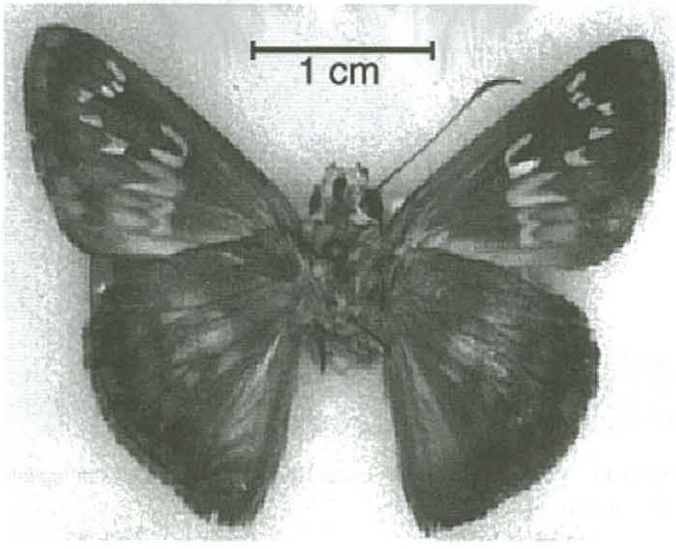
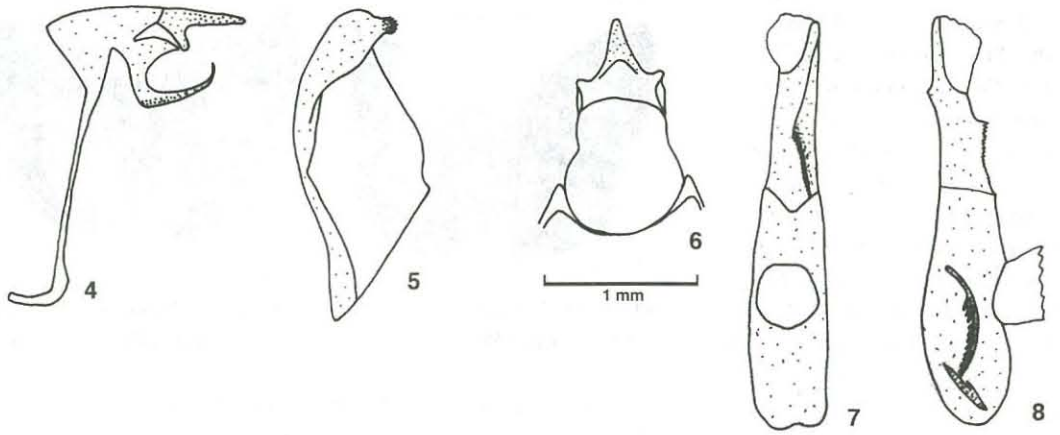


Plate 18. *Clito trinidadensis* **n.sp** holotype ♂ UNS, Morne Catherine, 24.iii.1982;

brown; spaces 1A, 1B and 1C pale brown in basal 2/3; disc as UPH but paler violet with brown veins; dark brown sub-marginal fascia. Fringe of wings brown. Body above brown, except margin of collar, eyes and segments of labial palpi which are pale. Thorax below grey-brown; head below white. Antennae dark except anterior margin of shaft which is chequered with white, and pure white basally; nudum dark chestnut brown, 21 segments of which 2-6 could be considered on



Figures 4-8 male genitalia of *Clito trinidadensis* n. sp. holotype (Trinidad, W.I., Morne Catherine, 24.iii.1982, M.J.W. Cock).

4, genitalia with valves and aedeagus removed, lateral view;
5, left valve internal view;
6, uncus and gnathos dorsal view;
7, aedeagus, dorsal view;
8, aedeagus, lateral view from left.

the club. Costal fold 5-6 mm; reaches level of club.

Male genitalia. Figures 4 8. Uncus with a pair of lateral lobes near base. Gnathos broad, turned up sharply at apex. Cucullus slender, the tip heavily toothed. No costal process. The aedeagus is pointed, with an angled ventral projection near apex, a sclerotized dorsal ridge towards the apex and a striking pectinate cornutus.

Female. Unknown.

Type material. Holotype male: TRINIDAD, W.I., Morne Catherine, 24.iii.1982, M.J.W. Cock. Paratype males: TRINIDAD, W.I., Northern Range, La Laja Ridge, 17.iii.1982, M.J.W. Cock; TRINIDAD, W.I., Morne Catherine, 28.i.1980, S. Alston-Smith; 3 ♂♂ TRINIDAD, W.I., El Tucuche, iii.1989, S. Alston-Smith. There are three specimens from Trinidad in the Angostura-Barcant collection in Laventille, Trinidad, but for lack of reliable data these are not included in the type series. The holotype will be deposited in the Natural History Museum, I retain the first paratype, and the remaining paratypes are in the collection of S. Alston-Smith, Petit Valley, Trinidad.

Diagnosis. In appearance this species is close to *C. littera* Mabille which occurs in Peru (ssp. *littera*), French Guiana (ssp. *anda* Evans) and Bolivia (ssp. *nebulosa* Draudt) (Evans 1953) and *C. jonkersi* de Jong from Surinam (de Jong 1983). It differs in the dusky discal band of the hindwing which is white in *C. jonkersi* and *C. littera anda*, and faint in *C. littera littera*. Hitherto, I have treated this species as *C. littera littera* (Cock 1982b), but the basal edge of the cell spot of the fore wing of *C. littera littera* is straight and perpendicular to the costa, whereas that of *C. trinidadensis* is somewhat rounded, but clearly angled to the costa.

