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LIFE HISTORY OF THE NORTH QUEENSLAND DAY-FLYING MOTH,
ALCIDES ZODIACA BUTLER (LEPIDOPTERA:URANIIDAE)

by N.C. Coleman* and G.B. Monteith⁺

INTRODUCTION

Most moths are nocturnal, but a notable exception is the subfamily Uraniidae which includes four genera and about twenty species scattered through the tropical regions of the world. Three of these genera are entirely diurnal in habits and their large size, brilliant colours and tailed hindwings lead many casual observers to assume they are butterflies. Chrysidia occurs in Madagascar and Zanzibar and one of its species, madagascariensis, is often hailed as the most beautiful insect in the world with its fiery, opal-like patterns of green, gold and red on a velvety black background. Almost as beautiful is the genus Urania which has species in northern South America and on the islands of the West Indies. The third day-flying genus is Alcides which has several species centered on the island of New Guinea and nearby land masses. Alcides zodiaca Butler, sometimes called the "Zodiac Moth", is our only Australian representative of these diurnal moths. It occurs at Iron Range and from Cooktown to Mackay and is sometimes extremely abundant, especially in lowland areas. Species of Alcides do not quite measure up to the magnificence of Chrysidia and Urania, but Alcides zodiaca is still a striking insect with broad bronze bands on blue-black wings with white tails. It is very similar to the New Guinea species. Alcides agathyrsus Kirsch and the two obviously arose from a common ancestor.

The fourth genus of the Uraniidae is Nyctalemon which includes several conventionally nocturnal species in the Indo-Pacific area. The only one to occur in Australia is Nyctalemon patroclus L. which ranges from India and China through to North Queensland where, like Alcides zodiaca, it occurs at Iron Range and in the Cairns region. N. patroclus is a large brown moth with a longitudinal white band on each wing and with two prominent white tails on each hindwing; though common in New Guinea it is very rare in Australia most specimens having been taken in the wet lowlands near Babinda.

Most day-flying uraniids seem to share similar flight behaviour in the adults. They often appear in large numbers which persist for a relatively short time during which they feed in swarms at flowering trees; often they build up to such large numbers that they bend the branches of their night-time roosting trees. This behaviour is noted for Chrysidia by Eltringham (1923) and for Urania by Guppy (1907) and Gosse (1880). Similar observations for Alcides zodiaca are by Alexander (1933), who noted hundreds roosting in two small shrubs at Yarrabah, by LeSouef (1979) who mentions sightings by Clive Pratt at Shiptons Flat (near Helenvale) of swarms which broke small branches from trees, and by R. Straatman (pers. comm.) who reports great numbers migrating near Kuranda. A. zodiaca is typically a high-flying insect, keeping up near the canopy where they vigorously dogfight with other insects, even the larger Birdwing butterflies. One of their characteristics is the spiralling upwards flight of pairs and small groups, often going hundreds of feet in the air.

* Edmonton, North Queensland (deceased April 8, 1981).

⁺ Queensland Museum, Brisbane.

