Swallowtails

(Papilionidae)

5

Four-barred Swordtail, Kakadu Swordtail

Protographium leosthenes (Doubleday, 1846)

Plate 3 Kakadu National Park, NT
Photo: Ian Morris

Plate 4 Kakadu National Park, NT
Photo: Ian Morris

Distribution

This species is represented by the subspecies *P. leosthenes geimbia* (Tindale, 1927), which is endemic to the study region. It occurs in the Top End, where it is restricted to western Arnhem Land, extending from Ubirr Rock (A. Carlson) south to Deaf Adder Gorge (M. B. Malipatil) in Kakadu National Park, NT. Its geographic range closely corresponds with the spatial distribution of its larval food plant, which is also endemic to western Arnhem Land, although the food plant extends slightly further south (to the upper Gimbat Creek area). Outside the study region, *P. leosthenes* occurs in north-eastern and eastern Australia.

Habitat

Protographium leosthenes breeds in patches of monsoon vine thicket on sandstone escarpments in steep rocky hill-slopes and the base of rock overhangs and boulders where the larval food plant grows as a scrambling vine. Adults also fly in open woodland and males congregate on hilltops to locate females, but they do not breed in these habitats.

Larval food plant

Melodorum rupestre (Annonaceae).

Seasonality

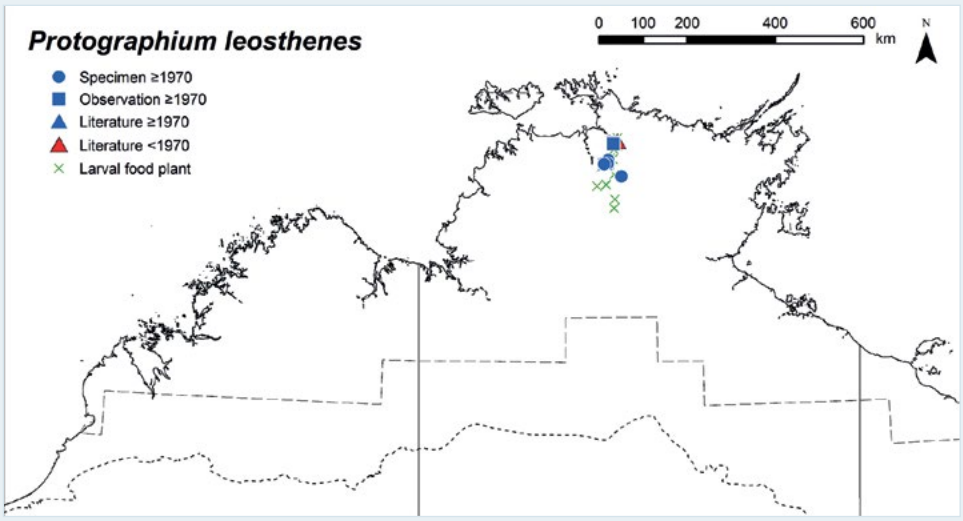
Adults are seasonal, occurring from October to May. They are most abundant during the 'build-up' and early wet season (November–January), when humidity and temperatures are high before the onset of the first monsoon rains, when the larval food plant produces flushes of new leaf growth. The species breeds mainly during the pre-monsoon period, with the immature stages (eggs or larvae) found in December and January. There is possibly only a single generation in most years, with a partial second generation during the late wet season and early dry season (March–May), when some adults may emerge during or after the monsoon. The butterfly survives the long dry season in pupal diapause (Sands and New 2002)—a strategy also adopted by the nominate subspecies in Queensland.

