ASGAP PALM & CYCAD STUDY GROUP
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Cycad Pests & Diseases : (1) Around February 2004 I visited a commercial cycad nursery on the Sunshine Coast which had just had a major visitation by the Cycad Blue butterfly, Theclinesthes onycha . I knew this existed but had no previous experience with it. The small reddish-brown (other colours exist ; see the text following) caterpillars had given a great chewing to a wide range of young cycad seedlings, including members of the genera Cycas, Macrozamia & Dioon. They don't seem to like Lepidozamia. A few of the small brown-&-blue butterflies were still on hand. The usual contact insecticides like Malathion control the larvae, as would things like Confidor. The attached article is from 'Butterflies of Australia' by Braby, which I then included in newsletter no. 88 , & now repeat.

Since that time, the butterfly has spread widely, including greater Brisbane & the Gold & Sunshine coasts. At my place it has killed a few seedlings near the house that I see frequently, so as I spray whenever I see the butterflies or their larvae, they can kill in a couple of days. I still have 70-plus mature Macrozamia mooreis in a back paddock, with trunks between 1 & 3.2 m tall, & each with dozens of 2 m fronds, so spraying them is more of a chore. I was ill recently for several weeks, with a relapse of Ross River Fever, & neglected them, & had several trees attacked, one so badly it has lost all leaves & is probably dead (hard to be sure with any cycad that still has firm tissue). None of these big cycads was flushing new leaves at the time, & the larvae had tunnelled among the leaf bases & adjacent crown tissue, detaching the fronds at the base.

In some places around Brisbane & the coasts, I have seen great devestation among cycads. It has been suggested that the S-E Qld. strain of *Theclinesthes onycha* , present in the wild in small numbers, only attacked *Macrozamia & Lepidozamia,* & appeared to only attack new leaves. In northern Qld. the local strain always attacked *Cycas,* & now attacks other genera, & it seems it has now migrated south, probably on plants from N. Qld. It certainly attacks Australian & exotic *Cycas* species, as well as *Dioon, Encephalartos & Stangeria*, & seems to prefer these to *Lepidozamia.* I am not sure about *Bowenia,* as they tend to die down spontaneously in dry &/or cold times anyway.

(2) A second less severe cycad pest I also mentioned in newsletter no. 88 in 2004. My big Macrozamia mooreis arrived as bare caudices, with all leaves & roots removed by chainsaw. All were saturated in Diazinon very soon after arrival, which should have killed any adult insects as well as larvae. Some of these coned soon after planting, & in several cases the new short fronds showed signs of attack, & some browning off. One plant later died. The apparent cause was weevils of the genus Tranes, which appear to 'hatch' as adults once the cycads cone. Either eggs or pupae must be able to lie dormant for months to a couple of years, as some caudices do not sprout leaves, or cone, for up to 2 years (or, in rare cases, longer). Can they detect chemicals secreted by the cones? I suspect so. The larvae chew the axis of male cones , in particular, & then pupate. They are probably the main pollinator in the wild : see for instance the 1994 article (Biotropica 26: 2:217-222) by Forster, Machin, Mound & Wilson. In plants with their full complement of leaves & roots, the weevils probably cause no damage of any note. Spraying with Diazinon has controlled them. I presume the timing of the first proper (a few cut fronds may also extrude a short length of frond, doubtless the base of a new leaf) leaf flush, & the average length of leaves (either a little less than usual, or a lot less), depends primarily on the plant's reserves of energy after removal & 'trimming'.

(3) Chemicals to control the above pests. One acquaintance, with just a few cycads, does a daily walk among them with a squash raquet, slaying the butterflies on the wing. Would not work with my big cycads, as most hide among the leaves until sprayed. I presume very frequent spraying with contact insecticides like Malathion would work, but be impractical. Two of my cycad wholesaler friends recommend using the 2 relatively new insecticides, Procide 80 SC & Crown, both marketed in Australia & the US by Scotts (, & used in rotation to avoid premature insecticide resistance buildup. Both are relatively benign for humans, but take the usual precautions. Both are expensive, for what you get, in retail packs, & a litre pack does a lot but may be $200 or so. Procide (sometimes sold as; 'Bugs be gone') is a very fast acting contact insecticide with some residual properties, & is a synthetic pyrethroid which is light

stable & supposed to stay active for 2 weeks, presumably if not rained on heavily. It has miticide activity also, due to addition of Bifenthrin if my memory serves me.

