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Biodiversity of insect pest complex of Muskdana, *Abelmoschus moschatus* (L.) in Northern tracts of West Bengal

Swapna Rani K.[1*], Suprakash Pal[2], Shivakumara K.T.[3], Dosa Rajeshwari[1] and Dhanapati Gokul Krishna[1]
[1]M.Sc. Ag., Department of Agricultural Entomology,
Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar (West Bengal), India.
[2]Professor, Directorate of Research (RRS-TZ),
Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar (West Bengal), India.
[3]Scientist, Division of Genomic Resources,
ICAR-National Bureau of Agricultural Insect Resources, Bengaluru (Karnataka), India.

(Corresponding author: Swapna Rani K.)*
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Abstract: Muskdana, *Abelmoschus moschatus* (L.) is a medicinal cum minor vegetable crop in India. The knowledge of insect pests infesting the crop is especially important for its sustainable management. But the information on the pest complex of this crop is very scanty, particularly from the Northern part of West Bengal. Therefore, field experiments were explored to document the biodiversity of insect pest complexes of muskdana in Pundibari, West Bengal for two seasons in the year 2021 and 2022 respectively to document the pest situations throughout the crop growth period. The present study reports nearly twelve species of insect pests that occurred on muskdana. The leaf beetle *Monolepta* sp. occurred during the seedling stage to the early vegetative stage. The foliage feeders like leaf folder, *Helcystogramma hibisci,* and leaf roller, *Sylepta derogata* caused noticeable damage to the foliage by occurring in large populations from the early vegetative to maturity stage of the crop, while cotton semi looper, *Anomis flava* was observed sporadically with a moderate population. The activity of leaf blotch miner, *Trachys* sp. was observed from the mid- vegetative stage to the maturity stage. Red cotton bug, *Dysdercus cingulatus,* and mealy bug, *Phenococcus solenopsis* were recorded as minor pests occurring from flowering to pod maturity stage. Aphid *Aphis gossypii,* hopper *Amrasca biguttula,* and one mite species *Tetranychus urticae* were observed as minor pests but occurred persistently throughout the cropping period. Besides, pests like cutworms, *Spodoptera litura,* and transverse moth, *Xanthodes transversa* were found for a short period during the rainy season in a low population causing negligible damage to the crop. The present comprehensive pest information would help in formulating the management practices effectively.

Keywords: Muskdana, *Abelmoschus moschatus*, pest complex, *Kharif* seasons, percent incidence.

INTRODUCTION

Muskdana, *Abelmoschus moschatus* (L.) a member of the family Malvaceae, locally called as 'Bonobendi', is an edible plant. It is a tropical weedy, erect shrub that reaches a height of 1.5m and is indigenous to India, commonly found in the forests of the sub-Himalayan region and Deccan plateau. Different parts of this plant are used for different purposes. Tender shoots and pods are used as minor vegetables by the local people. Root and leaf decoction is used as a remedy for curing gonorrhea, rheumatism, snake bite, Kapha, and Vata. Leaves and root mucilage are used in venereal disease (Agharkar, 1985; Warghat *et al.*, 2011). Seeds are used as flavoring liquors or coffee. The seed oil has a strong, peculiar, and long-lasting odor; reminiscent of musk used in high-grade perfumery. Seeds oil is also applied externally to treat cramps, poor circulation, and aching joints. The tincture of seed is used in nervous disability, hysteria, and nervous disorders (Datta *et al*., 2011). Estimated annual trade is tuned to 100-200 MT (NMBP, 2015) out of which nearly 1000 kg of musk mallow seed goes for oil production annually (Kumar and Jnanesha 2017). However, the plant is regarded as a weed outside its natural habitats and has been introduced across tropical, sub-tropical, and temperate regions of the world. It is listed as invasive in many areas across the Asia-Pacific region, where it is threatening the growth and survival of native flora and fauna. It is also listed as widespread and potentially invasive on many Caribbean islands and has been introduced to South American countries as well. Owing

