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WEB BUILDING, MODES OF HUNTING, AND FEEDING BEHAVIOUR IN ORB-WEB SPIDERS *ARANEUS MITIFICUS* AS KEY PREDATORS OF NOCTURNAL INSECTS IN THE GARDEN

Ravi Kant Upadhyay*

Department of Zoology, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur.

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***Corresponding Author**

Ravi Kant Upadhyay

Department of Zoology, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur.

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ABSTRACT

The current study examined the eating habits, hunting strategies, and web construction of Orb-Web Spiders (*Araneus mitificus*). This spider species primarily hunts moths, flies, mayflies, crickets, tiny grasshoppers, and butterflies, mainly nocturnal insects in the garden. Predatory behaviour, including web spinning, hiding and attacking, has been routinely investigated for up to 40 days under typical climatic conditions, mainly temperature, sunlight and humidity. This study explains how to record and evaluate web development and hunting. The spinning of the web depends on natural day-night cycles, light and temperature; the frequency of web creation increased. The feeding behaviour of *Araneus mitificus was* found to be associated with seasonality and climatic conditions. This was also found to depend on the spinning of a web network. This article aims to investigate web construction, feeding behaviours, and neutralisation of prey and hunting behaviour.

KEYWORDS: Spider webs, hunting behaviours, prey and predation, behavioural susceptibility.

INTRODUCTION

Orb-Web Spiders *Araneus mitificus* (Family: Araneae) are opportunistic, polyphagous predators who kill at night by jumping on their natural prey. These keystone species are members of the family Araneidae and the class Arachnida.[1] They are the most prevalent type

that creates the wheel-shaped, circular webs that are frequently found in fields, gardens, and forests.[2,3] The word "orb" refers to a spherical shape that has earned its name as orb weaver. These spiders cannot generate sounds by rubbing their body parts together, have eight nearly identical eyes, and have hair or spines covering their legs.[4] These are primarily found in terrestrial habitats, mainly in agroecosystems such as gardens, vegetation grounds, green canopies and orchards.[5] These make webs for hunting prey after sunset in the post-rainy season.

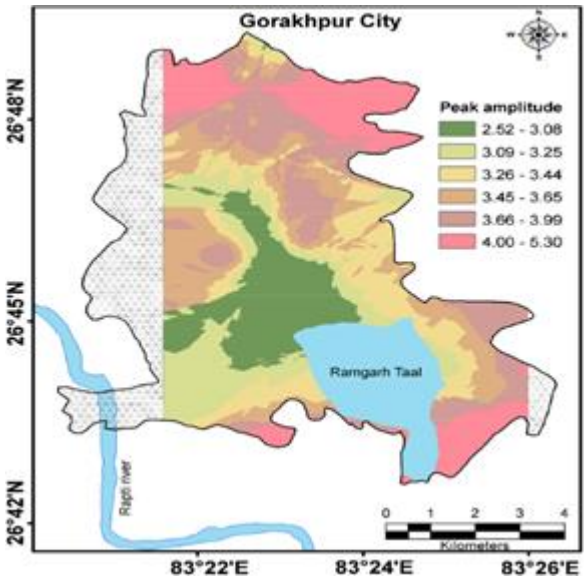
Araneus mitificus, or orb-web spiders, are common predators that act as natural biocontrol agents and are crucial in controlling insect populations in a variety of environments. Most terrestrial species are ground hunters, vegetation hunters, and web builders (WB). Moths and grasshoppers are the primary herbivorous nocturnal insects which are eaten by this spider species. *Araneus mitificus* may also consume other insect pests.[6] *Araneus mitificus* built the web and consumed nocturnal insects, which helps in their biological control of insect pests in the terrestrial ecological system.[7] Web-building spiders use vibratory cues (mechanosensation) to capture prey, but e cursorial hunting spiders rely on visual cues.[8]

Insects provide spiders with all the resources they need to survive. According to Eric Bollinger et al. (2023), there are significant differences in energy transfers between spider hunting styles and seasons.[9] Orb web spiders use their chelicerae to target nocturnal creatures, primarily moths, flies, mayflies, crickets, small grasshoppers, and butterflies. In the present investigation, web-building, modes of hunting and feeding behaviour were studied in *Araneus mitificus*, the orb web spider.

