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Occurrence of insect-pests on mulberry in selected villages of Bangalore district of Karnataka

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Abstract
The result shows that, different pests are damaging the mulberry crop from the study area which causes heavy economical loss to sericulture farmers. Amongst the insect fauna; 2 Hemipterans, 1 Thysanopteran, 1 Homopteran and 4 Lepidopteran species were recorded. The occurrence of insect-pest from various sites shows that, the incidence of two Hemipterans namely viz., Jassid and pink mealybug, one Thysanopteran i.e., thrips, one Homopteran is whitefly and four Lepidopterans namely viz., leaf eating caterpillar, leaf roller, wasp moth and Bihar hairy caterpillar.

Keywords: Mulberry, insect-pests, and Lepidopteran

1. Introduction
Silk is the only natural protein fiber commercially exploited in the world and is the primary end product of "Sericulture". Indian sericulture is a unique ancient cottage industry at the global sphere as it produces four kinds of silks namely; mulberry, Eri, Muga and tasar. Sericulture is an important means of livelihood and socio-economic development of the farming community in general and Karnataka in particular. India ranks second amongst silk producing countries which shares about 12.00 per cent of the global raw silk production, besides the silk industry continues to play an important role in Indian economy as a constant source of foreign exchange earnings (Rs. 3000 Crores per annum) [1]. The productivity and profitability of silkworm rearing depends on quality and yield of mulberry leaves.
Mulberry leaves serve as the sole food for silkworm, *Bombyx mori* L. It's production on the scientific lines is essential for practicing sericulture on the sound economic lines. From the economic point of view, moriculture coupled with silkworm rearing remains as a highly labour intensive activity providing vast scope for employment. Due to its evergreen, perennial, luxuriant foliage, mulberry provides food and shelter to a variety of insects and non-insect pests. A large number of insect pests have been reported on mulberry from different countries. List of 87 insects and 6 non-insect pests on mulberry in Farmosa [2], whereas 118 insects were reported on the mulberry in Korea [3]. In China and Japan, more than 126 and 200 insect species cause damage to mulberry, respectively [4, 5]. In India, more than 70 insects and non-insect's species belonging to Lepidoptera, Hemiptera, Coleoptera, Thysanoptera, Orthoptera, Isoptera and Tetranychidae are known to feed on mulberry [6].
In Karnataka, the production by the state that stood at 7338 MT out of 16360 MT by the country during 2010-11 increased to 11592 MT of 25213 MT during 2018-19. Poor yield of mulberry has been reported due to attack by several pests. Leaf roller, Bihar hairy caterpillar, wingless grasshopper, mealy bug, thrips, weevils, root grubs, etc., occur in serious proportions causing loss of leaf which in turn affects the production of silk. Hence, a present survey was conducted in mulberry garden to study the distribution and occurrence of the insect fauna associated with mulberry fields from Bangalore district of Karnataka.

2. Materials and methods
The present study was carried out during June 2019toApril 2020, Bangalore to know the insect fauna associated with mulberry crop. Bangalore, a capital of India's southern Karnataka state situated at 12.97° North latitude, 77.56° East longitude and at an altitude of 900 m above mean sea level. The place lying in Eastern dry zone (zone-5) receives an annual rainfall of 974 mm distributed all over the year.

The temperature and relative humidity ranges from 15 to 35°C and 35 to 70 per cent, respectively.

In Bangalore district, some of the mulberry fields were selected for the collection of insect pests. The selected fields were from Anekal taluk of Bangalore district and are Handenahalli, Halashalli, Kommasandra and Kalanayakanahalli. Insects were collected by visiting each mulberry garden from June to April with more or less monthly periodicity. The representative samples of each of the pest observed during the course of the study was collected and identified to the level of species, when possible; using published systematic keys and with the help of available literature.