to the medicinal and aromatic values of the crop in its natural habitats and also potential threats as invasive species in non-native habitats, it is very much essential to know about the pest complex, and their succession of occurrence on this crop playing an important role in planning the pest management programme. Earlier, *Empoasca biguttula, Pectinophora gossypiella, Earias vitella, E. insulana, Anomis flava* have been reported on this medicinal plant from different parts of India (Misra *et al.*, 1995; Datta *et al.*, 2011). As far as this state is concerned, leaf roller *Sylepta derogate*, cotton semilooper *Anomis flava*, flea beetle *Podagrica* sp., grey weevil *Myllocerus discolor*, blister beetle *Mylabris pastulata*, aphid *Aphis gossypii*, mealy bug *Phenococcus solenopsis*, red cotton bug *Dysdercus koenigii*, whitefly *Bemisia tabaci*, jassid *Amrasca sp.* and a mite pest *Tetranychus urticae* have been recorded causing significant damage to the crop in the Southern part of West Bengal (Pandit and Das 2012; Hansda *et al*., 2018). However, there has been no systematic study on the pest complex of maskdana from the Northern sub-Himalayan region of the state. Therefore, the present investigation on the biodiversity of insect pests was carried out to address this issue and bridge the existing research gap.

MATERIALS AND METHODS

The field experiment to study the insect pest complex of the medicinal and aromatic crop, muskdana was conducted at the medicinal plant's field at UBKV, Pundibari, Cooch Behar, West Bengal during two successive *Kharif* seasons in the year 2021 and 2022 respectively. Seeds of muskdana were collected from locally available plants and grown as a *Kharif* crop ina medicinal plant garden, UBKV, Pundibari. The seeds were sown in rows provided with 90 cm plant-to-plant spacing in 6 plots with each plot having a 4 × 5 m size. All the recommended agronomic practices like manuring, irrigation, and weeding were followed for growing the crop while spraying any pesticides was strictly avoided throughout the crop season.

The field was monitored regularly either daily or at weekly intervals for the observation of insect pests on the crop. To calculate the percent plant incidence and pest status, five plants were randomly selected from each plot and observed for the occurrence of different pests which was carried out at weekly intervals simultaneously. The approximate number of pests per plant was counted to estimate their relative abundance. The immature stages of the pests were collected and brought to the laboratory for rearing. The collected adult insects were killed in a killing bottle, mounted either on insect pins or paper points depending on their size and labeled properly. The specimens were identified in the entomology laboratory, Regional Research Station (TZ), Directorate of Research, UBKV, Pundibari following available literature. The unidentified pest specimens were sent to ICAR-NBAIR for authorized identification.

RESULTS AND DISCUSSION

Twelve pests were recorded during the cropping season of muskdana of which five belonged to Lepidoptera, four to Hemiptera and two to Coleoptera, and one to the order Acarina (Table 1). It was observed that the insect-pest species infested different parts *viz.*, leaf, shoot, flower and pod. Major pests which caused significant damage were foliar feeders *viz.*, *Helcystogramma hibisci, Sylepta derogata, and Trachys* sp.

Table 1: Pest complex recorded on muskdana during pre- kharif season of 2021 and 2022.

Order	Family	Common name	Damaging stage of crop	Scientific name	Relative abundance	Pest status*
Lepidoptera						
	Gelechiidae	Leaf folder	Early to late vegetative stage	*Helcystogramma hibisci*	++	Moderate, regular, oligophagous
	Crambidae	Leaf roller	Mid vegetative stage to maturity stage	*Sylepta derogata*	+++	Major, regular, polyphagus
	Erebidae	Cotton semi looper	Vegetative stage	*Anomis flava*	++	Moderate, seasonal, polyphagus
	Noctuidae	Cutworm	Late vegetative stage	*Spodoptera litura*	+	Minor, occasional, polyphagous
	Nolidae	Transverse moth	Vegetative stage	*Xanthodes transversa*	+	Minor, occasional, polyphagous
Hemiptera						
	Pyrrhocoridae	Red cotton bug	Flowering to pod maturity stage	*Dysdercus cingulatus*	+++	Minor, seasonal, polyphagous
	Pseudococcidae	mealybug	Flowering to pod maturity stage	*Phenococcus solenopsis*	+++	Minor, seasonal, polyphagous
	Aphididae	Aphid	Persistent	*Aphis gossypii*	++++	Minor, seasonal, polyphagous
	Cicadellidae	Leaf hopper	Persistent	*Amrasca biguttula*	++++	Minor, regular, polyphagous
Coleoptera						
	Chrysomelidae	Leaf beetle	Seedling to mid-vegetative stage	*Monoleptas*p.	++++	Minor, regular, polyphagous
	Buprestidae	Leaf miner	Mid-vegetative to the late vegetative stage	*Trachys*sp.	+++	Major, sporadic, monophagous
Acarina	Tetranychidae	Two-spotted red spider mite	Persistent	*Tetranychus urticae*	++++	Minor, regular, polyphagous

*Minor: Upto 10% plant infestation; Moderate: 11-30% plant infestation, Major: more than 30% plant infestation

Leaf folder, *Helcystogramma hibisci* (Stainton) (Gelechiidae: Lepidoptera) (Fig. 1 A). Early instar larvae attacked the tender leaves folding them and feeding the leaf contents by scraping. During the peak period of infestation as many as three larvae can be seen on a single leaf. Later stage instars moved into mature leaves folding them and fed within by biting and chewing while the matured larva went pupation within the leaf fold. The incidence of this pest was observed from the early vegetative stage to the maturity stage.

