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DRY SEASON AGGREGATIONS OF INSECTS IN AUSTRALIAN MONSOON FORESTS

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ABSTRACT

Observations are recorded on aggregation behaviour by insects in monsoon forest patches in tropical Australia during the dry winter months. Species of the Hemiptera, Lepidoptera and Diptera were involved, some of which normally inhabit open forest but which migrate into the monsoon forest patches to form aggregations. The behaviour is interpreted as having a group defence function whereby natural defences of distastefulness, repugnatorial glands or buzzing behaviour are reinforced by massed individuals.

INTRODUCTION

The northern third of Australia experiences a tropical monsoon climate with a pronounced wet season occurring during the summer months of December to April under the influence of the northwest monsoon air flow. Typically, the rest of the year is very dry. This highly seasonal rainfall pattern is not normally adequate to support true tropical rainforest (closed forest) except in areas where the monsoonal rains are augmented by winter rain systems which reduce the impact of the monsoonal dry season. This only occurs along the eastern seaboard of Queensland where the combined effect of a moist southeast airflow off the Pacific Ocean and the orographic influence of the coastal mountains yields the necessary rains for a fully developed evergreen rainforest. However, on the remainder of the tropical zone several types of closed canopy forest occur which are taxonomically and structurally similar to true rainforest but are usually referred to as 'monsoon forest' because of their lower plant diversity and tendency to deciduousness in the dry season. They include several of the structural categories of Australian rainforests defined by Webb (1978). They can be regarded as a type of rainforest which has developed under extreme seasonality of rainfall. Monsoon forests in Australia are very limited in area and occur as small patches and strips in favourable locations in Cape York Peninsula, the 'Top End' of the Northern

Territory and the Kimberleys. Their boundaries are clearly defined and they generally stand in marked contrast to the open eucalypt/melaleuca forests and woodlands which surround them.

During the hot, dry season conditions in the open forests are extremely harsh and the pockets of shady, moist monsoon forest become important refuges for many animal species. This is conspicuous in the grazing mammals, for instance, and in the Northern Territory the monsoon forest patches are shelters for wallabies and feral buffalo, pigs and cattle which feed in adjacent grasslands. This behaviour is poorly documented among the insects but recent observations by the author during a collaborative project (Kikkawa and Monteith, 1980) indicate that some butterfly species normally restricted to open forest shelter in the monsoon forests during the dry season (e.g. *Acraea andromacha* (Fabricius) *Danaus chrysippus* (Linnaeus), *Junonia orithya* (Linnaeus)). A remarkable related phenomenon is the formation of massive aggregations of certain insect species which persist in a semiquiescent state for several months in these monsoon forests during the dry season. This behaviour has received only cursory mention in the Australian literature. The present paper presents new field observations on this behaviour, summarizes the sporadic literature and discusses the possible significance of these aggregations.

RECORDS OF INSECT AGGREGATIONS FROM AUSTRALIAN MONSOON FORESTS

In the following account insect species are discussed systematically under order and family. Where no other source is cited the observations were made by the writer. Most of these were made during a 4 week visit to the Northern Territory in July, 1979, during which insect surveys were conducted in eleven monsoon forest patches. In nine of these, insect aggregations were encountered. The localities and the insect species concerned are tabulated in Table 1.

HEMIPTERA : SCUTELLERIDAE

Lampromicra senator (Fabricius) 1803

On May 21, 1972, clusters of up to 50 individuals of this metallic green species were found hanging from shrub foliage in gallery monsoon forest along Beame's Brook, 30 km SW of Burketown, Gulf of Carpentaria. The insects were tightly packed, semiquiescent and showed little inclination to disperse when disturbed. At the same site crow butterflies (*Euploea core* Cramer) were also aggregating. McDonald (1963) records *Lampromicra senator* in southern Queensland as breeding on the shrub *Breynia oblongifolia* in open forest and hibernating as adults in winter in various concealed situations. At Beame's Brook the clusters were quite exposed and occurred on several species of plants, not all of which could have been *Breynia*. It is assumed that the bugs had migrated into the monsoon gallery forest to pass the dry winter. In southern Queensland another scutellerid, *Cantao parentum* (White), undergoes mass over-wintering, adult clustering, often on non-host plants to which it migrates (McDonald, 1963; pers. obs.)

