

Major and minor insect pests of *Glycine max* L. and their management

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Abstract

Soybean (*Glycine max*), a vital leguminous and oilseed crop, is grown globally and serves as a primary protein and oil source. Its cultivation faces significant challenges from numerous arthropod pests, which affect various growth stages and cause severe yield losses. These pests, including defoliators, stem borers, pod borers, and sucking insects, inflict damage by feeding on the plant's foliage, stems, and seeds. Effective pest management in soybean requires accurate identification and an understanding of pest life cycles to inform timely interventions. Integrated Pest Management (IPM) approaches—combining biological control agents, cultural practices, pheromone traps, and selective chemical treatments—are critical for reducing pest populations while minimizing ecological impacts. IPM strategies, by promoting environmental balance, help mitigate yield losses and support sustainable soybean production. The lifespan, possible harm, and control strategies of major and minor insect pests of soybeans are highlighted in this review, with an emphasis on IPM techniques appropriate for soybean-growing areas.

Keywords: Soybean, yield loss, integrated pest management, biological control, sustainable agriculture

Introduction

Soybean (*Glycine max*), often called the "golden bean" or "jewel bean," is a globally significant crop, primarily cultivated in the Brazil, US, Argentina, China, and India. With 121.80 million tons produced annually, Brazil leads the world in soybean production, followed by the US, Argentina, China, and India (Anonymous, 2024) [3]. India ranks fourth in soybean cultivation area, covering 12.12 million hectares, which constitutes 8.86% of the global area, and ranks fifth in production, yielding 11.23 million tonnes in 2020-21, with primary soybean-growing states including Maharashtra, Madhya Pradesh, Rajasthan, Andhra Pradesh, Karnataka, and Uttarakhand (ICAR-IISR, 2016) [25]. At a rate of 1,025 kg/ha, Karnataka alone produces over 1.84 lakh MT from 1.80 lakh hectares.

Soybean faces threats from 273 insect species, one mite, two millipedes, ten vertebrates, and one snail in India (Biswas, 2013) [9]. Twenty arthropods are considered major pests, including pod borers like *Helicoverpa armigera*, *Melanagromyza obtusa*, and *Cydia ptychora*, with *C. ptychora* being especially damaging in Karnataka's Dharwad region. Additionally, defoliators including *Spilarctia obliqua*, *Thysanoplusia orichalcea*, and *Spodoptera litura* are significant, causing losses by attacking foliage, flowers, and pods. Arthropods and diseases result in a total yield loss of about 32%, with arthropods alone causing over 25% loss (Harish *et al.*, 2009) [21]. Globally, soybean supports nearly 380 insect species, with over 100 in India from orders like Hemiptera, Lepidoptera, and Coleoptera that affect crop quality. Key pests that affect the crop from seedling to maturity are stem borers, defoliators, and sucking insects (Turnipseed and Kogan, 1976) [47].

Key Insect Pests of Soybeans

Based on the plant portions they infiltrate, the insects are divided into the following groups:

A. Insect Pests that Damage the Stem

1. Stem Fly: *Melanagromyza sojae* (Zehnter) (Agromyzidae: Diptera)

Dispersion: In areas that cultivate soybeans, such as Australia, Russia, China, Taiwan, India, Nepal, and Northeast Africa, the stem fly is a serious annoyance. (Arnemann *et al.*, 2016) [4]. In India, it is particularly problematic in states like Madhya Pradesh, Delhi, Uttar Pradesh, and Uttarakhand.

Host Plants: Although soybeans are the main host, other leguminous crops are also impacted by the stem fly.

Identification: About 2 mm in length, adult stem flies are identified close to the coast. They are light brown at first, then turn metallic black with translucent wings. Compared to men, females are slightly larger. Maggots are yellowish, legless larvae that burrow into stems and consume interior tissues (Arnemann *et al.*, 2016) [4].

Life Cycle: First reported by Van der Goot (1984) [48], the life cycle starts when females deposit 60–80 eggs on the underside of the leaf. The larvae feed for 10–15 days after mining through the leaf to the stem after the eggs hatch in 2–4 days. After that, the larvae make an exit hole and pupate for seven to ten days. The life cycle lasts 21–35 days in total (Singh, 1982) [41]. The pest is most active in conditions with high humidity, heavy rains, and temperatures between 24.9 and 25.2°C (Due & Hong, 1982) [15].

Damage: Infestations are most severe in crops planted between July and August, with rates reaching 93–100%, compared to 63% in crops planted in April (Adimani, 1977) [1]. Young plants are especially vulnerable, and early infestations can result in 20–30% yield loss. Adult flies feed on sap, while larvae damage the plant by tunnelling into the

veins, stem, and root. Severe infestations can cause wilting and plant death, leading to potential yield losses of up to 30.26% per hectare (Patel and Rahul, 2020) [30].

