Nursery levy at work: **Nursery Production Plant Health & Biosecurity Project**

Cycad Blue Butterfly

A pretty name for an ugly problem

Background

Cycad blue butterfly, *Theclinesthes onycha*, is actually represented by two sub-species that are very similar in appearance. Sub-species *capricornia* occurs along coastal Queensland from Cape York to about Mackay and Rockhampton. Sub-species *onycha* occurs from about Rockhampton to as far south as Mt Dromedary, near the NSW-Victoria border. The *onycha* sub-species occurs along the coast and inland regions, as far west as Carnarvon in Queensland, and Coonabarabran in NSW. Their biology is quite similar, but differences are highlighted in each relevant section below.

Cycad blue butterfly is virtually indistinguishable from wattle blue butterfly (*T. miskini*), which feeds on many *Acacia* species, some *Corymbia* spp., *Eucalyptus* spp., *Atalaya* spp. (Sapindaceae), *Sesbania* spp. and some other species from Fabaceae. In fact, these two species often cannot be identified unless host plant information is available. Overseas, cycad blue butterfly can refer to different species. For example, *Chilades pandava* in Guam and Asia shares a common name, is closely related and appears very similar to Australian species.

Fig. 1. Variable colouration in cycad blue butterflies on *Cycas revoluta* in Brisbane.

Description

Cycad blue butterflies are medium sized, with a wingspan of about 2.5 cm. There is a significant amount of variation in the appearance of butterflies with gender, sub-species and season, which are not described in detail here. In general, the upperside of wings are dull to bright lilac, which may sometimes reach the base of both fore and hind wings, but not always. Females sometimes have white rings around black spots towards the posterior of the hindwing, but these are not always present. Most individuals have a dark outline around the edges of both the fore and hind wing; sometimes this edge is very thin and the wing is largely lilac, other times the edge is very thick and there is relatively little lilac colouration on the upperside. The undersides of cycad blue butterfly wings are more uniform. They are largely light brown to dull grey that

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have bands of dark brown spots that are edged with dull white. The hind wing also has black spots, including two black spots near the base of the wing that are prominently edged above the spot in orange.

In winter, the underside of the wings of both sub-species may be darker brown and the upper side of the wing more strongly blue with smaller black spots. In summer, the northern sub-species tends to have a paler underside of the wing, with stronger black spots and is more distinctly white edged than the southern sub-species.

Eggs are mostly white, but can be pale greenish-blue, and are disc-shaped and finely pitted. Larvae do not look like typical caterpillars. They range in size from about 2 mm, when newly hatched, to about 10-15 mm just before pupation. Larvae are generally dark purplish-brown, with faint white streaks and slightly darker bands in certain areas. However, some larvae may be pale green to deep green or even bluish green. They have a flat base and are somewhat dome in cross section. Pupae are about 1 cm long, pale brown to purplish-brown with blotchy dark brown areas.

Lifecycle

Adults may be present continually through the year, though are more abundant during warm weather in spring and summer. They can often be observed flying around host plants and landing on or near host plants, particularly when host plants are flushing. They are strong fliers and are probably able to move considerable distances, though exact distances are unknown. Eggs are about 1 mm in diameter and are laid singly on host plants, but only on the seasonal flush of new growth or during regeneration after fire. Larvae feed only on new, soft growth and may

Fig. 2. Underwing of a cycad blue butterfly (above), small, white eggs on new growth (middle) and a caterpillar feeding (below).

burrow into the rachis. Larvae tend to feed at night or very late afternoon. During the day they remain at the base of fronds or rest on the underside of pinnae. When larvae are ready to pupate, they hide themselves near the apex of the trunk amongst plant material. During warm conditions, pupae emerge as adults after about a week.

Various ant species may attend larvae. This is generally associated with greater protection from predators and parasitoid wasps. However, high levels of parasitism may still sometimes occur.

Damage

Feeding on fronds can cause them to appear scorched, sticky and very unattractive. Larvae can be present within the uncurling leaves and may not be seen without careful observation. Larvae only feed on the very soft, new growth. As a result, photosynthetic area is lost and new leaves can appear unhealthy. Even low numbers of larvae can cause significant cosmetic damage. High numbers can cause almost complete loss of leaves. Furthermore, it is possible for very high numbers of larvae to burrow into the main stem of a plant, which may then die.