The male genitalia are intermediate between those of *C. jonkersi* and *C. littera*. The uncus has a pair of lateral lobes apparent in dorsal and lateral view; *C. jonkersi* has similar, but less well developed lobes. The valve is closer to *C. littera*, although clearly differently proportioned, and lacks the costal process of *C. jonkersi*.

Discussion. de Jong (1983) pointed out that Evans' (1953) diagnosis of the genus *Clito* as having 16 nudum segments is erroneous, based upon the material in the NHM arranged by Evans which has 18-22 segments. The nudum of 21 segments for *C. trinidadensis* fits well in the range for the genus.

Habitat. The localities for the type series include a hill top and a ridge top of the Northern Range of Trinidad. The southern summit area of Morne Catherine at the time of these captures was a wide trail overshadowed by light semi-deciduous forest, although in recent years, some of this trail has been tarmaced and some has become overgrown. The La Laja Ridge site is a wide, open track bordered by a mixture of, at that time, abandoned smallholdings and relatively undisturbed forest. I don't know where on El Tucuche the remaining paratypes were collected. The fact that at least nine specimens of this species are now known from the island suggests this is not that rare a species within its selected habitat.

114. E52/3 *Clito clito* Fabricius 1787
Plate 19

Apart from a specimen from Guatemala, this species is restricted to Trinidad, the Guianas (TL French Guiana) and

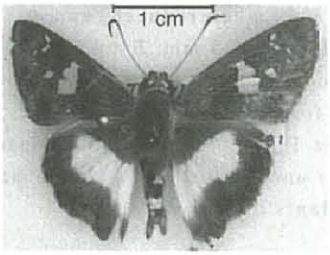


Plate19. *Clito clito* ♂, Spanish Farm, 12.x.1980;

Brazil; apart from a series from Belem, it is rare. I recently added this to the Trinidad list (Cock 1982b). Life history and food plants unknown.

This is a dark brown species with white markings. The only species it might be confused with is *Milanion hemes*, but they can be separated by the markings, size and wing shape. I do not know the female. Illustration in Lewis (1973, Plate 81,

No. 47). Costal fold very narrow, 3 mm long. F ♂ 15 mm.

I introduced this species to the Trinidad list on the basis of a male which I took at *Cordia curassavica* flowers (12.x.1980) at Spanish Farm, Las Lomas (Cock 1982b). Recently I took a second male resting under a leaf in a sunlit clearing in Bush Bush (7.v.1995). SAS has seen specimens at Valencia Forest, and Las Cuevas Road, but has yet to capture this species. Clearly, a very rare species, perhaps associated with lowland forest. A.M. Moss reared this species, although he does not record the food plant or any details (Moss 1949). I have examined his material in the NHM. The pupal skin is transparent, and hence probably green in life; the T1 spiracle projects and has a C shaped rim.

114a. E52/5 *Clito zelotes* Hewitson 1873
Plates 20, 21

This rare species is known only from French Guiana and the Upper Amazon (Evans 1953). It has not previously been

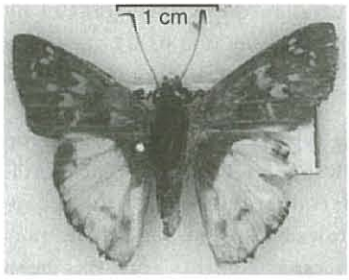


Plate 20 *Clito zelotes* ♂, Aripo Savanna, viii.1986, S. Alston-Smith

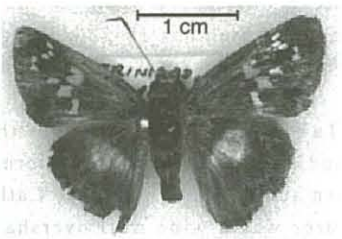


Plate 21 *Clito zelotes* ♀, Aripo Savanna, viii.1986, S. Alston-Smith

recorded from Trinidad (Cock 1982b). Indeed, the female described and illustrated here does not seem to have been previously recorded at all. This new record for Trinidad is based upon captures by S Alston-Smith at Waller Field and Aripo Savanna.

Male brown with white hyaline spots. The broad pale band H is yellow in spaces 1A-5, and white in spaces 6 and 7. The female has not been described before. It resembles the male, but the band H is much reduced, and white rather than yellow. Costal fold narrow, 5 mm; F ♂ 15 mm, ♀ 14.5 mm.

This rare and localised species is only known in Trinidad from the lowland forest of eastern Trinidad around Aripo Savanna and Waller Field. Captures were made in January 1986 (Waller Field) and August 1986 (Aripo Savanna). Life history and food plants unknown.

115. E53 *Xenophanes tryxus* Stoll 1780
Plates 22-24

This distinct species is the only one of the genus. It is common and widespread from Mexico to Argentina. Kaye (1904, 1921) records it as "a fairly common insect".

The ground colour of this species is brown, overlaid UPS with grey scales. The extensive pale hyaline markings F and H are distinctive. UNH broadly white except margin and narrow macular sub-marginal line. A distinctive species.

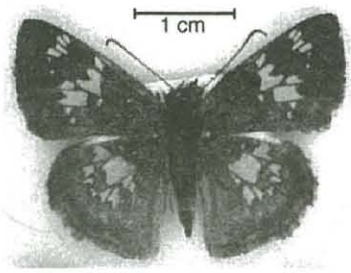


Plate 22 *Xenophanes tryxus* ♂, Cats Hill, 4.vii.1979;

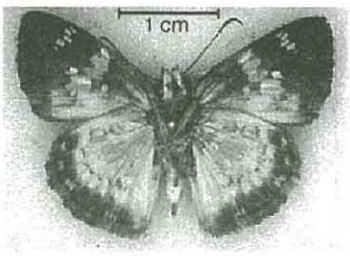


Plate 23 *Xenophanes tryxus* ♂ UNS, Moruga East, 24.ii.1980

Illustration in Lewis (1973, Plate 88, No. 34, ♀). No costal fold; F ♂ 14-16 mm, ♀ 15-15.5 mm.

