

What to grow: An annotated list of native larval food plants of butterflies and diurnal moths in the Darwin region, Northern Territory

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Abstract

An annotated list of native larval food plants (131 species) of butterflies and diurnal moths (92 species) is provided for the Darwin region. We also collate information on the broad habitat, life form, plant part eaten, and method of cultivation for each species of food plant. Mistletoes, shrubs, herbs and grasses are predominately used in savannah woodland, whereas trees and vines are mainly exploited in monsoon vine forest and semi-deciduous monsoon vine thicket. All plant parts are eaten, but larvae of most species feed on leaves or the soft, new growth of young leaves. While the larvae of most butterflies/diurnal moths feed on several plant species, at least 26 species are known, or suspected, to feed only on a single species of native plant in the Darwin region. The compilation of such a list of indigenous food plants is to encourage further establishment of these species, particularly in suburban gardens, parks and roadside verges, to attract local butterflies and diurnal moths, thereby enhancing insect biodiversity in the urban landscape.

Introduction

A recent analysis of the distribution of butterflies and diurnal moths of northern Australia (excluding Cape York Peninsula) identified the northwestern corner of the Top End as a biodiversity hotspot for this group of insects (Braby *et al.* 2020b). It is estimated that 120–122 species of butterflies/diurnal moths occur in the inner and outer conservation reserves of Darwin (i.e. within 60 km of the CBD) according to range-map data based on a recently published set of spatial distribution maps (Braby *et al.* 2018). Given this substantial diversity of Lepidoptera, and the strong interest in natural history, entomology (especially butterflies) and biodiversity conservation by the local community in the Darwin region, it is considered desirable to summarise the native plants exploited by this group of insects for this area. However, there is no readily available list of native plants used by species of butterflies and diurnal moths inhabiting

just the Darwin region. Knowledge of which lepidopteran species feed on which species of plant has obvious practical benefits in terms of restoration ecology and landscape rehabilitation, as well as augmentation of conservation reserves, nature parks, suburban gardens and rural properties (i.e. green space) to sustain insect diversity in the wider urban landscape.

The purpose of this article is to collate information on the native larval food plants used by butterflies and diurnal moths inhabiting the wider Darwin region (i.e. within c. 60 km of the Central Business District). Such a list of food plants may encourage local residents, non-government organisations and local councils to propagate and establish these species, particularly in suburban gardens, parks and roadside verges, to attract local butterflies and diurnal moths, thereby enhancing insect biodiversity in the urban landscape. These plants may also be useful in ecological restoration of degraded landscapes because the ecological interactions between butterflies/diurnal moths and their host plants contributes to overall ecosystem function (Lomov *et al.* 2006).

It should be noted that the larvae of several butterflies also feed on introduced or exotic plants in the Darwin region and the Top End more widely. Over 40 species of non-native plants have been recorded as larval food plants for 34 species of butterflies and diurnal moths in northern Australia (see Braby *et al.* 2018 for a more detailed compilation of the species involved). In most cases, these plants serve as supplementary dietary food items and, as far as we are aware, there is no species of butterfly or diurnal moth that is reliant on them for survival. In this article we have not included introduced species because we do not wish to promote such plants, particularly those that provide little ecological benefit for other organisms or comprise invasive weeds that threaten biodiversity. As examples, Pale-orange Darter (*Telicota colon*) is known to use Gamba Grass (*Andropogon gayanus*), and four butterflies (Yellow Swift (*Borbo impar*), Lyell's Swift (*Pelopidas lyelli*), No-brand Grass-dart (*Taractrocerina ina*) and Evening Brown (*Melanitis leda*)) readily use Annual Mission Grass (*Cenchrus pedicellatus*) (Braby *et al.* 2018). On the other hand, the Pale Triangle (*Graphium eurypylus*) often uses the Indian Mast Tree (*Monoon longifolium*), which is cultivated as an ornamental street tree around Darwin, but it also uses a suite of native plants in the family Annonaceae.

Methods

The list of plants of the Darwin region was based primarily on the review of butterfly food plants in the monsoon tropics of northern Australia by Braby *et al.* (2018, Appendix I). More detailed compilations of butterfly food plants can be found in Meyer (1996) and Braby (2011, 2015). Most of the plant-butterfly/diurnal moth associations were extracted for the Darwin region. However, in some cases records outside this geographical area were included if: (1) the species of butterfly/diurnal moth definitely occurs in the Darwin region, (2) the species of plant is known to occur within the Darwin region, and (3) it was considered highly likely that the plant species would be used as a food plant by the lepidopteran species in that part of the range. For example,

the Narrow-winged Awl (*Badamia exclamationis*) occurs frequently in the Darwin region during its annual migration and it appears to be a seasonal immigrant to the area (Braby *et al.* 2018). The only known food plant of this butterfly in northern Australia, Damson (*Terminalia microcarpa*), occurs in Darwin where it is restricted to monsoon vine forest. However, *T. microcarpa* has not been recorded as a food plant for *B. exclamationis* in Darwin, but it has been recorded for this species in the eastern Kimberley of Western Australia near Kununurra (Meyer 1996). Therefore, if *B. exclamationis* breeds in the Darwin region, then *T. microcarpa* is the most likely larval food plant.

