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Predation by the weaver ant *Oecophylla smaragdina* (Hymenoptera: Formicidae: Formicinae) on its mimic jumping spider *Myrmarachne plataleoides* (Araneae: Salticidae: Astioida: Myrmarachnini)

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Summary. The jumping spider *Myrmarachne plataleoides* is a well-known visual mimic of the weaver ant *Oecophylla smaragdina* in south and southeast Asia. This spider is thought to gain protection by its association with these ants, but it does not prey on them and warily avoids direct contact. The attack of *O. smaragdina* on *M. plataleoides* has only been described in one earier publication (Mathew 1954). Here we provide photographic documentation of a cooperative attack on a female *M. plataleoides* by a group of these ants in Mysuru, Karnataka, India.

Key words. ant mimic, Batesian mimicry, Green Tree Ant, India, Karnataka, Kerengga, *Myrmaplata*, *plataleoides* group, Red Ant

The jumping spider *Myrmarachne plataleoides* (O. Pickard-Cambridge 1869) is a well-known mimic of the weaver ant *Oecophylla smaragdina* Fabricius 1775 (also known as the Green Tree Ant, the Kerengga or the Red Ant), both widely distributed in south and southeast Asia (Figure 1). Across this range the two species are invariably found in close association on plants that are overrun by *O. smaragdina* (Edmunds & Prószyński 2003; Edmunds 2006). *M. plataleoides* has recently (Edwards & Benjamin 2009) been placed in the *plataleoides* group, a clade within the large genus *Myrmarachne* MacLeay 1839. Even more recently Prószyński (2016) designated *M. plataleoides* as the type species of a new genus, *Myrmaplata*. Pending further studies of the phylogeny of *Myrmarachne* and related genera (the Myrmarachnini) we continue to refer to this species as a member of the larger genus *Myrmarachne*.

Like other *Myrmarachne* species, *M. plataleoides* resembles and moves like the ant workers that it associates with (Marson 1946; Mathew 1934, 1954; Edmunds 1978; Tikader 1978; Nelson & Card 2016), and adults are thought to be Batesian mimics of *Oecophylla smaragdina* (Edmunds 1978; Ceccarelli 2006, 2007, 2012; Nelson & Jackson 2012; Nelson 2012; Leong & D'Rozario 2012). In a Bengaluru population of *M. plateloides* both red-brown and black forms of *M. plataleoides* are known to occur (Borges et al. 2007), but this polymorphism has not been described from other populations. With their greatly elongated chelicerae tipped with a pair of "eye spots," adult male *M. plataleoides* may mimic major ants carrying minor ants (Edmunds & Prószyński 2003; Edmunds 2006; Nelson & Jackson 2012). According to the classical theory of Batesian mimicry (e.g. Lindström et al. 1997; Rashad 2006) a palatable or harmless species mimics the appearance of an unpalatable or dangerous species to benefit from the avoidance of the latter by predators. Mimicry by *M. plataleoides* can be viewed as part of a more general symbiosis with colonies of *O. smaragdina* (see Brignoli 1986; Cushing 1997).

Figure 1. Distribution of *Myrmarachne plataleoides* in south and southeast Asia. Numbers correspond to references identified in Appendix 1. Eastern localities (14-Sabah, 27-Manila and 28-Sarawak) may represent a different but similar species such as *M. assimilis* Banks 1930 (Yamasaki & Ahmad 2013; Yamasaki 2015). Weaver ants (*Oecophylla smaragdina*) range over all of tropical south and southeast Asia through the islands of the East Indies to northern Australia. The background relief map is in the public domain (CC0), courtesy of maps-for-free (https://maps-for-free.com).

There is no evidence that these ants use their vision to recognize their spider mimics (Mathew 1954) but it remains a possibility that the *Oecophylla*-like appearance of *M. plataleoides* at a distance does reduce the tendency of *Oecophylla* to either approach or take alarm at their presence. *Oecophylla* recognize their nestmates by direct contact with colony-specific cuticular hydrocarbons and the chrysilline salticid *Cosmophasis bitaeniata* (Keyserling 1882) makes use of this fact as an aggressive chemical mimic, feeding on ant larvae as it avoids contact with ant workers (Allan & Elgar 2001; Allan et al. 2002; Elgar & Allan 2004; Nelson & Jackson 2012).