Leaf roller *Sylepta derogata* Fabricius (Crambidae: Lepidoptera) (Fig. 1 B). Larva folded the leaf into trumpets, feeding within the rolled leaf while a plug of excreta can be seen inside the leaf roll. Peak infestation was noticed during the mid-vegetative stage of the crop.

Cotton semilooper *Anomis flava* Fabricius (Erebidae: Lepidoptera) (Fig. 1 C). Larva voraciously fed on leaf lamina leaving only mid ribs intact. The entire plant was found defoliated at times of severe infestation. The population of this pest was observed more during the vegetative stage of the crop which coincides with rain.

Cutworm *Spodoptera litura* (Noctuidae: Lepidoptera) (Fig. 1 D). This pest occurred on the crop in low population for a brief period during the late vegetative stage to pod forming stage and caused defoliation of young leaves and rarely bored into tender pods.

Semi looper *Xanthodes transversa* Guenee (Nolidae; Lepidoptera) (Fig. 1 E). The pest has been observed for a short period with a low population causing defoliation of leaves.

Red cotton bug *Dysdercus cingulatus* (F.) (Pyrrhocoridae: Hemiptera) (Fig. 1 F). The occurrence was found from the flowering to pod maturity stage. Nymphs and adults were found to suck sap from tender pods causing them open prematurely.

Mealybug *Phenococcus solenopsis* (Fig. 1 G). Cottony masses of mealybugs were found on the undersurfaces of leaves, on petioles, flowers, and tender pods causing crinkling of leaves and premature flower drops. The occurrence of mealybug started from flowering to the pod maturity stage.

Aphid, *Aphis gossypii* Glover (Aphididae: Hemiptera) (Fig. 1 H) and *Amrasca biguttula* (Cicadellidae: Hemiptera) (Fig. 1 I). These two pests occurred in moderate to low populations and were observed to cause minor damage by sucking sap from tender shoots and leaves.

Leaf beetle *Monolepta* sp. (Chrysomelidae: Coleoptera) (Fig. 1 J). It was found damaging crops from as early as the seedling stage and continued to occur throughout the cropping season till harvesting. The adult beetles attacked tender leaves causing several shot holes on leaves in the early stage of the crop and during later stages they were also found to damage the tender pods.

Blotch miner *Trachys* sp. (Buprestidae: Coleoptera) (Fig. 1 K). The grubs are damaged by feeding the chlorophyll content between two epidermal layers causing mines on leaves. Adults are damaged by biting and chewing the leaves. As high as leaf miner larvae per leaf were observed during the peak infestation period.

Two-spotted red spider mite *Tetranychus urticae* Koch (Tetranychidae) (Fig. 1 L). The population was observed more on under the surface of older leaves forming small webs and causing discoloration of leaf lamina and was regarded as minor pests. The red spider mite infestation attained the peak level during the mid-vegetative stage and continued till the maturity stage. The pest calendar showing the sequence of pest occurrence on the crop during 2021 and 2022 has been represented in (Fig. 2).

DISCUSSION

Misra *et al.* (1995) investigated the integrated pest management in *Abelmoschus moschatus*, an aromatic cum medicinal plant and they have documented that *Earias vitella* as the dominant pest of muskdana in Lucknow. The lepidopteran pests like *Earias insulana*, *Pectinophora gossypiella*, *Anomis flava* were observed as dominant pests on muskdana (Datta *et al.*, 2011). The insects like pink bollworm, *Pectinophora gossypiella* were found to cause significant damage to pods and seeds. Whereas, caterpillars of *Anomis flava* defoliated *Abelmoschus moschatus* during the rainy seasons. During the present study also the lepidopteran foliage feeders have been recorded as occurring regularly and causing the most significant damage to the crop which draws support from the earlier works. The leaf roller, *Sylepta derogata* has been recorded as a major pest of muskdana in this Terai region which was also observed as very widely distributed all over India. But, unlike earlier reports another leaf feeding pest, *Helcyctogramma hibisci* has been recorded regularly as a moderate pest during the present study. Earlier, *H. hibisci* has been recorded on okra damaging the leaves by rolling them and feeding from within in Pusa (Nair, 1986). The coleopteran leaf blotch miner, *Trachys* sp. was found to cause significant damage to muskdana leaves from vegetative stage to the maturity stage. Earlier, okra has been reported to be infested severely by *Trachys virescens* in Madhya Pradesh and Gujarat (Nair, 1986). During the present study the sucking insects including the leaf hopper were recorded as only seasonal pests having minor significance which corroborates with the past experimental results of Kumar and Jnanesha (2017) studying improved cultivation practices on ambrette, *Abelmoschus moschatus* and observing that the plant was highly resistant to the cotton jassid, *Empoasca biguttula*. A survey on the pest complex of muskdana has been conducted in the Southern region of West Bengal,