We also collated information on the life form of the food plant, noting the habit of each species as palm, tree, shrub, vine, herb, grass, sedge or mistletoe. For the plant part eaten, we distinguished nine categories as follows: leaf, young new leaf growth, flower bud, flower, fruit, seed, woody stem, photosynthetic vine, and root. Information on propagation for each plant species where known was obtained from Brock (2001), Fern (2014), ANPSA (2020) or made by inference from congeners or other closely related species.

The food plants for the Darwin region were then assigned to one (or more) of four categories according to the broad vegetation community in which each plant most commonly occurs: (1) savannah woodland; (2) monsoon vine forest and semi-deciduous monsoon vine thicket; (3) paperbark woodland/swampland associated with freshwater floodplains; and (4) mangrove and saltmarsh associated with saltwater. The reason for this distinction is that each of these broad vegetation communities are generally comprised of a suite of plants characteristic of that environment, with only minor overlap in species composition. Accordingly, it follows that the butterfly/diurnal moth assemblage of these habitats are also quite distinct, although some species do occur in more than one vegetation community. For example, the pierids Large Grass-yellow (*Eurema hecabe*) and Scalloped Grass-yellow (*Eurema alitha*) and the lycaenids Northern Pencil-blue (*Eirmocides margarita gilberti*), Small Dusky-blue (*Erina erina*), Black-spotted Flash (*Hypolycaena phorbas*) and Purple Cerulean (*Jamides phaseli*) breed in both monsoon vine thicket and savannah woodland, often on the same species of plant in each of these habitats.

Nomenclature for the butterflies and diurnal moths follows Braby *et al.* (2018) and two recent papers (Braby *et al.* 2020a; Hsu 2020), while that for the plants follows the Northern Territory Herbarium (Cowie *et al.* 2017).

Results and Discussion

An annotated list of larval food plants exploited by butterflies and diurnal moths in the Darwin region is presented in Appendix 1. We stress, however, that this list is provisional and by no means complete. For example, Tissa Ratnayake (pers. comm.) recently recorded larvae of the Common Crow (*Euphloea corinna*) feeding on *Ficus aculeata* at Holmes Jungle Nature Park (Figures 1–4), a plant species that was previously not known to be used by this butterfly.



Figures 1–4. The Common Crow (*Euploea corinna*) and one of its larval food plants at Holmes Jungle Nature Park, Darwin: (1) *Ficus aculeata*, (2) larva, (3) pupa, and (4) adult butterfly. This species of fig was previously not known to be used by this species of butterfly. (Tissa Ratneyeke)

Moreover, there are several species of butterflies and diurnal moths in the Darwin region for which there are no documented records of their food plants. Good examples of species with unknown or poorly documented food plant associations are the Poaceae-feeding skippers (e.g. Spotted Grass-skipper (*Neobesperilla senta*), Narrow-brand Grass-skipper (*N. crocea*), Yellow Grass-skipper (*N. xanthomerra*), River Sand Grass-dart (*Taractrocera dolon diomedes*), Green Grass-dart (*Ocybadistes walkeri olivia*), White-margined Grass-dart (*O. hypomeloma*), Narrow-brand Grass-dart (*O. flavovittatus vesta*), and Wide-brand Grass-dart (*Suniana sunias sauda*)), some of the smaller blues (e.g. Glistening Line-blue (*Sabulana scintillata*), Common Grass-blue (*Zizina otis*), Dainty Grass-blue (*Zizula hylax*), and Orange-tipped Pea-blue (*Everes lacturnus*)) and several agaristine moths (e.g. Pale Banded Day-moth (*Leucogonia cosmopsis*), Laced Day-moth (*Ipanica corniger*), Indigo Day-moth (*Idalima leonora*) and Central Spotted Day-moth (*Mimusemia centralis*)). The food plants for most of these species are well documented from other areas of their range, such as northeastern and southeastern Queensland (Braby 2000; Moss 2019), but the actual species involved for the Top End have not been recorded. In other words, although knowledge of the butterfly/diurnal moth-plant associations is reasonably complete there is still much to learn about the food plant preferences for the Northern Territory.

In other cases, species recorded from the Darwin region are possibly vagrants to the area and do not breed within the region. For example, both the Purple Beak (*Libythea geoffroyi genia*) and Orange Tiger (*Danaus genutia alexis*) have very occasionally been recorded from the Darwin region (Meyer *et al.* 2006; Braby *et al.* 2018). However, the known larval food plants for these butterflies – *Celtis strychnoides* (Braby 2014) and *Oxytelma esculentum* (Meyer 1995), respectively – do not occur in the Darwin region, indicating that either breeding populations of these butterflies are not permanently established or, if they are established, they breed on alternative (as yet unreported) food plants.

Overall, we estimate that at least 131 species of native plants are used, or potentially used, by 92 species of butterflies/diurnal moths in this area (Appendix 1). At least 75 species of native plants are known to be used in savannah woodland (by 60 species of butterflies/diurnal moths), whereas fewer food plants are recorded from paperbark woodland/swampland (18 species) and mangrove/saltmarsh (9 species) (by a total of 26 species of butterflies/diurnal moths) (Table 1). Monsoon forest/vine thicket habitats support an intermediate number of species, with a total of 49 species of plants known to be used (by 44 species of butterflies/diurnal moths), including those that breed only along the edge or ecotone of the habitat. Some species like Fiery Jewel (*Hypobryopsis igniua erythrina*) frequently use at least four monsoon forest tree species (e.g. *Alphitonia excelsa*, *Clerodendrum floribundum*, *Glochidion apodogynum*, and *Marantbes corymbosa*), but only when they are saplings growing in savannah woodland or along the margins of monsoon forest/vine thicket.