Larval food-plant

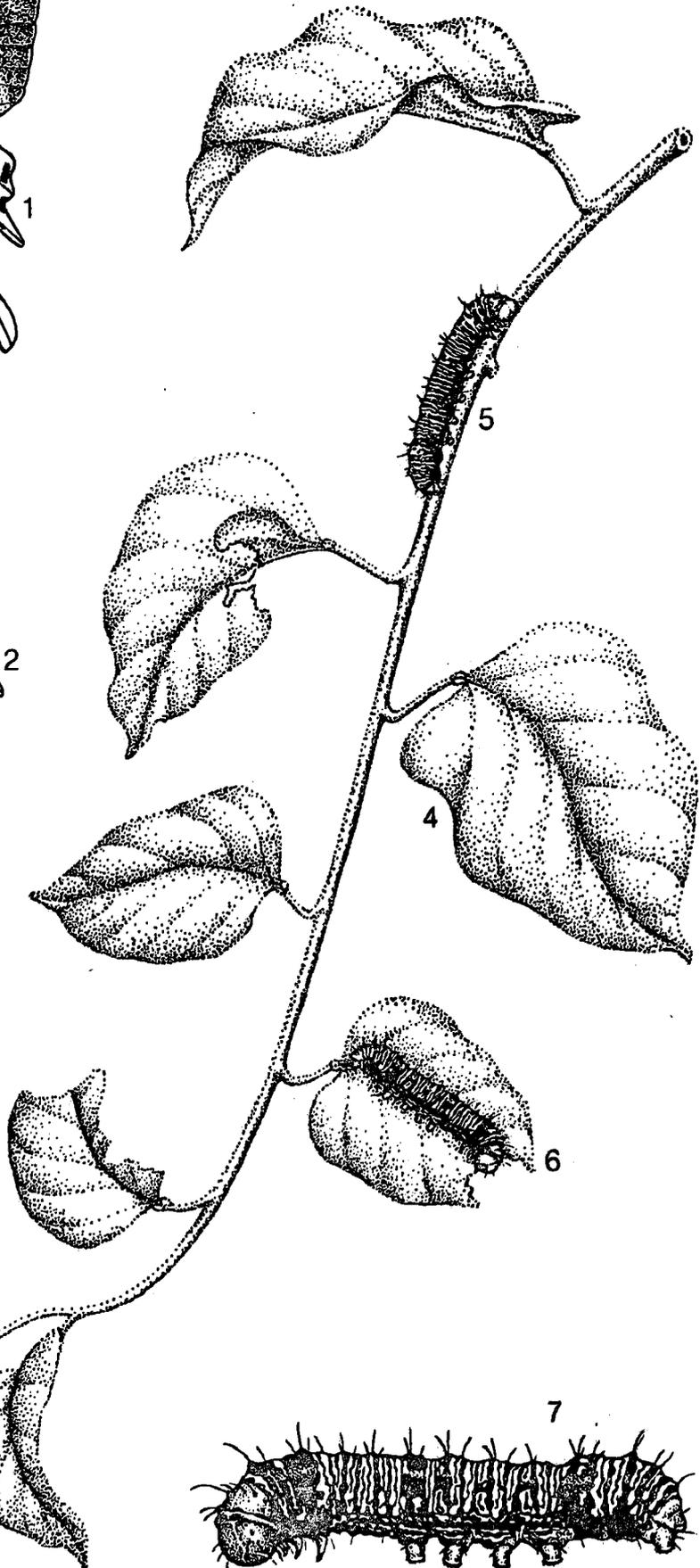
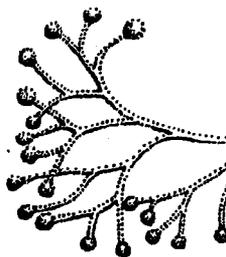
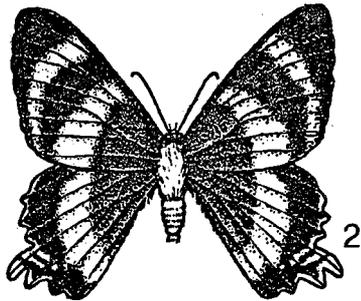
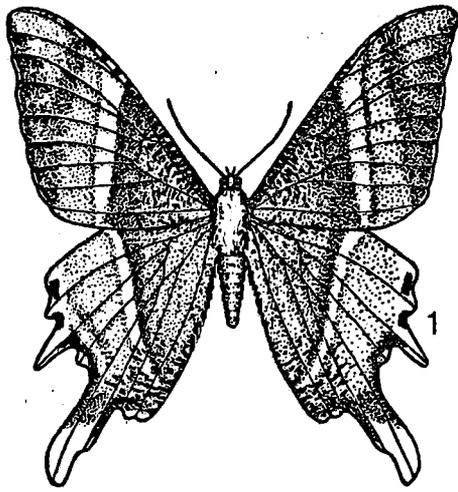
Many collectors have searched for the larval food-plant of this common, conspicuous moth without success. We record here its discovery. In February, 1980, one of us (Coleman) collected a number of boldly-marked caterpillars on foliage of a large canopy vine which had been brought to the ground by logging operations in rainforest on the upper Mulgrave River (Goldsborough Road), via Gordonvale. These were reared through on leaves of the same vine and eventually emerged as Alcides zodiaca. The plant has been identified as Omphalea queenslandiae F.M. Bail. (Euphorbiaceae).

