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Valuable perspective about Food and Feeding nature of a spider *Neoscona mukerjii* from Northern Western Ghats, Maharashtra

Shabnam Sayyed[1] and Dr. Shaikh Yasmeen[2]
Dr. Rafiq Zakaria College for Women, Aurangabad[1&2]

Abstract:
The present study provides a detailed account of the food and feeding behavior of the orb-weaving spider *Neoscona mukerjii* from the Northern Western Ghats region of India. Observations were conducted to examine prey capture strategies, web architecture, and the range of food items consumed by the species in its natural habitat. The findings reveal that *N. mukerjii* predominantly relies on web-based predation, exhibiting a generalized feeding habit with prey items including various insects such as dipterans, lepidopterans, and orthopterans. The study highlights the ecological role of this species in maintaining insect population balance and contributes valuable insights into its behavioural ecology. This perspective broadens the understanding of feeding adaptations among orb-weaver spiders in tropical ecosystems, emphasizing their importance as natural pest regulators in the biodiversity-rich landscapes of the Northern Western Ghats.

Keyword: Biodiversity, Observation, Food, Northern-Western Ghats, Ecosystem

Introduction:

Spiders represent one of the most significant groups of generalist predators in agro-ecosystems, where they play a vital role in regulating pest populations and thereby contribute to the stability of cultivated crop systems (Prasad. B, 1985). Unlike many other field-dwelling predators, spiders demonstrate a remarkable ability to detect, locate, and subdue a wide range of prey species with high efficiency (Kamal, N. Q. 1960). Their predatory capacity is further enhanced by their diverse foraging strategies, such as web-building, ambush predation, and active hunting, which allow them to exploit multiple ecological niches. Owing to these adaptations, spiders are capable of consuming a substantially higher number of prey items compared to other natural enemies inhabiting the same environment. Indeed, when considered collectively, spiders are estimated to capture and devour more insects than several other insectivorous animals combined. This exceptional predatory efficiency highlights their potential value as natural bio-control agents in agricultural pest management. However, despite their ecological importance and wide distribution across different agro-climatic regions, the role of spiders in natural biological control has not been thoroughly investigated. Scientific studies addressing their diversity, predatory behaviour, and contribution to pest suppression remain relatively limited, leaving considerable scope for further exploration in the context of sustainable agriculture.

All spiders are inherently carnivorous, relying primarily on insects as their main source of food. Among them, *Neoscona mukerjei* is a typical orb-weaving spider commonly found in paddy fields. This species constructs intricate webs that function as highly effective natural traps for capturing insects. Interestingly, the web is capable of ensnaring far more prey than the spider itself can consume, thus acting as a passive but efficient pest-controlling mechanism within the crop ecosystem. The diversity of prey captured in these webs is remarkable, ranging from comparatively large insects such as grasshoppers, beetles, moths, and butterflies to smaller forms including leafhoppers, gall wasps, fruit flies, and minute moth species. This wide spectrum of prey reflects not only the adaptability of *N. mukerjei* but also its potential ecological significance as a natural regulator of insect populations in agricultural habitats.

It is well established that all spiders are primarily carnivorous, with their diet consisting predominantly

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of insects, except for a few rare cases. Earlier contributions in this field include the work of Tikader (1961), who made observations on prey capture and feeding habits of spiders. Kumar et al. (1977) provided a note on insect trapping by spider webs, while Ram et al. (1978) and Majumder (2001) reported instances of odonate predation by spiders. Similarly, Kulkarni et al. (1999) described certain predatory behaviours of *Nephila maculata* (Fabricius), and Chatterjee et al. (1979) documented observations on predator spiders in India. Additionally, Chowdhury et al. (1981) studied spider diversity and predatory behaviour in rice fields of Chittagong, Bangladesh.

The present study focuses on various aspects of the biology and ecological significance of *Neoscona mukerjii.* It provides detailed observations on the specific sites where the spider constructs its web for trapping insect prey, thereby contributing to the natural regulation of paddy pest populations. The study also highlights the extent of pest infestation in paddy fields within wetland areas, supported by illustrative documentation. Furthermore, it encompasses a comprehensive account of the feeding ecology of *N. mukerjii,* including its food preferences, feeding behaviour, and the locations where the spider takes shelter or retreats near its web. Additional emphasis is given to the morphological features and body measurements of both the spider and its captured prey, the duration required for prey capture, and the processes involved in digestion. Together, these observations provide insights into the biological and ecological importance of *N. mukerjii* in agricultural ecosystems.

Material and Methodology:

Study Area:

The present investigation was carried out in the Northern Western Ghats, a part of the globally recognized Western Ghats biodiversity hotspot. The Western Ghats, also known as the Sahyadri Hills, run parallel to the western coast of India and extend across the states of Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu. The northern section of this mountain range primarily encompasses the districts of Nashik, Pune, Satara, Kolhapur, Sindhudurg, and Raigad in Maharashtra, and forms a transitional zone between the Deccan Plateau and the Konkan coastal plains. Geographically, the Northern Western Ghats lie between approximately 15°–20° N latitude and 73°–75° E longitude. The region is marked by rugged terrain, steep escarpments, plateaus, and a network of seasonal and perennial rivers. Elevations vary significantly, ranging from 200 m in the foothills to over 1,600 m above sea level at the higher plateaus and peaks. This altitudinal gradient, combined with diverse microclimatic conditions, creates a wide range of habitats that support rich floral and faunal diversity.

