

## STUDIES ON NATURAL ENEMIES IN DRUMSTICK ECOSYSTEM

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**ABSTRACT :** The study was conducted at the campus of University of Horticultural Sciences, Bagalkot, on an established garden of drumstick. The drumstick garden was maintained without any pesticide application and was kept under observation for all types of natural enemies on the herbivorous species. During the present study drumstick (*Moringa oleifera*) Lamk. was found to harbour 19 natural enemies. Among them four were insect predators, one was parasitoid, one bird and thirteen species of spiders. All the spider species inhabiting the drumstick are recorded for the first time.

**Key words :** Drumstick, parasitoid, predators, spiders.

### INTRODUCTION

An agro ecosystem typically comprises of biotic factors like plants, herbivores and natural enemies on herbivores viz., predators, parasites, disease causing organisms etc. Drumstick ecosystem is thus no exception in harbouring all these components including lot of natural enemies. As many as 17 natural enemies were observed in the drumstick ecosystem by various workers earlier. Among them, 14 parasitoids, few species of unidentified predatory spiders, four insect predators, two insect pathogens and six birds have been recorded in the ecosystem (Charian and Basheer, 1939; Butani and Verma, 1981; Shamila *et al.*, 1996; Honnalingappa, 2001; Beulah *et al.*, 2010; Math, 2013).

A species of Ichneumonids (*Peristomerus* sp.), three species of Braconids (*Apanteles* sp., *Microbracon brevicornis* Wesman, *Chelonus* sp.) and three species of Chalcidids (*Elasmus hyblacae* Ferr., *Perilampus* sp., *Systasis* sp.) are reported as larval parasitoids on *Noorda moringae* (Cherian and Basheer, 1939). While *Aspergillus flavus* Lk. and *Aspergillus niger* Van Tiegh on larvae of *Noorda blitealis* Walker from Rajasthan (Shamila *et al.*, 1996). *Pericallia ricini* Fabricius was found to be parasitized by *Apanteles ricini* Bhatnagar, *Meteorus* sp., *Sturnia* sp., *Thelaira nigripes* Fab., *Euplectrus* sp. and *Henicospilus rufus* Tosq (Butani and Verma, 1981). However, the spiders though reported to be inhabiting in large numbers exerting natural control over *Noorda blitealis* on drumstick, they have not been identified. Hence, in the present study was undertaken to explore the spider fauna and other natural enemies on *Noorda blitealis*.

### MATERIALS AND METHODS

The various natural enemies on insect defoliators of drumstick were studied during the year 2013-14 at UHS, Bagalkot, Karnataka. Already established drumstick cv. Bhagya (KDM- 01) garden was pruned, manured and maintained throughout the course of study by following recommended horticultural practices except plant protection. The natural enemies associated with the defoliating caterpillars on the crop were recorded at regular intervals of 15 days. The insect natural enemies occurring on drumstick defoliator were collected, killed and preserved for identification by following standard entomological tools and techniques. The spiders were preserved in 70 per cent alcohol. The natural enemies so collected were got identified by comparing the type specimens preserved in the Department of Entomology, COH, Bagalkot and the spider species collected in drumstick ecosystem were sent for identification to Dr. P. S. Bhatnagar, Scientist- C and Officer - In- Charge and Sachin R. Patil, Assistant Zoologist, Zoological Survey of India, Pune, Maharashtra.

### RESULTS AND DISCUSSION

It was observed that the drumstick ecosystem harboured lot of natural enemies. During the period of investigation, one parasitoid, four insect predators, thirteen species of spiders and one bird were recorded as natural enemies in drumstick ecosystem (Table 1).

#### Lady bird beetle, *Menochilus sexmaculatus* Fabricius

The coccinellid, *M. sexmaculatus* is a black spotted lady bird beetle. The long and narrow black band at the pronotal base is connected to the transverse oval black