Crown is a systemic insecticide based on a nicotine derivative (acetimide?), & acts faster than Confidor, which I had been mainly using, & so kills the grubs earlier. Originally Confidor was marketed just as a surface (knockdown) spray, & then it was found to be systemic also, but what the maker still never tells you is that the systemic action is only by root uptake, which is slow. Crown is absorbed by leaves & by roots, like Rogor. Rogor still works well, but I prefer to avoid members of that family because of their possible effects on humans ; most of the others are worse.

(4)I don't think this pest is attacking my cycads, but in 2004 found some grasstrees slowly declining, with some leaves dying, others going brown, & no obvious pest. Ex-DPI horticultural pest expert, David Hockings, told me the likely culprit was Banana Weevil Borer, or a close relative. A spray of Chlor Pyrifos seems to have done the trick, but I have used Rogor also, to be sure. I have since heard of other cases. I presume Crown would work well here also.

Best wishes to all, & may those of you in drought areas get the rain you so badly need. As I type this (10-6-07) I hear on the news of the 100-year floods around Newcastle & the Hunter Valley, & good rain over southern NSW & much of Victoria, but in S-E Qld. it has only gone 20 or so km inland round here, although it has rained enough on part of the Darling Downs for winter crops to now be sown (after 2 to 3 years of total crop failures in most areas) in some areas. That rain belt slid north, & watered the Sunshine Coast, which has been consistently wetter than Brisbane-&-S-to-the –border over the last 5 years. Still desperately dry here, & Brisbane's water supply is down below 20% of full ; enough to last until Christmas. Proposed pipelines from the north look unlikely to be finished in time, unless we get normal summer rains, which usually start in October, & have been non-existent for 2 years, & low for eight years before that.

3.

Genus *Theclinesthes* Rober, 1891

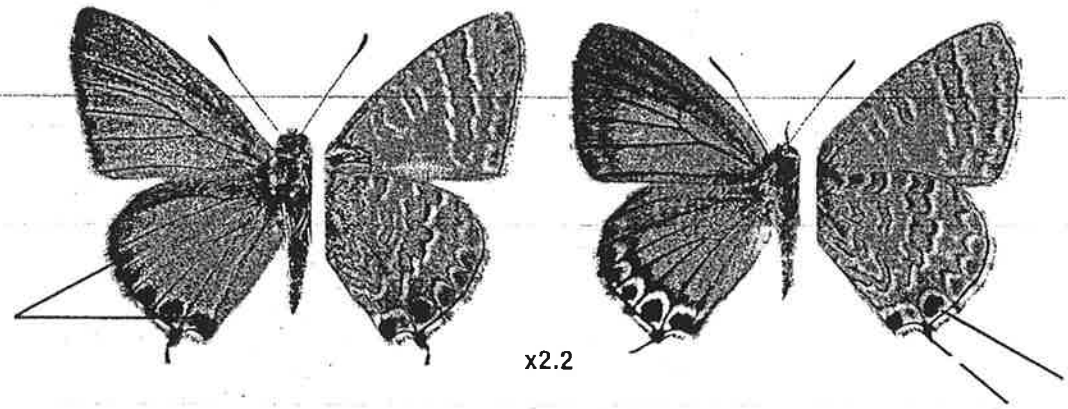
This genus is restricted to the Australian Region, ranging from Indonesia, east of Wallace's line, through New Guinea and Australia to the Bismarck Archipelago (Hirowatari 1992). It comprises six species, all of which occur in the Australian faunal subregion, where four are endemic to the Australian continent. The genus comprises two species groups (Sibatani and Grund 1978): the *onycha* group with four species (*T. onycha, T. miskini, T. albocincta, T. hesperia*) and the *serpentata* group with two species (*T. serpentata, T. sulpitius*). The latter group, which for many years was placed in *Neolucia*, is distinguished from the *onycha* group by the greater number of segments on the antennal club, the more rounded apex of the fore wing and tornus of the hind wing, and the underside bands being more broken or displaced. With one exception, all members of the *onycha* group are widespread, exhibit very complex variation, and possibly include one or more cryptic species. The exception is *T. hesperia* from south-western WA, which possibly is a relict taxon. Larvae feed on a diverse array of plants; one species feeds on species in two gymnosperm genera, *Cycas* (Cycadaceae) and *Macrozam* (Zamiaceae), another feeds on Fabaceae, Mimosacea Myrtaceae and Sapindaceae, two closely related species feed o *Adriana* (Euphorbiaceae), while members of the *serpenta* group specialise on Chenopodiaceae. Larvae usually feed o leaves, occasionally eating flower buds and flowers, and they a usually attended by a few ants in the subfamilies Dolichoderina Formicinae, Myrmeciinae, Myrmicinae or Ponerina *Theclinesthes* is believed to be most closely related to *Sahulana*.