The study area

Deen Dayal Upadhyaya Gorakhpur University (DDUGU), located in Civil Lines, Gorakhpur, spans over a 190.96-acre urban campus. The layout is divided into distinct academic, administrative, and residential zones, easily navigable via the Deen Dayal Upadhyaya Gorakhpur University Location Map.[1] The study was conducted regularly from late September to December. This observation was taken regularly for three hrs a day up to 40 days. The observation time was set between 5.30 to 10.30 pm.

Pictures of the area were collected from Google Maps.



OBSERVATION

Araneus mitificus make a web of silk-like fibres after sunset in early September and late December. *Araneus mitificus,* the orb web spider, started spinning around 5.30 pm, as sunlight was disappearing. This is an evolutionary survival strategy in orb web spiders that is quite harmonious with the time of prey search. This orb web spider waits for the exact moment the sun goes down to start its nightly construction or spinning of a web. It captures nocturnal insects as they hit the tube light or flood light. It attacks very silently as soon as insects get strangled in the web. Unlike some spiders that keep the same web for weeks, many orb-weavers destroy and rebuild their webs almost every single day. They often eat their old web at dawn to recycle the silk proteins, rest during the day, and spin a brand-new, ultra-sticky web just as dusk falls. Silk degrades quickly, losing its stickiness and elasticity due to wind, dust, and daylight heat. A fresh web ensures maximum efficiency for the night's hunt. During the day, birds, wasps, and lizards are actively hunting the spiders. Hence, they remain hidden inside the green leaves during the daytime and come out in the darkness. Their pale, greenish-white abdomen helps them in camouflage, which is the safest mode of their survival and helps them remain safe from their predators. As soon as sunlight disappears, the spider ensures its trap is wide open right when insect traffic is at its peak. They wait for nocturnal insects like moths, mosquitoes, and beetles to start flying around precisely at dusk. By this time, *Araneus mitificus,* the orb web spider, completes their web, which is a routine activity. *Araneus mitificus* does not always sit right in the centre of its web like other orb-weavers. They often built a silky rope that wraps around a single signal line connected to the

main web. When any insect touches the web, vibrations run up the line and send an alert to the spider to rush out of its hiding spot and swiftly target the prey after its neutralisation by injecting the venom.

DISCUSSION

These are top-class web engineers who made a large-sized, regular and highly elastic web of silk. They start spinning around 5.30 pm or as sunlight disappears. They come out from their hidden home that is inside plants or crevices of a wooden window. They start making nets just after seeing edible food, mainly lepidopteran insects, mainly moths in flood white or yellow light. As they saw edible food, they started making an elastic rope. They hold the silk net between their front legs and actively move themselves over the prey. Their main home is an open garden with greenery, herbs, and trees. They shift themselves toward the light poles around 5 p and just start hunting the prey. For making the web, they have tied the elastic silk rope on four corners on window metal, light pole, and twig of the plant or any woody material found in the nearby area. These move in rounds and secrete silk from spinneret glands located at the tip of their abdomen. *Aranus mitificus* spiders start making a web as the sun sets near light sources for capturing prey.[9] Orb spiders web larger than 2-4 square feet wide to capture larger prey like mayflies, beetles and grasshoppers (Picture 1A).