Since cycads do not produce foliage continuously, once damaged, plants will not regenerate until the following flush. With repeated severe damage, it is likely that plant health will decline, particularly in a home garden situation. Widespread and repeated damage to home garden plants have had a social impact on the public growing cycads; there are now an increasing number of people who have given up growing cycads because of cycad blue butterfly in urban environments.

Host plants

The northern sub-species feeds on *Cycas* spp., including *C. media*, *C. megacarpa*, *C. ophiolitica, C. circulus* and other cultivated species. The southern sub-species feeds on *Macrozamia* spp., including *M. communis*, *M. miquelii*, *M. lucida* and *M. pauli-guilielmi*. In recent years, however, *Cycas* spp., particularly sago palm (*Cycas revoluta)* have started to receive significant damage from cycad blue butterfly in NSW, southeast Queensland and in north Queensland, where previous damage had not been known to occur. It is not known exactly what has changed. It is possible that the northern sub-species has extended its range south into Brisbane and NSW, however, this is not consistent with observations that *C. revoluta* has only started to receive damage in north Queensland recently. Another hypothesis is that there are more than two subspecies present in Australia, each specific to a certain group of host plant species. Research is required to resolve this mystery.

Fig. 2. Pupae exposed from amongst the cycad apex (top), white pupae of a parasitoid wasp and eggs present on larvae (middle), the wasp (about 7mm long) reared from parasitised larvae, *Apanteles* sp. (below).

In suburban areas, where sago palm and other host plant species are common, cycad blue butterfly is probably a greater problem than in more isolated, rural areas with a greater proportion of mixed native species. When host plants are very common and have synchronised flushing events, cycad blue butterfly populations can build up quickly and result in extensive and widespread damage.

With that said, not all species of cycads appear to receive similar levels of damage from cycad blue butterfly. Quantitative studies on the relative damage received by different species of cycads has not been completed, therefore information here is only a guide based on available literature and unofficial reports. It is widely accepted that sago palm is now severely damaged, as are many other *Cycas* species, by subspecies *capricornia,* and *Macrozamia* species, by *onycha* subspecies. Cardboard palm (*Zamia furfuracea*), other *Zamia* spp., *Bowenia* spp., *Encephalartos* spp. and *Ceratozamia* spp. are not reported as hosts of cycad blue butterfly.

Management

Cycad blue butterfly only damages new growth. Since new growth occurs infrequently, management of cycad blue butterfly must focus on preventing infestations of cycad blue butterfly, particularly during spring and summer. There are a number of strategies that can be used, all of which require one to be proactive. If you wait until an infestation has occurred, it is too late and some damage will result, sometimes severely. Ultimately, cycad blue butterfly impacts production nurseries, retail nurseries and home gardens. To address the social impact of cycad blue butterfly, recommendations are provided to each of these sectors.

Management actions that are appropriate to all sectors include the following actions.

- Grow species of cycad that are not damaged by cycad blue butterfly. In many cases, such species are just as attractive as sago palm, and many are native to Australia.
- If susceptible species are to be preserved, or to be persevered, provide optimal nutrition and water. This will assist cycads in tolerating damage and may allow plants to produce more frequent growing flushes. Flushes that occur out of phase with high populations of cycad blue butterfly (i.e. not during warm spring and summer periods), are less likely to receive damage. Cycads require high nitrogen fertilisers with trace elements.
- Monitor susceptible plants regularly for signs of new growth, particularly in spring and summer. At the first sign of growing flushes, begin to regularly treat with an appropriate insecticide until new growth has hardened off (see Table 1). Contact insecticides must also be applied after rain.
- For production nurseries, it is possible to grow cycads within protected cropping environments that exclude all butterflies. Since cycad blue butterfly is relatively large; a wide mesh screen will achieve

Fig. 4. Mild and severe damage caused by cycad blue butterfly on sago palm.

this goal and is less likely to hinder ventilation. As such, tunnels and other structures can be retrofitted at relatively little cost. Since cycad blue butterfly can occur at any time, it is imperative that doors remain closed at all times and any holes in structures and screens be repaired promptly.