**Plate 1 :** Lady bird beetle *Menochilus sexmaculatus* Fabricius.



**Plate 2 :** Pentatomid bug *Eocanthecona furcellata* Wolf.



**Plate 3 :** Green lace wing *Chrysoperla zastrowii simili* (= *Chrysoperla carnea* Stephens).



**Plate 4 :** Preying mantid *Anaxarcha limbata* Goglio Toss.



**Plate 5 (a) :** Orb-weaver spider *Argiope arcuata* Simon.



**Plate 5 (b) :** *Stegodyphus mirandus* Pocock (Male).



**Plate 5 (c) :** *Stegodyphus mirandus* Pocock (Female).



**Plate 5 (d) :** Brown sailor spider *Neoscona nautica* (L) Koch.



**Plate 5 (e) :** Lynx spider *Peucetia latikae* Tikader.



**Plate 5 (f) :** Common garden spider *Neoscona mukerjei* Tikader.



**Plate 5 (g) :** Crab spider *Thomisus dhakuriensis* Tikader.



**Plate 5 (h) :** Spotted orb-weaver *Neoscona theis* (Walckenaer).

**Plate 5 :** Different species of spiders observed on Drumstick ecosystem (a, b, c, d, e, f, g, h, i, j, k, l, m & n).

*Plate 5 continued....*



**Plate 5 (i) :** *Cheiracanthium insigne* O. P. Cambridge.



**Plate 5 (j) :** Flower crab spider *Thomisus projectus* Tikader.



**Plate 5 (k) :** *Neoscona sinhagadensis* (Tikader).



**Plate 5 (l) :** *Peucetia jabalpurensis* Gajbe & Gajbe.



**Plate 5 (m) :** *Neoscona punctigera* Doleschall.



**Plate 5 (n) :** *Neoscona* sp.



**Plate 6 :** Parasitoid *Agathis* sp. on *Noorda blitealis*.



**Plate 7 :** Black drongo, *Dicrurus macrocerus*.

discal spot by a short and narrow longitudinal constriction or line. Each elytron has two wavy black bands and a rounded black sub- apical spot and a narrow black band is present on both anterior edges of the elytron (Plate 1). The grubs and adults of Coccinellid beetles, *Menochilus sexmaculatus* F. were observed to predate on the eggs of *N. blitealis* in drumstick ecosystem. Predator was particularly active during study period of September, October and November months of 2013-14 (Table 2). This predator was earlier reported by Math, (2013).

#### **Pentatomid bug, *Eocanthecona furcellata* (Wolf)**

The nymphs of *E. furcellata* were black with red markings on their abdomen having reddish prothorax and proboscis. Adults are black or dark- grey in colour with

white grey spots over prothorax and hemielytra (Plate 2). This predator was observed to prey on caterpillars of *Noorda* spp. by sucking the blood. The predatory activity was observed during August, November and January months of the study period (2013-14) (Table 2). This predator was earlier reported by Math (2013).

#### **Green lace wing, *Chrysoperla zastrowii similis* (= *Chrysoperla carnea* Stephens)**

The green lace wings or aphid lions *C. carnea* were observed to prey on eggs and early instar larvae of *N. blitealis* in addition to their preying habit on aphids (Plate 3). The grubs were active during November and January (Table 2). This predator was earlier reported by Math, (2013).

**Table 1 :** Natural enemies observed on drumstick defoliator *Noorda blitealis* during 2013-14.

Sl. No.	Natural enemies	Scientific name	Family	Order	Remarks
1.	Lady bird beetle	<i>Menochilus sexmaculatus</i> F.	Coccinellidae	Coleoptera	
2.	Pentatomid bug	<i>Eocanthecona furcellata</i> (Wolf)	Pentatomidae	Hemiptera	
3.	Green lace wing	<i>Chrysoperla zastrowii simili</i> (= <i>Chrysoperla cornea</i> Stephens)	Chrysopidae	Neuroptera	
4.	Preying mantids	<i>Anaxarcha limbata</i> Goglio- Toss	Mantidae	Mantodea	
<b>Spiders</b>					
5.	Orb-weaver spider	<i>Argiope arcuata</i> Simon	Araneidae	Araneae	*
6.		<i>Stegodyphus mirandus</i> Pocock	Eresidae	Araneae	*
7.	Brown sailor spider	<i>Neoscona nautica</i> (L. Koch)	Araneidae	Araneae	*
8.	Lynx spider	<i>Peucetia latikae</i> Tikader	Oxyopidae	Araneae	*
9.	Common garden spider	<i>Neoscona mukerjei</i> Tikader	Araneidae	Araneae	*
10.	Crab spider	<i>Thomisus dhakuriensis</i> Tikader	Thomisidae	Araneae	*
11.	Spotted orb-weaver spider	<i>Neoscona theis</i> (Walckenaer)	Araneidae	Araneae	*
12.		<i>Cheiracanthium insigne</i> O.P. Cambridge	Miturgidae	Araneae	*
13.	Flower crab spider	<i>Thomisus projectus</i> Tikader	Thomisidae	Araneae	*
14.		<i>Neoscona sinhagadensis</i> (Tikader)	Araneidae	Araneae	*
15.		<i>Peucetia jabalpurensis</i> Gajbe & Gajbe	Oxyopidae	Araneae	*
16.		<i>Neoscona punctigera</i> Doleschall	Araneidae	Araneae	*
17.		<i>Neoscona</i> sp.	Araneidae	Aranaea	*
18.	Braconid	<i>Agathis</i> sp.	Braconidae	Hymenoptera	
19.	Black drongo (King crow)	<i>Dicrurus macrocercus</i>	Dieruridae	Passeriformes	

\*- New record on *N. blitealis* in drumstick ecosystem.

