

Nocturnal ant attendance of *Jalmenus eichhorni* Staudinger (Lepidoptera: Lycaenidae) on Cape York Peninsula, Queensland

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Abstract

Near Cooktown on Cape York Peninsula, Queensland, larvae of *Jalmenus eichhorni* Staudinger are reported being attended by different ants at night to those in the daytime on the same individual plants. A meat ant, *Iridomyrmex sanguineus* attended larvae throughout the day and parts of the night, but at night, *Camponotus confusus* also tended them on several wattles and in company with *I. pallidus* on one small wattle. This remarkable temporal pattern of attendance repeated the following year suggesting it is routine behaviour, rather than a rare event or a unique instance of novel attendance.

Field Notes

On 10 January 2001, at 2km SE (by road) of Isabella Falls Qld, I searched roadside *Acacia* woodland at night using floodlights, in order to see if there might be any larvae of *Jalmenus eichhorni* Staudinger present. The site selected was about 1km from where, years earlier, I had found larvae on a visit to Cooktown in the dry season (Dunn 1994). During the day on that first encounter in July 1994, the northern meat ant, *Iridomyrmex sanguineus* attended all larvae found on foliage near the top of several broad-leafed wattles, variably 1-2m in height. This ant was a similar but visibly different species to the southern *I. purpureus* (Dunn 1994), which commonly attends juveniles of a different, but related butterfly, *J. iclinus*, in southern Queensland (Eastwood & Fraser 1999). Braby (2000) later listed *I. sanguineus* along with two other *Iridomyrmex* species (one undetermined to species) as attendant ants, no doubt observed during the daytime when most collectors seek the juveniles.

J. eichhorni is widespread on Cape York Peninsula (Braby 2000) and locally common near Isabella Falls, so on my return visit in 2001, it was not long before I found larvae. They were in small numbers on several wattles within close proximity of each other, consistent with the localised habits of the species. It did not matter that it was after dark, as I reasoned that the larvae were unlikely to seek shelter at night. However, given that *I. sanguineus* is largely diurnally active, I wondered whether attendance might be relatively sparse after sunset and perhaps even absent very late at night. In this regard, I closely examined the circumstances of the first two larvae and a pupa I found. All were situated about 1.8m metres above ground, near the top of a broad-leafed wattle species prolific in the area. Not surprisingly northern meat ants (*I. sanguineus*) were still tending them at 2200h EST, although the sun had set at 1945h EST.

These wattles appeared to be the same species as those utilised by the larvae in 1994 and so I quickly recognised them as potential food plants. There were no flowers on the hosts, but staff at the DPI at Mareeba later, in 2002, identified them from stems and phyllodes as *Acacia leptocarpa*. To this identification was added the qualifier, "if this species occurs in the area" or, if it does not, then a differential identification applied, as "seemingly *Acacia aulacocarpa*." *J. eichhorni* utilises four wattle species, *A. leptocarpa* being one of these (Braby 2000). It is likely that *A. leptocarpa* is a correct identification for my host plants in this instance, and which I take as factual in absence of further eliminative data, but they may utilise *A. aulacocarpa* as well.

On another slightly taller *A. leptocarpa* shrub some 2m away, I found more juveniles of this butterfly. Larvae were active about 2.5m above ground, and the pupae had secreted themselves in partly curled leaves, as is commonly the habit of this species. *I. sanguineus* appeared absent, and it looked as though the larvae were unguarded, but I had glimpsed some retreating ant movements in the shadows and so lowered the direct beam, reducing its intensity, and watched. To my astonishment, large sugar ants, *Camponotus confusus* were tending several larvae and pupae. Their inspections at the openings of curled leaves served as an obvious indicator of a secreted live pupa within. I had never seen this ant-genus in attendance during the daytime, and being crepuscular and nocturnal in its foraging habits, it is unlikely to do so. Most enthusiasts are familiar with its generic association with nocturnal larvae of *Ogyris zosine* and *O. genoveva* elsewhere in Queensland (Braby 2000), which shelter by day in ant galleries in soil, at the base of trees. As *J. eichhorni* larvae remain continuously exposed on the host plants, it seemed obvious then that a different ant species replaces the *Camponotus* ants after daybreak. Most likely, *I. sanguineus*, but if so, why were they replaced on this particular shrub and not on the neighbouring one from which *Camponotus* was absent? This discovery raised more questions than it answered. My night visit in January 2001 was too brief for a detailed study, and I could not stay until sunrise to determine what the attendant ant(s) would be. I had to shelve the mystery and a seemingly interesting study too, until the following year.

