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Insect Pests Associated with Soybean Crop and their Management

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INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is one of the most important oilseed crops in the world. It contains 18 to 22 percent oil and is highly desirable in the diet and have 40 to 42 percent of good quality protein. Therefore, it is the best source of protein and oil and truly claim the title of the meat/oil that grows on plants. Generally, it is used in the food industry for flour, oil, margarine, cookies, biscuit, candy, milk, vegetable cheese, lecithin and many other products. At present, the United States of America has the largest area under its cultivation. Its cultivation remained limited to a very small acreage and showed a declining trend.

1) Hairy caterpillar: *Spilosoma obliqua*

Symptoms of Damage

- Young larvae feed gregariously on chlorophyll mostly on the under surface of the leaves, due to which the leaves look like brownish yellow in colour.
- In later stages the larvae eat the leaves from the margin.
- The leaves of the plant give an appearance of net or web.

Identification of the pest

- **Eggs**: Laid in cluster on the under side of leaves.
- **Larva:** Covered with long yellowish to black hairs
- **Adult:** Medium sized brown moth with a red abdomen.

Management practices:

- Deep summer ploughing.
- Avoid pre monsoon sowing.
- Use optimum seed rate.
- Adequate plant spacing should be provided
- Intercrop soybean either with (early maturing) pigeon pea variety or maize or sorghum in the sequence of 4:2 should be practiced.
- Collect & destroy infested plant parts, egg masses and young larvae.

- **Field Sanitation**: Remove the infested plant parts at least once in 10 days and bury them in compost pit to monitor and reduce the population.
- **Light Trap**: Install one light trap (200W mercury vapour lamp) per hectare to catch the adults of some nocturnal pests such as hairy caterpillar (positively phototropic).
- Apply chlorpyriphos 20 EC @ 1.5 lit/ha or trizophos 40 EC @ 0.8 Lit/ha or quinalphos 25 EC @ 1.5 lit/ha.
- Dust Chlorpyriphos 1.5% DP quinalphos 1.5% @ 25kg/ha when the population is likely to reach 10/m row length (ETL). Repeat it as needed

2) Gram pod borer: *Helicoverpa armigera*

Symptoms of damage

- The young larvae feeds on the chlorophyll of young leaves and skeletonize it.
- They feed voraciously on the foliage in early stage, may defoliate the plant and later they feed on flowers and pods.

Identification of the pest

- **Eggs:** Spherical in shape and creamy white in colour, laid singly
- **Larva:** Shows colour variation from greenish to brown.
- It has dark brown grey lines on the body with lateral white lines and also has dark and pale bands.
- **Pupa:** Brown in colour, occurs in soil, leaf, pod and crop debris.

Management practices:

- Deep summer ploughing.
- Install pheromone traps at a distance of 50 m @ 5 traps/ha for each insect pest.
- Erect bird perches @ 50/ha.
- Clip terminal shoots on 100 days of crop growth.
- Setting of light traps (1 light trap/5 acre) to kill moth population.
- Dusting with Chlorpyriphos 1.5 % DP or fenvalerate 0.4% or quinolphos 1.5% @ 25 to 30 kg/ha.
- Spray with Chlorpyriphos 1.5 % DP @1200 ml/ha or quinolphos 25 EC @ 1.0 lit/ha.

3) Tobacco caterpillar: *Spodoptera litura*

Symptoms of Damage Larva

- Larvae feed on the chlorophyll of the leaves.
- The eaten leaves give the appearance of whitish yellow web.

Identification of the pest

- **Egg:** Egg masses appear golden brown.
- **Larva:** Pale greenish with dark markings.
- Gregarious in the early stages.