This species is to be found occasionally in the lowlands of central and southern Trinidad, with just two records from the valleys of the Northern Range. It is found in open, disturbed situations including open secondary forest. A disproportionate number of captures seem to have been made close to the sea (e.g. Nariva Swamp, Irois Beach, Manzanilla, La Brea, Manzanilla Windbelt Reserve).

Moss (1949) found this species to feed upon *Malachra fasciata* (Malvaceae), and one or two other members of this family. He records the larva to be whitish green, freckled and slightly hairy with a rough, sepia-brown head, and the pupa to be hairy, warm brown, freckled and white powdered. In Rio Grande do Sul, Brazil, Biezanko (1963) and Biezanko and Mielke (1973) record the food plant as *Pavonia spinifex* (Malvaceae). In Texas, which is the northern limit of the range of this species, Kendall and Rickard (1976) found the food plant to be *Malvaviscus drummondii* (Malvaceae).

In Trinidad, food plants include *Urena lobata*, *Malachra* sp. and *Hibiscus* sp. (all Malvaceae). I have reared a male found on *U. lobata* at Spanish Farm (collected 13.xi.1981), and reared a larva through to the distinctive pupa on *Malachra* sp. from Saunder's Trace (collected 11.x.1993), while SAS has reared this species from *Hibiscus* sp. On *U. lobata*, the larval shelter was a nearly square flap from the margin of the leaf, folded over onto the top of the leaf. Full grown, the larva (Plate 24) measured about 15 mm; the head was rugose, black, and chordate; body yellow-green dorsally, with dorsal line darker; a thin white dorso-lateral line; blue-

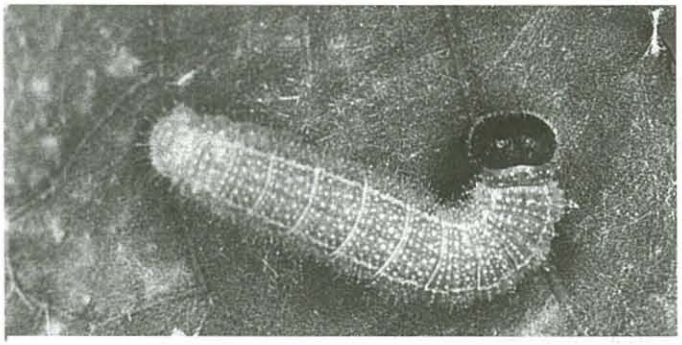


Plate 24. *Xenophanes tryxus* fifth instar larva collected on *Malachra* sp., junction of Rio Claro - Guayaguayare Road and Saunders Trace, 11.x.1993

green laterally with scattered short, fine, white setae arising from small white dots; T1 and all legs concolorous. Moss's pupal case preserved in the NHM is transparent brown, rounded and covered with long, brown, projecting hairs; loose white waxy patches are arranged in a pattern on the thorax and abdomen, patches on T, transverse lines on A1-3, transverse rows of patches on A4-8. My larva pupated on 26.xi.1981, and an adult male emerged eight days later.

One 10 mm field collected larva (Spanish Farm, 13.xi.1981) was parasitised by larvae of an externally feeding eulophid parasitoid, which pupated in the host shelter.

Antigonus

Biezanko (1963) records that another species of the genus, *Antigonus liborius areta* Evans 1953, feeds on *Chorisia speciosa* (Bombacaceae) and species of *Abutilon*, *Pavonia* and *Hibiscus* (Malvaceae). Both these families are quite closely related to Sterculiaceae, the family of the food plant given below for *Antigonus erosus*.

116. E55/1 *Antigonus nearchus* Latreille 1824 Plates 25, 26

This common and widespread species is found from Mexico to Paraguay (TL South America). Two males labelled Jamaica in the NHM are most probably mis-labelled (Brown and Heineman 1972). Kaye (1904, 1921) records this as a common species around Port of Spain.

This species shows strong sexual dimorphism. Male dark brown above with indistinct markings UPF: pale scales in basal band, apical patch and sub-marginal above tornus; grey-brown discal band from space 1B to costa (paler at costa), with a projecting extension in space 3; chestnut scales in sub-discal patch space 1B and at margin spaces 1B and 2. UPH with indistinct brown bands, clearest in spaces 2 and 3. UNF chestnut brown, brown basally; indistinct discal band and arced submarginal band from apex to tornus. UNH costal half chestnut brown, shading into pale brown at dorsum; irregular dark bands and patches except in spaces 1A and 1B. Female light purplish brown above with much clearer markings:

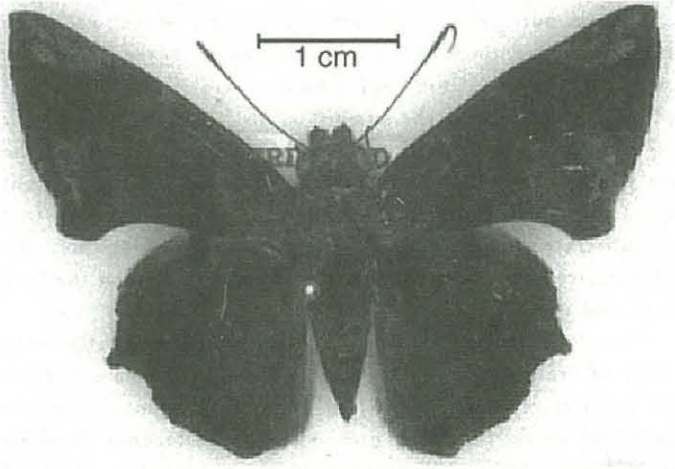


Plate 25. *Antigonus nearchus* ♂, Arima-Blanchisseuse Road, milestone 3.5, 5.x.1979;