The larval food plants utilised include all life forms, but mistletoes, shrubs, herbs and grasses predominate in savannah woodland, whereas trees and vines are mainly exploited in monsoon forest/vine thicket (Table 1), which reflects the different prevalence of those life forms in savannah and monsoon forest. All plant parts are eaten, but larvae

Table 1. Number of larval food plant species exploited by butterflies and diurnal moths in the Darwin region for each major habitat according to plant life form. For plants that occur in more than one habitat, the species are tallied for each habitat. Percentages refer to proportional representation of each life form among the four habitats. Data are based on the list presented in Appendix 1.

Life form	Savannah woodland	Monsoon forest/vine thicket	Paperbark woodland/swampland	Mangrove/saltmarsh	Total
Palm	1 (33.3%)	1 (33.3%)	1 (33.3%)	0	3
Tree	7 (22.6%)	19 (61.3%)	2 (6.4%)	3 (9.7%)	31
Shrub	24 (68.5%)	8 (22.9%)	3 (8.6%)	0	35
Vine	13 (36.1%)	16 (44.4%)	5 (13.9%)	2 (5.6%)	36
Herb	12 (66.7%)	1 (5.5%)	2 (11.1%)	3 (16.7%)	18
Grass	9 (64.3%)	1 (7.1%)	4 (28.6%)	0	14
Sedge	1 (33.3%)	1 (33.3%)	1 (33.3%)	0	3
Mistletoe	8 (72.7%)	2 (18.2%)	0	1 (9.1%)	11
Total	75	49	18	9	

of most species feed on leaves or the soft, new growth of young leaves. Flower buds and flowers are only exploited by certain species of Lycaenidae (blues). Fruits, seeds, wood and roots are rarely used – only single species are known to specialise on each of fruits (by Princess Flash (*Deudorix smilis*)) and woody tissue (by Clearwing Moth (*Pseudosesia oberthuri*)), whereas the roots of the grass *Chrysopogon latifolius* support an extensive rhizomatous mat that is eaten by the larvae of Northern White-spotted Sun-moth (*Synemon phaeoptila*).

In addition, the age or height of the plant is important for some species. For example, Wattle Blue (*Theclinesstes miskini*) and Fiery Jewel (*Hypochrysois ignitus*) only feed on the sapling stage of their host plants, many individuals of which typically grow into trees. Clearing Moth (*Pseudosesia oberthuri*) feeds on seasonal perennial vines of *Ampelocissus* (several species) but only once they have matured and developed vigorous woody stems. Conversely, many species which feed on trees will also use the same plant species when they are saplings or shrubs. For examples, Ornate Dusk-flat (*Chaetocneme denitzga*), of which the larvae feed on the mature leaves of Cocky Apple (*Planchonia careya*), and Chrome Awl (*Hasora chromus*), of which the larvae feed on the soft, new growth of young leaves of Pongamia (*Millettia pinnata*), will utilise tree, sapling/shrub growth forms regardless of height.

Some species of plants are exploited by many butterflies and diurnal moths. The mistletoes *Decaisnina signata*, *Amyema sanguinea*, *A. bifurcata*, *A. miquelii*, *A. villiflora*, *Dendrophthoe glabrescens* and *Dendrophthoe odontocalyx* each support three or more species of butterflies/diurnal moths. Collectively, these plants provide food for a total of nine species, highlighting the importance of mistletoes as a keystone resource in the landscape (Watson 2001; Anderson & Braby 2009). The monsoon forest/vine thicket trees Coastal Tuckeroo (*Cupaniopsis anacardioides*) and *Millettia pinnata* are particularly important, each being used by five species of butterflies, as is the vine/shrub *Capparis sepiaria* with three, and possibly, four species. The grasses *Imperata cylindrica* and *Ischaemum australe* are each used by four species of butterflies, and the vine *Cynanchum carnosum* is used by three species of danaine butterflies. The vine *Ampelocissus acetosa* and related shrub *A. frutescens* provide food for three species of diurnal moths.

A mix of native plant species is desirable to attract a large diversity of butterfly/diurnal moth species. While some species, such as *Cupaniopsis anacardioides*, *Millettia pinnata*, *Capparis sepiaria*, *Imperata cylindrica* and *Ischaemum australe*, provide food for many species, it is important to consider that a number of species of butterflies and diurnal moths in the Darwin region utilise only a single species of food plant (i.e. are monophagous) or a very narrow range of plant species, such as a few species in the same genus or a few genera in the same family. For example, the following trees are the only known food plants for five species of butterflies and diurnal moths: *Carallia brachiata* (for Six O'clock Moth (*Dysphania numana*)), *Drypetes deplanchei* (for White Albatross (*Appias albina albina*)), *Excoecaria ovalis* (for Mangrove Jezebel (*Delias aestiva aestiva*)), *Millettia pinnata* (for Chrome

Awl (*Hasora chromus*), and *Strychnos lucida* (for Princess Flash (*Deudorix smilis*)). Similarly, the following shrubs are the only native food plants for three species of butterflies/diurnal moths in the Darwin region: *Boronia lanceolata* (for Spotted Opal (*Candalides urumelia*), at Channel Island), *Flacourtia territorialis* (for Spotted Rustic (*Phalanta phalantha*)), and *Leea rubra* (for Painted Day-moth (*Agarista agricola biformis*)).

