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HOST PLANT ASSOCIATIONS OF GELECHIOID MOTHS AND THEIR SEASONAL FLIGHT ACTIVITY IN KARNATAKA INDIA

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ABSTRACT

The host plant associations and seasonal flight activity of Gelechioid moths in Karnataka identified a total of twenty-two moth genera, with peak flight activity in autumn. Seasonal trends were influenced by regions and host plant availability, whereas several species were recognized as major agricultural pests. The findings emphasize the need for integrated pest management and biodiversity conservation strategies.

Key words: Gelechioidiea, Gelechiidae, Host plants, Seasonal incidence, Karnataka

Introduction

Gelechioid moths of superfamily Gelechioidea (Lepidoptera) plays important ecological roles, such as pollinators, decomposers and agricultural pests. Some species cause significant damage to crops such as cotton, tomato, and potato (Hodges, 1998; Powell, 2003), while others contribute positively to ecosystems by aiding in nutrient recycling (Kaila, 2011). Their population dynamics and seasonal flight activity are influenced by environmental factors and host plant availability (Wagner *et al.*, 2011). Understanding these factors is essential for developing sustainable pest management strategies and promoting biodiversity conservation.

Several studies have emphasized the importance of monitoring moth populations to evaluate their impact on agriculture and ecological stability (Regier *et al.*, 2015; Mutanen *et al.*, 2016). In India, particularly in Karnataka, data on the seasonal occurrence of gelechioid moths and their host plant associations remain limited. This study aims to document the seasonal flight patterns of gelechioid moth species in Karnataka, establish their host plant associations, and provide insights into their ecological roles and agricultural impact.

Materials and Methods

Survey was undertaken in different localities of Karnataka covering Northern Karnataka *i.e.*, Bagalkot, Raichur, Arabhavi and Sirsi and Southern Karnataka *i.e.*, Bengaluru, Mudigere, Kolar and Hassan in 2022-24. During the survey, the larvae feeding on different plants were collected along with their host plants and reared in laboratory at Department of Entomology, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot until adult emergence. Identification of moth species at genus level was done based on available literature, online websites, taxonomic keys and species level through experts. Meanwhile, host plant details were documented through field observations and literature reviews, considering larval feeding habits.

Results and Discussion

Moths in the superfamily Gelechioidea, particularly Gelechiidae, show strong associations with a variety of plant species. These moths are often specialist herbivores, meaning they prefer specific plants for feeding and oviposition. The study presents lists of twenty-two gelechioid moth genera which are identified along with

Table 1: Host plant details and their related gelechioid species from Karnataka, India.

Sl. No	Host Plants	Gelechiid species	Other Gelechioidea spp.
1.	*Abrus precatorius* - Gulaganji	*Empalactis* sp. they prefer specific plants for feeding and oviposition. The study presents lists of *ctis* sp.	
2.	*Abutilon indicum*		*Anatrachyntis japonica*
3.	*Aegle marmelos* - Bael		*Psorosticha zizyphi*
4.	*Anacardium occidentale* - Cashew	*Polyhymno* sp., *Hypatima haligramma*	
5.	*Arachis hypogaea* - Groundnut	*Aproaerema modicella*	
6.	Avenue plant	*Hypatima scopulosa*	
7.	*Azadirachta indica* - Neem	*Hypatima* sp.2	*Odites* sp.
8.	Blueherb	*Dichomeris* sp., *Dichomeris acuminatus*, *Helcystogramma* sp.1	
9.	*Citrus chinensis* - Citrus		*Psorosticha zizyphi*
10.	*Cocos nucifera* - Coconut		*Batrachedra arenosella*
11.	*Crotalaria juncea* - Sunhemp	*Stomopteryx sphenodoxa, Dichomeris acuminatus*	
12.	*Dalbergia sissoo* - Dalbergia	*Anarsia altercata*	
13.	*Gossypium hirsutum* - Cotton	*Pectinophora gossypiella*	
14.	*Hibiscus rosa-sinensis* - Hibiscus	*Pectinophora* sp.	
15.	*Jasminum* sp. - Jasmine	*Empalactis* sp.	
16.	*Limonia acidissima* - Woodapple		*Psorosticha zizyphi*
17.	*Mangifera indica* - Mango	*Hypatima spathota, Anarsia* sp. 1, *Hypatima mangiferae*	*Stathmopoda auriferella, Anatrachyntis* sp.1, *Stathmopoda diplaspis*
18.	*Manilkara zapota* - Sapota	*Eustalodes achrasella, Helcystogramma* sp.2	
19.	Mealybug		*Anatrachyntis* sp.2
20.	Medicinal banded plant	*Helcystogramma* sp.1	
21.	Medicinal plant	*Hypatima scopulosa*	
22.	*Murraya koenigii* - Curryleaf		*Psorosticha* sp.
23.	*Oryza sativa* - Paddy	*Sitotroga cerealella*	
24.	*Pongamia pinnata* - Pongamia		*Anatrachyntis simplex*
25.	*Sapindus mukorossi* - Soapnut	*Hypatima scopulosa*	
26.	*Solanum lycopersicum* - Tomato	*Phthorimaea absoluta*	
27.	*Solanum melonagena* - Brinjal	*Scrobipalpa* sp.	*Stathmopoda auriferella*
28.	*Solanum tuberosum* - Potato	*Phthorimaea operculella*	
29.	Sweet orange		*Psorosticha zizyphi*
30.	*Syzygium cumini* - Jamun	*Hypatima* sp.1, *Idiophantis discura*	*Microcolona* sp.
31.	*Tamarindus indica* - Tamarind	*Hypatima ephippiastis, Anarsia* sp. 2	*Stathmopoda auriferella*
32.	*Terminalia cattappa*	*Hypatima* sp.3	
33.	*Vitex negundo, Vitex trifoli*		*Hodgesiella callistrepta*
34.	*Ziziphus mauritiana* - Ber		*Zizyphia* sp.

