



Integrated pest management approaches for the insect pests of moringa (*Moringa oleifera* L.): Practices

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The aim of this article to provide basic information on the insect pest and the management tactics of *Moringa oleifera* (Lam) at different stages of crop growth. The literature on the insect pest of moringa is scanty. Therefore this information will help intending farmers to be abreast of what insect pests to expect in the moringa. It is also intended to determine that IPM could meaningfully control these pests. This is necessary as most parts of moringa are eaten raw and consumers are constantly apprehensive of the deleterious effects of synthetic insecticides.

Introduction : *Moringa oleifera* L. belongs to the family Moringaceae, which is the family consisting of only one genus with about 13 species of deciduous trees (Keay, 1989). Leaves, tender pods, fruits, flowers, etc. are the edible parts of this plant as vegetable which have tremendous nutritional and medicinal values. It has multifarious uses of Moringa trees that include alley cropping (biomass production), animal forage (leaves and treated seedcake), biogas (from leaves), domestic cleaning agent (crushed leaves), blue dye (wood), fencing (living trees), fertilizer (seed cakes), foliar nutrient (juice expressed from the leaves), green manure (from leaves), gum (from tree trunks), honey and sugar cane juice clarifier (powdered seeds), honey (flower nectar), medicine (all plant parts), ornamental plantings, biopesticide (soil incorporation of leaves to prevent seedling damping off, etc.), pulp (wood), rope (bark), tannin for tanning hides (bark and gum), water purification (powdered seeds) etc. (Fugile, 2000). There are a number of biotic stresses of *M. oleifera* in its native Indian range, which affects its production from both qualitative and quantitative aspects. Infestations by insect pests and mites have been placed among the main limiting factors.

Butani and Verma (1981) reported twenty eight different insect species and two species of mites from India on various parts of drumstick trees. Among them major insect pests are given below : The important insect pests have been discussed hereunder :

Bark-eating caterpillar, *Indarbela quadrinotata* Wlk. (Metarbelidae: Lepidoptera) : It is a primitive lepidopteran pest and only about 14 species of these moths

under 3 genera have been reported from India. Among these, the genus *Indarbela* is the largest containing 12 species of which, at least 5 species occur in southern India.

Hosts of economic importance: *I. quadrinotata* is highly polyphagous pest. In addition to *Moringa*, recorded hosts of the pest include *Acacia catechu*, *Mangifera indica*, *Morus alba*, *Myrtogyna* sp., *Phyllanthus emblica*, *Psidium guajava*.

Identification and biology: The full grown larva is smooth, with sparse hairs and measures 3.5 to 4 cm in length. The thoracic legs are simple with the last segment ending in a curved claw. The caudal end (cremaster) bears several small spine-like 10 processes. These spines and teeth-like processes help the pupa to orient itself towards the tunnel mouth prior to eclosion. Eggs hatch in about 15-25 days. The larval period lasts for 9-10 months. Pupation occurs within the larval tunnel, with the cephalic end of the pupa slightly protruding outside. The pupal period lasts about 15-25 days.

Mode of feeding and symptoms of damage: Newly hatched larvae initially feed on the bark and subsequently bore into the trunk. The tunnel entry remains closed with a frass covering which is drawn out into a sleeve through which the larva moves. The tunnel is used as shelter by the larva and is kept clean of the faecal pellets and frass which are added on to the distal end of the sleeve. Zig-zag galleries and silken webbed masses comprising of chewed material and excreta of larva are seen on the trunk of infested tree.

Management: Mechanical method: This involved killing the larvae within the tunnels by inserting a sharp metallic probe and sealing the tunnel entrance using tar or wax.

Chemical method: – Application of a toxic substance either by injection or by inserting a cotton swab soaked in the chemical is the most widely used method.

– Spot application either by brushing or spraying may also be tried in certain cases.

– Application of 5-10 ml of a diluted solution of quinalphos 25 EC at 1:200 or deltamethrin 2.8 EC at 1:2000 into the borer holes resulted in good control of this insect on shade trees in north-east India.