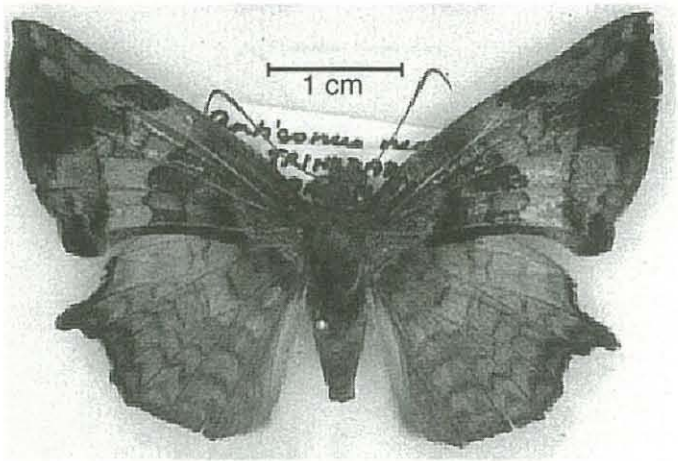


Plate 26 *Antigonus nearchus* ♀, Parrylands, 2.ii.1980

brown patches UPF sub-basally, termen, subapically and UPH along margin spaces 3-5. UNS light yellow brown, with narrow, brown irregular bands across both wings. The wings are broader, and the HW projection in space 6 is longer in the female. The wing shape and colouring is distinctive for this species. Illustrations in Riley (1975, Plate 22, Fig. 9, ♀) and Lewis (1973, Plate 80, No. 29, ♂). Narrow costal fold; F ♂ 21 mm, ♀ 23 mm.

I would normally regard this as an occasional species, but sometimes it can be common at *Eupatorium* flowers, especially in the south (e.g. in Parrylands in January 1988). It is widespread in or near forests in both the north and south, usually at low altitude, although I do have a specimen from 701 m or 2300 ft. (Morne Bleu), and there is a specimen labelled El Tucuche in the NHM (viii.1905, F Birch). In addition to regularly feeding on flowers, males can sometimes be found feeding on damp gravel beside streams (e.g. Arima Valley, 5.x.1979). This and the next are probably the only Trinidad species which I have observed to do this, although I have seen many other species do so in South America.

Kaye (1921) notes that the larva feeds on cashew, *Anacardium occidentale* (Anacardiaceae).

117. E55/2 *Antigonus erosus* Hübner 1812 Plates 27-35

This, like the last, is a common and widespread species. It is found from Mexico to Paraguay (TL unspecified). Kaye (1904, 1921) found this species frequent in the north of Trinidad, and Sheldon (1936, 1938) records it from Tobago (Cocoa Wattie, Roxborough, Scarborough).

This species is quite variable in the density of the markings and the extent of the hyaline markings of the female. It shows slight sexual dimorphism, the female normally having slightly hyaline pale markings in cell, and spaces 2 and 3, which are absent in the male. Male UPS dark brown with an overlay of grey-blue scales which define ground colour lines and bars, of which UPF two bars across end cell, and a broad submarginal line are the most distinct. UNS brown, yellow brown at margins; two violet discal spots space 1B UNH, and

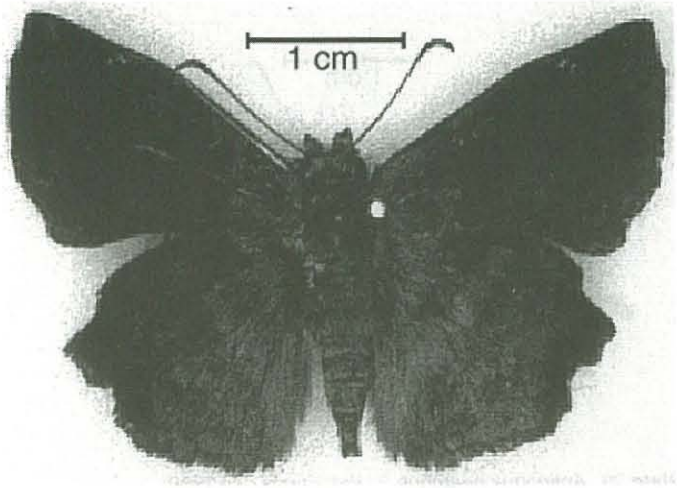


Plate 27. *Antigonus erosus* ♂, Parrylands, 20.i.1988;

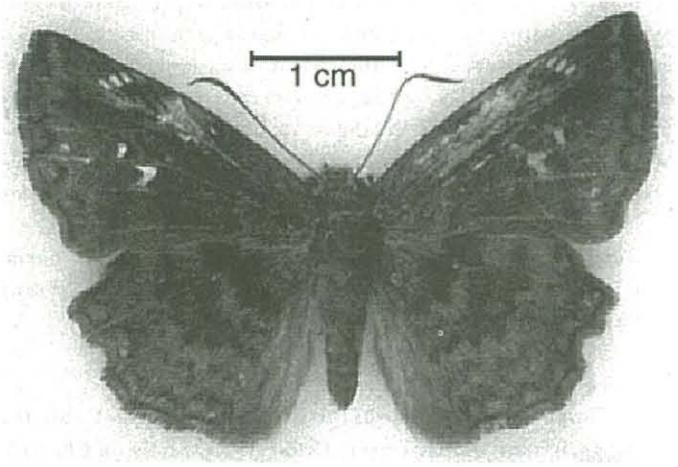


Plate 29. *Antigonus erosus* ♀, Morne Catherine, 6.viii.1979;