In *Theclinesthes*, the eye is hairy; the termen of the hind win bears a variable tail at the end of vein CuA_2 and the torn margin is slightly produced; veins Sc and R_1 in the fore wing a fused; the male usually has 'racquet-shaped' sex-scales, with series of ribs bearing nodules, on the upperside of the wings. Th male genitalia are distinctive, with the valva triangular with pointed process on its inner side (Hirowatari 1992).

Theclinesthes onycha (Hewitson, [1865])

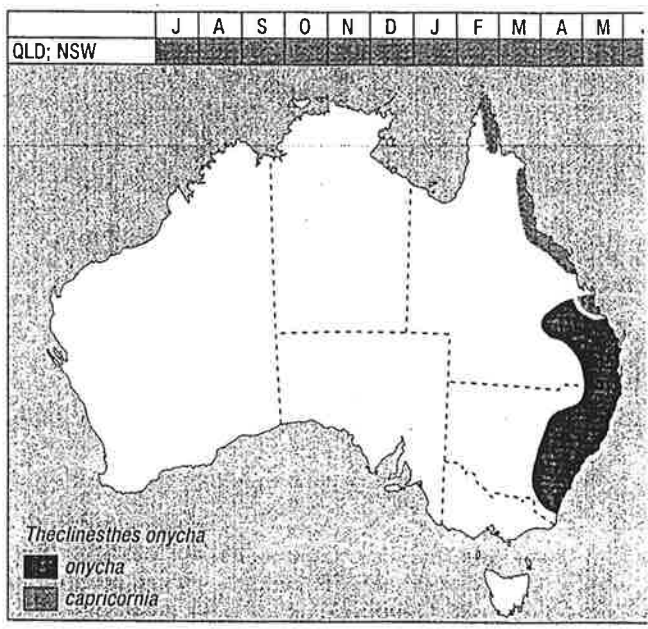
(Plate 60, fig.

Cycad Blue



x2.2

- Other common names. Onycha Blue.
- Description. *Wingspan*: male 24 mm; female 24 mm. *Upperside*: male – dull lilac or greyish-lilac, with a narrow brown termen; hind wing with a series of obscure brown-black subterminal spots fused with terminal line, the two nearest tornus larger and black, and a long slender tail tipped with white at end of vein CuA_2. Female – brown, with a large lilac-blue central area reaching base on both wings; the hind wing has a series of white subterminal rings, the two nearest tornus each enclosing a black spot, and has a long slender tail tipped with white at end of vein CuA_2. *Underside*: male – ground colour uniform grey-brown or brown, with a series of darker brown spots and bands edged with dull white; hind wing with two black subtornal spots, the one nearest the tail more prominent and edged above with orange. Female – similar to male.
- Variation. The underside pattern, in both sexes, is rather variable and two subspecies have been recognised (Sibatani and Grund 1978). Both exhibit seasonal variation with pronounced differences between specimens collected or reared during the warmer ('summer form') and the cooler ('winter form') months of the year. The 'winter form' is found predominantly in June and July in the northern end of the range, and from about April to October in the south, althoug specimens intermediate between the two forms a