Table 1 : Major insect pests of *M. oleifera* Lam

Sr. No.	Common name	Scientific name	Family	Order
1.	Bark-eating caterpillar	<i>Indarbela quadrinotata</i> Wlk. <i>Indarbela tetraonis</i> Moore.	Cossidae	Lepidoptera
2.	Green leaf caterpillar	<i>Noorda blitealis</i> Wlk.	Crambidae	Lepidoptera
3.	Budworm	<i>N. moringae</i> Tams.	Pyraustidae	Lepidoptera
4.	Hairy caterpillar	<i>Eupterote molifera</i> Wlk.	Eupterotidae	Lepidoptera
5.	Black hairy caterpillar	<i>Pericallia ricini</i> Fab.	Arctidae	Lepidoptera
6.	Fruit fly	<i>Gitonia distigmata</i> Meigon.	Drosophilidae	Diptera
7.	Long horn beetles	<i>Batocera rubus</i> Linn.	Cerambycidae	Coleoptera

Moringa budworm: *Noorda moringae* (Family: Crambidae) : It is one of the important pests of *Moringa* in India.

Identification and biology: The adult is small and dark brown. It lays oval, creamy white, slightly sculptured eggs in clusters and occasionally singly on the buds. A female may lay up to 250 eggs. Egg stages lasts for three to four days. The larve bores in to the bud and first feeds on the anthers and then on the other internal parts leaving the outer most petals intact. Full grown larvae measures 11 to 14 mm long, is dirty brown with a prominent mid- dorsal stripe, head and pro- thoracic shield being black. Infested buds drop down and the larve pupate in the soil in a cocoon of silk covered with soil particles. Adult emerge sin 6-10 days. Total life cycle is 10-28 days.

Mode of feeding and nature of damage : The larvae feed on young flower buds, which results in shedding. Infestation goes up to 78% in the affected plants. The infestation is generally lower during October- December and reaches the peak in June.

Management : Cultural control : – Plough around trees to expose and kill pupae

– Collect and destroy damaged buds along with caterpillars

Biological control : Its natural enemies include the following larval parasites: *Pristomerus* sp. (Ichneumonidae), *Bracon brevicornis*, *Chelonus* sp (Braconiae), *Elasmus hyblaeae*, *Perrilampus* sp. and *Stytasis* sp. (Chalcidoidea).

Physical control : Use light traps to attract and kill adults @ 1-2 /ha

Chemical control : Spray carbaryl 50 WP 1.0 kg or malathion or endosulfan 1.0 L in 500-750 ml of water per ha.

Moringa leaf caterpillar: *Noorda blitealis* Wlk. (Pyraustidae: Lepidoptera) : The leaf eating caterpillar (*N. blitealis* Wlk.) is the

sporadically serious pest of drumstick throughout the year especially in South India.

Hosts of economic importance : Besides moringa trees, it is also an important pest of niger

Identification and biology : Adult is similar to *N. moringae* but bigger in size. The moth is dark brown and the black pattern on forewings broader and wavy. Eggs are laid in clusters of 34 to 96 usually on ventral surface of tender leaves. A female lays up to 232 eggs in her life time. Incubation period is about 3 days. Larval period is about 7-15 days depending upon environmental conditions. It pupates in the soil and the adult emerges in six to nine days.

Total life cycle is completed in about 16-26 days.

Mode of feeding and nature of damage : *N. blitealis* larvae feed on the leaves of moringa while hanging from the undersurface of leaflets in a thin silken web. The leaves appear papery and get dried. If left untreated, the whole tree is defoliated. Severe infestation occurs on new flush of the crop during June-August which later recedes.

Management : Cultural control : – Plough around trees to expose and kill pupae.

–Collect and destroy damaged buds along with caterpillar.

Physical control : Set up light trap @ 1/ha.

Mechanical control : Provision for sitting arrangement for birds above the height of the moringa crop in field enabling the birds to visit and prey them.

Biologica control: Spiders are found inhabiting in large numbers on new flush which exert natural control on the increasing population.

Chemical control : Spray insecticides like Carbaryl 50 WP@ 1g/ lit or malathion 50 EC 2 ml/ lit of water. Also 1-2 sprays of malathion (2 ml/l) can be applied to reduce infestation.

Hairy caterpillar: *Eupterote mollifera* (Eupterotidae: Lepidoptera) : Host of commercial importance.



In addition to moringa, it recorded as a host of pest includes, Castor (*Ricinus communis*), *Brassica oleracea* and mulberry.

Identification and Life history : Eggs laid in clusters on leaves and tender stem. Larvae brownish in colour with densely hairy. Full grown caterpillar is about 4.4cm in length. Adult is large sized moth with uniform light yellowish brown in colour with faint lines. Lay eggs in groups on tender portions of trees like shoots and leaves. They pupate in soil.