3. Results and discussions

The present investigation shows that there was occurrence of insect pests from mulberry garden surveyed from various villages in Bangalore district, Karnataka. Amongst the insect fauna; 2 Hemipterans, 1 Thysanopteran, 1 Homopteran and 4 Lepidopteran species were recorded. The occurrence of insect-pest from various sites shows that, the incidence of two Hemipterans namely viz., jassid and pink mealybug, one Thysanopteran i.e., thrips, one Homopteran is whitefly and four Lepidopterans namely viz., leaf eating caterpillar, leaf roller, wasp moth and Bihar hairy caterpillar.

The occurrence of thrips, whitefly, jassid, leaf roller and Bihar hairy caterpillar was noticed in all the villages of Anekal taluk. While the presence of pink mealybug was observed in all villages except in Kalanayakanahalli. The wasp moth was noticed only in Handenahalli village. Leaf eating caterpillar presence was not noticed in Kommasandra village. A detail of occurrence in various collection sites from Bangalore district are shown in Table 1.

Table 1: Incidence of mulberry insect-pests in various villages of Bangalore

S. No.	Mulberry insect-pests	Villages			
		Handenahalli	Halashalli	Kommasandra	Kalanayakanahalli
1	Thrips	+	+	+	+
2	Whitefly	+	+	+	+
3	Pink mealybug	+	+	+	-
4	Jassid	+	+	+	+
5	Leaf roller	+	+	+	+
6	Bihar hairy caterpillar	+	+	+	+
7	Wasp moth	+	-	-	-
8	Leaf eating caterpillar	+	+	-	+

+: Present - : Absent

The insect-pests based on their orders namely; Hemiptera, Thysanoptera, Homoptera and Lepidoptera having total 8 insect species was found around mulberry garden of Anekal taluk of Bangalore district. The classification, locality and habitat, occurrence and type of damage symptoms caused by these insect-pests were described below as follows:

Order: Hemiptera

1. Pink mealybug, *Maconellicoccus hirsutus* Green

- **Classification**: [Common name: Pink mealybug; Phylum: Arthropoda; Class: Insecta; Order: Hemiptera; Family: Pseudococcidae; Genus: *Maconellicoccus*; Species: *hirsutus*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district except Kalanayakanahalli.
- **Occurrence:** The pest is found to occur from June to August and severe infestation was noticed in the month of March.
- **Type of damage symptoms:** The nymphs feed by sucking the sap from tender leaves and stem portion. Hence the affected apical shoots show bunchy appearance due to curling of leaves, shortening of internodes and thickening of stem. This symptom is popularly known as 'Tukra' in India. In advance stages of infestation black sooty mould is developed in the affected area due to growth of fungus on the honeydew secreted by the mealybug.

2. Jassid, *Empoasca flavescens* F.

- **Classification:** [Common name: Leaf hopper/jassids; Phylum: Arthropoda; Class: Insecta; Order: Hemiptera; Family: Cicaadellidae; Genus: *Empoasca*; Species: *flavescens*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district.
- **Occurrence:** Occurrence was noticed during November to January
- **Type of damage symptoms:** Both nymphs and adults damage the plant by sucking the sap of young leaves and tender shoots. The early symptoms are; the appearance of yellow or brown patches at the margin of the leaves followed by distortion of leaf veins. Finally, leaves curl upward becoming cup shaped, margins turn brown, dry and wither off prematurely. This characteristic symptom is known as "Hopper burn".

Order: Thysanoptera

1. Thrips, *Pseudodendrothrips mori* Newa

- **Classification:** [Common name: Thrips; Phylum: Arthropoda; Class: Insecta; Order: Thysanoptera; Family: Thripidae; Genus: *Pseudodendrothrips*; Species: *mori*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district.
- **Occurrence:** Occurrence was noticed during February to April
- **Type of damage symptoms:** Affected leaves showed white streaks or blotches which become yellowish brown on maturity.