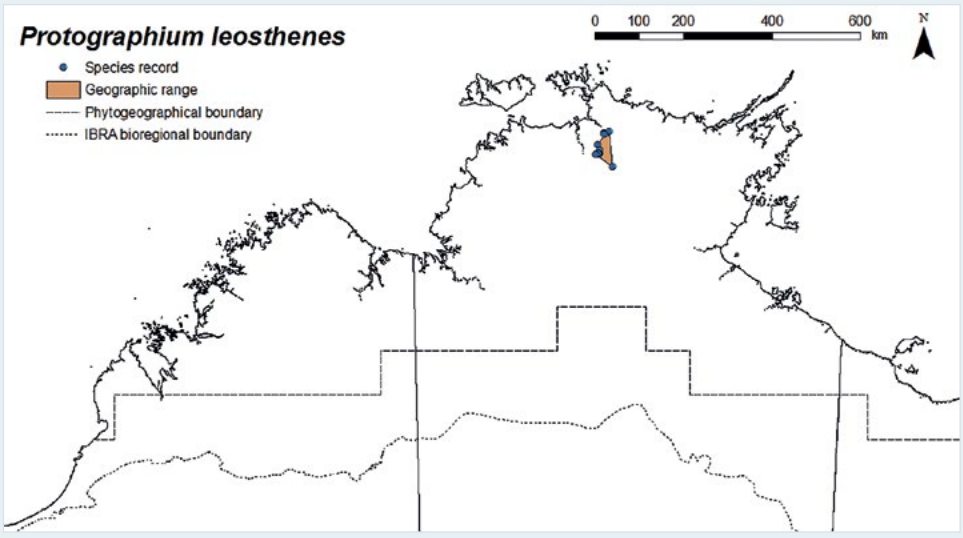
Breeding status

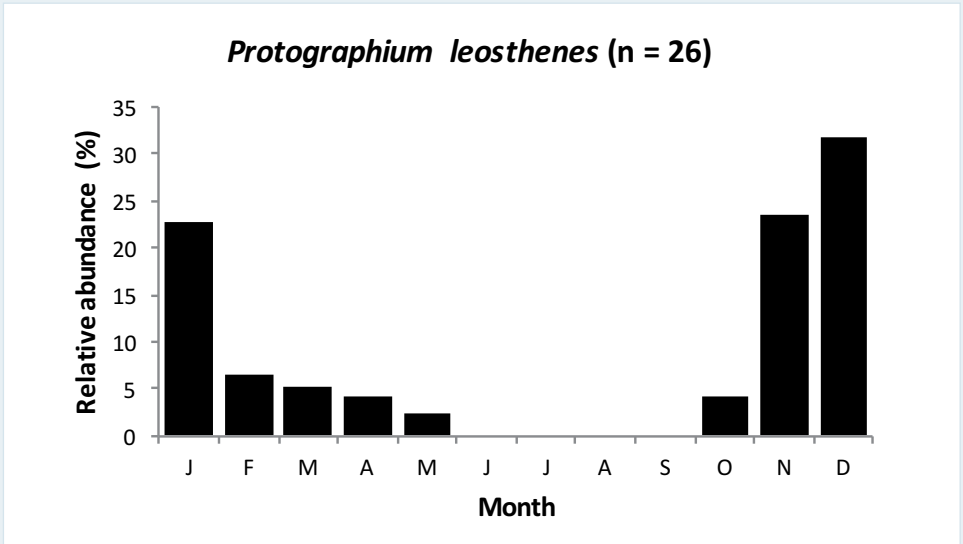
This species is resident in the study region.

Conservation status

LC. The subspecies *P. leosthenes geimbia* is a short-range endemic (EOO = 1,700 sq km) and its entire range occurs in two conservation reserves: Kakadu National Park and Warddeken IPA. Despite its restricted occurrence, there are no known threats facing the taxon (Sands and New 2002). The larval food plant is currently listed as LC under the *Territory Parks and Wildlife Conservation Act (2014) (TPWCA)*.







Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

Pale Triangle

Graphium eurypylus (Linnaeus, 1758)

Plate 5 Wanguri, Darwin, NT
Photo: M. F. Braby

Distribution

This species is represented by the subspecies *G. eurypylus nyctimus* (Waterhouse & Lyell, 1914), which is endemic to the study region. It occurs in the Kimberley and throughout the Top End. The geographic range closely corresponds with the spatial distribution of its larval food plants. The native food plants are absent from the western Gulf Country south of Groote Eylandt; hence, it is uncertain whether records from near Mataranka, Ngukurr and Limmen National Park, NT, and Doomadgee, Qld, represent vagrants from further north or localised populations breeding on ornamental or cultivated food plants. At Doomadgee, Puccetti (1991: 144) noted that only '[o]ne very worn specimen was observed but not taken', which suggests the species may not be established in the western Gulf Country. Similarly, in the south-western Kimberley, it was recorded on several occasions in the township of Broome, WA, during the mid to late 1990s, when it may have bred temporarily on ornamental *Annona* (G. Swann), but the population did not establish. More recently, G. Swann observed the species in Broome, in January 2018. Outside the study region, *G. eurypylus* occurs widely from India, southern China, Japan and South-East Asia through mainland New Guinea and north-eastern and eastern Australia to the Bismarck Archipelago.

Habitat

Graphium eurypylus breeds mainly in semi-deciduous monsoon vine thicket and mixed eucalypt woodland–vine thicket in coastal, riparian and inland areas where the larval food plants grow, some as semi-deciduous shrubs or small trees. It also occurs in suburban parks and gardens where the ornamental food plants are propagated.

Larval food plants

Meiogyne cylindrocarpa, *Melodorum rupestre*, *Miliusa brahei*, *Miliusa traceyi*, *Monoon australe*, *Hubera nitidissima* (Annonaceae), *Cryptocarya cunninghamii* (Lauraceae), *Diospyros maritima* (Ebenaceae); also **Annona muricata*, **Polyalthia longifolia* (Annonaceae).

Seasonality

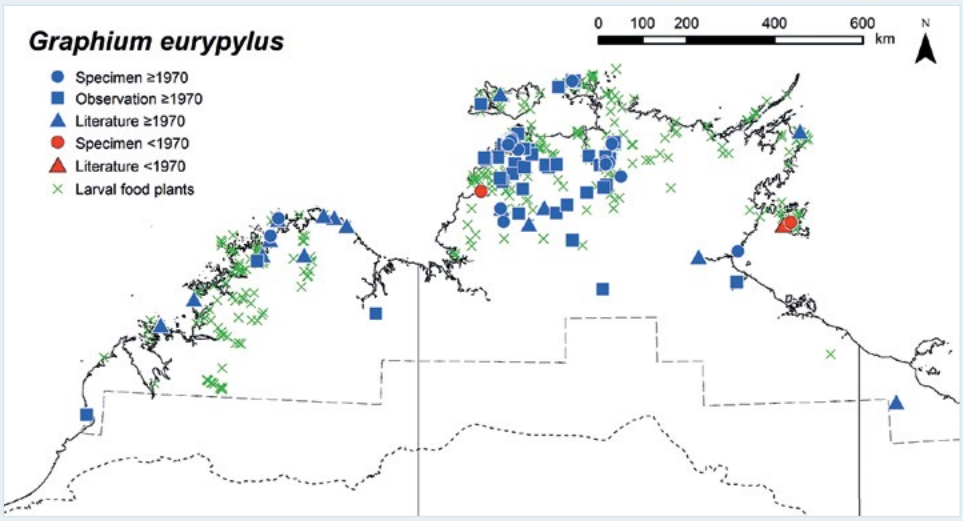
Adults occur throughout the year, but they are more abundant during the wet season. They are particularly numerous during the 'build-up' and pre-monsoon storms of the early wet season (October–January), when the larval food plants start to produce new leaf growth. Adults are generally absent during the cooler dry season (May–August), although a few have been recorded at this time of year. Several generations are completed annually; the immature stages (eggs or larvae) have been recorded from September to April, indicating that breeding occurs over an extended period. The population survives the dry season in the pupal stage, which may remain in diapause for up to seven months. In the Darwin area, adults start to emerge in September or October following the first heavy downpours.