HEMIPTERA : ALYDIDAE

Leptocoris acuta (Thunberg) 1783

This slender, grass-feeding bug is widespread in northern Australia and may become a pest of rice. Its biology in Papua New Guinea has been studied by Sands (1978). In the Northern Territory it was found aggregating in five of the monsoon forest patches in July (Table 1), particularly at Kemp Airstrip where enormous numbers occurred (Plate 1C). At none of the sites were grasses, the normal foodplant, present. The insects rested quietly in clusters beneath leaves or in rows along twigs and petioles of low shrubs and ferns, never more than a

again in the original site. Sands (1978) describes a pattern of behaviour in this species in Papua New Guinea where onset of dry weather triggers migration from open grassland to shaded sites where gregarious aestivation for up to two months takes place. He noted heavy egg mortality during dry weather and interpreted the migration aestivation behaviour of adults as a reproductive strategy to counter this. Undoubtedly the clustering seen in monsoon forests of Northern Australia is the same phenomenon, but with a much longer dry season the period of aestivation there probably reaches 5-6 months.

Noliphus erythrocephalus Stal

This species was noted clustering with *Leptocoris acuta* at the Kemp Airstrip forest in July (Table 1), where it was greatly outnumbered by *L. acuta*. Similar mixed clusters of *Leptocoris* and *Noliphus* have also been noted in gallery monsoon forest along the Stewart River in Cape York Peninsula in late June, 1976. At the latter site some pure clusters of *Noliphus* were observed (Plate 1B). Like *Leptocoris acuta*, *Noliphus erythrocephalus* appears to be principally an open forest species and thus this clustering activity away from the normal habitat is probably a similar migration-aestivation behaviour to that described for *Leptocoris*.

HEMIPTERA : COREIIDAE

Gralliclava australiensis Dolling, 1978

This small bug is distributed across the tropics north of Australia (Dolling, 1978) where it feeds on pods of leguminous herbs such as *Crotalaria* spp., principally in open forest. In July, 1979, it was found in considerable numbers in four lowland, monsoon forest patches in the Northern Territory (Table 1). It occurred there in small clusters, usually of no more than six individuals in concealed situations such as rolled dead leaves. An abandoned spider retreats among shrub foliage and among leaf litter on the ground. The insects in these small clusters were semiquiescent when disturbed and reluctant to disperse but eventually discharged their repugnatorial glands. At the time of observations no suitable foodplants for the bug occurred inside the monsoon forest patches, and the surrounding open forest where foodplants were

TABLE 1: PRESENCE OF AGGREGATIONS OF INSECT SPECIES OBSERVED IN 9 MONSOON FOREST TRACTS IN THE NORTHERN TERRITORY DURING JULY, 1979.

SPECIES	SITES									Favoured Aggregation Sites
	Mt. Gilruth Gorge 13-02Sx133-05E	Radon Creek 12-45Sx132-53E	Cahills Crossing 12-25Sx132-58E	South Alligator R. 12-40Sx132-30E	West Alligator R.(1) 12-12Sx132-13E	West Alligator R.(2) 12-11Sx132-16E	Kemp Airstrip 12-35Sx131-20E	North Point 12-25Sx132-22E	Innowinyin Gorge 12-23Sx133-03E	
<i>Lygostoma lyncea</i> (Hemiptera:Plataspidae)			X							tree foliage
<i>Noliphus erythrocephalus</i> (Hemiptera:Alydidae)							X			low herbage and grasses
<i>Leptocoris acuta</i> (Hemiptera:Alydidae)			X	X	X	X	X			low herbage and grasses
<i>Gralliclava australiensis</i> (Hemiptera:Coreidae)				X	X	X		X		in curled leaves and litter
<i>Euploea core</i> (Lepidoptera:Nymphalidae)		X	X	X	X		X	X		trunks and roots of 'banyan' fig trees; sheltered rock faces; tree foliage
<i>Euploea sylvester</i> (Lepidoptera:Nymphalidae)		X	X	X	X		X	X		trunks and roots of 'banyan' fig trees; sheltered rock faces; tree foliage
<i>Vanias affinis</i> (Lepidoptera:Nymphalidae)					X					tree foliage
<i>Stenophymosia papua</i> (Diptera:Calliphoridae)	X	X	X						X	sheltered rock faces near water
<i>Phaenocarpa</i> sp. (Diptera:Dolichopodidae)	X									base of tree trunks
indet. (Diptera:Milichiidae)	X									foliage hanging over stream bed
Totals	3	3	5	4	5	2	4	3	1	

HEMIPTERA : PLATASPIDAE

Lygostoma lyncea Stal

This stink bug was found in one very large aggregation and in several smaller clusters on deadleaved trees at one monsoon forest locality in the Northern Territory in July, 1979 (Table 1). Several species of trees were involved so it is assumed that at least some of the

bugs (Plate 1D). The bugs assumed a regular spacing on the underside of leaves and in rows along the petioles, giving the initial impression of being a natural pattern of galls or blemishes on the plant. The insects rested immobile when undisturbed and none were seen to feed on the plant. When disturbed, large numbers of bugs

DIPTERA : DOLICHOPODIDAE

Sympycnus sp. cf. *apicalis* de Meijere

This small, long legged fly was found in several aggregations on the base of tree trunks in monsoon forest at the bottom of a gorge near Mount Gilruth in July, 1979 (Table 1). The flies formed dense-packed carpets of individuals, usually ovate in shape and up to about half a square metre in area. When disturbed they were reluctant to take flight and soon settled into a quiescent swarm again. It is not known whether monsoon forest is the normal habitat of this species.

