OBSERVATIONS ON SITE FIDELITY IN THE IMPERIAL HAIRSTREAK, *JALMENUS EVAGORAS* (DONOVAN, 1805) (LEPIDOPTERA: LYCAENIDAE), AT TOOROURONG RESERVOIR, VICTORIA

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Abstract

Long-term observations spanning more than 20 years are reported on a breeding colony of *Jalmenus evagoras* (Donovan) at Toorourong Reservoir, Whittlesea, Victoria. The colony, which is still extant, persisted at this site for at least 21 years (from December 1989 to February 2011) and utilised a 7 m tall tree of *Acacia melanoxylon* for a minimum of 12 years and a likely maximum of 15-24 years.

Introduction

The lycaenid butterfly *Jalmenus evagoras* (Donovan, 1805) occurs widely in southeastern Australia (Braby 2000). Around Melbourne it is locally common in eucalypt woodland and open woodland, favouring disturbed sites or those in an early stage of ecological succession. A detailed review of the natural history, behavioural ecology and evolutionary biology of the species was provided by Pierce and Nash (1999) and, more recently, there have been investigations into its population genetics and taxonomy (Eastwood *et al.* 2006, Eastwood *et al.* 2008). The larvae exploit around 24 species of *Acacia* and, on rare occasions, the mistletoe *Amyema pendula* (Eastwood 1999). They are obligately attended by *Iridomyrmex* ants with at least six different species recorded throughout the butterflies geographical range (Eastwood *et al.* 2006) and, occasionally and atypically (usually only at the edges of populations or during population expansions), by a few other genera of ants (Pierce and Nash 1999).

The butterfly has a spatially patchy (localised) distribution, largely because of its dependence on suitable combinations of specific larval food plants and attendant ants. Within a given landscape it may occur in a number of discrete colonies, which possibly represent subunits of a metapopulation that are interconnected by occasional dispersal events. *Jalmenus evagoras* typically breeds on saplings of the larval food plant (<3 m high) that have colonies of the appropriate species of ant and the preference by females to lay their eggs on small plants appears to be related to the vertical foraging distribution of the attendant ant (Smiley *et al.* 1988). Occasionally, however, the butterfly breeds on taller, older trees up to 6-7 m high (Braby 1988).

The patchy distribution of *J. evagoras* is accompanied by strong site fidelity (Pierce and Nash 1999). Not only do most adults remain faithful to their breeding areas, but colonies often persist at the same sites for many years, possibly for several decades. The precise longevity or temporal duration of site occupancy, however, is not well documented. Indeed, among the

Australian Lycaenidae there are very little published data on the longevity of colonies that comprise metapopulations – do these subunits persist for several years, decades or centuries? Furthermore, it is not known for how long *J. evagoras* exploits individual trees. Braby *et al*. (1992) noted that a colony of the lycaenid *Paralucia pyrodiscus* (Doubleday, 1847) had persisted in the Castlemaine Botanic Gardens in central Victoria for at least 90 years and more recent observations and monitoring over the past 20 years indicate that the colony is still extant at this site (Canzano *et al.* 2007).

In a previous account (Braby 1998), I reported preliminary observations made on a breeding colony of the butterfly at Toorourong Reservoir near Whittlesea, Victoria (37°28'42"S, 145°09'32"E; WGS84), a recreation park at the base of Mt Disappointment in the Hume Range. At this site, the colony had persisted in the area and exploited a particular tree for at least seven years. Since that report I have made additional observations, now spanning over a 20-year period. These observations are summarised below.

Observations

I first observed the colony of *J. evagoras* at Toorourong Reservoir on 28 December 1989. The butterfly was particularly abundant, breeding on many shrubs (<3 m high) of *Acacia mearnsii* and *A. melanoxylon* in eucalypt woodland with a grassy understorey that was regularly slashed. On one particular tree of *A. melanoxylon* (Fig. 1), growing near the road not far from the entrance to the park, very large numbers of the butterfly were present. The tree was approximately seven metres high and I estimated that there were in excess of 250 individuals, comprising both pupae and adults. The pupae were clustered in small groups on the terminal branches of the foliage and were distributed over the entire tree; they were attended by a smaller species of *Iridomyrmex* than the ant (*Iridomyrmex* complex A sp. B) recorded near Melbourne by Eastwood *et al.* (2006). The adults flew around or alighted on the outer foliage and the presence of such large numbers made an impressive sight.

The site was revisited on 30 December 1991, 3 January 1993 and 26 December 1995 and, on each occasion, the species was still breeding on the same tree, with numerous pupae and adults present. The following season, on 24 December 1996, numbers were considerably fewer, with a total of only 10 late instar larvae and pupae present, mostly on the foliage in the lower third of the tree. However, it was noted that the early stages of the butterfly were abundant on smaller saplings growing adjacent to the tree.

The site was not visited again until 23 November 2001. On this occasion, the breeding colony was still visible and many larvae (>100) in various instars, plus one prepupa, were recorded on the lighter green new foliage of the tall *A. melanoxylon* tree. The larvae were distributed over the entire tree, from the lowest branches within 1 m of the ground to the uppermost foliage at the crown of the tree. Pupae and adults were absent, no doubt reflecting the fact

that the first (spring) generation had not yet completed its life cycle. Numerous clusters of old pupal exuviae from the previous season (2000-01) were also present. Larvae were also found on a nearby sapling of the food plant (*ca* 3 m high) growing 5 m distant from the tree, as well as pupal exuviae from the previous season.