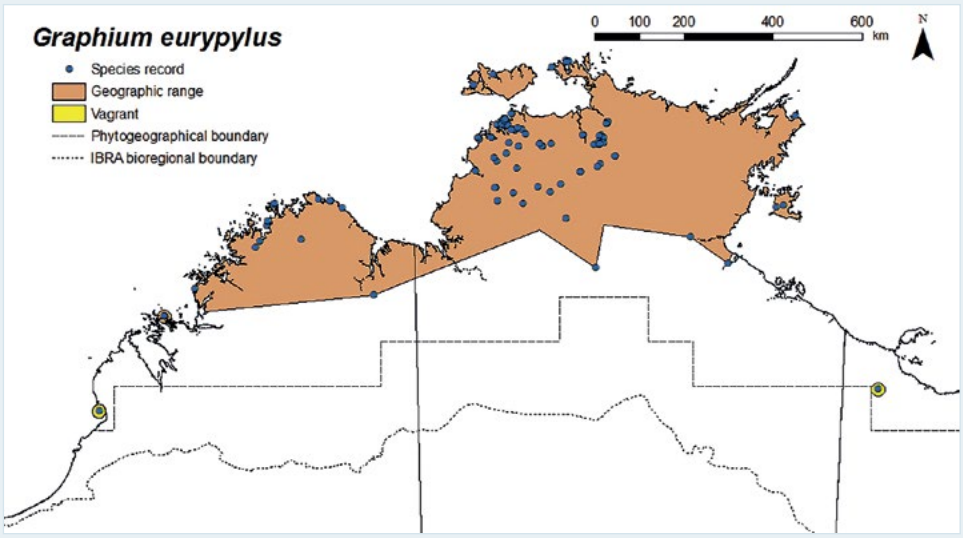
Breeding status

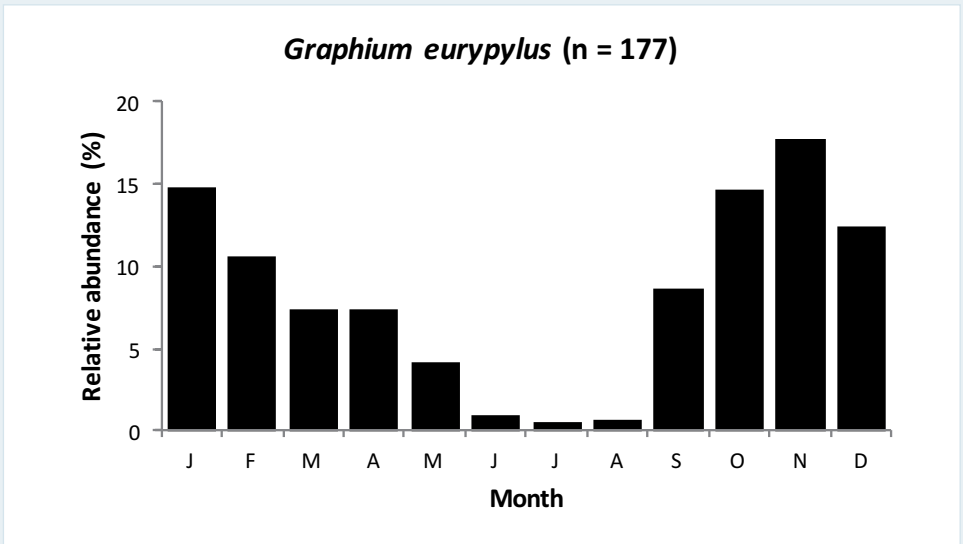
This species is resident in the study region. It is not known whether it migrates or disperses outside the normal breeding range.

Conservation status

LC.







Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

Dainty Swallowtail

Papilio anactus W. S. Macleay, 1826

Plate 6 Mt Piper, Broadford, Vic
Photo: M. F. Braby

Distribution

This species has been recorded only from the western Gulf Country of the study region, at Doomadgee, Qld (Puccetti 1991). Outside the study region, *P. anactus* occurs widely in eastern and south-eastern Australia.

Habitat

Papilio anactus has been recorded only from urban areas where its non-native larval food plant is propagated in suburban gardens; it does not appear to be established in natural areas outside this habitat.

Larval food plants

**Citrus* sp. (Rutaceae). The native food plant has not been recorded in the study region, but in eastern Queensland the species is known to feed on various native species of *Citrus* (Braby 2000).

Seasonality

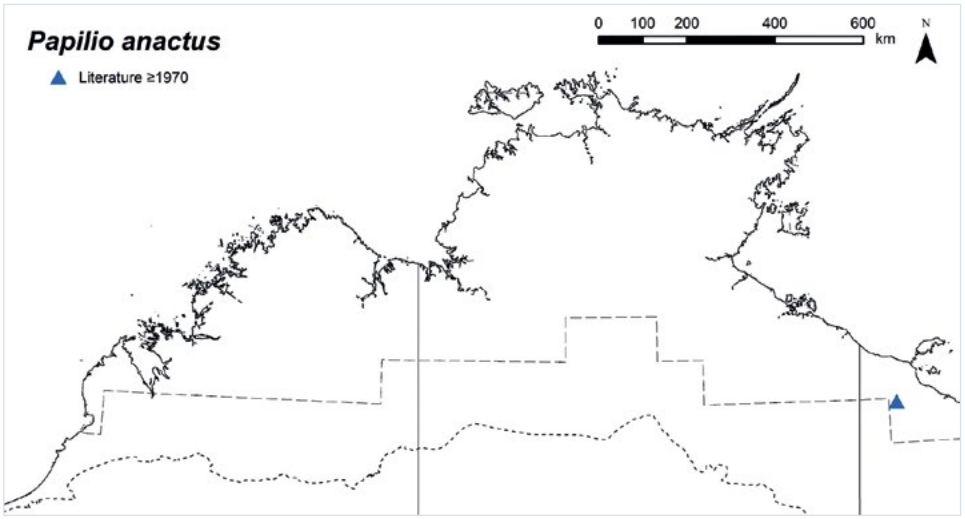
The seasonal abundance and breeding phenology of this species are not well understood. Adults have been recorded during most months of the year, but there are too few records (n = 8) to assess any seasonal changes in abundance. Puccetti (1991: 144) noted: 'This species has been common at times … the species appears to be well-established on local citrus'. Presumably, the species breeds throughout the year.

Breeding status

The breeding status of *P. anactus* is uncertain. It appears to be resident, but it is possible the species does not occur naturally in the region and is introduced, having become established recently with the cultivation of its ornamental larval food plant.

Conservation status

NA.



Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

Photo: Umbrawarra Gorge, NT, M.F. Braby

Orchard Swallowtail

Papilio aegeus Donovan, 1805

Plate 7 Mallacoota, Vic
Photo: Frank Pierce

Plate 8 Crystal Cascades, Qld
Photo: Frank Pierce

Distribution

This species is represented in the study region by the subspecies *P. aegeus aegeus* Donovan, 1805. It is restricted to eastern Arnhem Land (Wessel Islands, Gove Peninsula and Groote Eylandt, NT), Limmen Bight and the western Gulf Country, where it occurs sporadically in coastal and near-coastal areas. Despite the widespread distribution of its native larval food plant, *P. aegeus* is not permanently established further west in the Top End. The species is normally absent from Kakadu National Park, NT, but a male was observed at West Alligator Head in March 1991 and sightings of a second male for several weeks were subsequently made at the same location (K. McLachlan); these records are considered to be vagrants from further east. Outside the study region, *P. aegeus* occurs from Tanimbar, the Kai and Aru islands, through mainland New Guinea and adjacent islands and eastern Australia to the Bismarck Archipelago and the Santa Cruz Islands east of the Solomon Islands.

Excluded data

A previous record of *P. aegeus* from Darwin, NT (Dunn and Dunn 1991), based on a pair of specimens collected in January 1978 by J. T. Moss, appears to represent an accidental introduction that failed to establish following Tropical Cyclone Tracy (Braby 2014a).

Habitat

Papilio aegeus breeds in urban areas where its non-native larval food plant is propagated in suburban gardens (Braby 2011a); however, the natural breeding habitat is not well documented. Fenner (1991) recorded *P. aegeus* breeding on Marchinbar Island, NT, on the native food plant (*Micromelum minutum*), which, in coastal areas, typically grows in monsoon vine thicket on sand dunes and low lateritic cliffs above the beach. Males have been observed in savannah woodland, patrolling encounter sites to locate females.

Larval food plants

Micromelum minutum (Rutaceae); also **Citrus* sp. (Rutaceae).

Seasonality

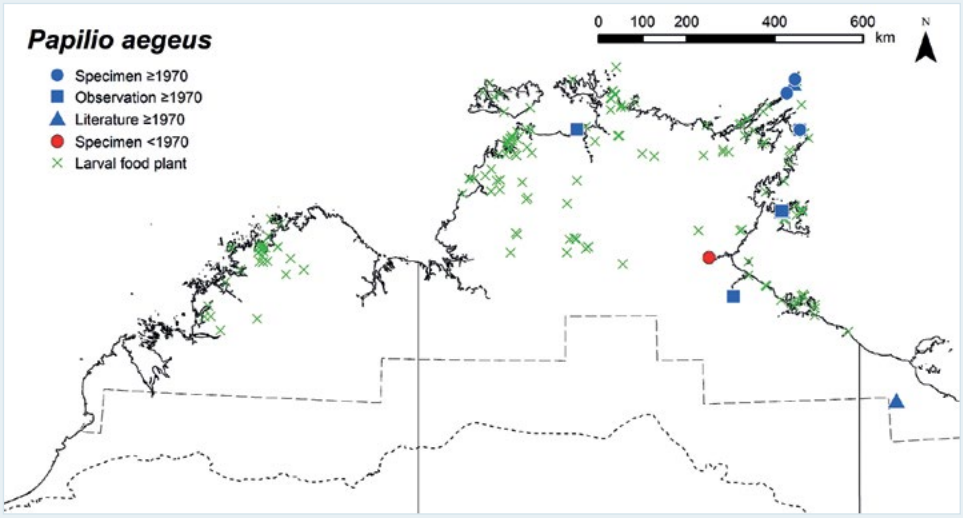
The seasonal abundance and breeding phenology of this species are not well understood. Adults have been recorded during most months of the year, usually in low numbers, but we have too few records (n = 16) to assess any seasonal changes in abundance. The immature stages (larvae or pupae) have been recorded during the dry season (July–September). Presumably, the species breeds throughout the year.

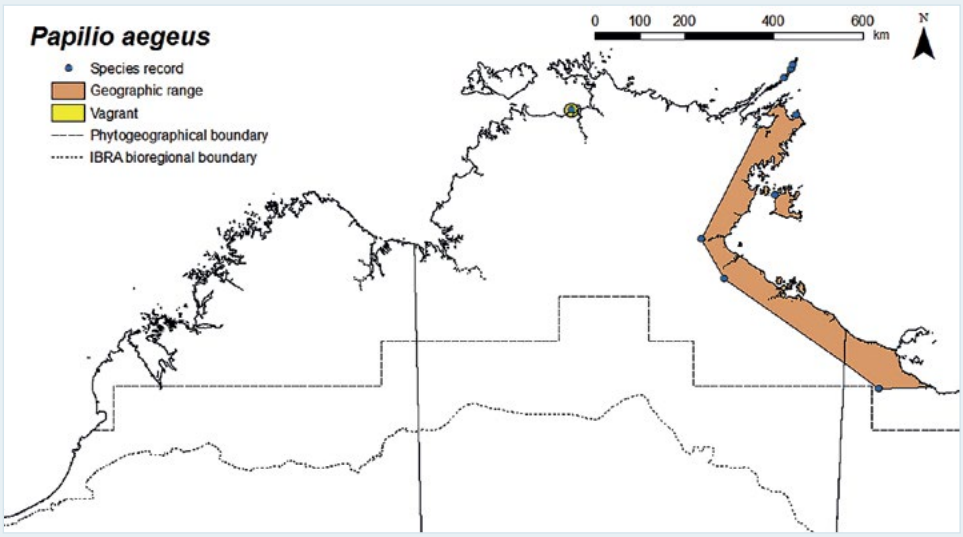
Breeding status

This species is resident in the study region. It is possible that *P. aegeus* does not occur naturally in the region, and has become established only within the past three decades, perhaps facilitated by the cultivation of its ornamental larval food plant in suburban areas on the mainland. The species did not become established on Gove Peninsula in north-eastern Arnhem Land until about 2000 (Braby 2011a). The only record prior to 1986 is a historical specimen (in SAM) from the Roper River, NT, by N. B. Tindale.