DIPTERA : MILICHIIDAE

gen. & sp. indet.

One cluster of this tiny black species was observed on low hanging foliage above the dry creek bed in a deep shady part of the gorge at Mt. Gilruth (Table 1). The flies densely covered several terminal leaves of a branch and were normally immobile (Plate 1A). When disturbed, the flies exhibited mass flight activity accompanied by high pitched buzzing before eventually settling down again on the original leaves. This cluster was above a path used by our collecting party and was disturbed many times during the 3 days work at that locality, but it never moved from its site. The flight buzzing closely resembled that of a disturbed wasps' nest and is thought to be defensive. It is not known if monsoon forest is the normal habitat of this species.

DIPTERA : CALLIPHORIDAE

Euphumosia papua Guérin - Meneville

This large, strikingly-coloured blowfly was recorded from Arnhem Land by a previous survey (CSIRO, 1975) and their report comments on its commonness in sandstone areas. Its breeding habits are unknown but Ferrar (1978) described the larvae. In July, 1979, it was noted aggregating at 4 sites in Arnhem Land (Table 1), always on shaded rockfaces and usually near water. Groups of up to several thousand individuals occurred, resting quietly and were sluggish when disturbed and reluctant to fly.

LEPIDOPTERA : NYMPHALIDAE

Euploea core corinna (W.S. Macleay) 1826

The Common Crow is a ubiquitous butterfly of northern and eastern Australia where it is principally an open forest species. Like most other danaines its larvae feed on toxic plants and the adults are considered to be distasteful to birds. There are a number of passing remarks in the literature concerning sightings of aggregations of

this species but these do not appear to have been summarized. In the following they are treated, together with various unpublished observations, geographically by States:

QUEENSLAND: Alexander (1933) records a roosting site near Westwood 45 km W of Rockhampton. The aggregation occurred in *Casuarina* trees on a creek bank and some butterflies occupied the site at all times of the day. Alexander notes that the roosting site seemed active at all times of the year during his 3 years' residence at Westwood. McCubbin (1971) writes that this species 'congregates during winter at various places around the coast. Large numbers collect in sheltered gullies on some Barrier Reef islands including Lindeman Island, Hayman Island, Brampton Island and Magnetic Island.' McCubbin also records observations of J.C. LeSouef that 'hundreds gather during winter on bamboo clumps in both Rockhampton and Darwin gardens.' Monteith (1972) records clusters of the species on *Pandanus* foliage in gallery forest along Beames Brook near Burketown on May 21, 1972. A map accompanying Anonymous (1974) shows an aggregation site for *Euploea core* seen in August, 1973 at the bottom of a sandstone gorge in the Isla Gorge National Park, near Theodore. Unpublished observations of aggregations in Queensland are those by M. DeBaar (pers. comm.) of clusters in clefts between boulders at Laura Gorge in June, 1978, and by R. Molnar and G. Czechura (pers. comm.) of massed butterflies on rock overhangs and trees at the bottom of Porcupine Gorge, near Hughenden, in June 1980. Three occurrences of these aggregations of *Euploea core* have been witnessed by the writer in Queensland. The first was on May 23, 1968, when a dense roost of between two and four thousand individuals was encountered on several shady trees clumped together on the bank of Major's Creek, at the western base of Mt. Elliot, near Townsville. The second was in June, 1971, when a very large aggregation was seen extending for about 50 metres on dense, shady trees overhanging a dry anabranch channel of the Coen River, near Coen township. The third was in June 1971, at a sandstone outcrop 30 km west of Fairview, near Laura, where small quiescent clusters of butterflies occurred on cool, shaded rockfaces around the base of the outcrop.