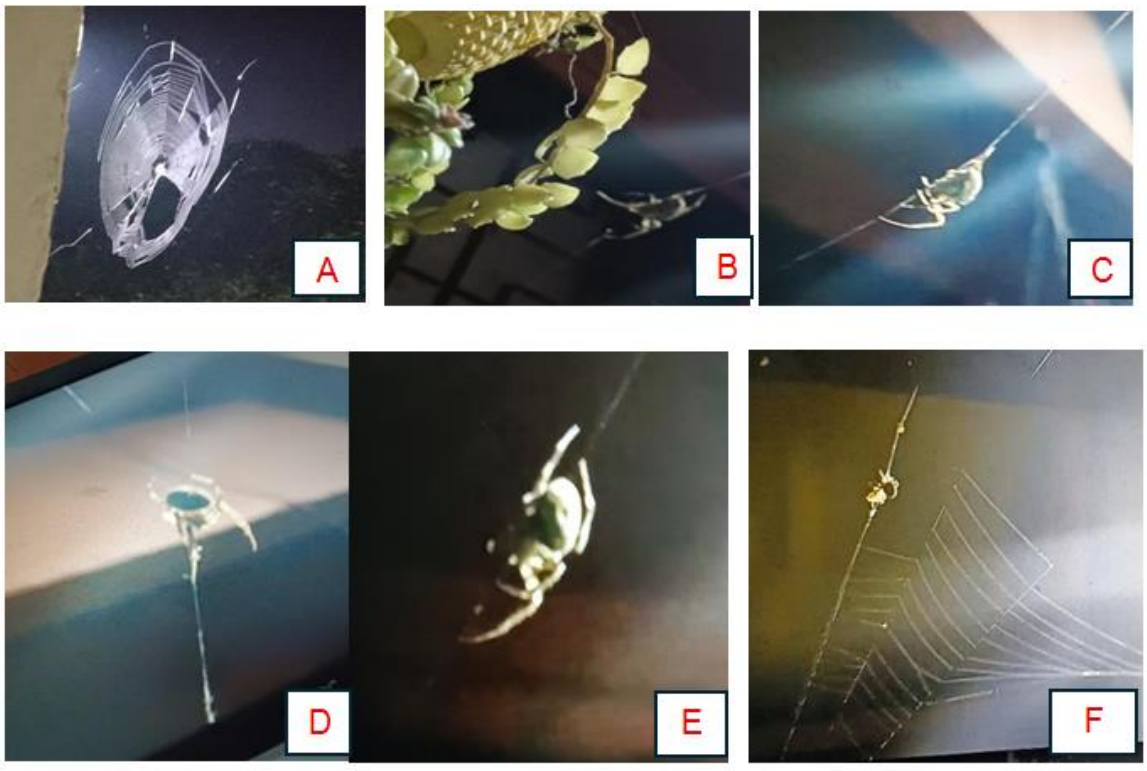
The *Araneus mitificus*, after spinning its web, then waits on or near the web for a prey insect to become trapped. The spider senses the impact and struggle of a prey insect by vibrations transmitted through a rope attached to the web. Shifting of feeding sites: Due to a sudden decrease in night temperature due to cyclonic rains, spiders have changed their web-building and hunting site. It was shifted from the light source corner window to the plant haze site, and the web built was shorter in size and side perpendicular steel threads were woven in a triangular shape and additional short punches of threads with upper most poles so that it can face windy shocks.[10] Jumping hanging threads were not observed, but upper threads were strong, and the spider can run and hunt the prey very comfortably. Most of the prey were mayflies and butterflies. *Araneus mitificus made* a web structure created by proteinaceous silk extruded from their abdominal glands, generally made to catch their prey.[11]

Araneus mitificus strengthens the web's core with roughly five circular threads once the radials are finished (Figure 1A). To facilitate easy movement around its own web during building, it forms a spiral of widely spaced, non-sticky threads, working from the interior outward. The spider then carefully replaces this spiral with a more tightly spaced one

consisting of adhesive threads, starting from the outside and working its way inward. Both the non-sticky spirals and the early radiating lines serve as guidelines. The distance from the tip of its rear legs to its spinners is precisely proportional to the gaps between each spiral. The spider uses its own body as a measuring and spacing tool in this way.[12]

