Anecdote of spiders and their model ants of Bibhutibhusan Wildlife Sanctuary, N-24 Parganas, West Bengal

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ABSTRACT

Our study on ant diversity of Bibhutibhusan Wildlife Sanctuary, N-24 Parganas, West Bengal during the period, August 2017-July 2018, unfolded wonderful Batesian and Wasmannian mimicry (chemical mimicry) between model ants Tetraponera rufonigra (Jerdon) and its sibling T. allaborans (Walker), Oceophylla smaragdina (Fabricius) and salticid spiders of the genus Myrmarachne Macleay. Siblings of Myrmarachne encountered are M. plataleoides O. P. Cambridge, M. maratha Tikader and M. orientales Tikader. It is supposed that chemical or Wasmannian mimicry enables species with ant-like pheromones to live in close contact with ants. The members of spider Myrmarachne that resemble the aggressive weaver ant Oceophylla smaragdina, with which they live in close contact, also show chemical resemblance. Further, by mimicking the ants they gain protection from predators. Since weaver ants have a painful bite and also taste bad, this strategy appears to be successful. Though these spiders mimic the weaver ants very well, they are known to stay away from them. They weave a thin web on the leaves, hide under their webbing and ambush their prey. Present communication attempts to discuss the morphological and structural similarities between the mimics and their models. It is worthwhile to mention that such a mimicry is reported for the first time from this part of the country.

Keywords: Myrmecomorphy, Mimicry, Salticid Spiders, Model Ants, Bibhutibhusan Wildlife Sanctuary, West Bengal

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1. **INTRODUCTION**

Myrmecomorphs are arthropods that have evolved a morphological resemblance to ants. Myrmecophiles are arthropods that live in or near ant nests and are considered true symbionts. Myrmecomorphy in spiders is generally considered a type of Batesian mimicry in which spiders are gaining protection from predators through their resemblance to aggressive or unpalatable ants (Reiskind, 1970; Vane-wright, 1980; Brignoli, 1984; Parker & Cloudsley-Thompson, 1986; Cushing, 1997). Selection pressure from spider predators and egg sac parasites may trigger greater integration into ant colonies among myrmecophilic spiders. Chemical or Wasmannian mimicry enables species with ant-like pheromones to live in close contact with ants (Vander meer et al., 1989). Over 300 species of ant-mimicking spiders are presently known (Viegas, 2014). The majority is found among salticids (e.g. *Myrmarachne*, *Synemosyna*, *Synageles*, *Belippo*, *Myrmecium*, *Myrmecotypus*, *Mazax*), clubionids (e.g. *Sphectotybus*), corinnids (e.g. *Castianeira*), gnaphosids (e.g. *Micaria*), thomisids (e.g. *Amyciaea*, *Aphantochilus*) and zodariids (e.g. *Zodarion*, *Storena*). Present study attempts to discuss the morphological and structural similarities between the mimics and their models.

2. **STUDY AREA (Fig. A)**

Bibhutibhusan Wildlife Sanctuary (formerly Parmadan Forest) is in North 24 Parganas, West Bengal. It is located (Latitude: 23.1930° N & Longitude: 88.7734° E) on the banks of Ichhamati River covering an area of 0.68 km². The average temperature ranges from 9 – 43 °C; and annual rainfall is 1579 mm (approx.).

3. **MATERIALS & METHODS**

Survey is conducted once a week since August 2017 - till June 2018 within Bibhutibhushan Wildlife Sanctuary. Samplings are being done by pit fall trap, hand picking, bush beating & using inverted umbrella (Figs. B & C). Samples are killed and preserved in 70% alcohol as per recommendation of Raychaudhuri & Saha (2014). The materials are studied using Stereo Zoom Binocular Microscope, model Olympus SZX-16. The measurements are in millimeters, made with an eye piece graticule. Specimens are identified following Bingham (1903); Datta (1988); Bhattacharjee (2009); Metzner (2017); Raychaudhuri & Saha (2017); WSC (2019). Materials are in the deposition of Post Graduate Department of Zoology, Barasat Government College, Barasat, Kolkata.