Vines are particularly important for a number of butterflies, and at least eight species specialise on single species of vines, as follows: *Adenia heterophylla* (by Orange Lacewing (*Cethosia penthesilea*)), *Cassytha filiformis* (by Small Dusky-blue (*Erina erina*)), *Derris trifoliata* (by Broad-banded Awl (*Hasora burama*)), *Embelia curvineria* (by White-banded Line-blue (*Nacaduba kurava felsina*)), *Flagellaria indica* (by Bright-orange Darter (*Telicota augias*)), *Galactia tenuiflora* (by Scalloped Grass-yellow (*Eurema alitha*)), *Marsdenia geminata* (by Two-brand Crow (*Euploea sylvester pelor*)), and *Trophis scandens* (by Small Brown Crow (*Euploea darchia darchia*)). Several herbs, grasses and sedges are also important, with 10 species serving as the only natural food plants in the Darwin region: *Aristolochia holtzei* (for Clearwing Swallowtail (*Cressida cressida*)), *Chamaecrista mimosoides* (for Macleay's Grass-yellow (*Eurema berli*)), *Patersonia macrantha* (for Northern Iris-skipper (*Mesodina gracillima*)), *Portulacca oleracea* (for Danaid Eggfly (*Hypolimnas misippus*)), *Pseuderanthemum variabile* (for Blue-banded Eggfly (*Hypolimnas alimena darwinensis*)), *Typhonium flagelliforme* (for Tiger Day-moth (*Cruria darwiniensis*)), *Triodia bitextura* (for Spinifex Sand-skipper (*Proeidosia polysema*)), *Chrysopogon latifolius* (for Northern White-spotted Sun-moth (*Synemon phaeoptila*)), *Cyperus javanicus* (for Riverine Sedge-skipper (*Hesperilla sexguttata*)), and *Scleria sphaelata* (for Wide-brand Sedge-skipper (*Hesperilla crypsigramma*)). This conservatism in food plant preference highlights the extreme specialisation of Lepidoptera and their host plants – butterflies and diurnal moths are fussy eaters!

In addition to providing the appropriate species of plant for particular species of butterflies/diurnal moths, several members of the Lycaenidae also require ants. For Shining Oak-blue (*Arhopala micale*), Purple Oak-blue (*A. eupolis asopus*), Black-spotted Flash (*Hypolycaena phorbis*) and Dark Ciliate-blue (*Anthene seltuttus*), the larvae are reliant on the Green Tree Ant (*Oecophylla smaragdina*). Because this ant is a common arboreal species in savannah woodland and along the edges of monsoon forest/vine thicket, generally little provision needs to be made to establish colonies of the ant. The ant is also the food for the Moth Butterfly (*Liphyra brassolis*), which does not feed on plants but consumes the ant brood inside the ant-nest (i.e. myrmecophilous). However, the larvae of other species that have specific obligate associations with ants will not survive unless colonies of the appropriate ant species are present. For example, Northern Purple Azure (*Ogyris zosine*) and Fieri Jewel (*Hypochrysops ignitus*) require subterranean colonies of *Camponotus* sp. and *Papyrius* sp., respectively, whereas Copper Jewel (*Hypochrysops apelles*) requires *Crematogaster* sp., which live in the mature trees of its mangrove food plants, especially *Lumnitzera racemosa*. Orange-tipped Azure or Dodd's Azure (*Ogyris iphis doddii*), should it still occur in the Darwin region, requires extensive colonies of the ant *Froggattella kirbii* in addition to its mistletoe food plant.

It is envisaged that the list of food plants provided herein will encourage suburban residents and those living in the rural area, as well as non-government organisations (e.g. Top End Native Plant Society, Greening Australia) and the Darwin City Council, to propagate and establish indigenous species to attract butterflies and diurnal moths to their suburban gardens, parklands and roadside verges (i.e. green spaces). Insects play important roles in ecosystem function, such as pollination, nutrient cycling, herbivory and provide food for other animals, such as vertebrates (e.g. reptiles and birds) (Taylor *et al.* 2018). The larvae of butterflies and moths rarely kill their food plants by overexploitation, although in some circumstances they may cause temporary defoliation when numbers are high. However, in our experience the plants quickly recover from such instances of herbivory.

In addition to the above-mentioned biodiversity and environmental benefits of growing indigenous plants, such species have the advantage of being more likely to successfully establish as they are inherently adapted to local climatic and soil conditions. Some local indigenous plants are available commercially through various nursery outlets. However, many species have not been developed horticulturally due to their actual or perceived lack of ornamental appeal (e.g. absence of large showy flowers). Relatively few of the larval food plants listed in this article are readily available in retail nurseries, but many may be amenable to cultivation, after propagation from seed or stem cuttings, or by transplanting or division of plants (Appendix 1). Cultivation of others remains uncertain or has not been tried. Information on propagation and cultivation of local native plants is available from plant nurseries, Top End Native Plant Society or online, for example, via Greening Australia and Gardening Australia websites.