occasionally collected or reared in spring and autumn and sometimes in winter. The distributions of the two subspecies are difficult to delineate, and in central and south-eastern QLD where their ranges meet there is possibly a cline (see also Sibatani and Grund 1978; Dunn and Dunn 1991). It is also possible that the differences between the northern and southern populations of *T. onycha* are more strongly tied to ecological rather than a geographical factors: in populations from coastal north-eastern and central QLD, (subspecies *T. o. capricornia*) larvae feed on *Cycas* (Cycadaceae), whereas in inland areas of central and southern QLD, coastal southern QLD, and in NSW (subspecies *T. o. onycha*) larvae feed on *Macrozamia* (Zamiaceae). Further work is needed to determine the status of these populations.

T. o. onycha (Hewitson, [1865]) is described above (Plate 60, figs 1a, 1c). The description refers to the 'summer form' (Plate 60, fig. 1a): it shows slight variation in the extent of the white edging to the dark brown spots and bands and size of the black subtornal spots on the underside of the hind wing. In the 'winter form' (Plate 60, fig. 1c), the underside ground colour and markings are often darker brown and are more contrasting, and the subapical area beyond the postmedian band of the fore wing and the area beyond the postmedian band of the hind wing are distinctly whitish or pale grey. The upperside, in both sexes, is usually much bluer, the hind wing often has a straighter termen and shorter tail, and the black subterminal spots are smaller than in the 'summer form'. In this subspecies, the male sex-scales are numerous, broader than long, approximately inverted heart-shaped but with a flat base and about 15 ribs (Sibatani and Grund 1978).

T. o. capricornia Sibatani & Grund, 1978 (Plate 60, figs 1b, 1d) differs from *T. o. onycha* in having a paler underside ground colour, more prominent black subtornal spots on the underside of the hind wing, and the underside markings more distinctly edged with white. Adults, as in *T. o. onycha*, exhibit seasonal variation and the differences noted above refer to the 'summer form' (Plate 60, fig. 1d). The 'winter form' (Plate 60, fig. 1b) is similar to *T. o. onycha* 'winter form'. In this subspecies, male sex-scales are usually longer than broad with 11 or 12 ribs, somewhat resembling those of *T. miskini* (Sibatani and Grund 1978).

- **Similar species.** *Theclinesthes miskini* (p. 807), *T. albocincta* (p. 809), *T. hesperia* (p. 812).

  T. onycha can usually be distinguished from *T. miskini* by its larger size, brown rather than greyish underside ground colour, and greater number of subterminal spots on the upperside of the hind wing in the male. Both sexes can be distinguished from *T. albocincta* and *T. hesperia* by the longer and more slender tail, and the more prominent subtornal spots on the underside of the hind wing.

- **Taxonomic status.** Prior to the work of Sibatani and Grund (1978), this species was known as *Theclinesthes miskini* and the species that feeds on acacias and related plants was known as *T. onycha*. There has been no detailed comparative study of immature stages of *T. onycha* and *T. miskini*, and although Sibatani and Grund (1978) were unable to find any differences in the male genitalia, the two species are ecologically separated by food plant usage. In the absence of information on their larval food plants, however, many specimens are difficult to place to species, especially females.

- **Immature stages.** *Egg*: pale greenish-blue or white; disc-shaped with upper surface flattened, densely and finely pitted. *Larva*: body rather humped and sloping posteriorly from mesothorax, meso- and metathorax with a shallow longitudinal depression, colour very variable, either pale green to deep green or bluish-green, with faint oblique whitish streaks, and a dark green, brownish-green, yellowish-green or dark reddish-brown middorsal band edged laterally by a whitish line, band sometimes extending only from mesothorax to abdominal segment 6; or colour reddish-brown or dark purplish-brown, with faint oblique white streaks, and a darker dorsal band; noticeable marginal hairs, especially at anterior and posterior ends, and dense minute secondary setae with stellate base and central seta (Fig. 32B); head brown. *Pupa* (Plate 70, fig. 15): 11 mm long; pale brown, strongly spotted and blotched with dark brown; surface dull with raised fine reticulated pattern, and moderately dense short erect hairs.