where leaf roller *Sylepta derogata*, cotton semilooper *Anomis flava*, flea beetle *Podagrica* sp., grey weevil *Myllocerus discolor*, Blister beetle *Mylabris pustulata*, Cotton aphid *Aphis gossypii* Mealybug *Phenococcus solenopsis*, Red cotton bug *Dysdercus koenigii*, whitefly *Bemisia tabaci*, jassid *Amrasca* sp. and a mite pest *Tetranychus urticae* were found causing significant damage to the crop (Pandit and Das 2012; Hansda *et al*., 2018). The variations in the pest complex of the crop in different regions of the country are attributable to varying agroclimatic conditions and crop cultivation practices. The present findings on the biodiversity of pests of muskdana will be helpful for formulating sustainable pest management practices under this sub-Himalayan Terai zone in the Northern tract of West Bengal.

Fig. 1. Pest complex of muskdana A) *Helcystogramma hibisci* B) *Sylepta derogata* C) *Anomis flava* D) *Spodoptera litura* E) *Xanthodes transversa* F) *Dysdercus cingulatus* G)*Phenacoccus solenopsis*H) *Aphis gossypii*I) *Amrasca biguttula*J) *Monolepta* sp. K) *Trachys* sp. L) *T. urticae*

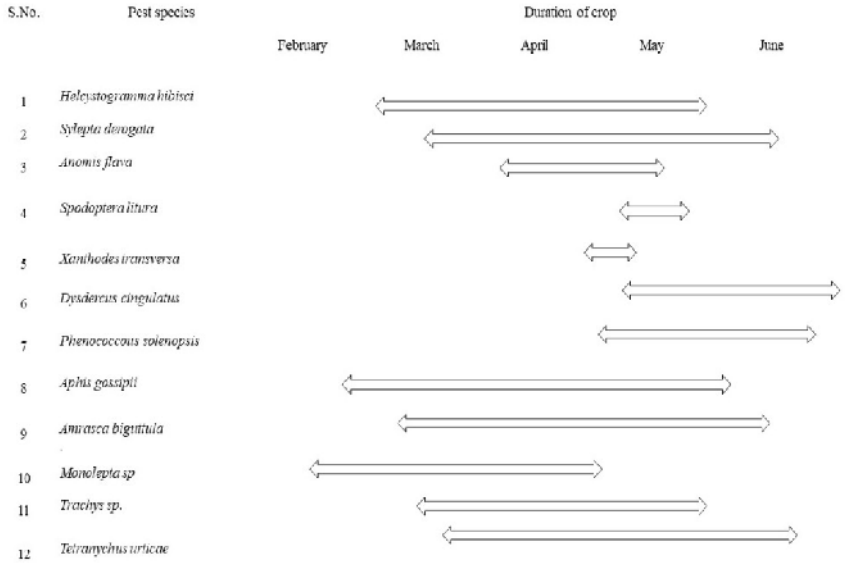

Fig. 2. Pest calender on muskdana at UBKV, Pundibari during pre- kharif season of 2021 and 2022.

CONCLUSION

The present study documented twelve pest species including insects and mites associated with *A. moschatus* in the northern tracts of West Bengal. The bio-ecology, nature of the damage and sequence of occurrence on crop has been represented in detail which provides a wholesome knowledge on various pests associated with muskdana under Northern tracts of West Bengal.

FUTURE SCOPE

Considering the economic importance and the medicinal properties of the muskdana, there is an urgent need to study biology, population dynamics, the severity of the damage, and natural enemy complex to formulate effective management practices of the major pests of this crop for reducing the crop loses of muskdana in the Northern track of West Bengal.

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Conflict of Interest. None.

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