Conservation status

LC. Although the species *P. aegeus* has a restricted range in the study region, there are no known threats facing the taxon.





Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

Fuscous Swallowtail

Papilio fuscus Goeze, 1779

Plate 9 Lee Point, Darwin, NT
Photo: M. F. Braby

Plate 10 Wanguri, Darwin, NT
Photo: M. F. Braby

Distribution

This species is represented by the subspecies *P. fuscus canopus* Westwood, 1842, which is endemic to the study region. It occurs widely in coastal areas of the western and northern Kimberley and throughout the Top End, extending as far south as Judbarra/Gregory National Park (Limestone Gorge) (Braby and Archibald 2016), near Mataranka and Bing Bong, NT, in the Gulf of Carpentaria. Its geographic range closely corresponds with the spatial distribution of its native larval food plants. Outside the study region, *P. fuscus* occurs from the Andaman Islands, the Malay Peninsula and Indonesia, through mainland New Guinea and adjacent islands and north-eastern and eastern Australia to the Solomon Islands and Vanuatu.

Habitat

Papilio fuscus breeds mainly in semi-deciduous monsoon vine thicket in both coastal and inland areas where the native larval food plants grow as tall shrubs (Hall 1976). It also occurs in suburban gardens where ornamental citrus trees are cultivated. Adults sometimes disperse into savannah woodland, but they do not breed in this habitat.

Larval food plants

Glycosmis trifoliata, *Micromelum minutum*, *Zanthoxylum parviflorum* (Rutaceae); also **Citrus* sp. (Rutaceae). The main food plants are *M. minutum* and *G. trifoliata* (Hall 1976; Meyer 1996a), but occasionally the species also breeds on *Z. parviflorum* (Braby 2015e) and cultivated *Citrus* (Braby 2011a).

Seasonality

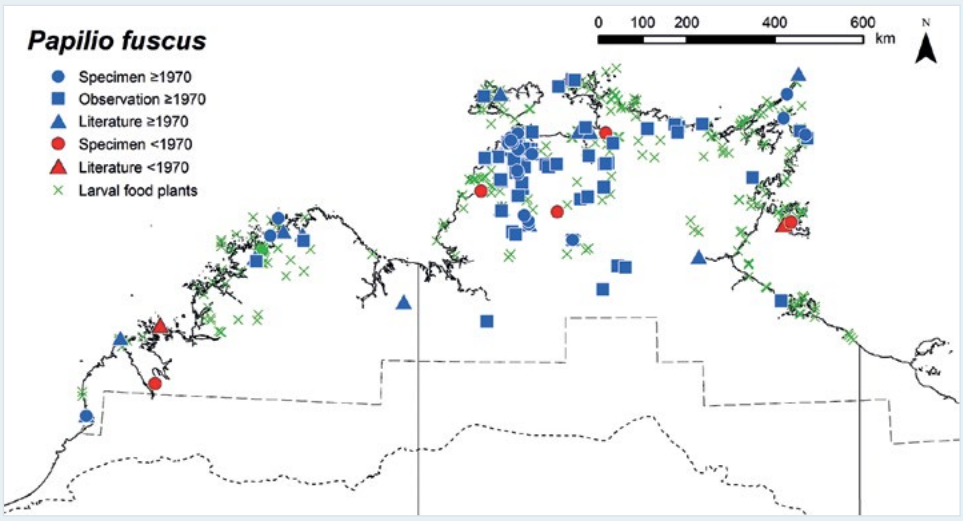
Adults occur throughout the year, but they are most abundant during the pre-monsoon 'build-up' and throughout the wet season. Franklin (2011) found similar trends near Darwin, NT, in that adults were most abundant during the wet season, based on quantitative studies conducted over 14 months during 2008–09. Very few adults occur during the winter dry season (June–August), when the species does not breed and remains in pupal diapause. Hall (1976: 41) noted that 'the pupal duration … is extremely variable, ranging from 14 days to a little over 24 months'. In the higher rainfall areas, the immature stages (eggs or larvae) have been recorded from October to June, indicating that breeding occurs over an extended period during which several generations are completed.