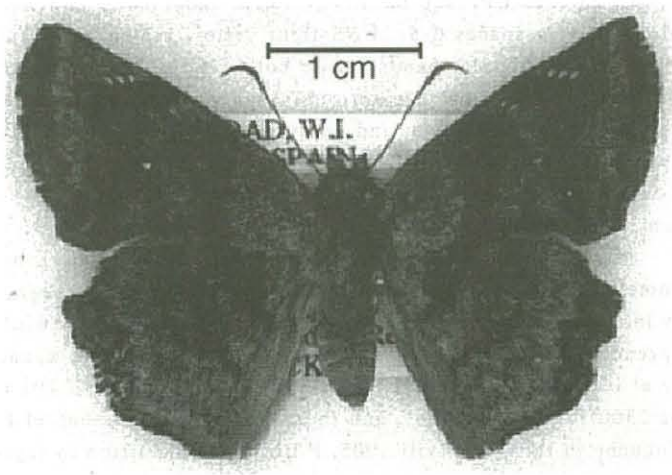


Plate 28. *Antigonus erosus* ♀, Port of Spain, reared from a larva collected on *Guazuma ulmifolia*, 10.x.1995

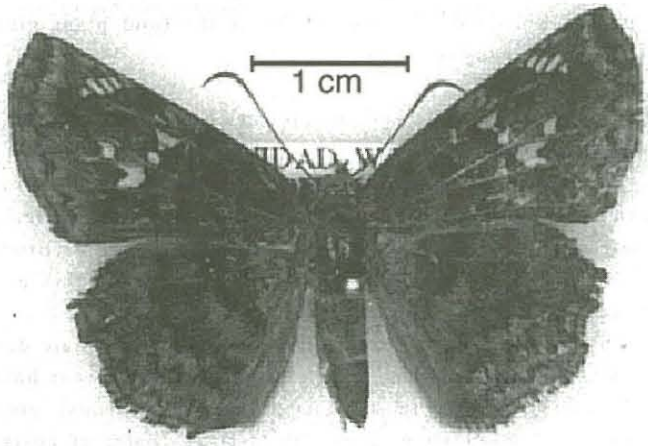


Plate 30. *Antigonus erosus* ♀, Port of Spain, 9.x.1995

a black spot at termen UNH. Female UPS dark brown, the overlay of grey-blue scales strong only in space 1B UPF and UPH; margins variable shaded chestnut brown. UNS light brown, with irregular brown bands on both wings; light violet discal bars across space 1B UNF, space 1A UNH yellow and dark spot termen UNH. The wing shape and colouring is distinctive for this species; *Noctuana stator* Godman and Salvin (Cock 1992) perhaps comes closest, but the wing shapes are different, those of *N. stator* projecting at end of veins 3 and 4 H, and angled at end of vein 6 F. Illustration in Smart (1976, Page 113, Fig. 42, ♂). Narrow costal fold; F ♂ 19 mm, ♀ 20 mm.

In Trinidad, this species is common and widespread, especially in and around secondary forest. Although it is mainly found in lowland situations, I have specimens from Morne Catherine (457 m or 1500 ft.), Mt. Tamana (305 m or 1000 ft.) and the summit of Brigand Hill. *A. erosus* is attracted to flowers and is sometimes common at *Eupatorium* flowers in the south. I have seen males drinking at mud puddles several times in the valleys of the Northern Range, and once at Scotland Bay on the mud behind the beach (9.i.1981); this is probably the skipper which shows this behaviour most frequently in Trinidad. I once found a male feeding on fresh donkey droppings on the Blanchisseuse-Paria Bay Track (22.i.1980); this is the only instance of a skipper feeding on mammalian excreta which I have seen in Trinidad.

I have noticed a characteristic resting stage when the adult is inactive, once by a female resting for several hours on the Port of Spain Hilton roof walkway late in the afternoon, and once by a male on the summit of Mt. Tamana during very overcast and showery weather. In this position (Plate 32) the fore wings are held slightly raised, with the dorsum at right angles to the body, while the hind wings are pressed against the substrate and held with the dorsum tight against the abdomen, so that there is almost no overlap between the fore wings and the hind wings.

Comstock and Vazquez (1961) record and illustrate details of the biology of *A. erosus* in Mexico on an unidentified small tree. Subsequently, a larval food plant in Mexico was found to be *Guazuma ulmifolia* (Sterculiaceae) (Kendall and McGuire 1975). The same food plant is used in Trinidad where it is known as Bois l'orme or West Indian elm (Freeman and Williams 1928). SAS and I found larvae on this host in

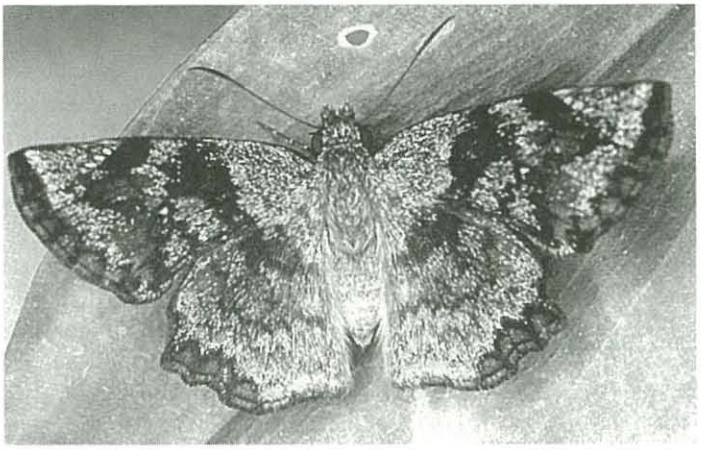


Plate 31. *Antigonus erosus* ♀ in normal resting position (reared, Port of Spain 1.xi.1995)