Mode of feeding and symptoms of damage : Larva seen in groups in tree trunks and they feed gregariously by scraping the bark and gnawing foliage. Severe infestation leads to defoliation of the tree.

Management : *Cultural control :* Collection and destruction of egg masses and caterpillars by burning or using strong contact insecticide.

Physical control : Setting up of light trap @ 1/ha to attract and kill adults immediately after rain.

Mechanical control : Use burning torch to kill congregating larvae on the trunk.

Chemical control : – Spraying of fish oil rosin soap @ 25g/lit or carbaryl 50 WP @ 2g/lit.

– Spray chlorpyrifos 20 EC or quinalphos 25 EC or endosulfan 35 EC 1.0 L in 500 -750 L of water per ha on the trunks and foliage, immediately after rain and 15 days later

Black hairy caterpillar, *Pericallia ricini* (Fab.) (Arctidae: Lepidoptera) : This is a foliage feeding pest that occasionally appears in large numbers.

Hosts of commercial importance : Besides drumstick trees, it has been reported to infest banana, black gram, cotton, cucurbits, castor, cowpea, soybean, tea, yam etc.

Identification and biology : Full grown caterpillars are 40-50 mm. long, dark brown in colour, specked with white and have dorsal and lateral tufts of long dark hair. Eggs are laid in clusters on ventral surface of leaves. Egg, caterpillar and pupal periods occupy 4 to 8, 26 to 32 and 10-12 days, respectively. Total life cycle is completed in about 40 days during April-May.

Mode of feeding and symptoms of damage : On hatching the caterpillar feed on the leaf lamina initially by scraping epidermal layers and later by cutting the lamina.

Management : Same as hairy caterpillar.

Fruit fly, *Gitona distigmata* (Drosophilidae: Diptera)

Hosts of commercial importance Moringa

Identification and biology : Adult is a small yellowish fly with red eyes. Wings extend beyond body and have a dark spot near the coastal margin. Maggot is cream coloured. Activity is maximum from April to October and declines thereafter. Egg is Cigar shaped, sculptured and

white coloured eggs are laid on the grooves of tender pod either singly or in groups of 3-4. Egg period 3-4 days, maggot period 18-25 days. Full-grown cream coloured maggots pupate in soil for 5-9 days.

Symptoms of damage : Drying and splitting of fruits from tip. Oozing of gummy exudate from fruit comes out.

Management : *Cultural control :* Weekly removal of affected fruits

Mechanical control : Rake up the soil under the trees or plough the infested field to destroy puparia

Botanical control : Use attractants like citronella oil, eucalyptus oil, vinegar, dextrose or lactic acid.

Chemical control : – Spray insecticides like nimbecidine 3ml/lit during 50 % fruit set and 35 days later. Application of fenthion 80 EC 0.04 per cent during the vegetative and flowering stage.

– Emamectin benzoate 5 SG at 0.25 g/l and spinosad 45 SC at 0.20 ml/l were significantly superior throughout the period of investigation against *G. distigmata*.

Long horn beetles: *Batocera rubus* (Cerambycidae: Coleoptera)

Hosts of commercial importance Moringa

Identification and biology : Grubs are stout, about 100 mm long, yellowish in colour with well-defined segmentation. Adults are medium sized beetles and yellowish brown with white spots on elytra. Eggs are laid singly in cracks or crevices in the bark of the tree. Pupation takes place within the tunnels. Egg, grub and pupal periods last for 1 to 2, 24 to 28 and 12 to 24 weeks, respectively. There is only one generation in a year.

Damage symptoms : Grubs make zig-zag burrow beneath the bark, feed on internal tissues, reach sapwood and cause death of affected branch or stem. Adults feed on the bark of young twigs and petioles.

Management : Clean affected portion of tree by removing all webbed material, excreta etc.

– Insert in each hole, cotton-wool soaked in monocrotophos 36 WSC 5 ml or any good fumigant like carbon disulphide, carbon tetrachloride, chloroform or even petrol and seal treated hole with mud.

Conclusion : We have clearly demonstrated that different insect pests amongst which insects of various groups associate with and live on Moringa crops in the South alluvial plain zone of Bihar during the rainy season period. These and others are potential pest species and therefore, pose likely threats to crop production in this area. It is therefore necessary to develop and follow a rational approach with greater reliance on IPM to promote sustainability and to reduce the number of application of hazardous chemicals.