4. **RESULTS & DISCUSSION**

4.1. **Morphological adaptations (Batanian mimicry) (Figs. F & G)**

Mimetic resemblance to ants include colour pattern similarities as well as more dramatic morphological changes (body-form modifications) such as abdominal constrictions and/or constriction of the cephalothorax, both of which give the illusion that spider has three body parts instead of two.
4. 2. Behavioural mimicry (Figs. H, I & J)

Erratic movement much more akin to ant-like fashion than non-mimics, raising either the first or second pair of legs as an antennal illusion. This functionally reduces the number of legs in the mimic from four pairs to three.

Equally we feel it relevant to highlight the fact that only male morphs could be encountered within the ants’ populations throughout the period of survey. Explanation to such a record is relegated to the male palp that apparently appear as a copy of the clubbed antennae of ants. Such a Batesian mimicry exhibited only by the male spiders is possibly an intrinsic escape behaviour from their female mates so as to avoid cannibalism. This is over and above the usual defensive strategy adopted by spiders.

4. 3. Wasmannian (Chemical) mimicry

It enables species with ant-like pheromones to live in close contact with ants. The members of spider Myrmarachne that resemble the aggressive weaver ant Oceophylla smaragdina, with which they live in close contact, also shows chemical resemblance. Since weaver ants have a painful bite and also taste bad, this strategy appears to be successful. Though these spiders mimic the weaver ants very well, they are known to stay away from them. They weave a thin web on the leaves, hide under their webbing and ambush their prey.

5. CONCLUSIONS

Four different hypotheses have been proposed by McIver & Stonedahl (1993) to explain the adaptive significance of myrmecomorphy in depth: 1) Wasmannian mimicry, 2) Mullerian mimicry, 3) Aggressive, or Peckhammian mimicry and 4) Batesian mimicry. All three myrmecomorphic siblings of Myrmarachne spiders encountered during collection of ants, are probably Batesian mimics.

Most ants are unpalatable for generalist predators because they have efficient defence mechanisms such as hard integument, sometimes with spines, strong mandibles and stings, which expel irritating acid substances. The colour pattern of three Myrmarachne spp. presents a striking similarity with their model ant.

Together with morphological and behavioural adaptations, the spiders are almost impossible to be distinguished from their model ants. It would be interesting to determine the phylogenetic relationship between myrmecophilic taxa and their free-living relatives. Are there certain preadaptations that make myrmecophilophy more likely for certain lineages and less likely for others? Find of males only in the populations raises some more questions:

Those are: 1. Why females are not there? 2. Where are they? 3. How then the other biological activities are carried out? 4. Should it only be a phylogenetic relationship or it is also an intrinsic escape behaviour of the males in question? Our perception is that during co-evolution that occurred between the model and the mimic, males have been favoured to adopt further escape strategy from their female counterparts.

It is important to document those myrmecophilic spiders that may be encountered in the field. Studies of myrmecophilic spiders can provide insight into the evolution of interspecific associations between social hymenopterans and their guests.
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References

Fig. A.
Fig. B. Field Work

- Hand picking
- Using inverted umbrella
- Visual search
- Pitfall trap
Fig. C. Field Work
COLLECTED ANTS & SPIDERS

**ANT MODEL**

*Oecophylla smaragdina* (Fabricius)

**MIMICIKING SPIDER**

*Myrmarachne plataleoides*  
O.P. Cambridge

**ANT MODEL**

*Tetraponera rufonigra* (Jerdon)

**MIMICIKING SPIDER**

*Myrmarchne orientales* Tikader
ANT MODEL

Tetraponera allaborans (Walker)

MIMIC KING SPIDER

Myrmarachne maratha Tikader

Fig. D
Fig. E. Forest niches shared by the encountered MODEL ANTS & MIMICKING SPIDERS
**Fig. F**

*Tetraponera rufonigra*  
(Jerdon)

*Myrmarachne orientales*  
Tikader
Fig. G
Fig. H

Oecophylla smaragdina (Fabricius)

Myrmarachne plataeoides O.P.Cambridge ♀

Fig. I

Oecophylla smaragdina (Fabricius)

Myrmarachne plataeoides O.P.Cambridge

Antennal club

Male palp
Fig. J