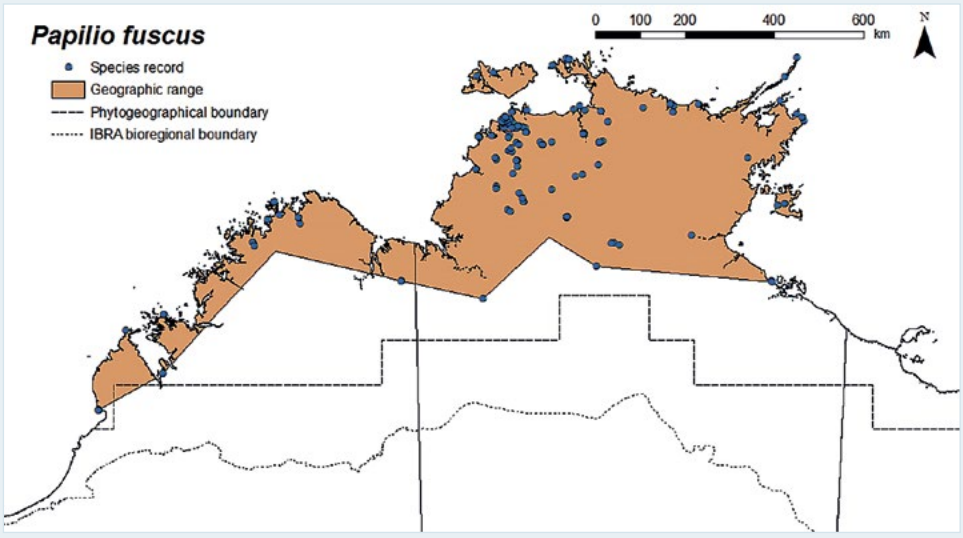
Breeding status

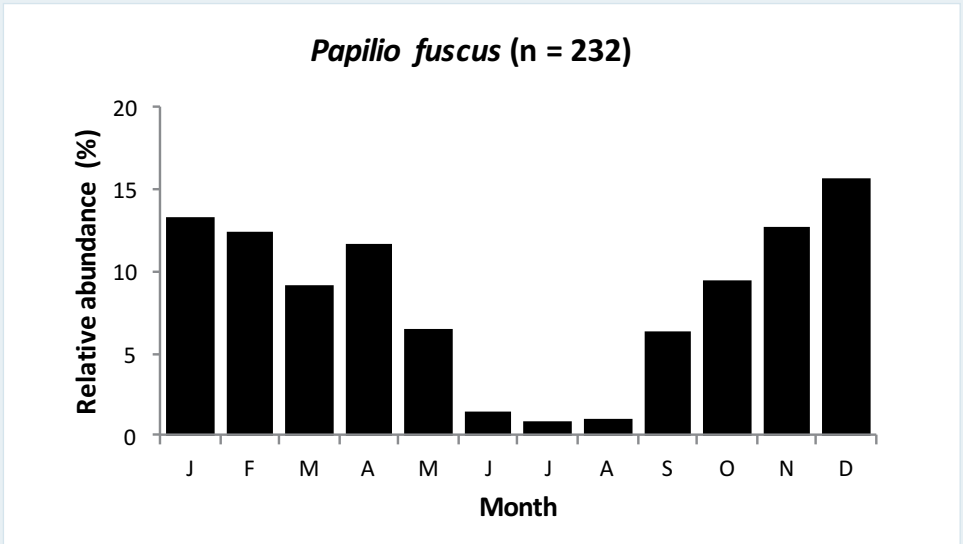
This species is resident in the study region.

Conservation status

LC.







Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

Chequered Swallowtail

Papilio demoleus Linnaeus, 1758

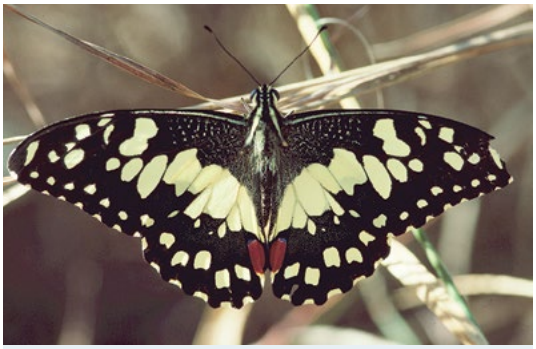


Plate 11 Cardwell, Qld
Photo: M. F. Braby

Plate 12 Cardwell, Qld
Photo: M. F. Braby

Distribution

This species is represented in the study region by the subspecies *P. demoleus sthenelus* W. S. Macleay, 1826. It occurs throughout almost the entire region, extending from moist coastal areas to the arid zone of central Australia beyond the southern boundary of the study region. The broad geographic range closely corresponds with the spatial distribution of its larval food plants, of which two (*Cullen balsamicum* and *C. cinereum*) occur widely in the drier inland areas. There are no records of either the butterfly or the food plants from the Tiwi Islands, so *P. demoleus* may be absent from this area. Outside the study region, *P. demoleus* occurs widely from the Middle East, India, southern China and South-East Asia, through mainland New Guinea to Australia, where it occurs throughout the continent, as well as in the Dominican Republic, where it has been accidently introduced (Eastwood et al. 2006; Morgun and Wiemers 2012).

Habitat

Papilio demoleus breeds mainly in savannah woodland and open, low-lying grassy areas and floodplains where the larval food plants grow, either as perennial shrubs (*Cullen badocanum* and *C. balsamicum*) or as a seasonal annual (*C. cinereum*). Males also commonly fly on prominent hills, ridges and other landmarks, which are used as encounter sites to locate females for mating, but they do not breed in these habitats.

Larval food plants

Cullen badocanum, *C. balsamicum*, *C. cinereum* (Fabaceae).

Seasonality

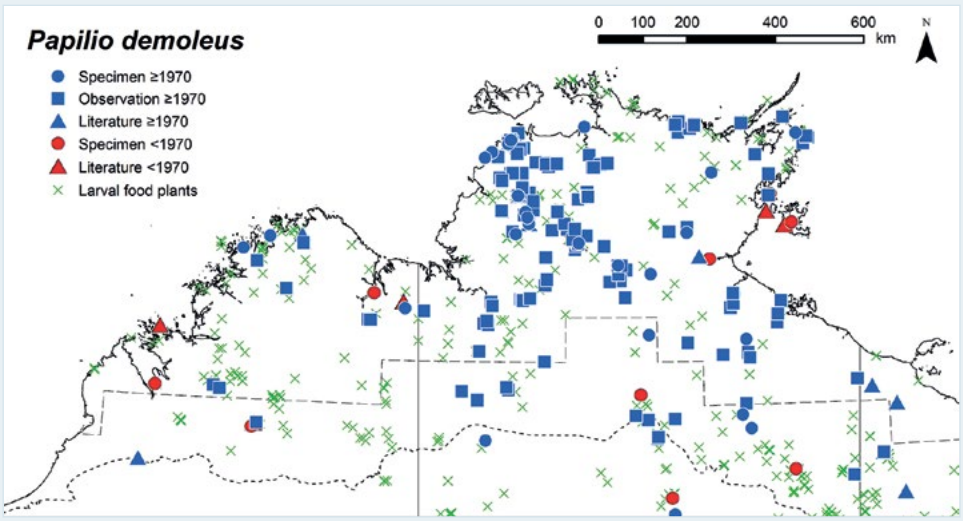
Adults have been recorded throughout the year, but they are generally more abundant during the early dry season (April–June) following good wet seasons of average or above average rainfall. In some seasons or months, immense numbers of adults have been observed, particularly in semi-arid areas. The species becomes scarce as the dry season progresses, and there are very few records in the early wet season (November and December). The breeding phenology is not well understood. The immature stages have been recorded from February to June, which broadly coincides with the late wet season and early dry season and is when adults are more abundant, but it is not clear whether the species breeds at other times of the year. *Papilio demoleus* is a well-known migrant, but there are few published details of movement patterns (Smithers 1978). Smithers and McArtney (1970) recorded hundreds of specimens flying south-east over a distance of 25 km across the Stuart Highway between Elliott and Renner Springs, NT, in May 1969. In Darwin suburban and rural areas, a large-scale population movement, which lasted for about two weeks, was recorded in February 2015 (Braby 2016b). Adults flew rapidly between mid morning and mid afternoon, but the direction of flight progressively shifted from easterly, through southerly to westerly over the migration period.