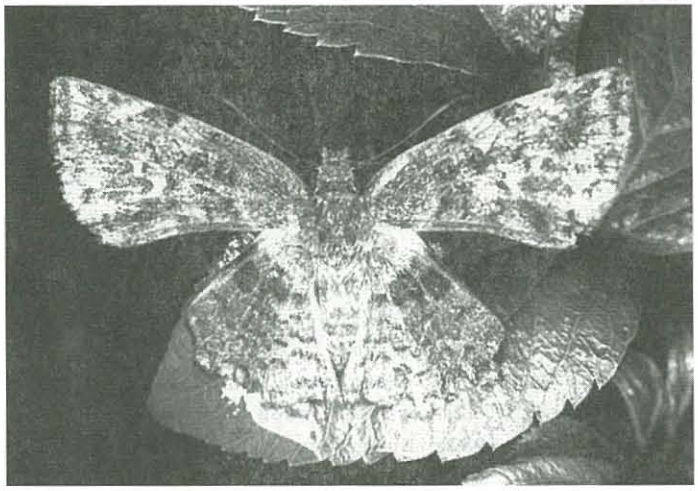


Plate 32. *Antigonus erosus* ♀ in long term resting position, Mt. Tamana, 12.xi.1995.

Parrylands (ii.1988) but failed to rear them. Subsequently SAS reared out a larva collected on this tree on Point Gourde (x.1993), and I have reared it from the same host and locality (14.vii.1996) as well as from a larva collected at Port of Spain, above the Hilton Hotel (10.x.1995). In Trinidad, *G. ulmifolia* is found on hillsides and in forests in moist and dry districts (Williams and Cheesman 1929). There is substantial variation in the foliage (Williams and Cheesman 1929) which I tentatively associate with plants growing in shade, small, thin, shiny leaves, and open sun, larger, thicker, mat leaves, so much so that initially I thought two different species were involved. The larval description below is based on the female specimen which I reared from Port of Spain which was collected from a plant growing beside the road above the Hilton in open sunlight. The description matches that of Comstock and Vazquez (1961) closely, although not exactly, e.g. the Mexican material has a narrow black dorsal plate on T1, whereas this is concolorous in Trinidad larvae.

The stage I shelter of the Port of Spain material is a small triangular flap (c. 8 x 4 mm) cut from the edge of the lamina near the base of the leaf; it is hinged on a leaf vein, opposite the longest side, and folded over upwards; the larva ate a row of small holes along each side of the vein under the shelter. The stage II shelter is a pocket (c. 20 x 15 mm) between two leaves one on top of the other; the lower leaf has the shelter margin eaten very irregularly, and several holes on the UNS of the shelter, some bridged by one or two strands of silk; upper leaf has three small round holes adjacent to the edge of the shelter, and several large irregular holes adjacent to a vein on the opposite margin of the shelter. Shelter III is also between two leaves, the lower, small leaf completely covered by the upper leaf; the larva rests on the undersurface of the upper leaf.

Three final larval shelters of the Point Gourde material were also formed by attaching one leaf on top of another; one shelter had both leaves extensively perforated with round holes and lines, about 2mm wide; the second resembled the first, but the upper leaf had a broad central line without holes and the larva rested on the undersurface of this; the third shelter had no perforations at all in the leaves. I suspect that these differences merely reflected the maturity of the larva in the shelter, and by the time the larva is ready to pupate the whole shelter is perforated.

The final instar larva (Plate 33) measured 30 mm. The head is broad and chordate, slightly indent at vertex, apical portions flattened; posterior opening very narrow, half the width of the head; covered with short, scattered, pale setae; ground colour light brown; posterior margin dark brown; the head is decorated with rows of small protruding bumps (tubercles): a triple row parallel to the epicranial suture, converging to a double row near frons, the apical tubercles dark brown; a second triple row converging to a double row from the apex downwards and then angled inwards stopping short of the frons; the lateral portions of the epicrania are covered with semi-regularly arranged tubercles, but the pattern is not clear; each side of the frons there is a short grey streak. T1 concolorous with body. Body dull green, covered with scattered yellow dots to give a yellow-green appearance; dorsal line only slightly darker; narrow yellow dorso-lateral line; narrow, diffuse, pale ventro-lateral line; body covered with short, erect yellowish setae; anal plate slightly pointed.

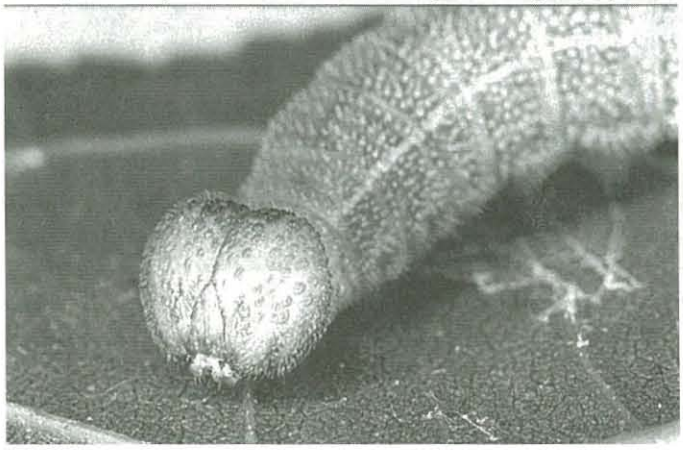


Plate 33. *Antigonus erosus* fifth instar female larva collected on *Guazuma ulmifolia*, Port of Spain, 10.x.1995

Spiracles more or less concolorous. Legs and prolegs concolorous.

The pupa (Plate 34) was formed in the last larval shelter, lined with brown silk and supported by the cremaster and a Y-shaped silk support. The pupa measured 18 mm; rounded with no projections; brown; whole surface covered with erect seta-like white waxy spikes, except for T1 spiracles, costal margin of wing cases and outline of appendages. The pupal stage lasted 15 days.