When danger presents itself the response of *M. plataleoides*, which flees and hides or hangs from a dragline, is quite different from that of the ants (Mathew 1934, 1954; Edmunds 1978). Worker ants assume an "alarm attitude" in response to prey or intruders and recruit other workers from their colony at either close range with secretions from a terminal sternal gland, or at long range with trails comprised of rectal gland secretions (Hölldobler 1983). Since a single *O. smaragdina* colony can include 21 major

trees and cover a territory of 1500 m^2 (Hölldobler 1983), long range recruitment can produce a large-scale response to a major threat or feeding opportunity. Thus when one of these jumping spiders flees from a potential predator its escape can be covered by an army of alarmed and aggressive ants in the vicinity. This, even more that any protection afforded by mimicry, may represent the greater advantage of living with these ants (Mathew 1954; Edmunds 1978).

O. smaragdina workers represent a considerable threat to adult *M. plataleoides*. These jumping spiders do not feed on the ants, but flee at their approach to avoid being attacked and eaten (Mathew 1954; Edmunds 1978; Ceccarelli 2006, 2007). According to Marson (1946) *M. plataleoides* feed on smaller insects, including Diptera and Hemiptera. It is however possible that *M. plataleoides* may take some larvae or pupae from an abandoned ant nest (Mathew 1954; Edmunds 1978). Ceccarelli (2006, 2007) did not observe any encounters with ants that resulted in harm to a *Myrmarachne* sp., but Mathew (1954), based on his extensive field observations of *M. plataleoides* and *O. smaragdina*, provided us with a vivid description of such an encounter:

> My observations convince me that the *Oecophylla* recognize these spiders as strangers and are alarmed. I have often closely watched specimens of *M. plataleoides* as they move about on plants with streams of red ants. The spider is very careful to avoid the ants, and if it comes across one, it immediately beats a hasty retreat and escapes. The ant recognising it (or recognising that something is amiss) assumes its alarm attitude which gives the spider time to escape. Should the ant pursue, the spider quickens its pace, dodges under a leaf, or as a last resort lets itself down by a thread and hangs suspended in air where the ant cannot pursue it. The ant, losing its quarry, abandons the chase. If somehow this method of escape is rendered impossible or prevented, the ant pounces upon it in the most relentless manner and carries it triumphantly to the nest.

One of the authors (PR) observed a colony of these weaver ants and their mimic jumping spiders in Mysuru, Karnataka, India for about three years without observing any instances where a jumping spider was captured by an ant. During this time *M. plataleoides* were observed wandering in the ants' territory and nesting in close proximity to them. On 6 NOV 2016 what appeared to represent an attack by an *O. smaragdina* worker on another ant was captured in the series of photographs shown in Figure 2.

Figure 2 (continued on next page). Attack on an adult female *Myrmarachne plataleoides* by members of an *Oecophylla smaragdina* colony in Mysuru, Karnataka, India (6 NOV 2016). **1,** Attack by a single worker (14:43). **2,** Recruitment (14:44). At this stage most of the recruited attackers were holding legs of the captured spider.

Figure 2 (continued from previous page, continued on next page). Attack on an adult female *Myrmarachne plataleoides* by members of an *Oecophylla smaragdina* colony in Mysuru, Karnataka, India (6 NOV 2016). **2A,** detail of [2]. Note liquid exuding from book lungs of the victim under pressure. **3-5,** More recruitment (14:44). **4,** Note the ant at right holding one leg of the captured spider in its mandibles. **5A,** Detail of [5].

Figure 2 (continued from previous page, continued on next page). Attack on an adult female *Myrmarachne plataleoides* by members of an *Oecophylla smaragdina* colony in Mysuru, Karnataka, India (6 NOV 2016). **6-8,** More ants joined in carrying their prey (14:46). **6A,** Detail of [6]. Note the spinnerets of the captured female *M. plataleoides* (at center). **9-10,** The prey was subsequently moved up the stem by this attending group of ants (14:47).