This food-plant has since been confirmed by detective work by Don and Irene Kajewski, of Tolga, and Garry Sankowsky of Tamborine. In August 1979 the Kajewskis had collected pupae south of Babinda which emerged as Alcides, but the food plant was not found. In May 1980 Garry Sankowsky visited the spot with the Kajewskis, found more empty pupal shells, and concluded that a large, defoliated, canopy vine there might be the food-plant. Armed with the evidence of the Mulgrave River larvae mentioned in the preceding paragraph, the Kajewskis revisited the site in April 1981. This time many larvae were found on the vine which was later confirmed by Bernie Hyland of CSIRO, Atherton, as Omphalea queenslandiae. In May, 1976, Garry Sankowsky had noted a female Alcides moth laying eggs on ferns near Fishery Creek, south of Gordonvale. When this site was rechecked in July, 1981, stems of Omphalea were found, obviously having provided the egg laying stimulus (G. Sankowsky, pers. comm.)

Omphalea queenslandiae is a large, uncommon, tree-top vine with a stem diameter up to 15cm. It has large, glabrous, alternate, broadly ovate leaves which reach about 15cm by 10cm in size. The leaf petioles bear a pair of bulging glands where they join the leaf blade; in this respect they resemble the leaves of the common North Queensland vine, Adenia heterophylla (Passifloraceae), but Omphalea is readily separated from Adenia by its lack of climbing tendrils. Omphalea bears large, globular fruits, up to 12cm in diameter, each of which encloses 2-4 spherical seeds which were eaten by the aborigines under the name "Camboo". Cut stems ooze a viscous, sticky, transparent sap. In Australia, O. queenslandiae occurs at Iron Range and in mainly lowlands between Bloomfield and Innisfail. However, it does reach the edge of the Atherton Tableland at altitudes as high as 680m (B.P.M. Hyland pers. comm.). It has also been collected in New Guinea and the Solomon Islands. Clearly the high-canopy habit of the vine explains in part why this larval food-plant of Alcides has remained undetected for so long. This plant's habit also correlates with the moth's high-flying behaviour.

The genus Omphalea is rather obscure with about 20 species in the new and old world tropics. O. queenslandiae is the only Australian species. Search of the literature reveals that Chrysiridea madagascariensis breeds on Omphalea biglandulosa in Madagascar (Eltringham, 1924), Urania sloanus breeds on Omphalea triandra in Jamaica (Gosse, 1881), Urania boisduvali breeds on Omphalea triandra in Cuba (Macleay, 1834) and Urania leilus breeds on Omphalea megacarpa in Trinidad (Guppy, 1907). There is thus a strikingly close association between these diurnal uraniid moths and Omphalea in widely separated parts of the world, so close in fact that we may speculate that the association dates from before continental drift separated the southern continents.