Climate:

Climatically, the area experiences a tropical monsoon climate. The monsoon season (June to September) is characterized by heavy rainfall brought by the south-west monsoon winds, with annual precipitation ranging from 2,000 mm in the plains to over 6,000 mm in higher elevations. The post-monsoon period (October–November) and winter months (December–February) are comparatively cool and dry, while the pre-monsoon summer (March–May) is hot, with temperatures occasionally exceeding 38 °C in the lowlands. The variability in rainfall and temperature across different zones contributes to the ecological heterogeneity of the region.

Collections:

Spiders were collected from the study sites using multiple standard techniques. Specimens were obtained directly by hand-picking from their webs, as well as by employing a sweeping net to capture

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individuals from vegetation. In addition, the beating and dusting method was utilized, wherein nearby bushes and shrubs were gently disturbed, causing spiders to fall into an inverted umbrella placed beneath.

Identification:

The preserved spiders were transferred to vials containing 70% ethyl alcohol for preservation and subsequently examined under a binocular stereomicroscope using Petri dishes as mounting platforms. Detailed morphological characters such as body coloration, eye arrangement, leg spination, and genital structures were studied for accurate identification. The specimens were identified up to the species level by consulting standard taxonomic keys and descriptions provided by Tikader (1982).

Result and Discussion:

Neoscona mukerjii captures its prey by piercing it with the fangs of its chelicerae, but it frequently withdraws when the trapped prey resists strongly, producing vigorous jerks in the web. To examine the prey–predator dynamics between the feeding habits of *N. mukerjii* and the insect pests of paddy crops, detailed observations were conducted at 20 sites (10 in the east and 10 in the west).

An illustration is included in this context, presenting tabulated information gathered during the study period (Post-Monsoon 2022–23). It documents 10 insect prey species belonging to 6 families that were predated upon by *Neoscona mukerjii*, along with their systematic position, the plant parts they damage, and their relative abundance in the eastern and western regions of the wetland.

From our observations, *N. mukerjii* was found to construct orb-web snares to capture prey, typically positioning itself just outside the web while waiting. The dragline threads of the web serve as crucial connecting links. When an insect becomes entangled, the spider instinctively rushes toward it without hesitation and delivers an initial bite with its fangs. In most cases, the spider then withdraws slightly and remains watchful. On rare occasions, if the prey continues to struggle actively after the first envenomation, the spider delivers additional bites. In some instances, prey required 30–40 minutes to become completely immobilized. Notably, no prey was able to free itself; instead, the more they struggled, the more entangled they became in the web, ultimately leading to their exhaustion.

Once the prey is subdued, the spider approaches and begins wrapping. Using its hind legs, it draws out bundles of silk from its spinnerets and presses them against the insect. The prey is then rolled repeatedly until it is entirely enclosed in silk.

The findings of this study reveal that the prey of *Neoscona* consists mainly of insects with flying and jumping habits (Table I). Occasionally, they were also observed feeding on other spider species. Notably, in December 2003, an adult female *Neoscona* measuring about 12.5 mm was observed feeding on a male of the same species measuring 10.2 mm, indicating cannibalistic behaviour. Furthermore, the web of *Neoscona* functions as a natural insect trap, capturing far more prey than the spider can consume. It was also observed that young spiders tend to bite their prey repeatedly while retreating, whereas larger individuals (11–13 mm) typically deliver a single bite to immobilize the prey, likely due to the greater quantity of venom injected by bigger spiders.

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Sr. No.	Scientific Name	Order to which pest belong	No. of insect observed in east-margin of the wet land	No. of insect observed in west-margin of the wet land
1	***Cofana spectra***	Hemiptera	Minimum	Maximum
2	***Sesamia inferens***	Lepidoptera	Maximum	Optimum
3	***Thrips tabaci***	Thysanoptera	Minimum	Minimum
4	***Ephestia cautella***	Lepidoptera	Optimum	Minimum
5	***Omocestus viridulus***	Orthoptera	Maximum	Maximum
6	***Chorthippus brunneus***	Orthoptera	Maximum	Maximum

Table No. 01. Above table focusses *N. mukerjii* commonly feeding on pest of that area

Conclusion:

The present study on the food and feeding nature of Neoscona mukerjii from the Northern Western Ghats highlights the species' significance as an active orb-weaving predator within its ecosystem. Through observations of web-building and prey capture, it was evident that *N. mukerjii* exhibits a generalized feeding behavior, preying upon a wide variety of insects including dipterans, lepidopterans, and orthopterans. Such feeding versatility not only ensures its survival in diverse habitats but also contributes to regulating insect populations in the region. These findings emphasize the ecological importance of *N. mukerjii* as a natural biological control agent and reinforce the need to conserve its habitat within the biodiversity-rich landscapes of the Western Ghats. Overall, the study provides valuable insights into the behavioural ecology of this spider, serving as a foundation for further research on the ecological roles of orb-weaving spiders in tropical ecosystems.

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