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References

- Anderson S.J. and Braby M.F. (2009) Invertebrate diversity associated with tropical mistletoe in a suburban landscape from northern Australia. *Northern Territory Naturalist* 21, 2–23.
- ANPSA [Australian Native Plants Society Australia] (2020) <http://anpsa.org.au/propagat.html> (accessed 6 November 2020).
- Braby M.F. (2000) *Butterflies of Australia. Their Identification, Biology and Distribution*. CSIRO Publishing, Collingwood, Melbourne.
- Braby M.F. (2011) New larval food plant associations for some butterflies and diurnal moths (Lepidoptera) from the Northern Territory and eastern Kimberley, Australia. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory* 27, 85–105.
- Braby M.F. (2014) Remarks on the spatial distribution of some butterflies and diurnal moths (Lepidoptera) in the Top End of the Northern Territory, Australia. *Northern Territory Naturalist* 25, 29–49.

- Braby M.F. (2015) New larval food plant associations for some butterflies and diurnal moths (Lepidoptera) from the Northern Territory and Kimberley, Australia. Part II. *Records of the Western Australian Museum* 30, 73–97.
- Braby M.F., Franklin D.C., Bisa D.E., Williams M.R., Williams A.A.E., Bishop C.L. and Coppen R.A.M. (2018) *Atlas of Butterflies and Diurnal Moths in the Monsoon Tropics of Northern Australia*. ANU Press, Canberra.
- Braby M.F., Espeland M., Müller C.J., Eastwood R., Lohman D.J., Kawahara A.Y., Maunsell S.C. and Pierce N.E. (2020a) Molecular phylogeny of the tribe Candalidini (Lepidoptera: Lycaenidae): systematics, diversification and evolutionary history. *Systematic Entomology* 45, 703–722.
- Braby M.F., Williams M.R., Coppen R.A.M., Williams A.A.E. and Franklin D.C. (2020b) Patterns of species richness and endemism of butterflies and day-flying moths in the monsoon tropics of northern Australia. *Biological Conservation* 241, 108357.
- Brock J. (2001) *Native Plants of Northern Australia*. Reed New Holland, Sydney.
- Cowie I.D., Cuff N.J., Lewis D.L. and Jobson P. (2017) *Checklist of the Vascular Plants of the Northern Territory*. Northern Territory Herbarium, Department of Environment and Natural Resources, Palmerston.
- Fern K. (2014) Useful Tropical Plants Database. <http://tropical.theferns.info>. (accessed 6 November 2020).
- Hsu Y.-F. (2020) The identity of Alfred Wallace’s mysterious butterfly taxon *Lycaena nisa* solved: *Famegana nisa* comb. nov., a senior synonym of *F. alsulus* (Lepidoptera, Lycaenidae, Polyommatainae). *ZooKeys* 966, 153–162.
- Lomov B., Keith D.A., Britton D.R. and Hochuli D.F. (2006) Are butterflies and moths useful indicators for restoration monitoring? A pilot study in Sydney’s Cumberland Plain Woodland. *Ecological Management and Restoration* 7, 204–210
- Meyer C.E. (1995) Notes on the life history of *Danaus genutia alexis* (Waterhouse and Lyell) (Lepidoptera: Nymphalidae: Danainae). *The Australian Entomologist* 22, 137–139.
- Meyer C.E. (1996) Butterfly larval food plant list for the Northern Territory and the Kununurra District in Western Australia. *Victorian Entomologist* 26, 66–72.
- Meyer C.E., Weir R.P. and Wilson D.N. (2006) Butterfly (Lepidoptera) records from the Darwin region, Northern Territory. *The Australian Entomologist* 33, 9–22.
- Moss J.T. (2019) *Butterfly Host Plants of South-east Queensland and Northern New South Wales*. Fourth Edition. Butterfly and Other Invertebrates Club Inc., Runcorn, Brisbane.
- Taylor G.S., Braby M.F., Moir M.L., Harvey M.S., Sands D.P.A., New T.R., Kitching R.L., McQuillan P.B., Hogendoorn K., Glatz R.V., Andren M., Cook J.M., Henry S.C., Valenzuela I. and Weinstein P. (2018) Strategic national approach for improving the conservation management of insects and allied invertebrates in Australia. *Austral Entomology* 57, 124–149.
- Watson D.M. (2001) Mistletoe – a keystone resource in forests and woodlands worldwide. *Annual Review of Ecology and Systematics* 32, 219–249.

Appendix 1. Annotated list of larval food plants for butterflies and diurnal moths occurring in the Darwin region. Plant species are listed alphabetically according to life form. For habitat: Sw = savannah woodland, Mv = monsoon vine forest or semi-deciduous monsoon vine thicket, P = paperbark woodland/swampland (freshwater), Ma = mangrove or saltmarsh (saltwater). For cultivation: S = from seed, C = from cutting, D = from transplant or division. ? = uncertain/untried. For plant part eaten: L = leaf, Ly = leaf (young new growth only), Fb = flower bud, Fl = flower, S = seed, W = stem woody, V = vine photosynthetic, R = root. Note that the mistletoes *Anyema*, *Decasina signata* and *Dendrophthoe* also require a host tree to survive.

Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
Palm				
<i>Carpentaria acuminata</i>	Mv	S	<i>Cepbrenes augiades</i>	L
<i>Livistona benthamii</i>	P	S	<i>Cepbrenes trichopepla</i>	L
<i>Livistona humilis</i>	Sw	S	<i>Cepbrenes trichopepla</i>	L
Tree				
<i>Acacia auriculiformis</i>	Mv	S	<i>Prosotas dubiosa</i> , <i>Theclinesibes miskaini</i>	Fb/Fl, L
<i>Alphitonia excelsa</i> (sapling)	Sw	S	<i>Hypochrysops ignitus</i>	L
<i>Atalaya varifolia</i> (sapling)	Sw	S?	<i>Theclinesibes miskaini</i>	L
<i>Bachanania obovata</i>	Sw	S	<i>Arhopala eupolis</i>	Ly
<i>Calophyllum inophyllum</i>	Mv	S	<i>Arhopala micale</i>	Ly
<i>Carallia brachiata</i>	Mv	S	<i>Dysphania numana</i>	L
<i>Cerriops australis</i>	Ma		<i>Hypochrysops apelles</i>	L
<i>Corymbia bella</i>	P	S	<i>Arhopala eupolis</i>	Ly

Continued on next page

Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
<i>Corymbia bella</i> (sapling)	P	S	<i>Thecinesibes miskaini</i>	L
<i>Corymbia dijuncta</i>	Sw	S	<i>Anthere selattutus</i> , <i>Arhopala eupolis</i>	Ly, Ly
<i>Corymbia ferruginea</i> (sapling)	Sw	S	<i>Thecinesibes miskaini</i>	L
<i>Cryptocarya cunninghamii</i>	Mv	S	<i>Graphium eurypylus</i>	Ly
<i>Capaniopsis anacardioides</i>	Mv	S	<i>Prosotas dubiosa</i> , <i>Anthere bycaenoides</i> , <i>Anthere selattutus</i> , <i>Arhopala eupolis</i> , <i>Arhopala micale</i>	Fb, Fb/Fl/ Ly, Ly, Ly, Ly
<i>Drypetes deplanchei</i>	Mv	S	<i>Appias albina</i> , <i>A. paulina</i>	Ly, Ly
<i>Excoecaria ovalis</i>	Ma	S	<i>Delias aestiva</i>	L
<i>Ficus virens</i>	Mv	S	<i>Euploea corinna</i>	Ly
<i>Gardenia megasperma</i> (sapling)	Sw	S	<i>Hypochrysoys ignitus</i>	L
<i>Huberantha nitidissima</i>	Mv	S	<i>Graphium eurypylus</i>	Ly
<i>Lumnitzera racemosa</i>	Ma	S	<i>Hypochrysoys apelles</i>	L
<i>Mallotus nesophilus</i>	Mv	S	<i>Catopyrops florinda</i>	Fb/Fl/Ly
<i>Maranthes corymbosa</i>	Mv	S, C	<i>Arhopala eupolis</i>	Ly
<i>Maranthes corymbosa</i> (sapling)	Sw	S, C	<i>Hypochrysoys ignitus</i>	L
<i>Mitusa traceyi/brabei</i>	Mv	S	<i>Graphium eurypylus</i>	Ly
<i>Millettia pinnata</i>	Mv	S	<i>Anthere bycaenoides</i> , <i>A. selattutus</i> , <i>Haemora chromus</i> , <i>Jamides phaselis</i> , <i>Prosotas dubiosa</i>	Fb/Fl/Ly, Ly, Ly, Fb/ Fl/Ly, Fb/ Fl

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Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
<i>Planchonia careya</i>	Sw	S	<i>Chaetocneme denitzæ</i> , <i>Hypolycaena phorbæ</i>	L, L
<i>Planchonia careya</i> (sapling)	Sw	S	<i>Hypobryops ignitus</i>	L
<i>Sterculia quadrifida</i>	Mv	S	<i>Arhopala micale</i>	Ly
<i>Strychnos lucida</i>	Mv		<i>Deudorix smilis</i>	Ft
<i>Terminalia ferdinandiana</i>	Sw	S	<i>Arhopala eupolis</i>	Ly
<i>Terminalia microcarpa</i>	Mv	S	<i>Badamia exclamatoris</i>	Ly
<i>Zanthoxylum rhetsa</i>	Mv	S	<i>Papilio fuscus</i>	L
<i>Vitex acuminata</i>	Mv	S, C	<i>Charaxes sempronius</i>	L
Tree/shrub				
<i>Barringtonia acutangula</i>	P	S	<i>Anthere bycaenoides</i>	Fb/FI/Ly
<i>Capparis umbonata</i>	Sw	S	<i>Belenois java</i> , <i>Cepora perimale</i>	L, L
<i>Clerodendrum floribundum</i>	Mv, Sw	S	<i>Hypobryops ignitus</i> , <i>Hypolycaena phorbæ</i>	L, L
<i>Ficus aculeata</i>	Sw	S, C	<i>Euploea corinna</i>	Ly
<i>Glochidion apodogynum</i> (sapling)	Sw	S	<i>Hypobryops ignitus</i>	L
Shrub				
<i>Acacia difficilis</i>	Sw	S	<i>Theclimnesthes miskæni</i>	L
<i>Acacia holosericea</i>	Sw	S	<i>Theclimnesthes miskæni</i>	L
<i>Ampelocissus frutescens</i>	Sw, Mv	S?	<i>Periopta ardescens</i> , <i>Radinocera vagata</i> , <i>Pseudosexia oberthuri</i>	Ly, Ly, W
<i>Boronia lanceolata</i>	Sw	S, C	<i>Candulides urumelia</i>	L