The only published reference to food-plants for other species of Alcides is Szent-Ivany and Carver (1967) who record Pittosporum sp. for Alcides agathyrus in New Guinea. However, Mr. Ramon Straatman, now of Kuranda but with many years experience with Lepidoptera in New Guinea, informs us that the common food-plant there is Endospermum formicarum Beccari, a small tree with hollow twigs inhabited by ants. He states that this same plant is also the food-plant of the nocturnal uraniine, Nyctalemon patroclus, in New Guinea. Interestingly, Endospermum also belongs to the Euphorbiaceae and is placed in the same subfamily as Omphalea. Pittosporum is quite unrelated and requires confirmation as an



Alcides food-plant. Although the genus Endospermum does not appear in standard works on the Australian flora the Queensland Herbarium holds material of four species from North Queensland, including Endospermum formicarum, itself, from "Cape York". Both E. medullosum and E. myrmecophilum occur south of Cairns and resemble species of Macaranga. Considering the close relationship between Alcides zodiaca and A. agathyrsus, it will be worth investigating whether, in North Queensland, either Alcides zodiaca or Nyctalemon patroclus utilizes any Endospermum species as food-plant.

The conspicuous behaviour and bright colours of these uraniid day-flying moths suggest that they may have toxicity which protects them from bird attack. This is further indicated by the fact that, in New Guinea, Alcides agathyrsus is the model for uncanny mimicry by a swallowtail butterfly, Papilio laglaizei (Straatman, 1975). Normally suspected toxicities are confirmed by reference to the larval food-plants which are also toxic. Although the Euphorbiaceae contains many toxic plants there is no direct evidence that Omphalea or Endospermum are toxic, although crushed leaves of Omphalea have an acrid smell. Seeds of Omphalea were eaten by native people in both Australia and Trinidad, and leaves of Endospermum are used to wrap cooking foods in New Guinea (Paijmans, 1976).

Larval description and behaviour

Larvae of several species of Uraniinae have been described and/or figured, viz. Nyctalemon patroclus (Hampson, 1895, fig. 56, p.110), Chrysidia madagascariensis (Eltringham, 1924, plate 22, p.443), Urania leilus (Guppy, 1907, plate 26) Urania sloanus (Gosse, 1881). All have the same general form, being thick fleshy caterpillars with a prominent pattern of rings and blotches and with a sparse vestiture of setae set upon small tubercles. In Urania and Chrysidia some of the body setae are elongated with clubbed tips. All have the full complement of five pairs of abdominal prolegs.

Larvae of Alcides have not been described, but a photograph of those of Alcides agathyrsus appears in D'Abbrera, 1975, (p.60). The figures and brief description given here for Alcides zodiaca are based on photographs taken by one of us (Coleman). Unfortunately specimens were not preserved. The smallest larvae collected were 15mm long and these reached about 32mm in length and 6mm in diameter before pupation.

Smaller larvae have a ground colour of black with a pattern of transverse white bands, usually three per body segment. The white rings may be broken laterally in the middle region of the abdomen. The rings are absent on the second thoracic segment, above the first proleg and behind the fourth proleg, giving the appearance of three broad, transverse dark bands at these spots. Each proleg has a pair of short, longitudinal pale bands above its base. The head, the dorsal surface of the thoracic segments and the thoracic legs are light red. The prolegs and claspers are yellow. There are sparse short black setae on the head and forming an irregular ring around each body segment; these are often white-tipped and those on the dorsal surface are mounted on small conical tubercles.

In later instars the appearance of the larva changes considerably. The number of transverse white rings doubles to six per segment, separated by very narrow bands of black. The three broad dark bands caused by the partial absence of white rings on the second thoracic segment, the segment above the first proleg and the segment behind the fourth proleg remain but are marked by red blotches on the dorsal surface. In the final instar the red blotches darken to bright crimson and cover most of the dorsal surface of the thorax. The setae remain similar to those of earlier instars and are never long and clubbed as in Urania and Chrysidia.

An unusual feature of the larvae of this group of moths is their ability to escape attack by suddenly dropping from the foliage on a thread of silk, afterwards climbing the thread to resume their original position. This is

graphically described for Urania spp. by both Guppy (1907) and Gosse (1881), the latter reporting descents from trees forty to fifty feet high. Species of Alcides seem to share this ability. The photograph of A. agathyrsus larvae in D'Abbrera (1974) shows them suspended on silken threads, and Ray Straatman confirms this from his own observations on A. agathyrsus in New Guinea. The pupae of A. zodiaca collected by the Kajewskis near Babinda were all in crevices, etc., 1-3 metres above the ground; some of these pupae were still connected to the food-plant vine above by a strong silk thread. This indicates that larvae of A. zodiaca also utilize silken threads for descent.