On 9 January 2002, I returned to this exact site to investigate the phenomenon, reasonably hopeful that juveniles would be resident again on these same trees. At 2200h EST, exactly 2 hours and 15 minutes after sunset, I excitedly began my search. *J. eichhorni* now occupied two species of *Acacia*, an undetermined species with narrow phyllodes and reddish tips, and the familiar *A. leptocarpa*, easily recognised by its broad phyllodes. Juvenile presence seemed strongly linked to small wattles and saplings, and using this as a guide, I soon found *C. confusus* tending larvae on several *A. leptocarpa* plants ranging in height from 1-4m. I then made a second unexpected discovery. Multitudes of tiny ants swarmed the stems and attended a mature larva and a pupa on a small, 1m high wattle of the same species. These timid tan-coloured ants were extremely photophobic, rapidly fleeing to the plant base and their underground galleries when exposed to the direct beam of a torch. If they were present on larger trees, they would be very hard to find due to sensitivity to low levels of light. On initial encounter, one could be mistaken in believing that the larvae were untended at that precise moment, which very occasionally can occur if they become isolated on outer branches away from the main larval aggregations and ant congestions.

Planning a pre-dawn search, I put up my tent in the dark and retired to bed. Next morning, I was delighted to find the tiny tan-coloured ants still attending larvae in darkness at 0530h EST, 38 minutes before sunrise. A trail on the ground led from their nest to the host plant. I needed to obtain samples of the ant for identification and had failed to catch more than a few, the night before. Again, the ants proved very difficult to collect from the host plant in limited light, so I placed a shallow alcohol-pitfall trap along the trail near the base of the wattle. In a short time, I had collected an adequate series for taxonomic examination. These ants were *Iridomyrmex pallidus*, yet looked nothing like their congener, *I. sanguineus*. At 0530h, the diurnal *I. sanguineus* was not yet present or at least not obvious on hosts examined. Evidently, it ceased attendance sometime earlier in the night. On wattles without nocturnal ants, *I. sanguineus* perhaps continues its attendance in lower numbers all night, but I did not see this as I was watching wattles dominated by nocturnal ants. By 0630h little had changed – *I. pallidus* was in somewhat lower numbers and *C. confusus* still patrolled the stems of this and other *A. leptocarpa* shrubs. Fifteen minutes later (37 minutes after sunrise), the Northern meat ant, *I. sanguineus* now occupied the 1m high sapling formerly dominated by *I. pallidus* and were attending most larvae, including all previously tended in darkness by *I. pallidus*. At this time (0645h), only a single ‘tan ant’ lingered and it was departing down the stem for its nest on the ground nearby, but some workers of *C. confusus* still remained on this same plant. Hence, soon after sunrise at about the time of the rapid ‘change of shift’ involving the two

species of *Iridomyrmex*, all three ant species were briefly coincident and tolerating each other's presence. I similarly recognised that *I. sanguineus* now tended at least one larva that *C. confusus* had attended some five minutes earlier. It appeared that replacement of this species too had now begun, albeit more gradually than for *I. pallidus*. Light quickly increased visibility and at this time (0645h), I saw the first butterfly active, not a *J. eichhorni* though, but a female of *Cressida cressida* (Papilionidae) fluttering in oviposition-type flight nearby.