2. Girdle Beetle: *Obereopsis brevis* (Gahan) (Coleoptera: Cerambycidae)

Dissemination: The stem-girdling beetle, which was initially discovered infesting soybeans in India in 1909 (Fletcher, 1917) [17], is currently present in Myanmar as well.

Host Plants: This polyphagous pest primarily affects soybean, sunflower, and mungbean but also feeds on various plants, including *Hibiscus micranthus*, *Phyllanthus maderaspatensis*, *Euphorbia hirta*, *Euphorbia glomifera*, *LAGASCEA mollis*, *Acalypha indica*, *Eclipta alba*, and *Sesbania aculeata* (NBAIR, 2013) [27].

Identification: Adults are medium-sized beetles, yellowish with red and black markings. The larvae are initially pale white, maturing into deep yellow, and reach 19–22 mm in length (Rai and Patel, 1990) [35].

Life Cycle: The female beetle deposits 8–72 eggs in the inner groove of plants that are 20–25 days old, and forms two rings around the stem or petiole, spaced roughly 2–3 cm apart (Singh & Dhamdhare, 1983) [39]. The girdling helps eggs survive by limiting water flow. Larvae continue to eat inside the stem for 30 to 35 days (August to October) or 40 to 60 days (June to July) after the eggs hatch in 3 to 8 days. It takes 10–13 days for pupation to take place inside the girdled stem or plant detritus. Life takes 40–70 days to complete (Patel and Rahul, 2020) [30].

Damage: Beginning in late July and lasting from July to October, infestations are less common in crops grown later or in regions with little rainfall (Rai & Patel, 1990) [35]. The girdling by female beetles restricts nutrient flow, causing plant sections above the girdle to dry out. Larvae burrow down the stem, reducing yields by up to 40% in severe cases (Thipse, 2012) [46].

B. Insect Pests that Damage Leaves and Pods:

1. Tobacco Caterpillar: *Spodoptera litura* (Fabricius) (Noctuidae: Lepidoptera)

Dissemination: In the Pacific Islands, Australasia, and tropical and subtropical parts of Asia, the tobacco caterpillar is a significant annoyance.

Host Plants: This polyphagous pest attacks over 112 plant species, including key crops such as groundnut, cotton, chili, tobacco, okra, pulses, and castor (NBAIR, 2013) [27].

Identification: With a wingspan of 32–38 mm, adult moths have whitish hindwings with a brown border and greenish-brown forewings dotted with wavy white patterns. Each forewing of males has a yellow spot. When the caterpillars reach a size of 20 to 30 mm, they change from being green with a dark head to having dark bodies with dark rings and yellowish-green stripes (Bhattacharya & Rathore, 1977) [8].

Life Cycle: Females cover their eggs with buff-colored hairs and lay 1,000–2,000 eggs on leaves. The eggs take three to five days to hatch, and the larvae feed in groups at

first before spreading out. There are six instars during the 15–30 day larval stage. During the 7–15 day pupation period under the soil, the entire life cycle takes 30–37 days, and up to eight generations can be produced each year. 19.5°C is ideal for reproduction, and temperatures above 37°C are harmful (Fand *et al.*, 2015) [16].

Damage: Young larvae consume chlorophyll from the undersides of leaves, while mature larvae create holes, leaving only veins and petioles. *S. litura* thrives in warm, wet conditions from late July to October, coinciding with soybean's peak growth period, and can cause yield losses of 26–29% (Punithavalli *et al.*, 2014) [33].

2. Bihar Hairy Caterpillar: *Spilarctia (Spilosoma) obliqua* (Walker) (Arctiidae: Lepidoptera)

Dissemination: This pest is found across south-eastern Bangladesh, Myanmar, India, Bhutan, Afghanistan, and northern Pakistan (CPC, 2004) [11]. In India, it poses a significant threat in states such as Punjab, West Bengal, Assam, Uttar Pradesh, Haryana, Andhra Pradesh, Bihar, and Madhya Pradesh.

Host Plants: Highly polyphagous, the pest affects 124 plant species from 25 families, including approximately 25 weed species. Key crops impacted include beans, oilseeds, grains, various vegetables, mulberry, and aromatic plants (NBAIR, 2013) [27].

Identification: The adult moth has dark yellow wings with a span of 40–50 mm, featuring dark spots along the forewing's leading edge. The abdomen is orange-red dorsally and yellow ventrally. Mature larvae, covered in long yellowish-gray hairs, grow to a length of 40–45 mm (Gupta & Bhattacharya, 2008) [20].