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Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
<i>Bossiaea bossiaevoides</i>	Sw	S	<i>Jamides phaseli</i>	L
<i>Brachybiton megaphyllus</i>	Sw	S	<i>Hypochrypsus ignitus</i>	L
<i>Breynia cernua</i>	Sw, Mv	S, C	<i>Eurema hecabe</i> , <i>Hypobyaena phorbas</i>	Ly, L
<i>Bridelia tomentosa</i>	Sw, Mv		<i>Anthea bycaenoides</i>	Fb/FI/Ly
<i>Cathormion umbellatum</i>	P	S	<i>Theclinesibes miskini</i>	L
<i>Chamaecrista mimosoides</i>	Sw		<i>Eurema herla</i>	L
<i>Crotalaria novae-hollandiae</i>	Sw	S	<i>Lampides boeticus</i>	Fb/FI/S
<i>Callen badocanum</i>	Sw	S	<i>Papilio demoleus</i>	L
<i>Dodonaea hispida</i>	Sw	S	<i>Catopyrops florinda</i>	Fb/FI/Ly
<i>Flacourtia territorialis</i>	Mv	S?	<i>Phalantia phalanthia</i>	Ly
<i>Flemingia lineata</i>	Sw	S	<i>Catochrypsus panormus</i> , <i>Freyeria patuli</i>	Fb/FI/Ly, FI/L
<i>Glycosmis trifoliata</i>	Mv	S	<i>Papilio fuscus</i>	L
<i>Hibbertia brevipedunculata/cistifolia</i>	Sw	C	<i>Idalima aethrias</i>	L
<i>Hibbertia dilatata/juncea</i>	Sw	C	<i>Idalima metasticta</i>	L/FI
<i>Leea rubra</i>	Mv	S, C	<i>Agarista agricola</i>	Ly
<i>Micromelum minutum</i>	Mv	S	<i>Papilio fuscus</i>	L
<i>Senna surattensis</i>	Sw, Mv	S	<i>Anthea bycaenoides</i> , <i>Catopsilia scylla</i>	L, L
<i>Sesbania cannabina</i>	P	S, C	<i>Eurema hecabe</i> , <i>Theclinesibes miskini</i>	L, L

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Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
Vine/shrub				
<i>Capparis sepiaria</i>	Mv	S	<i>Appias paulina</i> , <i>Beleinois java</i> , <i>Cepora perimale</i> , <i>Elodina walkeri</i>	Ly, L, L, L
<i>Cyrtananchum viminale</i>	Sw	C	<i>Euploea corinna</i>	Ly
<i>Embelia curvineria</i>	Mv		<i>Nacaduba kurana</i>	Fl/Ly
Vine				
<i>Adenia heterophylla</i>	Mv	C?	<i>Acræa andromacha</i> , <i>Cetbosia penthesilea</i>	L
<i>Ampelocissus acetosa</i>	Sw, Mv	S?	<i>Periopta ardescens</i> , <i>Radnocera vagata</i> , <i>Pseudoesia oberthuri</i>	Ly, Ly, W
<i>Canavalia rosea</i>	P	S	<i>Jamides phaseli</i>	Fb/Fl
<i>Cassytha filiformis</i>	Sw, Mv, P		<i>Erina erina</i>	V
<i>Cayratia maritima</i>	P	C?	<i>Radnocera vagata</i>	Ly
<i>Cayratia trifolia</i>	Sw	C	<i>Cruria donovani</i> , <i>Radnocera vagata</i>	Ly, Ly
<i>Cynanchum carnosum</i>	P	C?	<i>Danaus affinis</i> , <i>D. petilia</i> , <i>Trimala hamata</i>	Ly, Ly, Ly
<i>Cynanchum pedunculatum</i>	Sw	C?	<i>Danaus petilia</i>	Ly
<i>Derris trifoliata</i>	Ma		<i>Hasora burama</i>	Ly
<i>Flagellaria indica</i>	Mv		<i>Anthere bycaenoides</i> , <i>Telicota augias</i>	Fb/Fl/ Ly, L
<i>Gynnanthera oblonga</i>	Ma, P		<i>Euploea corinna</i>	Ly
<i>Ichnocarpus frutescens</i>	Mv	C?	<i>Euploea corinna</i>	Ly

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Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
<i>Marsdenia geminata</i>	Mv	S?	<i>Euploea corinna</i> , <i>E. sylbester</i>	Ly, Ly
<i>Marsdenia glandulifera</i>	Mv	S?	<i>Tirumala hamata</i>	Ly
<i>Marsdenia velutina</i>	Mv	S?	<i>Tirumala hamata</i>	Ly
<i>Marsdenia viridiflora</i>	Sw	S?	<i>Danaus affinis</i> , <i>Euploea corinna</i>	Ly, Ly
<i>Secamone elliptica</i>	Mv	C?	<i>Euploea corinna</i> , <i>Tirumala hamata</i>	Ly, Ly
<i>Smilax australis</i>	Mv, Sw		<i>Hypochrysois ignitus</i> , <i>Hypolycaena phorbos</i>	L, L
<i>Thunbergia arubemica</i>	Mv, Sw		<i>Junonia orithya</i>	L
<i>Trochis scandens</i>	Mv	S	<i>Euploea darchia</i>	Ly
<i>Tylophora flexuosa</i>	Mv	S?	<i>Danaus petilia</i>	Ly
<i>Vigna</i> (4 species)	Sw	S	<i>Euchrysois crejus</i> , <i>Famegama nisa</i>	Fb/FI/S, Fb/FI
Vine/herb				
<i>Galactia tenuiflora</i>	Sw, Mv	S	<i>Eurema alitha</i>	L
Herb				
<i>Aristolobchiaholtzei</i>	Sw		<i>Cressida cressida</i>	L
<i>Buchnera</i> (3 species)	Sw		<i>Junonia orithya</i>	L/FI
<i>Hybanthus enneaspermus</i>	Sw		<i>Acraea andromacha</i> , <i>A. terpsicore</i>	L, L
<i>Hygrophila angustifolia</i>	P		<i>Junonia bedonia</i>	L
<i>Indigofera tinjolia</i>	Sw		<i>Freyeria putli</i>	FI/L
<i>Patersonia macrantha</i>	Sw	D	<i>Mesodina gracillima</i>	L