Pupation takes place in a strong, but thin and transparent cocoon formed between one or two dead leaves. This accords with observations on pupation in both Chrysidia and Urania.

The eggs of A. zodiaca collected by Garry Sankowsky were spherical with about 25 longitudinal ridges. They bore an equatorial band of reddish blotches, some of which extended on to the upper hemisphere. In structure they are similar to eggs described for Chrysidea and Urania.

ACKNOWLEDGMENTS

We are most grateful to both Mr. Ray Straatman and Mr. Garry Sankowsky for permission to cite their observations on these fascinating moths. Mr. B. Hyland of CSIRO, Atherton, identified and gave information on Omphalea, while staff of the Queensland Herbarium provided further details. Maria-Ann Wrench, of the Queensland Museum, prepared the illustrations from colour slides.

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ILLUSTRATIONS (PAGE 4)

URANIINE MOTHS OF NORTH QUEENSLAND

1. The nocturnal Nyctalemon patroclus (wing span 120mm).
2. The diurnal zodiac moth, Alcides zodiaca (wing span 100mm).
3. Egg of A. zodiaca.
4. Omphalea queenslandiae (Euphorbiaceae), larval foodplant of A. zodiaca.
- 5/6 Older and younger larvae of A. zodiaca.
7. Detail of larva of A. zodiaca.

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CARING FOR 'KIDNA'

by Andrew Dennis

Kidna is a baby echidna (*Tachyglossus aculeatus*) who arrived at the Cairns Pet Centre on 9th December 1980. He was found wandering on the road on the Tablelands. He weighed half a pound and was small and weak when I first got him and I estimated his age at one month. He had lots of black fur and a few yellow spines and was no bigger than a man's fist. His attempts at walking were miserable and he just slid around on his belly for the first month.

During the first week he ate Animalac Milk mixture for young animals. At this stage he had about two lids full or half a nip of milk per feed. I then introduced him to a mixture of 1½ tablespoons full cream powdered milk, 2 teaspoons cornflour, 1 teaspoon Prolac, 3-5 drops Pentavite and beaten raw egg. Vitamin E oil was also added to this mixture because, on waking, his eyes were stuck together and caked with matter. Once he was on the Vitamin E they cleared up.

After one month his weight was one pound and he was beginning to walk; although still unsteady and slow, it was walking. At this stage I tried him on termites and ants but he showed no interest and after this I tried him with them about once a week. He wasn't a very demanding baby at this stage as he slept most of the day and only woke in the evenings for his feed which was now about ¼ to ½ ounce. Occasionally if he had a big meal one day he would skip a meal and sleep for two days. Once when he had been one or two months in my care he went for four days without eating and I was panicking but he ate quite well afterwards.

After two months he was 1¼ lbs. and eating ½ to 1 oz. of milk mixture per feed and waking slightly earlier each evening. He still showed no interest in termites or ants. He was growing continually and his spines were larger, stronger and becoming a straw colour and not so many were hidden by his long black fur.

At three months he was 1¾ lbs. and his spines were about one inch long, strong and sharp. It was now that he first sampled termites. He started off just licking up a few and then losing interest but after a week he was eating many more. At this stage he got diarrhoea and his weight dropped to 1½ lbs.

By the fourth month he was 2 lbs., very strong and would not stop eating termites till there were none left, then he would search about the yard for ants. Although he got plenty of ants and termites he hardly ever showed signs of going off his milk. From three months on he would drink anything from 2 to 4 ozs. as well as his generous helping of ants and termites.