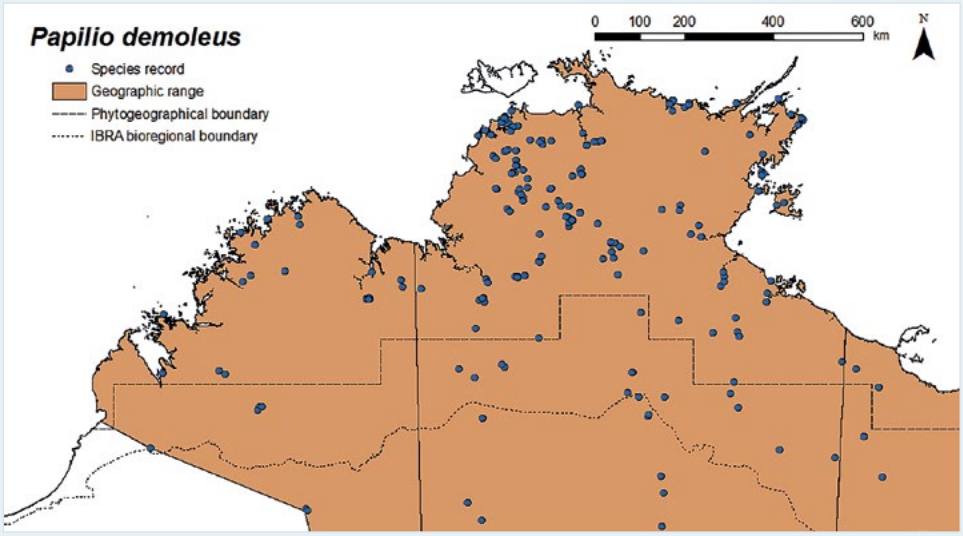
Breeding status

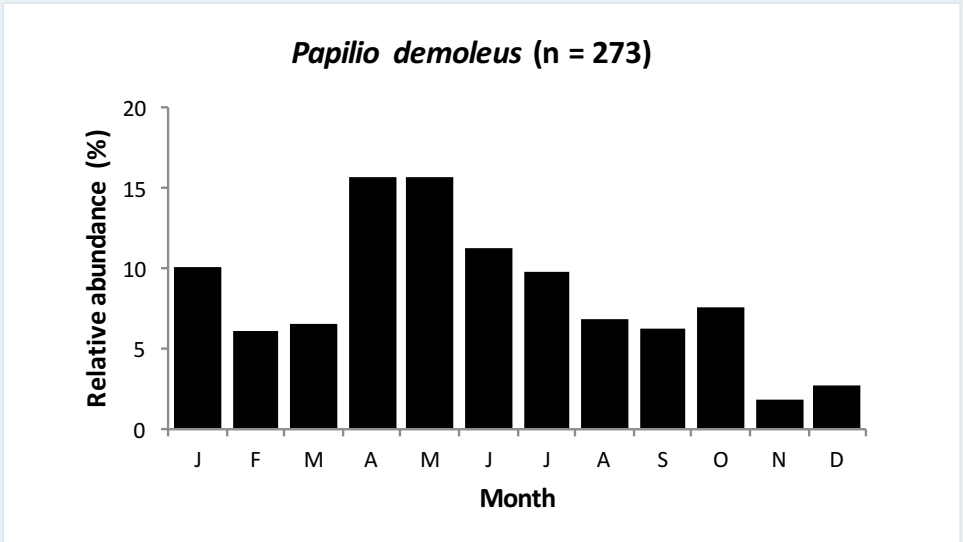
This species is assumed to be resident in the study region, but populations appear to be nomadic and are possibly temporary in many areas.

Conservation status

LC.







Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

Clearwing Swallowtail

Cressida cressida (Fabricius, 1775)

Plate 13 Irvinebank, Qld
Photo: Don Franklin

Distribution

This species is represented in the study region by the subspecies *C. cressida cressida* (Fabricius, 1775). It has a disjunct distribution, occurring in the western Kimberley and in the Top End; there are also a few records from the western Gulf Country. The geographic range is substantially broader than the spatial distribution of its known native larval food plant (*Aristolochia holtzei*), which is limited to the north-western corner of the Top End, indicating that several other (as yet unreported) food plants are used. In particular, *A. acuminata*, which occurs in the coastal areas of the western Kimberley, and *A. pubera*, which occurs commonly in north-eastern Arnhem Land, Wessel Islands and Groote Eylandt, NT, are known food plants of *C. cressida* in Queensland (Braby 2016a). However, in northern Australia, the native *Aristolochia* spp. are restricted to the higher rainfall areas (generally > 1,300 mm mean annual rainfall) and, in the Northern Territory, are not known to extend south of latitude 14°S. Hence, scattered occurrences of *C. cressida* in the southern areas of the Top End and western Gulf Country represent either vagrants that have extended beyond the normal breeding range or resident populations that have become established on naturalised food plants. Outside the study region, *C. cressida* occurs from the Lesser Sunda Islands, through south-eastern mainland New Guinea and adjacent islands to north-eastern and eastern Australia.

Habitat

Cressida cressida breeds in a variety of savannah woodland and eucalypt open woodland habitats where the larval food plants grow—typically as herbs or small vines in the ground layer.

Larval food plants

Aristolochia holtzei (Aristolochiaceae); also **Aristolochia indica*; probably *A. acuminata*, *A. pubera*, *A. thozetii*. On Groote Eylandt, Tindale (1923: 351) noted: 'The female was discovered laying eggs on one of the Aristolochia vines'. He listed the food plant as '*A. indica*', but this record refers to either *A. pubera* or *A. thozetii*, both of which have been collected from the island. Meyer (1996a) listed the food plant from Channel Island near Darwin as *Aristolochia* sp. 'Channel Island', and this record now refers to *A. indica*, which appears to have been introduced to the island from Asia. The food plant in the western Kimberley is likely to be *A. acuminata*.