Management practices:

- Deep summer ploughing.
- Avoid pre-monsoon sowing.
- Optimum seed rate (70-100 kg/ha) should be used.
- Collect and destroy infested plant parts, egg masses and larva.
- Install sex pheromone trap @ 10 traps/ha for early deduction of the pest.
- Erection of bird perches @ 10-12/ha.
- **Field Sanitation**: Remove the infested plant parts at least once in 10 days and bury them in compost pit to monitor and reduce the populations of tobacco caterpillar. Traps are used for monitoring the pest situation.
- Install one light trap (200W mercury vapour lamp) per hectare to catch the adults of some nocturnal pests such as tobacco caterpillar (positively phototropic).
- Install five sex pheromone traps per hectare (change septa after 3 weeks), specific for male adults of tobacco caterpillar (separate pheromone for each).
- Apply Profenophos 50 % EC @ 1000 ml/ha or deltarnethrin 2.8 EC @ 750 ml/ha or quinolphos 25 EC @ 1000ml/ha
- In case of severe infestation apply polytrin 44% @ 1 lit/ha or profenophos 50 EC 2.00 lit/ha
- Dust Deltamethrin 2.8% EC or quinalphos 1.5% @ 25kg/ha when their population is

likely to reach 10/m row length (ETL). Repeat it as needed.

4) Thrips: *Thrips tabaci*

Symptoms of damage

- The infected leaf turns whitish-brown in colour.
- In case of heavy infestation the leaves get dry and drop down and slowly the plant becomes leafless.

Management practices:

- Dusting of cow dung ash and spraying of clay suspension as asphyxiants (in small area and low incidence of sucking insects)
- Spray 0.05 % quinalphos 25 EC, or oxydemeton methyl 25 EC, or dimethoate 30 EC @ 2ml /lit at the crop age of 35-40 days and repeat after 15 days if needed.

5) White fly: *Bemisia tabaci*

Symptoms of damage

- Due to attack of the insect the leaves turn yellow and become curled.
- This insect spread the mosaic disease in soybean.

Identification of the pest

Nymphs and pupae:

- Black and round or oval.
- Pupae have marginal bristles.

Adults:

- Small, yellow bodied insects with white wings which are densely covered with a waxy powder.

Management practices:

- Dusting of cow dung ash and spraying of clay suspension as asphyxiants (in small area and low incidence of sucking insects).
- Spray 0.05 % quinalphos 25 EC oxydemeton methyl 25 EC, or dimethoate 30 EC @ 2ml /lit at the crop age of 35-40 days and repeat after 15 days if needed.

6) Soybean Aphid: *Aphis spp.*

Symptoms of damage

- They suck the plant sap from the stem, leaves and pods which cause reduction in yield.
- The infested leaves are wilted or curled.
- Plant stunting, reduced pod and seed counts, puckering and yellowing of leaves.

Identification of the pest

- **Winged adults:** Have a black head and thorax.
- **Aphids:** Excrete honeydew on surface of lower leaves.

Management practices:

- Dusting of cow dung ash and spraying of clay suspension as asphyxiants (in small area and low incidence of sucking insects)
- Spray 0.05 % quinalphos 25 EC, oxydemeton methyl 25 EC, or dimethoate 30 EC @ 2ml /lit at the crop age of 35-40 days and repeat after 15 days if needed

7) Jassids: *Apheliona maculosa*

Symptoms of damage

- Infested leaves start yellowing from the margins.
- In case of severe attack, all the leaves become yellow and eventually fall off from the plants.

Identification of the pest

Adults and nymphs:

- Are light green in colour and suck the sap from leaves and stem.

Management practices:

- Install one light trap (200W mercury vapour lamp) per hectare to catch the adults of some nocturnal pests such as jassid, (positively phototropic).
- Spray 0.05 % quinalphos 25 EC, oxydemeton methyl 25 EC, or dimethoate 30 EC @ 2ml /lit at the crop age of 35-40 days and repeat after 15 days if needed.

8) Girdle beetle: *Oberea (Obereopsis) brevis*

Symptoms of damage

- Girdling of stems and petioles.

- The inside of the stem is eaten by the larvae and a tunnel is formed inside the stem.
- The leaves of plant of infected portion are unable to get the nutrient and are dried up.
- In later stages the plant is cut at about 15 to 25 cm above the ground.

Identification of the pest

- **Larva:** White, soft-bodied worm with a dark head.
- **Adult:**The freshly emerged adult is yellow, red, brown on the head, thorax and bases of elytra.