In contrast, mature larvae from Point Gourde (Plate 35) were smaller, measuring about 24mm. They resemble the

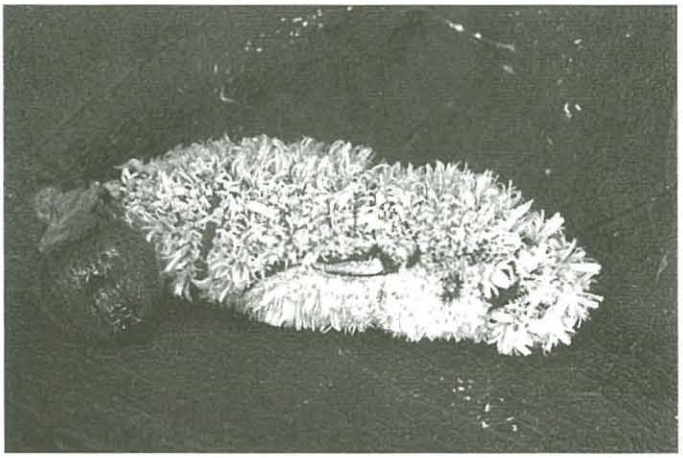


Plate 34. *Antigonus erosus* pupa, collected as larva on *Guazuma ulmifolia*, Point Gourde, 14.vii.1996

Port of Spain larva except that the head is darker brown, especially around the mouth parts, and the dorsal portion around each apex and across the vertex is black.

Further investigation is needed to understand the differences between the two types of larvae described above. As

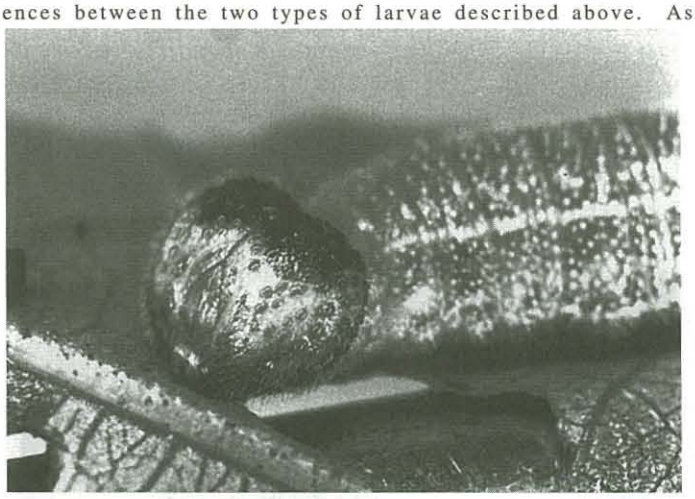


Plate 35. *Antigonus erosus* fifth instar male larva collected on *Guazuma ulmifolia*, Point Gourde, 14.vii.1996

noted, all three larvae from Point Gourde were males, whereas that from Port of Spain was female, so possibly these are sexual differences. Equally, it may be that the larvae are variable, like the adults.

E58/2 *Zopyrion satyrina* Felder 1867

There are two female specimens of *Zopyrion satyrina* in the Lamont collection at UWI from Patos Is (Cock 1982b). These were collected vi.1918 by "CBW" (I assume this is C B Williams), when the island belonged to Trinidad and Tobago. There are no records from the country as recognised today. I am not familiar with this species or genus in the field.

Female UPS brown, light brown along margin; UNS light brown, striated with brown and chestnut brown UNH; a marginal dark spot in each space UNF and UNH, strongest in spaces 1C-3 and 5-6 UNH; UNH with indistinct discal and submarginal bands of chestnut brown with dark margins. Illustration in Lewis (1975, Plate 88, Fig. 36 UNS). Costal fold; F ♀ about 16 mm.

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FIELD OBSERVATIONS OF *TROPIDACRIS COLLARIS* (ORTHOPTERA: ROMALEIDAE)

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Tropidacris is a neotropical genus of three known species that include the largest grasshoppers in the world (Carbonell 1986). Two species, *T. collaris* and *T. cristata*, have very broad ranges that include most of South America north of the southern cone. The former is the species found on Margarita Island, while the range of the latter includes Trinidad and Tobago. The two are readily distinguished by the following adult characters (Carbonell 1984, 1986): a) antennae entirely yellow in *T. collaris*, basal two segments brown to black in *T. cristata*, b) dorsal crest of pronotum continuing onto posteriormost lobe (metazona) in *T. cristata* but not *T. collaris*, c) hindwings mainly orange to red in *T. cristata*, green to blue in *T. collaris*. We will disregard here the third, smaller species, *T. decampsi*, known from a single locality in Colombia.

Hoppers (larvae) of *Tropidacris* show contrasting, evidently warning colouration, while adults at rest are very well camouflaged against vegetation. The forewings bear a strong resemblance to leaves, while the hindwings present striking flash colouration, especially in *T. cristata* (Rowell 1983; pers. obs.).

Adult *Tropidacris* are spectacular insects and are not rare throughout most of the genus's range. *T. collaris* is often encountered along much of the Caribbean coast and the llanos region of Venezuela (F. Cerdá, pers. comm.). Nonetheless, they are not often encountered in large numbers. In Trinidad I have never seen two adult *T. cristata* in one day and possibly not two in the same calendar month. Rowell's (1983) brief account of *T. cristata* summarized the biological information on record for the genus, ending with the remark that "Nothing very much is known of any of them." Carbonell (1986) supplied some further details, noting that in both species the hoppers are gregarious, generations are not discrete, and all stages feed on a variety of plants. He also noted that *T. collaris* shows a very broad habitat range from humid forest to drier, more open formations, while *T. cristata* is largely absent from open, dry formations.