Seasonality

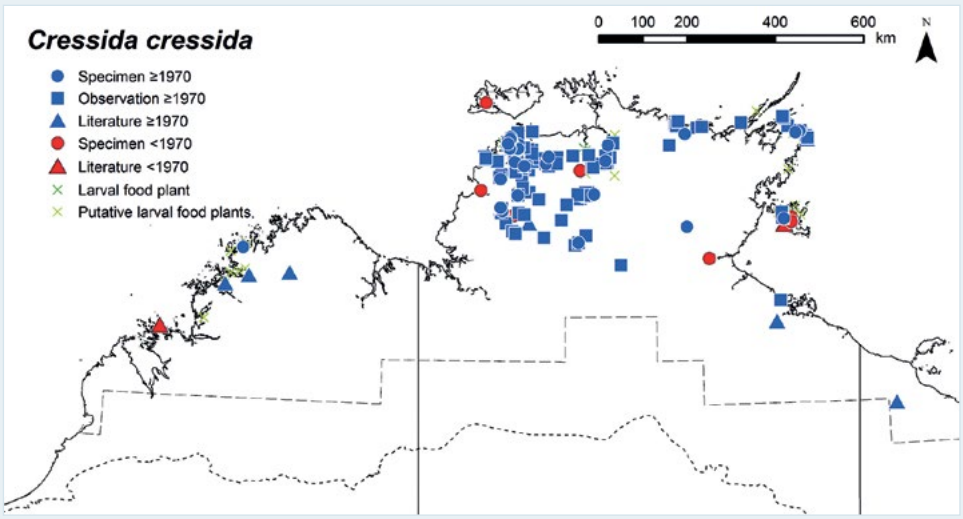
Adults have been recorded throughout the year, but they are generally more abundant during the wet season (January–April) and less common during the cooler dry season (May–August). We have few breeding records of this species, with the immature stages (eggs or larvae) recorded in February, June and November. Presumably, the species breeds throughout the year.

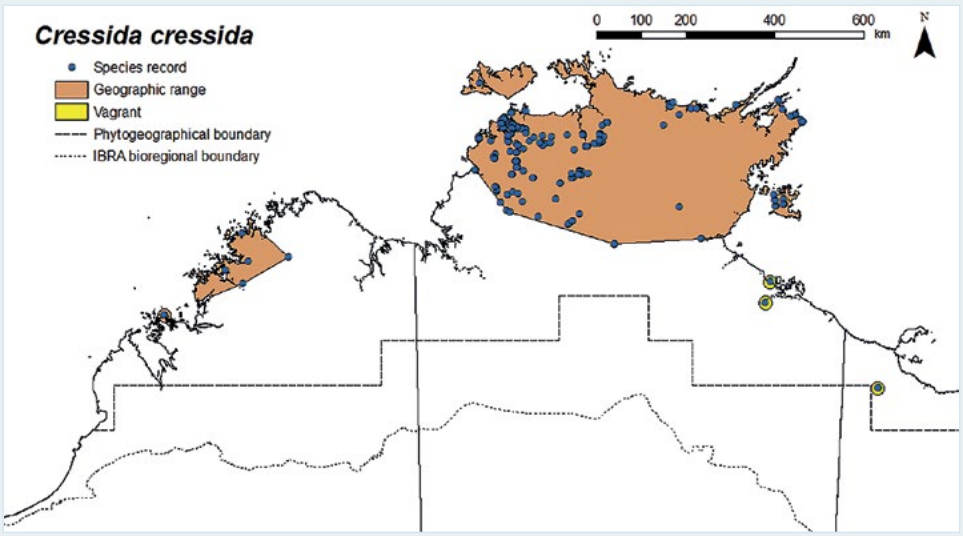
Breeding status

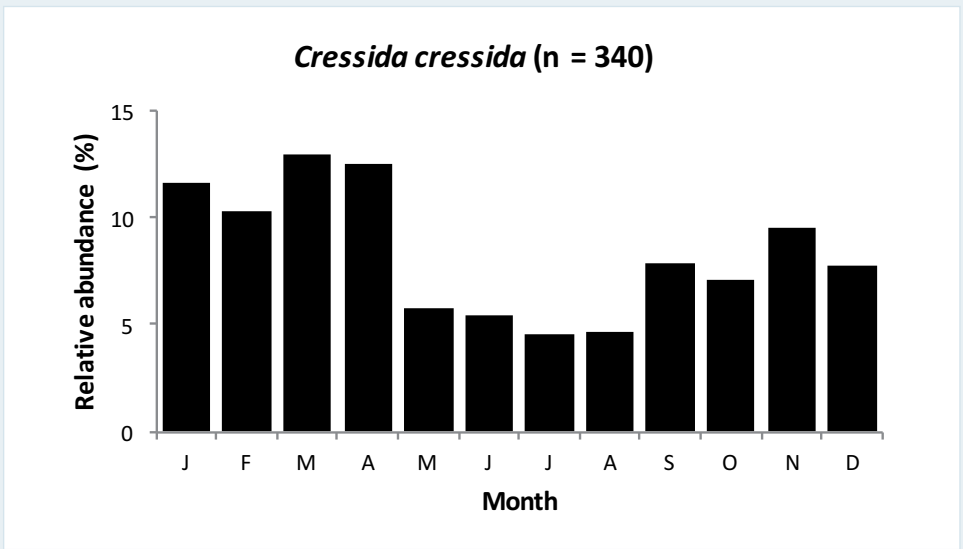
This species is resident in the study region, but it is not known whether it disperses outside the normal breeding range.

Conservation status

LC.







Month	J	F	M	A	M	J	J	A	S	O	N	D
Egg												
Larva												
Pupa												
Adult												

This text is taken from *Atlas of Butterflies and Diurnal Moths in the Monsoon Tropics of Northern Australia*, by M.F. Braby, D.C. Franklin, D.E. Bisa, M.R. Williams, A.A.E. Williams, C.L. Bishop and R.A.M. Coppen, published 2018 by ANU Press, The Australian National University, Canberra, Australia.