I revisited the site on 1 March 2005, but on this occasion the butterfly was absent. Moreover, the tree was showing early signs of senescence, with the crown and upper third dead but the lower half still alive (Fig. 2). However, despite the absence of early stages and adults, the attendant ant was present on the tree and the butterfly still persisted in the area, breeding on many other smaller acacias growing in the immediate vicinity.

Figs 1-2. Tree of *Acacia melanoxylon*, larval food plant of *Jalmenus evagoras* at Toorourong Reservoir, Whittlesea, on which a breeding colony of the butterfly persisted for at least 12 years, from 1989 to 2001. Figures show comparative changes in tree condition: (1) 30 December 1991; (2) 1 March 2005.

Three seasons later, on 26 December 2007, the butterfly was still absent from the tree, which was now dying, with only the lower third supporting green foliage. Interestingly, despite an extensive search, only eggs, 10 pupae and a few adults of the butterfly were found on nearby shrubs of *A. mearnsii*, suggesting that the population had either crashed or largely moved to another site. On 27 December 2009, the site was found to have been completely destroyed by the Black Saturday fires of 7 February 2009, with all the

eucalypt overstorey trees killed and the understorey vegetation vaporised. I was not able to determine if the butterfly colony was extant because the park was closed to the public; however, given the intensity and severity of the firestorm that swept through the park, it is doubtful that the early stages would have survived. However, two years after Black Saturday on 26 February 2011, G. Paras (pers. comm.) visited the site and found *J. evagoras* breeding abundantly on seedlings of *A. mearnsii* that had germinated following the fire. Presumably, the butterfly had recolonised the site from nearby unburnt patches.

Discussion

Reports of the longevity or temporal extent of site occupancy do not seem to have been published previously for *J. evagoras*. In my experience in Victoria, when this species exploits saplings less than three metres high, individual food plants are used for only a few years and each season the butterfly colonises new seedlings or regenerating plants as those from previous seasons grow taller and apparently become unsuitable. Australian wattles are frequently prone to early senescence due to insect attack (New 1984) and it is well known that colonies of *J. evagoras* on individual acacias are ephemeral, often lasting only a few seasons (N.E. Pierce pers. comm.). However, long-term observations made at Toorourong Reservoir indicate that a breeding colony or metapopulation subunit of *J. evagoras* can persist at a given site for at least 21 years and, moreover, it can persist on a particular plant for a minimum of 12 years. In New South Wales, R. Eastwood (pers. comm.) recorded a colony of *J. evagoras* at a site at Menai, about 24 km south-west of Sydney, persisting for at least 31 years from 1971 to 2002. During his last visit, in December 2002, Eastwood (pers. comm.) noted that the colony was still extant, despite the fact that the site had been transformed into a car park for a new supermarket, most of the surrounding bushland had been converted to housing and a highway with an overpass adjoined the site. Taken together, these observations suggest colonies of *J. evagoras* can persist at breeding sites for several decades, indicating high fidelity.

Exploitation of food plants greater than three metres high is unusual in this butterfly (Pierce and Nash 1999). It is not known if such plants are colonised by *J. evagoras* when they already have attained this height or if the butterfly initially colonises the plants when they are saplings and then persists on them for many years as they grow taller. The age of the seven metre high *A. melanoxylon* tree was unknown, but given its height and diameter of the trunk at breast height (*ca* 150 mm), together with local environmental conditions of topography and rainfall, the plant may have been about 15 years old when it was first noticed in 1989 (C. Beardsell pers. comm.). Given the large numbers of individuals of *J. evagoras* present on the tree that season, the butterfly might already have been breeding on it for at least one and possibly

several seasons. If the butterfly had colonised the tree when it was small and young, then it may have been using the food plant for more than 10 years prior to its detection in 1989. The butterfly abandoned the tree sometime during the drought years between the 2001-02 and 2004-05 flight seasons, indicating that it could have continued to breed on the tree for a maximum of two more seasons after my last positive record in November 2001. Thus, it is possible that *J. evagoras* was breeding on this particular tree for 15-24 years.

The factors governing site fidelity and exploitation of individual plants, especially taller trees, would make an interesting study. Based on the work of Smiley *et al*. (1988), the foraging activity of the attendant ant possibly determines the height/age of the larval food plants utilised. A testable hypothesis, therefore, is that the taller food plants (>5 m high) are occupied by a different species of attendant ant, whose vertical foraging activity is less constrained compared with those ants that specifically associate with the butterfly on smaller food plants (<3 m high). Alternatively, variation in nutritional quality among taller food plants may be a factor and it is interesting to note that the butterfly avoided using the tree during a period of senescence in the mid to late 2000s. Pierce and Nash (1999) summarised early experimental work that showed that females laid more egg masses on plants with higher nitrogen content, which also had deeper green leaves, compared with host treatments that were not fertilised.

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