Between four and five months (when we let him go), his weight fluctuated between 2 and 2½ lbs. I thought this was due to not enough solids and no matter how much I put in front of him he would eat the lot.

Another problem that arose was that some of his spines or needles broke, and on close inspection I noticed that a few of them had constrictions near the base and middle which I thought could have been due to a lack of some necessary vitamin or mineral.

From three months on he became very friendly and came to my voice or smell or the sound of termite mounds being chopped open. At four months he was waking at 11 a.m. which was difficult as I was at school and Mum would put him in a 2½ ft. high enclosure made in my aviary. Here he would eat termites and then, showing no fear, he would climb out by wedging himself in the corner and edging his way up. Once out he would wander about the aviary and climb up a brick wall on to a 3 ft. shelf and then up another 15 ins. into a dry fishtank. It was on these escapades he damaged his spines.

Because he obviously needed the extra solids and he wanted to wander we decided to let him go. He proved he was strong enough by ripping up the carpet

in my bedroom.

After consulting with the National Parks and Wildlife Service we decided to let him go at Davies Creek National Park and did so on April 24th 1981.

We all miss him greatly.

--oOo--

NORMAN CLYDE COLEMAN

Norman Clyde Coleman died on 8th April, 1981, as a result of burns received when his home was destroyed by fire during the early morning of the previous day.

News of this remarkable man's death shocked not only his many friends and associates in Far North Queensland but also field naturalists at national and international level. Raymon Mascord, acknowledged as Australia's leading arachnologist, was quoted in the 'Cairns Post' of 20/4/'81 as saying -

"It will probably never be known by the people of Australia, and particularly of North Queensland, just how much Clyde contributed to the natural history of the North. With regard to arachnology he advanced the knowledge of our northern species in leaps and bounds over the past fifteen years. He contributed so many new species to our lists that it will take many years to have them all named and placed in their correct familial and generic order. The new species he found in the north number hundreds. Many of the genera he discovered were only known in other countries before Clyde found them in and around Edmonton."

Spiders were not his only interest. His dedication as a collector extended to all fields of natural history, while his expertise as a nature photographer won him wide recognition. As a bushman he was superb; he knew every inch of the Cairns hinterland and coastal lowlands, a knowledge he shared unselfishly with both amateur and professional naturalists.

Clyde was born at Stannary Hills, near Herberton, on March 20th 1913, the fifth child of a family of eleven. His parents were Charles Henry and Martha Britannia Coleman. The father was a teamster who carted firewood and supplies to the tin mines which supported Stannary Hills on Eureka Creek. Large families were not rare on the mining fields in those days, and these survived through the co-operative efforts of all members of the unit. From early childhood children were allocated chores and the one chore Clyde remembered all his days was watering the sixteen draught horses of his father's team. After school he and his brother drew water from a well by windlass to fill the drinking trough which the thirsty beasts emptied far too rapidly in the opinion of the two small boys. Naturally their father insisted that water had to be continually drawn until the last horse had drunk its fill.

The Coleman children attended the Stannary Hills State School but Clyde was a disinterested pupil apart from the field trips guided by the head teacher, a Mr. Johnson, who taught the children to love the natural environment and kindled an interest in Clyde for which the future naturalist was forever grateful.

Leaving school at an early age, Clyde and his brother followed the many occupations of bush workers including mining, cane cutting, sugar growing, until the outbreak of World War II drastically changed his life. Joining the army Clyde served as an army electrician with a unit in Darwin. He saw further service in the Islands and joined the army of occupation posted to Japan at the end of the Pacific war. There he saw the devastation of Hiroshima caused by the atomic explosion. He also saw the care of the Japanese farmers for their soil and heard their saying that 'every grain of soil in Japan has passed through human fingers'. Clyde's army experience had a profound effect on his thinking. Upon discharge he decided that he must acquire a trade and, with this as a base, further his education. A rehabilitation course qualified him as a motor mechanic and for eight years he underwent a course of study with an orientation towards science subjects.