- In home garden situations, it may be possible to put a net over cycads during periods of growing flushes, similar to placing nets over fruit trees to protect against fruit fly. However, it is important that the net does not come into contact with unfurling new growth as this will cause permanent deformity. Check to make sure that eggs and larvae are not present prior to placing nets over plants. Note that this method has not been tested. It is not known if butterflies will lay eggs through the net. It is also not known if the net will cause new growth to be relatively soft; there is a possibility of increased risk of sunburn after the net is removed.

Chemical management

Most of the products listed in Table 1 have contact activity only. This means that the application must be thorough and contact all caterpillars present. There is one systemic product listed, imidacloprid. This active ingredient remains in plant material for about three weeks. However, the concentration may

Fig. 5. Cycad blue butter fly flying around a cycad. Eggs have been laid on the apex of the plant even before the flush has begun to occur.

Table 1. Active ingredients that can be used against cycad blue butterfly in commercial and home garden scenarios.

MOA group	Activity	Active ingredient	Example product name	Packtype
1A	C	Carbaryl	Bugmaster	Commercial and home garden
1B	C	Maldison	Malathion	Home garden only
1B	C	Methidathion	Suprathion	Commercial only
3A	C	Bifenthrin	Talstar, Out of bounds	Commercial and home garden
3A	C	Esfenvalerate	Allround house and garden	Home garden only
3A	C	Various pyrethroid active ingredients including, Myclobutanil + bifenthrin; permithrin, pyrethrins	Rosepride, bug beater	Mainly home garden only, some products in commercial settings
3A + unknown	C	Garlic, chilli and pyrethrins	Naturally based insect spray concentrate	Commercial and home garden
4A+3A	S + C	Imidacloprid + beta-cyfluthrin	Temprid	Commercial only
5	T	Spinetoram	Success neo	Commercial and home garden
11	I	*Bacillus thuringiensis* subsp. *Kurstaki* (various strains)	Delfin, Dipel	Commercial only
21B	C	Rotenone	Derris dust	Home garden only
NA	C	Azadirachtin	Eco-Neem	Home garden only

Activity abbreviations C = contact, S = systemic, T = translaminar and I = ingestion.

decrease as the leaf expands and therefore application of a different product may still be required. Spinetoram is a translaminar active ingredient, meaning that it moves across the leaf surface. This has the benefit of being more likely to affect caterpillars feeding from within curled up leaves. *Bacillus thuringiensis* (Bt) is a bacteria that must be ingested by caterpillars. It is best applied when individuals are small; less product must be ingested to cause mortality to small caterpillars. Furthermore, some products are very sensitive to ultraviolet radiation, e.g. Bt and spinetoram. These products should only be applied very late in the afternoon to avoid breakdown in the sun before larvae feed at night. It is recommended to rotate between products from different mode of action (MOA) groups. This will reduce the risk of pesticide resistance occurring.

Please note that product labels change over time and not all labels for active ingredients listed in Table 1 will be relevant to cycad blue buttefly; always check the current label to ensure that it covers your exact situation. Refer to the Nursery Pesticide Application Best Practice Manual for detailed information on the use of pesticides.

Conclusion

Cycad blue butterfly can be managed proactively, by providing ideal nutrition and water and applying pesticides when plants are flushing. However, the best method to manage this butterfly is to grow plants that are not susceptible to damage. It is worthwhile noting such information on plant tags such that home gardeners can buy these plants, confident that it will not receive damage.

Further reading

Braby, M. (2000) *Butterflies of Australia. Their Identification, Biology and Distribution*. CSIRO Publishing, Collingwood, Vic, Australia.

Moss, J. (2009) The mysterious cycad blue butterfly, *Theclinesthes onycha* (Hewitson [1865]). *Metamorphosis Australia,* **53**, 11-14.

This document was prepared by Andrew Manners (Agri-science Queensland, Department of Agriculture and Fisheries , Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of NY11001 Plant health biosecurity, risk management and capacity building for the nursery industry in 2015. Thanks go to John Hall (University of Queensland), John Duff and Lindy Coates (both DAF) for helpful comments on previous versions of this factsheet. All photographs in this factsheet were taken by Andrew Manners (DAF).

Fig. 6. Cycad blue butterfly laying an egg (bottom-most butterfly).