Araneus mitificus make webs of silk which work as adhesive traps and help in catching the prey (Picture 1B). They easily entangle and restrain prey before biting, and to transmit tactile information. They use radial silk thread as the major structural component of the web. They prepare solid, silky rope-like threads; they use them to collect mechanosensory information from major circuits in both web-building and cursorial hunting spiders.[8] Silk fibres are made of a protein spidroin rich in glycine and alanine amino acids. Though silk fibres are elastic in nature, they provide tensile strength to spiders and make safe routes to run much faster over them to hunt the prey. *Araneus mitificus* uses radial silk thread rather than the spiral silk thread in web-making (Picture 1A-1F). *Araneus mitificus* attacks and overwhelms insects trapped in their web in a large range of sizes. They spent a maximum of 6.725±0.25, 7.311±0.32 and 8.156±0.36 minutes in niche activities, hunting and feeding, which determines their natural survival in their habitat (Figure 1).

They hunt insects in large numbers in October and November. They use stored nutrients for the winter season. *Araneus mitificus* spends more time hunting and searching for prey. They predate over different prey groups, and the trophic web's structure changes depending on the time of year.[13] Hunting spiders show a high functional redundancy in their predation, but contrary to their polyphagous nature.[7] These spiders assist in regulating insect populations and more successfully carry out biological control of insects.[14] They eat three to four insects in initial attempts and wrap up paralysed insects with silk fibres, like Saran Wrap, and eat them in scarcity of food or in the early morning if more prey were not collected.



Pictures 1A-1F show web spinning, hunting and feeding behaviour in the Orb web spider *Araneus mitificus*.

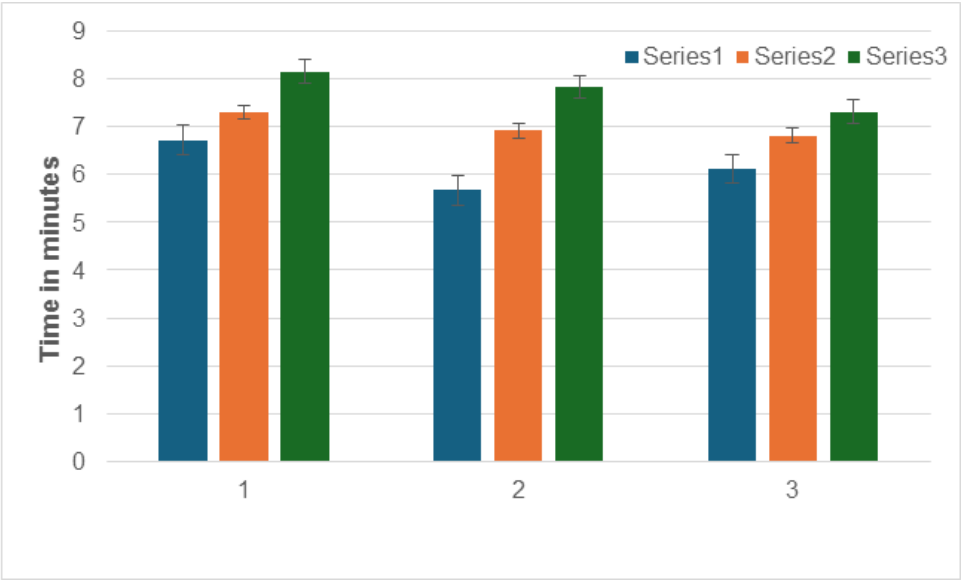


Figure 1: showing time expenditure in niche activities, hunting and feeding in Orb web spider *Araneus mitificus in* the post-rainy season from Late September to December.

CONCLUSION

Araneus mitificus hunting and prey-eating behaviours are operated by mechanotactic sensory tactile web-building fibres. Neuroendocrine regulation may be linked to this action, and

current garden spider species appear to have a much broader adaptability. Genetics may control eating patterns. Extreme efforts were taken to capture the primarily lepidopteran insects, and predator selection is completed in a matter of seconds. The highly specialised web-building of Araneus mitificus helped the spiders seek and feed. Based on facts and real-time data gathered from the study site, this was an attempt to study the ecological regulation of eating behaviours in *Araneus mitificus* spiders.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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