NORTHERN TERRITORY: McCubbin's (1971) mention of LeSouef's observation of *Euploea core* aggregating on bamboo clumps in Darwin gardens has already been noted. LeSouef (1971) records

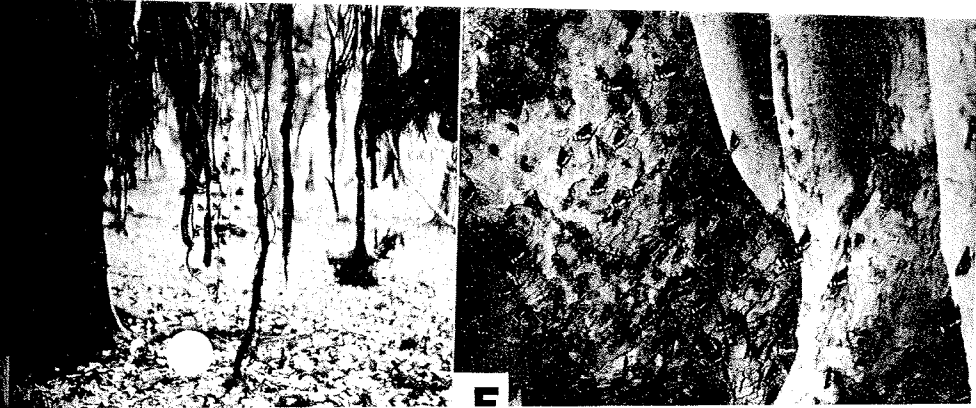
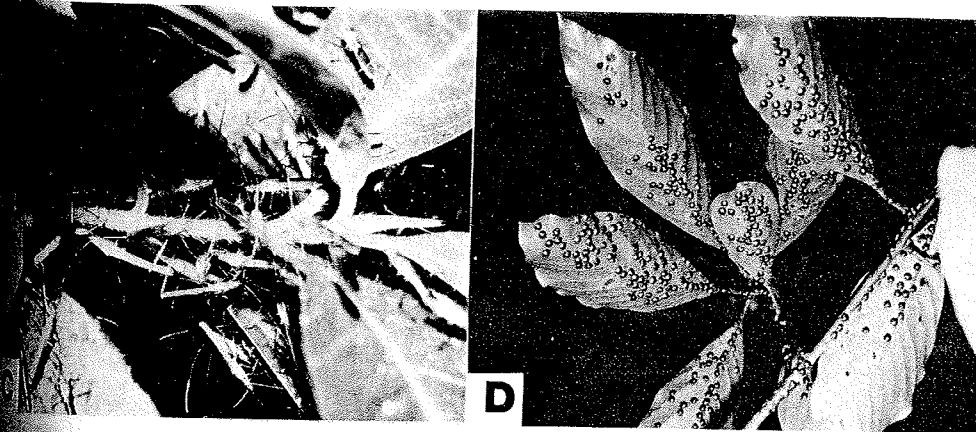
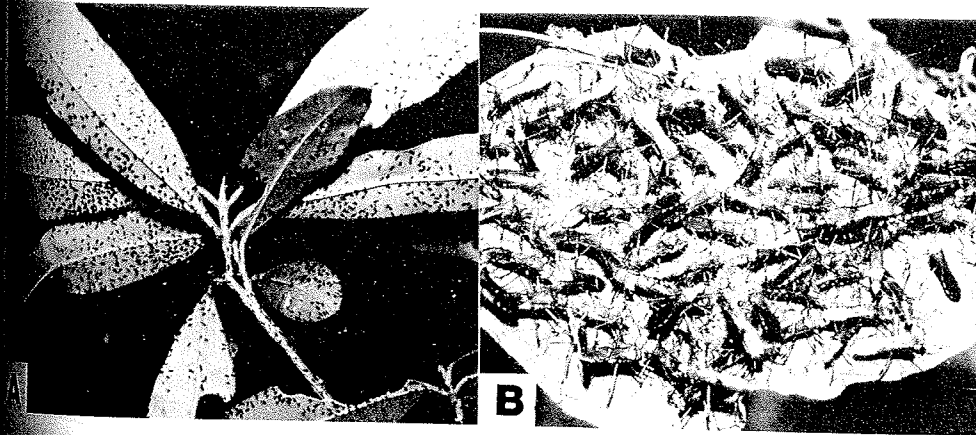


PLATE 1

- A. Aggregating flies of the family Milichiidae on foliage near Mount Gilruth, Northern Territory, July 1979.
 B. A pure cluster of the alydid bug, *Noliphus erythrocephalus*, on foliage at the Stewart River, Cape York Peninsula, June 1976.
 C. *Leptocoris acuta*, clustering of foliage at Kemp Airstrip, Northern Territory, July 1979.
 D. Quiescent aggregation of the plataspid bug, *Coptosoma lyncea* on foliage at Cahill's Crossing, Northern Territory in July 1979.
 E. *Euploea core* and *E. sylvester* resting on aerial roots of *Ficus virens* at North Point, Northern Territory, July 1979.
 F. *Euploea core* and *E. sylvester* resting on trunk of *Ficus virens* at North Point, Northern Territory, July 1979.