Figure 2 (continued from previous page). Attack on an adult female *Myrmarachne plataleoides* by members of an *Oecophylla smaragdina* colony in Mysuru, Karnataka, India (6 NOV 2016). **11,** The prey was moved back down the stem by the group of attacking ants (14:48). **11A,** Detail of [11] showing four workers holding the body of this female *M. plataleoides* with their mandibles.

When these photographs were subsequently examined it became apparent that the victim of this attack was not an ant, but an adult female *Myrmarachne plataleoides*. To the best of our knowledge this is the first photographic record of the kind of attack described previously by Mathew (1954). Initially the spider was attacked by a single worker that used its mandibles to grasp the spider from the rear (Figure 2:1). A subsequent sequence of photographs (Figure 2:2-11) show the close range recruitment of nearby ants that assisted in both capture and transport of this prey toward their nest.

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Appendix 1. Distribution records for *Myrmarachne plataleoides*

1	Sri Lanka	O. Pickard-Cambridge 1869; Peckham & Peckham 1892
2	India: Mavalikara, Central Travancore	Mathew 1931, 1940
3	India: Siripur, District Saran, Bihar; West Bengal; Tamil Nadu; Maharashtra	Tikader 1978
4	India: Daitari, Jaipur-Keonjar District, Odisha	Prószyński 1992
5	China: Yunnan	Song et al. 1999
6	Malaysia: Malayan Peninsula	Edmunds & Prószyński 2003
7	India: Mannavan shola forest, Kerala	Sudhikumar et al. 2005
8	India: Bengaluru, Karnataka	Borges et al. 2007; Caleb 2016; Nalini & Ravindranatha 2017
9	Singapore	Bodner 2009; Hill 2010; Leong & D'Rozario 2012
10	India: Gibbon Wildlife Sanctuary, Jorhat, Assam	Chetia & Kalita 2012
11	India: Puttur and Shanthigodu, Karnataka	Bhat et al. 2013
12	India: Kumarakom Bird Sanctuary, Kottayam, Kerala	Jobi & Samson 2014
13	Malaysia: Malayan Peninsula, West Coast	Nasir et al. 2014
14	Malaysia: Sabah, Tawau Gemok Hill; Sabah, Sukau	Dzulhelmi et al. 2014
15	India: Sirpur Lake, Indore, Madya Pradesh	Sharma & Sharma 2014. 2015
16	India: Karimganj District, Assam	Hill & Otto 2015
17	Sri Lanka: Kandy; Kegalle; Colombo; Anuradapura; Ampara; Southern Province; Monaragala; North Western Province; Matale	Benjamin 2015
18	Northern Vietnam; Thailand; Malaysia, Malayan Peninsula	Yamasaki 2015
19	India: Laltong, Dooars, West Bengal	Sen et al. 2015; Roy et al. 2016
20	India: Chennai, Tamil Nadu	Caleb 2016
21	Bangladesh: Savar, Dhaka	Rain et al. 2016
22	India: Chakrashila Wildlife Sanctuary, Assam	Basumatary & Brahma 2017
23	India: Taranga Hills, Satlasana Taluka, North Gujarat	Parmar & Patel 2017, 2018
24	Angkor, Northwest Cambodia	FLICKR: S. De Greef
25	Malaysia: Putrajaya, Malaysian Peninsula	FLICKR: S. H. Omar
26	India: Koratty, Kerala	FLICKR: J. P. Thekkumthala
27	Philippines: Manila, Quezon City, National Capital Region	FLICKR: R. B. Rovillos
28	Indonesia: Northeast Sulawesi	FLICKR: P. Kirillov
29	Thailand: Pa Ko, Mueang Phang-nga District	iNaturalist: rueangritp 2007
30	Thailand: Bangkok	iNaturalist: tonykris 2018
31	Thailand: Kon Kaen	iNaturalist: naturalist 2335
32	India: Mysuru, Karnataka	Ramachandra & Hill 2018 (this paper)