- **Larval food plants.** *Cycas media, C. megacarpa, C. ophiolitica* (Cycadaceae), *Macrozamia communis, M. pauli-guilielmi, M. spiralis* (Zamiaceae); introduced plants include *Cycas circulus, C. robusta* (Cycadaceae).

  Larvae feed on a range of cycads; this is the only butterfly species in Australia known to feed on plants in the Gymnospermae. The food plant of subspecies *T. o. capricornia* in coastal areas of northern and north-eastern QLD, is *Cycas media* on Cape York Peninsula (Sibatani and Grund 1978), Cardwell, Cape Upstart (Braby 1997b) and probably on Scawfell Island near Mackay (Moss 1995). Adults were reared from larvae on a species of *Cycas* in central subcoastal QLD just north of Rockhampton (Common and Waterhouse 1972), subsequently determined as *C. ophiolitica* (Forster and Machin 1994), and eggs and larvae have been found on cultivated *C. circulus* and *C. robusta* in the Rockhampton Botanical Gardens (Fox 1995a). Larvae and pupae have been found recently at Mt Morgan on *C. megacarpa*, (R. Oberprieler) a species closely related to *C. ophiolitica*. Further south at Cooloola, QLD, larvae of subspecies *T. o. onycha* feed on *Macrozamia pauli-guilielmi* (Forster and Machin 1994), a plant around which the adults fly near Stanthorpe (Harslett 1965). Food plants in coastal NSW include *M. spiralis* at Newport (Waterhouse 1932b; Sibatani and Grund 1978) and *M. communis* at Depot Beach (Sibatani and Grund 1978), but almost certainly larvae feed on other species in the genus in the inland areas of NSW and QLD (Forster and Machin 1994). Manski (1960) and Sibatani and Grund (1978) listed *Macrozamia lucida* from the Cairns-Kuranda district but this species does not occur naturally in north-eastern QLD, although larvae from inland NSW will accept this plant in captivity (Forster and Machin 1994). At Mt Archer near Rockhampton, adults were observed flying around *M. miquelii* and damaged leaves were noted, apparently caused by larvae (L. Randall). In captivity, mid to late instar larvae will accept young shoots of Kurrajong, *Brachychiton populneus* (Sterculiaceae) (E.D. Edwards).

- **Attendant ants.** *Iridomyrmex purpureus, Ochetellus glaber* (Dolichoderinae), *Calomyrmex* sp., *Camponotus* sp., *Notoncus ectatommoides, Notoncus* sp., *Paratrechina* sp., *Polyrhachis* sp. (*ammon* group), *Polyrhachis* sp. (Formicinae).

  Facultative myrmecophilous: larvae are usually attended by a few individual ants belonging to one of the seven genera listed above, but sometimes they are not attended by ants (see Eastwood and Fraser 1999 for review).

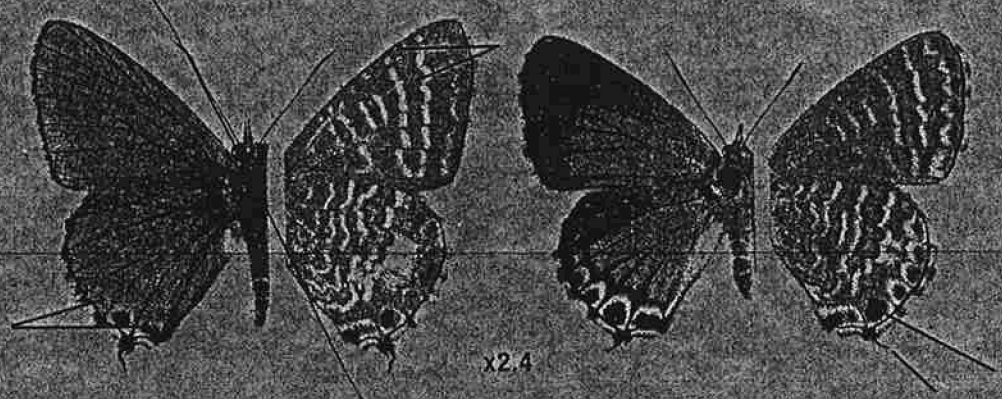
- **Life cycle and behaviour.** Eggs are laid singly on soft young fronds of the larval food plant when it has a seasonal flush of new growth or when it is regenerating after fire (Common and Waterhouse 1981; Braby 1997b). The larva feeds only on new, soft growth of the fronds and may even burrow into the rachis. It feeds mainly at night or sometimes very late in the afternoon, retreating for much of the day to the base of fronds or resting on the undersides of pinnae. If many larvae occur on an individual plant their feeding causes considerable damage