Order: Homoptera

1. Whitefly, *Dialeuroporadecempuncta* (Quaintance & Baker)

- **Classification:** [Common name: Whitefly; Phylum:

Arthropoda; Class: Insecta; Order: Homoptera; Family: Aleyrodidae; Genus: *Dial europora*; Species: *decempuncta*].

- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district.
- **Occurrence:** Occurrence was noticed during October to December and in March.
- **Type of damage symptoms:** The adult and nymphal stages of whitefly infest lower surface of mulberry leaves, suck the sap, cause speckling, upward curling, yellowing of leaves, premature fall and retardation of growth.

Order: Lepidoptera

1. Leaf roller, Diaphania pulverulentalis Hampson

- **Classification:** [Common name: Leaf Webber/roller; Phylum: Arthropoda; Class: Insecta; Order: Lepidoptera; Family: Pyralidae; Genus: *Diphania*; Species: *pulverulentalis*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district.
- **Occurrence:** Occurrence was noticed during June to December.
- **Type of damage symptoms:** The target area of the leaf roller is apical portion of the mulberry leaves, the young caterpillar binds the leaflet together by silky secretion and settle inside and devour the soft green tissues of the leaf surface. Grown up caterpillars feed on the tender portion and their faecal matter can be seen on the leaves below the affected portions.

2. Bihar hairy caterpillar, *Spilosoma obliqua* Walker

- **Classification:** [Common name: Bihar hairy caterpillar; Phylum: Arthropoda; Class: Insecta; Order: Lepidoptera; Family: Arctidae; Genus: *Spilosoma*; Species: *obliqua*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district.
- **Occurrence:** Occurrence was noticed with onset of monsoon and attained peak in July and August months.
- **Type of damage symptoms:** Dried or mesh like appearance of the leaves. The grown-up larvae feed on the entire leaf rendering the branches without leaves.

3. Wasp moth, *Amata passalis* Fab.

- **Classification:** [Common name: wasp moth; Phylum: Arthropoda; Class: Insecta; Order: Lepidoptera; Family: Arctidae; Genus: *Amata*; Species: *passalis*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from the mulberry fields surveyed in Handenahalli village.
- **Occurrence:** Occurrence was noticed in the month of August.
- **Type of damage symptoms:** They feed by scraping the chlorophyll layer of the leaf.

4. Leaf eating caterpillar, *Spodoptera litura* Fab.

- **Classification:** [Common name: Cutworm/ leaf eating caterpillar; Phylum: Arthropoda; Class: Insecta; Order: Lepidoptera; Family: Noctuidae; Genus: *Spodoptera*; Species: *litura*].
- **Locality and Habitat:** From the mulberry plant, *Morus Alba* L., from all mulberry fields surveyed in Anekal taluk of Bangalore district except in Kommasandra.
- **Occurrence:** Occurrence was noticed during August to September.
- **Type of damage symptoms:** They feed on mulberry leaves voraciously. In heavily infested mulberry gardens, the plants are seen without branches and sometimes with dried leaves.

The present findings are in close agreement with the study on the seasonal incidence of frequently occurring leaf eating pests of mulberry viz., leaf roller, Bihar hairy caterpillar and wingless grasshopper was undertaken in Tumkur district (Karnataka) for two consecutive years which shows severe to moderate infestation was record77ed in rainy and winter season, while mild infestation was recorded in summer due to these pests [7]. The distribution of Bihar hairy caterpillar in oriental region as sporadic pest was noticed in several agricultural crops [8, 9]. A study in CSR&TI, Mysore recorded mulberry defoliator occurrence consisting 13 species of Lepidoptera, 3 Coleopteran and 2 Orthopteran species [10]. Recently the lepidopteran leaf roller, *D. pulverulentalis* has attained a serious pest status in the south of India during rainy and winter months with high percentage of infestation [9, 11-13]. The higher activity of leaf roller on mulberry were also noted in the present findings.

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