It is this sparseness of biological information that justifies the present brief observations. All are from an area of cactus scrub outside the village of La Vecindad on the island of Margarita, Venezuela, on 19 August 1997. This was toward the end of a dry season that lasts the greater part of the year on Margarita. Observations were concentrated in a shallow, dry gulch about 150 m long, lined with grasses, sedges, and many herbaceous broadleaf plants but few trees.

My attention was drawn to *T. collaris* when I happened to see two adults in quick succession. I began a deliberate search and collected all adults that I could find.

The only hoppers that I encountered were a single, dense aggregation close to the ground on a small shrub close alongside the gulch. I netted a sample of these, which disturbance caused the remaining individuals to scatter. Some time later I returned to that spot and found the aggregation re-formed in a similar situation less than a meter from where I had first found it. Although I did not attempt to quantify adult density in any part of the gulch, they appeared to be most concentrated within a very few meters of the aggregation of hoppers.

I tasted one hopper and found it to be very bitter, approximately like an adult monarch butterfly (*Danaus plexippus*). This distastefulness is consistent with the orange-and-black body colouration.

Casual observations elsewhere around La Vecindad confirmed that the adult grasshoppers were abundant over a large area. The local people with whom I spoke seemed unsurprised by this and told me that it is a seasonal phenomenon, although they were vague about the particular season of appearance of adults or whether they are abundant every year. They told me that *T. collaris* is locally known as *langosta* or *ñangaragato*.

The adults that I collected amounted to four females and 22 males with mean hind-femur lengths of 38.8 mm (range 36.5 - 42.0 mm) and 33.3 mm (range 29.0 - 37.5 mm), respectively. Measurement was of alcohol-preserved specimens with an ordinary ruler to the nearest half millimeter.

Dissection of the females showed that the two largest had well-developed ovaries with apparently mature ova. The next largest had slightly developed ovaries, while the smallest showed no ovarian development.

The sample of hoppers comprised 19 females and 10 males, with hind-femur lengths shown in Fig. 1. Sex is readily determined by ventral examination of the abdominal terminalia. Measurement was with an eyepiece micrometer to the nearest 0.16 mm; choice of the left or right leg was according to convenience.

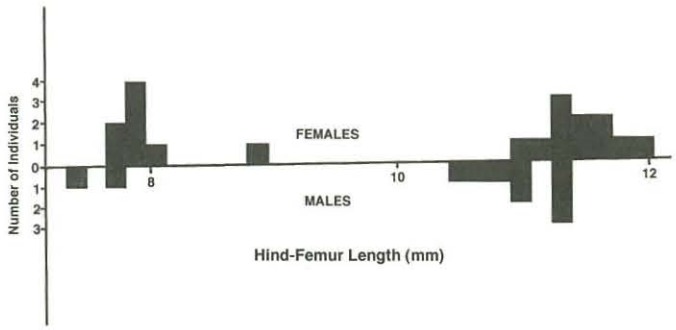

Figure 1: Frequency distribution of hind-femur length in 19 female and 10 male hoppers of *Tropidacris collaris* from an aggregation.

The size-frequency distribution of hoppers indicates that these represent two instars, with males on average slightly smaller than same-instar females. This conclusion is corroborated by consistent within-sex differences in the form of the abdominal terminalia between the two size-groups.

The basis of the strongly skewed sex-ratio in the sample of hoppers is not readily apparent. Given the small data-set, I do not discount the possibility that it is due to sampling bias.

Taken by themselves, the observations of adults are consistent with the hypothesis of a highly seasonal life cycle, with males developing somewhat faster than females and a concentration of breeding around the start of the rainy season. The presence of hoppers during the same time suggests that *T. collaris* breeds at two distinct seasons on Margarita.

I regret that I was unable to extend these few opportunistic observations and hope that they may stimulate someone else to undertake a more thorough study.

Thanks to C.S. Carbonell, F. Cerdá and H.F. Rowell for critical comment on these observations.

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Contents

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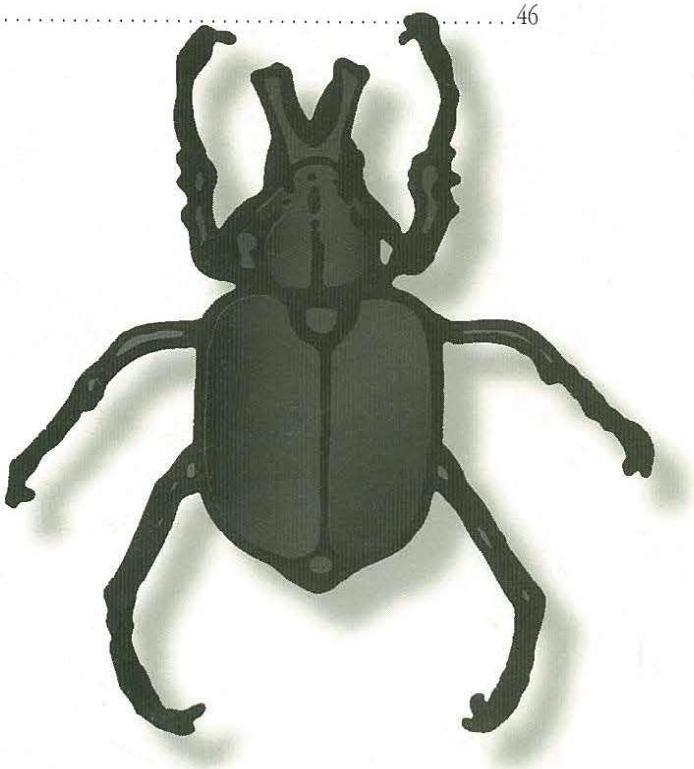

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