and affected fronds soon acquire a scorched sticky appearance; the plant may not regenerate until the following season. The pupa, which is attached by anal hooks and a central girdle, is usually well-hidden amongst the bases of older fronds, some distance from the apex of the trunk. Adults are often found flying around or settling on the larval food plant, or resting on the ground near by. Males are frequently collected on hilltops where for much of the day they perch about one to three metres above the ground on understorey shrubs (Atkins 1975b). Adults occur during all months of the year and there appears to be a succession of generations. Pupal duration in March at Cardwell, QLD, is six days (Braby 1997b).

- Distribution and habitat. This species is endemic to Australia, and occurs widely along the eastern coast.
  T. o. capricornia occurs sporadically from Cape York to Mackay, QLD (Sibatani and Grund 1978). The type locality is Kuranda, but specimens further south from Rockhampton and Yeppoon appear to belong here. A specimen from Darwin possibly belongs to this subspecies but further material needed to confirm its presence in the NT (Sibatani and Grun 1978).
  T. o. onycha occurs from the Blackdown Tableland, QLD, t Mt Dromedary near Central Tilba, NSW (Sibatani and Grun 1978). In central QLD, it occurs as far inland as Springsure an the Carnarvon Range (Sibatani and Grund 1978), and in NSV as far west as Coonabarabran (Common and Waterhous 1972) and Mt Kaputar (Daniels 1979).
  T. onycha is common in coastal eucalypt open-forest and ta open-forest where the larval food plants grow in the ope grassy understorey; it is much less common on the tableland and western slopes of the Great Dividing Range. Breedin populations are more numerous after bushfire when larva can be found commonly on young seedlings or new le growth of the food plants (Common and Waterhouse 198 Braby 1997b).
- Major reference. Sibatani and Grund (1978).

Theclinesthes miskini (T.P. Lucas, 1889) (Plate 60, fig. 2

Wattle Blue



x2.4

- Other common names. Miskin's Blue.
- Description. *Wingspan*: male 22 mm; female 22 mm. *Upperside*: male – colour varies from lilac, through silky lilac, bluish-lilac to occasionally blue, with a narrow grey-brown termen, and sometimes veins and bar at end of cell grey-brown; hind wing with a long slender tail tipped with white at end of vein CuA_2, and two black subtornal spots, that nearest tail the largest. Female – brown, with a large pale blue central area reaching base on both wings; hind wing with a series of whitish subterminal rings, the two nearest tornus each enclosing a black spot, and a long slender tail tipped with white at end of vein CuA_2. *Underside*: male – ground colour greyish or brownish-grey, with a series of darker spots and bands edged with dull white; hind wing with two black subtornal spots, the one nearest tail more prominent and edged above with orange. Female – similar to male.
- Variation. Six subspecies have been recognised (Sibatani and Grund 1978). Three of these occur in Australia, two of which are endemic.
  T. m. miskini (T.P. Lucas, 1889) (Plate 60, figs 2a, 2b) is described above. Adults of this subspecies are extremely variable in size, colour of the lilac or blue upperside, width of the grey-brown termen on the upperside, shade of the grey or grey-brown underside ground colour, and shape of the postmedian band on the underside of the hind wing, which sometimes is displaced outwards between veins M_3 and Sibatani and Grund (1978) recognised six regional or lo forms, but the differences are clinal. Furthermore, as *T. onycha*, adults exhibit seasonal variation, having summ