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Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
<i>Phyllanthus</i> sp.	Sw		<i>Eurema hecabe</i>	L
<i>Portulacca oleracea</i>	Sw		<i>Hypolimnas misippus</i>	L
<i>Pseuderanthemum variabile</i>	Mv, Sw	C/D?	<i>Hypolimnas alimena</i> , <i>Junonia orithya</i>	L, L
<i>Spermacoce phalloides</i>	Sw		<i>Periopta diversa</i>	L
<i>Tecticornia</i> (3 species)	Ma		<i>Theclinesthes sulphiteus</i>	L
<i>Typhonium flagelliforme</i>	P		<i>Cruria daminiensis</i>	Ly
<i>Tribulus cistoides</i>	Sw		<i>Zizeeria kearsandra</i>	L
Grass				
<i>Aristida macroclada</i>	Mv, Sw	D	<i>Hypocysta adiante</i>	L
<i>Arundinella nepalensis</i>	P	D	<i>Hypocysta adiante</i>	L
<i>Chrysopogon latifolius</i>	Sw	D	<i>Synemon phaeoptila</i>	R
<i>Cymbopogon procerus</i>	Sw	D	<i>Taractropera ina</i>	L
<i>Digitaria gibbosa</i>	Sw		<i>Hypocysta adiante</i>	L
<i>Eulalia aurea</i>	Sw	D	<i>Taractropera anisomorphia</i>	L
<i>Hymenacbe acutigluma</i>	P		<i>Borbo impar</i>	L
<i>Imperata cylindrica</i>	P, Sw	D	<i>Melanitis leda</i> , <i>Mydosama sirius</i> , <i>Samiana lascivia</i> , <i>Telicota colon</i>	L, L, L, L
<i>Ischaemum australe</i>	P	D	<i>Hypocysta adiante</i> , <i>Melanitis leda</i> , <i>Samiana lascivia</i> , <i>Telicota colon</i>	L, L, L, L

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Plant species	Habitat	Amenable to cultivation	Butterfly/ diurnal moth species	Plant part eaten
<i>Mnestibea rotthoellioides</i>	Sw	D	<i>Pelopidas byelli</i> , <i>Telicota colon</i>	L, L
<i>Sorghum intrans</i>	Sw	D	<i>Neohesperilla xiphophora</i>	L
<i>Triodia bixextura</i>	Sw	D	<i>Proeidosia polysema</i>	L
Sedge				
<i>Cyperus javanicus</i>	P	D	<i>Hesperilla sexguttata</i>	L
<i>Scleria sphaelata</i>	Sw, Mv	D	<i>Hesperilla crypsigramma</i>	L
Mistletoe				
<i>Amyema benthamii</i>	Sw		<i>Ogyris amaryllis</i> , <i>O. zosine</i>	L, L
<i>Amyema bifurcata</i>	Sw		<i>Comocrus behri</i> , <i>Ogyris amaryllis</i> , <i>O. oroetes</i> , <i>O. zosine</i>	L, L, L, L
<i>Amyema miquelii</i>	Sw		<i>Delias argenthona</i> , <i>Eirmocides margarita</i> , <i>Ogyris amaryllis</i> , <i>O. zosine</i>	L, Fb/Fl/ Ly, L, L
<i>Amyema sanguinea</i>	Sw		<i>Birbhana cleis</i> , <i>Comocrus behri</i> , <i>Delias argenthona</i> , <i>Eirmocides margarita</i> , <i>Ogyris amaryllis</i> , <i>O. iphis</i> , <i>O. zosine</i>	L, L, L, Fb/Fl/Ly, L, L, L
<i>Amyema thalassia</i>	Ma		<i>Ogyris amaryllis</i>	L
<i>Amyema niliflora</i>	Mv, Sw		<i>Comocrus behri</i> , <i>Eirmocides margarita</i> , <i>Ogyris zosine</i>	L, Fb/Fl/ Ly, L
<i>Decasina signata</i>	Sw, Mv		<i>Birbhana cleis</i> , <i>Delias argenthona</i> , <i>Eirmocides margarita</i> , <i>Hypolycaena phorbos</i> , <i>Ogyris zosine</i>	L, L, Fb/ Fl/Ly, L, L
<i>Dendrophloe glabrescens/ odontocalyx</i>	Sw		<i>Birbhana cleis</i> , <i>Delias argenthona</i> , <i>Eirmocides margarita</i>	L, L, Fb/ Fl/Ly