At 0715h, now one hour and eight minutes after sunrise, many *Camponotus* ants were still on the 1m sampling, but numbers of *I. sanguineus* were increasing. An approaching *C. confusus* ant, clearly apprehensive by the diurnal replacement ant guard, backed off by walking in reverse when it visually (nil tactile contact) detected *I. sanguineus*, at about 5mm distance. Yet, it remained close by, wandering within a centimetre or so in front of the larva. Two or three replacement attendant ants were now riding on this caterpillar or following immediately behind, stimulating its dorsal organs. Perhaps the *C. confusus* ant intended to tend again should the others depart, but showed no aggression or defence of the resource formerly guarded. Likewise, the *I. sanguineus* ants were not hostile toward the remaining *C. confusus* individuals, and the meat ants now also tended the many scale insects on the stems of these *A. leptocarpa* shrubs. It seemed the scales were their main attraction, the larvae being a bonus. Other wattles with larvae, but without scales, had only sporadic wandering ants mostly focused on the larvae, but not streaming along plant stems, as was the case when multiple resources were present. Not having noticed the scales in the dark, I did not check whether they were tended by the nocturnal ants, being preoccupied with the caterpillar activity. As light rapidly increased, I also saw that a braconid parasitoid, probably an *Apanteles* sp., had infested a few larvae, their fresh carcasses still resting on the stems. The wasp larvae had emerged from the hosts and their cocoons were present in batches underneath their caterpillar victims. The *I. sanguineus* ants, now the sole occupant species, ignored these ill-fated larvae.

The myrmecophily literature pertaining to these ant genera was also revealing. *Camponotus* sometimes attend larvae of *Jalmenus* species they are otherwise not associated with, especially during population explosions of the lycaenid butterfly (N.E. Pierce cited in Eastwood & Fraser 1999). In their review of the literature, Eastwood & Fraser (1999) reported similar situations with *Jalmenus* for two other ants, namely *I. purpureus* and *Papyrius nitidius*. In particular, Fraser *et al.* (2002) citing earlier writers, commented on one intensely studied, related species, common in southern Australia. They noted that "a given colony of *J. evagoras* is predominantly associated with only a single ant species" (p.862). This, I would add, applies to most myrmecophiles in eastern Australia in my experience. Moreover, based on findings by Pierce (1989) and Eastwood & Fraser (1999), it seems *J. evagoras* larvae can be "tended by *I. purpureus* and several other novel ant partners in the wild and under laboratory conditions" (Fraser *et al.* 2002, p.868). Fraser *et al.* (2002) concluded that this indicates "that appeasement of novel ant partners is possible" (p.868). These observations almost certainly apply strictly to diurnal attendance. Given my new findings, it is possible other ant species attend some populations of other *Jalmenus* species at night. At Isabella Falls, Eastwood & Fraser (1999) recorded *I. reburrus* as an attendant ant, so evidently at least four species are utilised singly or in association in the Isabella Falls area.

Interactions with another ant at Isabella Falls

Within 30 metres of the *J. eichhorni* colonies, Green tree ants, *Oecophylla smaragdina* occupied an *A. leptocarpa* shrub, where they tended mealy bugs on the wattle stems. These gregarious tropical ants nest in the trees and are aggressive predators. Yet, they will tend some thecline butterfly larvae. No *Jalmenus* larvae were present on this tree, suggesting that the female butterflies will not oviposit in response to this species' occupancy. I wondered about the concept of novel ant attendance in the wild as a rare event, and whether various ant species would accept untended larvae when encountered. After daybreak, I manually transferred a third instar larva to this tree to observe a response, if any, from *O. smaragdina*. The larva walked about for several minutes undetected by the ants. A patrolling worker ant on

finding it did not inspect or try to tend it, but instead briefly grasped it with its mandibles, raising it into the air momentarily, before returning it to the stem, seemingly uninjured. The ant then departed down stem in the direction it had come. About 30 minutes later I returned to seek out the caterpillar but it was gone. Perhaps the ants consumed it, or it died from a wound inflicted during its inspection, later falling from the plant in my absence. Alternatively, being untended perhaps it fell prey to another predator such as a wasp or roaming spider, some spiders can coexist on heavily ant occupied plants as they mimic the tree ants! Hazards awaiting an untended larva are obviously many and likely (Pierce 1984, Smiley *et al.* 1988).

Before leaving my study site at about 0900h, I took a few butterfly pupae to preserve the resultant adults as vouchers for this report. The pupae darkened to black the night preceding their emergence. Over the next few days, adults emerged from about 0600h through to 0900h. Having bred naturally from larvae in situ, not kept in dark containers creative of unnatural photoperiods, it is likely their biological clocks were undisturbed, so this is probably indicative of their usual time of emergence in the field.