Management practices:

- Deep summer ploughing.
- Planting time on the onset of monsoon
- Optimum seed rate (70-100 kg/ha) should be used
- Intercropping with maize or sorghum should be avoided
- Crop rotation should be followed
- Avoid excess nitrogenous fertilizers.
- Collect and destroy infested plant parts and egg masses.
- Remove the infested plant parts at least once in 10 days and bury them in compost pit to monitor and reduce the populations of girdle beetle
- Apply phorate 10 G @ 10 kg/ha or carbofuran 3 G @ 30 kg/ha at the time of sowing.
- One or two sprays of 0.03% dimethoate 30 EC or 0.05% quinalphos 25 EC or 0.05% methyl demeton 25 EC or 0.04% can check further damage.
- Spray quinalphos 25 EC triazophos 40 EC @ 2 ml/lit. at the crop age of 30-35 days and repeal after 15-20 days (1000 l spray/ha)

9) Stem Fly: *Melanagromyza sojae*

Symptoms of damage:

- Infested stem with bore holes.
- The eggs are laid on leaves.
- After hatching from the egg yellowish maggots bore the nearest vein of the leaf.
- The maggot then reach the stem through petiole and bore down the stem.
- If the infected stem is opened by splitting, distinct zig zag reddish tunnel can be seen with maggot or pupae inside it.
- The maggots feed on cortical layers of the stem, may extend to tap root, killing of the plan.

Management practices:

- Deep summer ploughing.
- Avoid pre monsoon sowing.
- Use optimum seed rate and plant spacing.
- Proper crop rotation with dissimilar crops should be followed.
- Remove and destroy the damaged plant parts.
- Soil application of phorate 10 G @ 10 kg/ha or carbofuran 3 G @ 30 kg/ha at the time of sowing will prevent early infestation by stem fly.
- One or two sprays of 0.03% dimethoate 30 EC or 0.05% quinalphos 25 EC can stop the damage.

10) Soybean looper: *Chrysodeixis includens (Walker)*

Symptoms of Damag

- Damaging infestations occur from early August through September.
- Soybean loopers usually reach higher populations in areas where cotton and soybeans are grown together.

Management practices:

- Remove and destroy all plant debris after harvest to kill pupae.
- Handpick and destroy larvae.
- Encourage natural enemies.

Ecological Engineering for Pest Management – Below ground

- Crop rotations with cereal crops which will break the continuity of soil borne pests as well as attract beneficial insects and predatory birds.
- Keep soils covered year-round with living vegetation and/or crop residue.

- Add organic matter in the form of FYM, Vermicompost, decomposed crop residue which enhance below ground biodiversity.
- Reduce tillage intensity so that hibernating natural enemies can be saved.
- Apply balanced dose of biofertilizers and nutrients.
- Apply mychorrhiza and PGPR.
- Apply *Trichoderma* / *Pseudomonas fluorescens* as seed, nursery treatment and soil application.

Cultural practices

- Cleaning of infected stubbles followed by deep summer ploughing, optimal fertilizer application, timely sowing, proper seedbed conditions and depth of sowing, optimum seeding rate and plant population, regular scouting, rogueing and destruction of infected crop/plant parts, elimination of collateral/alternate and reservoir hosts, crop rotation and intercropping, cultivation of soybean in rainy season only and avoidance of mono varietal culture. Inter-cropping soybean either with asafetida (early maturing variety) or maize or sorghum in the sequence of 4 rows of soybean with 2 rows of intercrop should be practiced. Such bio-diversity will help in build up and conservation of natural bio control fauna viz., coccinellid beetles, *Chrysoperla* etc. In girdle beetle and semilooper endemic areas, intercropping with maize or sorghum should be avoided.
- **Fertilizer dose** NPK and S at the rate of 20:60-80: 30-40:20 kg/ ha should be applied.
- **Seed treatment** Seed treatment by *Trichoderma viride* @ 5g or thiram 37.5% + carboxin 37.5% DS @ 3 g/kg seed for the management of seed, seedling and seed borne foliar diseases. This should be followed by seed treatment with Bradyrhizobium and Phosphate Solubilizing Bacteria (PSB) @ 5 + 5 gm / kg seed.
- **Sowing time** Sowing should be done timely when soil moisture is sufficient (8-12 cm depth) to ensure proper germination.
- **Seed rate and sowing** Optimum seed rate (65-75 kg/ ha) should be used depending upon seed size. After every 15 rows, a gap of one row should be given to provide moving space for spraying in standing crop.