their respective host plants. The most frequently occurring genera include: *Hypatima* and *Anatrachyntis* (5 host plants) followed by *Psorosticha* (4 host plants), *Helcystogramma*, *Stathmopoda* (3 host plants) and *Anarsia* (3 host plants); *Pectinophora* and *Dichomeris* (2 host plants). These genera are associated with economically significant crops, medicinal plants, and fruit-bearing trees as given in Table 1.

The flight activity of Gelechioidea moth species in Karnataka showed distinct patterns influenced by environmental factors such as temperature, humidity and food availability. In winter (December to February), the incidence was low, with two species in December, one in January and a slight increase to five in February, likely due to cooler temperatures reducing moth activity and metabolism, diapause and limited food resources. Spring (March to May) presented varied trends, with two species in March, zero in April and a spike to six in May, possibly due to fluctuating temperatures delaying emergence and a delayed onset of spring conditions. During summer (June to August), there was a gradual increase from zero species in June to four in August, influenced by the monsoon season, which initially suppressed activity but later supported more species with increased vegetation. Autumn (September to November) was found to be the highest incidence season, with eleven species in September, peaking at fifteen in October and decreasing to five in November, attributed to optimal conditions, breeding cycles and preparations for overwintering (Fig. 1).

The seasonal dynamics and host plant interactions of Gelechiidae moths are critical factors influencing their population ecology, pest status, and management strategies. Seasonal occurrence is primarily regulated by environmental factors such as temperature, humidity, rainfall, and host plant availability, leading to distinct activity patterns across different species. Many gelechiid moths synchronize their life cycles with the phenology of their host plants, optimizing their survival and reproduction. For instance, *Pectinophora gossypiella*, a major pest of cotton, reaches peak infestation during the mid-to-late cotton growth stages (Murthy *et al.*, 2018). Similarly, *Tuta absoluta*, which primarily affects tomato, exhibits higher population densities during warm, dry seasons (Sridhar *et al.*, 2014). *Dichomeris acuminatus*, a soybean pest, shows increased post-monsoon activity, indicating a climatic influence on its life cycle (Meena *et al.*, 2018).

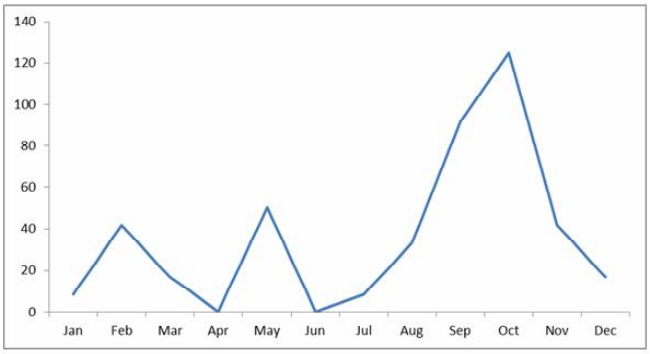

Fig. 1: Flight activity of Gelechioid moths recorded based on emergence patterns in laboratory

Host plant interactions further shape Gelechiidae population dynamics, influencing their adaptation and specialization. Some species exhibit strict host specificity, such as *Pexicopia tungabhadrai*, which exclusively feeds on *Abutilon indicum* in Karnataka, India (Varnitha *et al.*, 2023). Others, like *Hypatima mangiferae*, target commercially valuable crops such as mango (*Mangifera indica*), leading to significant agricultural damage (Sattler, 1989). In contrast, some moths display alternative host plant utilization; for example, *Pectinophora gossypiella* can develop on *Abutilon indicum*, *Hibiscus*, and cotton (Ballard, 1921). The invasive *Tuta absoluta*, known for infesting tomatoes, has also adapted to other solanaceous crops like potatoes (Sridhar *et al.*, 2014).

Regional studies provide further insights into the diversity and seasonal patterns of Gelechiidae moths. Surveys in the Western Ghats and Siwalik Hills have revealed seasonal variations in moth populations corresponding to host plant availability (Mathew, 2010; Pathania *et al.*, 2006). In temperate regions like Europe and Russia, species such as *Exoteleia dodecella* complete multiple generations annually, peaking in summer and early autumn (Adamski *et al.*, 2010). Recent taxonomic discoveries, including *Spiniductellus atraphaxi* associated with *Atraphaxis pyrifolia* (Bidzilya and Karsholt, 2008) and *Falcipenna irinae* with unknown hosts (Bidzilya and Aarvik, 2023), emphasize the need for continued research in understanding gelechiid biodiversity and host plant associations.

The impacts of climate change further complicate gelechiid moth dynamics, potentially extending breeding periods, shifting geographic distributions, and altering pest pressures (Ponomarenko, 2014). Integrating seasonal incidence data with host plant interactions can aid in developing predictive models for pest outbreaks and improving targeted management strategies. Future research should focus on ecological interactions, genetic adaptations, and sustainable pest control approaches to mitigate the agricultural damage caused by Gelechiidae moths.

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