Figure 1



Figure 2



Figure 3



Figure 4

Figure 1: A soldier of *Camponotus confusus* guarding a *Jalmenus eichhorni* pre-pupal larva and pupa video-recorded at night (Jan 2001). An accompanying worker ant tending the larva retreated into darkness when the foliage was illuminated. **Figure 2:** *Iridomyrmex sanguineus* worker tending mature larva at c.0800h (Jan 2002) – five eggs are visible on the foliage. **Figure 3:** *C. confusus* worker and soldier in attendance in darkness. **Figure 4:** *I. sanguineus* nocturnally tending larva and pupa on stems [Extracted video frames].

Summary

Maximum ant kinds attended larvae some 20-40 minutes after sunrise, their detection then made easier by the increased visibility. The three ant species were attending separate individual larvae, often in twos or threes, on the same 1m sapling of *A. leptocarpa*. At no time

was more than one ant species attending a single larva, yet they attended the species collectively, simultaneously. Larvae or larval groups remained spatially separated on the bush. On one occasion, I observed that where an ant of one species chance discovered a larva attended by an ant of a different species, the intruder ant retreated without offence or defence. It seemed the ant species were not directly competing with each other for the same larval resources, with ant species occasionally wandering past one another on the stems with indifference. Although the diurnal meat ants are aggressive by day and competitive for nutrients the larvae provide, their lack of aggression is curious. Samson & O'Brien (1981) reported attack on *Camponotus* tended larvae by meat ants in southern Australia, as one example of inter-ant aggression. Perhaps at night the larvae produce a different pheromone, limiting ant aggression. Fewer predators may then be active enabling safety with lowered ant vigilance and aggressiveness. All caterpillars looked similar and belonged to the same species, that is *J. eichhorni*, as we currently understand it (Braby 2000). About two hours after daybreak only the diurnal meat ant remained with the larvae. I believe these meat ants are the obligatory attendant species, as the other two do not tend them during the day when they are perhaps most vulnerable to predators. The two nocturnal ants may be facultative to varying extents, rather than pointing to ecological morphs within the butterfly species itself. In this regard, there was no evidence to suggest that larvae tended by *Camponotus* fed only nocturnally, sheltering during the day in ant galleries with the obligatory guard, in the manner of *Ogyris genoveva* and *O. zosine*. Clearly, mine is an unusual observation of myrmecophily worthy of further study.



Figure 5. Male of *J. eichhorni* in early morning at 2km E of Isabella Falls, emerged 10 Jan 2002.

Other allied observations

At 6km SE of Andoom, near Weipa in Jan 2002, I also found *I. sanguineus* tending larvae of *J. eichhorni* (Dunn 2002) on a broad leaf wattle in *Acacia* woodland, again probably *A. leptocarpa*. During my inspection from 1530-1630h EST, overcast weather gradually set in heralding the predictable late afternoon showers that soon followed. Perhaps a similar 'change of shift' of ant species also occurs at this more northern locality on the Peninsula, but I had no

opportunity to return at night to confirm this. Similarly, at 4km ESE of Watalgan, near Bundaberg Qld (in Jan 2002) I inspected a large colony of *Jalmenus ictinus* feeding on *Acacia ?leiocalyx* in woodland. They were found by torchlight in the dark, after smelling a strong ant odour, during a 30-minute roadside stop to break the long journey south. Where huge quantities of ants are active at head height on wattles, the stink wafting in warm and still conditions is a certain pointer of a likely attraction to mealy bugs, scales or caterpillars. The common meat ant, *Iridomyrmex purpureus*, which usually attends this species diurnally, was actively tending mature larvae one hour and 13 minutes after sunset, when I arrived at 2000h. I was unable to inspect the larvae again later that night, but such might prove interesting another time. In the meantime, others finding *Jalmenus* butterflies may wish to examine their colonies at intervals at night to seek evidence of any 'ant-replacement' phenomena, particularly in far northern Australia where more attendant ant species occur, increasing this likelihood.

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Alan Anderson kindly identified the ant species involved. Voucher series of each of the three attendant species from near Isabella Falls were deposited in the collection at the Tropical Ecosystems Research Centre, Darwin NT, where they were identified.

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