

sects that would suggest that less healthy parts of a plant are more attractive to or favour the development of the insect.

The coincidence of the current protracted outbreak with the occurrence of periods of unusually high rainfall over the past few years suggests a causal relationship which I have not been able to substantiate by a comparison of the available outbreak and precipitation records. True, the outbreak records are imprecise and incomplete, but nevertheless the distribution, development and persistence of the attack point to a causal factor other than weather.

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THE 1973 MIGRATION OF THE DAY-FLYING MOTH

URANIA LEILUS

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I have already described the 1969 migration of the white-tailed page, *Urania leilus* (Quesnel 1971) and at the time gave some references to the earlier literature. Here I record the salient facts of the migration of 1973.

Prior to mid-September I had seen single specimens of the moth on 28 June, 22 August, 25 August and 30 August 1973. The first three were in Petit Valley and the fourth was near Brazil Village. Although two of the four were flying east and another south, which directions were the main directions of the migratory movements in northern Trinidad in 1969, there was nothing now to indicate the imminence of a mass migration. I simply noted the moths and speculated on the possibility of a migration in 1974. However, on 16 September, A. Lopez saw several and on 17 September, although I saw only ten, Lopez recorded 67 between 4.45 and 5.30 p.m. at U.W.I. St. Augustine, all flying south-east. There could be no doubt now that a migration was under way.

DIRECTION OF FLIGHT

At the University of the West Indies in St. Augustine where many of the observations were made the predominant directions were east and south-east with many moths going south and some east-north-east. This trend was maintained at this locality throughout the whole period of the migration. Only the occasional moth travelled north and none went west. The trend was the same also between St. Augustine and Diego Martin.

In the late afternoon of 18 September all but one of the moths seen in the north-western peninsula between Dhein's Bay and Chaguaramas were flying either more or less eastward or out to sea in a south-easterly direction. One flew west but none came in to land from over the water. At Macqueripe on 20 September no moths came in from the sea between 5.30 and 5.50 p.m. but by then the migration had waned considerably (see later). However, on 22 September between 11.15 a.m. and 1.00 p.m. nine flew from Gasparee Island towards the Trinidad mainland in a more or less north-easterly direction. The prevailing wind was from the north-west and when blowing strongly the moths would be facing north but drifting almost directly east. On 26 September

at Dhein's Bay four were seen flying out to sea but others came in from over the sea.

Towards the centre of the Island near San Raphael the predominant direction on 26 September was east and south-east. At the north-eastern corner of the Island near Balandra Bay Ingrid Quesnel saw several flying north-east on 27 September and others swirling around some purple flowers.

NUMBERS

No estimate of actual numbers is possible but it can be stated that at no time were the numbers as great as in 1969. Thus, on 12 September 1969 at 4.15 p.m. 31 passed an observation post at U.W.I. in five minutes and rates of 6 per min. were observed frequently. At the same observation post on 26 September 1973 at 3.45 p.m. 28 passed in five minutes but this was an exceptionally high count for a little later counts of 16 and 23 per 5 min. were obtained. At the same post on 18 September 1973 at 4 p.m. 15 flew past in five minutes and this rate of 3 per min. seemed to be more representative of the daily peak rates.

The migration had become so insignificant by 21 September (only five days after the beginning) that it seemed to be almost over. However, it continued through the next three days at peak rates of 1 per min. The migration built up again remarkably on 26 and 27 September when the highest rates were recorded (see above). By 1 October the rate had fallen to only a few per day and after 4 October only the occasional moth was seen. As late as 3 Jan. 1974 four were seen at Las Cuevas Bay.

DAILY CYCLE OF ACTIVITY

On many days it was quite evident that no moths were flying for a period of some hours about midday. Thus, a note of 25 September says that none was observed from about 11 a.m. to 3.45 p.m. The weather during this period was changeable. On the following day the resumption of activity began earlier, at 2.00 p.m. This lack of activity around midday has been noticed by others but is not absolute as recorded in an earlier section.

FEEDING ACTIVITY

On 19 September one was seen to feed at the flowers of *Ixora* and on 22 September at Gasparee Island eight were seen feeding at the small, yellowish, tubular flowers of *Aspidosperma sessiliflorum* before flying off to the Trinidad mainland. Nearby purple flowers of *Longocarpus punctatus* were ignored.

REPRODUCTIVE STATE

No courtship activity was observed during this migration but several females were examined and found to be gravid.

DISCUSSION

In a very recent publication (1972) Smith has summarized all the information on *U. leilus* in Venezuela and Trinidad and on *U. fulgens* in Central America. The latter migrates from Costa Rica through the isthmus of Panama to Colombia. The former migrates from Venezuela to Trinidad and Guyana. It is probable that the two populations erupt together. According to Smith (pers. comm.) the *U. fulgens* populations exploded on 15 September 1973. This coincides with the explosion of the *U. leilus* population for the first migrants arrived here on 16 September. The 14 km hop from Venezuela to Trinidad is easy at the known average flying speed of 18 km per hr.