Mechanical Practices

- Collection and destruction of girdle beetle infested plant parts, egg masses and gregariously feeding larvae of hairy caterpillar and tobacco caterpillar should be done.
- Rogueing of Sclerotium affected seedlings and yellow mosaic affected plants should be undertaken.
- Erection of bird perches @ 10-12/ha.
- Installation of pheromone traps for monitoring incidence of *S. litura* and *H. armigera*.
- Use of Castor as trap crop for tobacco caterpillar and Dhaincha for girdle beetle.

Biological Control: Insects

- Conserve spiders, coccinellid beetles, tachinid fly, praying mantids, dragon fly, damsel fly, *Chrysoperla* and meadow grass hoppers through minimum use of broad spectrum pesticides, so as to exploit maximum potential of bio-control fauna.
- Release *Telenomus remus* @ 50000/ha against *S. litura*.
- Spray Bacillus thuringiensis var. kurstaki, Serotype H-39, 3b, Strain Z-52 @ 0.75 to 1.0 kg/ha for the management of semilooper complex (*Chrysodeixis acuta, Gessonia gemma*, *Diachrysia orichalcea* and defoliators).
- Spray SlNPV @ 250 LE/ha.
- Spray of NSKE @ 5% for management of early stage larvae and sucking pest.

Major parasitoids of insect pests of soybean

S.No.	Natural enemy	category of Natural enemy	Pest attacked and feeding activity
1.	Egg parasitoid	Trichogramma chilonis	Egg parasitoid of Spodoptera and *Helicoverpa.*
		Tetrastichus	Egg parasitoid of Spodoptera and *Helicoverpa*.
		Telenomus	✓ Egg parasitoid of *Spodoptera* and *Helicoverpa*, A female parasitizes 20-40 eggs and lives 2-4 days or longer if nectar or sugar solution is provided. ✓ Both *Tetrastichus* and *Telenomus* may parasitize the same egg mass but not the same egg
2.	Larval parasitoid	Ichneumon promissorius	Larva parasitoid of *Spodoptera* and *Helicoverpa.*
		Carcelia spp	Larval parasitoid of *Spodoptera* and *Helicoverpa.*
		Diglyphus isaea	Larva parasitoid of *Spodoptera* and *Helicoverpa.*
3.	Larval and pupal parasitoid	*Xanthopimpla flavolineata*	Larval borer Adult wasp is medium sized yellow orange in colour with black ovipositor.
4.	Pupal parasitoids	Encarsia formosa	Pupal Parasitoids of white fly.
		Eretmocerus spp	Pupal Parasitoids of white fly.
		Lissopimpla excels	Pupal Parasitoids of *Helicoverpa.*

Feeding/egg laying capacity of different parasitoids/predators

Predators/ Parasitoids	Feeding/Egg laying capacity
Ladybird beetle	Predatory rate of adult coccinellid on aphids is 50 aphids per day. It also feeds on the Lepidopteran species eggs.
Green lacewing	Larva can consume 100 aphids, 329 pupa of whitefly and 288 nymphs of jassids. It also feeds on Lepidopteran species eggs.
Bracon hebetor	Egg laying capacity is 100-200 eggs/female. 1-8 eggs/larva.
Trichogramma spp.	Egg laying capacity is 20-200 eggs/female.
Spiders	2-3 moths per day

CONCLUSION

The insect pests soybean showed that the population of different pest species occurred in an overlapping manner and the crop was under the continuous attack of one or more pests. Most of the major and minor pests appeared in the crop during vegetative to flowering stages (30-50 Days after sowing) and the maximum infestation occurred during flowering and pod formation stages of the crop in both the years. Although most of the insects recorded from soybean crop during the study period have been considered as minor, it is not unlikely that any one of the minor pests may attain the status of a major pest depending upon the environmental conditions and changing cropping pattern.