**Table 2 :** The seasonal occurrence of natural enemies and their hosts/prey.

Sl. No.	Natural enemies	Prey/ Hosts	Activity period
1.	<i>Menochilus sexmaculatus</i> F.	<i>Noorda blitealis</i>	September, October and November
2.	<i>Eocanthecona furcellata</i> (Wolf)	<i>Noorda</i> sp.,	August, November and January
3.	<i>Chrysoperla zastrowii simili</i> (= <i>Chrysoperla cornea</i> Stephens)	<i>Noorda blitealis</i>	November- January
4.	<i>Anaxarcha limbata</i> Goglio- Toss	<i>Noorda blitealis</i>	Throughout the year
<b>Spiders</b>			
5.	<i>Argiope arcuata</i> Simon	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
6.	<i>Stegodyphus mirandus</i> Pocock	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
7.	<i>Neoscona nautica</i> (L. Koch)	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
8.	<i>Peucetia latikae</i> Tikader	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
9.	<i>Neoscona mukerjei</i> Tikader	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
10.	<i>Thomisus dhakuriensis</i> Tikader	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
11.	<i>Neoscona theis</i> (Walckenaer)	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
12.	<i>Cheiracanthium insigne</i> O.P. Cambridge	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
13.	<i>Thomisus projectus</i> Tikader	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
14.	<i>Neoscona sinhagadensis</i> (Tikader)	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
15.	<i>Peucetia jabalpurensis</i> Gajbe & Gajbe	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
16.	<i>Neoscona punctigera</i> Doleschall	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
17.	<i>Neoscona</i> sp.	<i>Noorda blitealis</i> and <i>Noorda moringae</i>	Throughout the year peak during September
18.	<i>Agathis</i> sp.	<i>Noorda blitealis</i>	September- October
19.	<i>Dicrurus macrocercus</i>	Larvae of Lepidopterans	September, October and November

**Preying mantid, *Anaxaracha limbata* Goglio Toss**

During the present study a species of preying mantid, *A. limbata* was found to prey upon early instar caterpillars of *N. blitealis*. The activity and population was observed throughout the year (Plate 4) (Table 2). This was earlier reported by Math (2013).

**Spiders**

As many as 13 species of spiders were observed during the study (Table 1) (Plate 5). Spiders were the predominant species observed in drumstick ecosystem, as general predators, particularly on lepidopteran caterpillars like *N. blitealis* and *N. moringae*. The activity of spiders was observed throughout the year and the population was maximum during September. Spiders were invariably observed on drumstick branches and inflorescences on which the leaf eating caterpillar and budworm infestation used to be there. They were found to prey on the larvae of *N. blitealis* and *N. moringae*. The spiders viz., *Argiope arcuata* Simon, *Stegodyphus mirandus* Pocock, *Neoscona nautica* (L) Koch, *Peucetia latikae* Tikader, *Neoscona mukerjei* Tikader, *Thomisus dhakuriensis* Tikader, *Neoscona theis* (Walckenaer), *Cheiracanthium insigne* O.P. Cambridge, *Thomisus projectus* Tikader, *Neoscona sinhagadensis* (Tikader), *Peucetia jabalpurensis* Gajbe & Gajbe and *Neoscona punctigera* Doleschall were the predominant. These spiders species have not been recorded earlier in the drumstick ecosystem. However, Rachappa *et al* (2002) and Beulah *et al* (2010) reported that the spiders inhabiting in large numbers exerted a natural control on the increasing population of *N. blitealis*.

**Parasitoid, *Agathis* sp.**

One parasitoid, *Agathis* sp. was recorded from the field collected larvae of *N. blitealis*, while rearing under laboratory condition (Plate 6). The parasitoid was also reported by Honnalingappa (2001) and Math (2013).

**Bird**

Though several species of birds were observed (Math, 2013), one avian species, black drongo, *Dicrurus*

*macrocerus* was found feeding on the larvae of Lepidopterans (Plate 7).

**CONCLUSION**

From the studies undertaken to explore the natural enemy complex in drumstick ecosystem on insect defoliators, it was revealed that totally 19 species comprising of insect predators, parasitoid, spiders and a bird were recorded. The activity of most of these natural enemies coincided with the peak occurrence of the defoliators. Hence, the enlisted natural enemies can be exploited for the management of the defoliators, *N. blitealis* and *N. moringae* through conservation and augmentation.

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