All the moths of this migration seem to have entered Trinidad by way of the north-western peninsula. I have no observations from the southern part of the island but there was never any suggestion of a northward movement as though some were migrating from the south. Once out of the north-western peninsula the moths tended to keep heading east or to swing south to a greater or lesser extent. The movement north-east in Toco suggests a possible migration to Tobago.

This contrasts to some extent with the 1969 migration in which there was a suggestion of northward movement as though some moths had entered Trinidad from the south. It would be worthwhile to have observers in various parts of Trinidad when the next migration occurs to record simultaneously the areas through which the moths enter and also to determine if possible whether a migration to Tobago occurs. More information on the habitat of the larval food plant, *Omphalea diandra*, and its distribution in Venezuela would also be very useful. A more detailed picture of the migration and the possible areas of its beginnings in Venezuela would then be possible.

In his article Smith speculates on the possible causes of population explosion in terms of larval and adult food supply. In future migrations it would be good to have many more observations on the feeding behaviour of the adults and on their reproductive condition at various stages of the migration. Members of the club might assist in these projects. Many moths are killed by motor cars and some of these could be collected and preserved for later study.

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Errata: In my earlier paper the references to Williams's papers should have been cited as Trans. Ent. Soc. Lond. not Trans. Zool. Soc. Lond.

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SOME FIELD OBSERVATIONS ON THE BACHACS OF TRINIDAD

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INTRODUCTION

Since 1969, the Overseas Development Administration of the British Government has financed research on leaf-cutting ants (bachacs) with the aim of devising efficient control methods for those species which are considered pests. Several scientists in Britain are involved with the project and at least one person is based in South America to carry out most of the field work. Up until very recently, the field work on this project has been done in Trinidad and this together with the laboratory studies done in the U.K., means that much of our understanding of these insects is based on those species occurring on this island.

Before attempting to control a pest in the field, one must be thoroughly familiar with its biology, including its ecology, behaviour and so on. The leaf-cutting ant project is no exception. Over the past five years we have accumulated a great deal of knowledge as regards the biology of these ants and the purpose of this article is to summarise for the general naturalist some of the information that has emerged out of this and other people's work.

It would be impossible to cover all aspects of the biology of these interesting insects in a short article. In view of this, more attention has been paid to those behavioural aspects which the field naturalist may observe himself.

THE SPECIES IN TRINIDAD

There are only two species of bachac in Trinidad although several other ants are incorrectly given this name. Most people do not distinguish between these two species but to the entomologist and the serious naturalist the two are very different in both structure and habits. These differences warrant the placing of these ants in two separate genera. *Atta cephalotes* (L) (Fig. 1a-f) or the forest bachac as it is sometimes called, has a shiny appearance, is reddish-brown in colour and has long slender legs. This species is not confined to Trinidad for its distribution extends from Central America to Brazil. The majority of the nests are to be found in natural or semi-natural rain forest. *Acromyrmex octospinosus* (Reich.) (Fig. 1g-l) is a more ubiquitous species. The workers are generally smaller than those of *Atta* and there is no soldier caste. These ants vary in colour from brown to almost black and the legs are short compared with those of the previous species. It nests in various habitats including walls, under stones, under fallen tree trunks and in the ground itself.

LIFE CYCLE

Bachacs, like many other ants, have regular flights of winged males and females (Fig. 1) from the parent colonies. In Trinidad, *Atta cephalotes* and *Acromyrmex octospinosus* fly at about the same time with the former species reaching peak activity in July or August and the latter in May or June. The winged males and females of *Atta* (Fig. 1. d, e, f) are large, conspicuous insects about one inch (2.54 cm) in length. Those of *Acromyrmex* are smaller by comparison (Fig. 1. j, k, l) measuring about half an inch (1.27 cm) in total length. In both types the sexes can be told apart by the size of the head. In the males the width of the head capsule at its hind margin is never greater than half the width of the thorax, whereas in the females the head is as wide as or slightly less wide than the thorax.

A single female may copulate with several males either from a single nest or from different nests. In this was she builds up a store of sperm that will have to last her up to 20 years. Having mated, the young queen breaks off her wings by pushing them with her legs and proceeds to dig into the soil. She excavates a vertical tunnel and when this is a few inches deep (about 1 foot in *Atta*.) she proceeds to enlarge it to form a small chamber slightly to one side of the main shaft (Fig. 2). When the excavation of the nest is complete the queen spits out a small wad of