Life Cycle: Females lay 1,000–1,500 light green eggs in clusters of 50–100 on the undersides of leaves. Eggs hatch within 10–13 days. Early-stage larvae feed in groups, dispersing individually after the second instar. The larval period spans 4–8 weeks, progressing through six instars. Mature larvae pupate in plant debris or soil, with pupation lasting 6–22 days. The complete life cycle lasts 5–10 weeks, with the pest potentially completing 3–5 generations per year (Bhattacharya & Rathore, 1977) [8].

Damage: Infestations typically begin in late August. Early-stage larvae consume leaf chlorophyll, causing a yellow-brown, papery appearance. Later-stage larvae feed on leaves, stems, and branches. Severe infestations can result in up to 40% leaf area loss, leading to complete defoliation (Patel and Rahul, 2020) [30].

3. Green Semilooper: *Thysanoplusia orichalcea* (Fabricius), *Chrysodeixis acuta* (Walker) (Noctuidae: Lepidoptera)

Dissemination: *Trichoplusia orichalcea*, is widely distributed across regions such as Africa, Australia, New Zealand, Sri Lanka, Europe, South Asia, and Indonesia (Stringer *et al.*, 2008) [44]. *Chrysodeixis acuta* is prevalent in Africa, Australia, Japan, China, Indonesia, and India (Raju *et al.*, 2014) [36].

Host Plants: *T. orichalcea* is a polyphagous pest, feeding on crops in the Chenopodiaceae, Linaceae, Cucurbitaceae, Cruciferae, Compositae, and Leguminosae families, including soybean. *C. acuta* affects crops like tomato, barley, sorghum, soybean, and linseed.

Identification: Medium in size, the adult moth has brownish forewings. Whereas *C. acuta* has two characteristic shiny spots, *T. orichalcea* has a sizable golden patch on the forewings. The hindwings are brown and grey. The larvae are roughly 45 mm in size and have green bodies with white lines. The 5th, 6th, and final abdominal segments include three pairs of genuine legs and prolegs, which move in a distinctive looping pattern (Gaur & Mogalapu, 2018) [18].

Life Cycle: The underside of leaves, close to the midrib, is where female moths deposit 65–100 yellow-green eggs. In 3–4 days, the eggs hatch. In *T. orichalcea*, newly born larvae are pale greenish-white, while in *C. acuta*, they turn green in later instars. The six instars of larval development last 16–23 days for *T. orichalcea* and 15–21 days for *C. acuta*. The pupal time for mature larvae is 6–7 days for *T. orichalcea* and 7–10 days for *C. acuta*, and they pupate on the underside of leaves in a loose silken cocoon. *T. orichalcea* completes its life cycle in 30–35 days, while *C. acuta* does it in 24–34 days (Laute *et al.*, 2015; Raju *et al.*, 2014) [26, 36].

Damage: Green semiloopers damage soybean plants by feeding on leaves at various growth stages. Early instars create translucent feeding patches, while later instars cause holes. Severe infestations may lead to defoliation, leaving only stems. Soybean yield losses during flowering and podding stages due to green semilooper damage have been reported at 50.21%, with foliage damage ranging from 10.50% to 12.01% (Bailey, 2007) [7].

4. Soybean Leaf Miner: *Aproaerema modicella* (Deventer) (Lepidoptera: Gelechiidae)

Dissemination: The leaf miner is widely distributed across China, the Philippines, Indonesia, Myanmar, Bangladesh, Thailand, Vietnam, Laos, India, Pakistan, Sri Lanka, and Africa. In India, it is prevalent in states like West Bengal, Delhi, Gujarat, Rajasthan, Punjab, Madhya Pradesh, Maharashtra, West Bengal, Tamil Nadu, Andhra Pradesh, and Karnataka.

Host Plants: Although soybean and groundnut are its main hosts, it also infests berseem, clover, lucerne, babchi seeds, mungbean, wild soybean, pigeon pea, ragged indigo, and hyacinth bean (NBAIR, 2013) [27].

Identification: The adult is a small dark brown moth with a wingspan of 6–8 mm and features a distinctive white spot on the forewings. Larvae are yellowish-green, around 6–8 mm long. Males can be distinguished by pinkish testes visible between the 6th and 7th abdominal segments (Van der Walt *et al.*, 2008) [49].

Life Cycle: Females lay 87–186 shiny eggs individually on leaves and petioles, with an incubation period of 3–4 days. Upon hatching, larvae initially wander, then mine into the leaves. They progress through three larval instars over 8–13

days and pupate within webbed leaf cases, with the pupal stage lasting 6–8 days. The full life cycle is completed in about 29 days, with six to ten generations per year (Badgajar *et al.*, 2009) [6].

Damage: Early instar larvae tunnel between the leaf epidermal layers, forming mines as they consume the mesophyll. Later instars leave the mines, web the leaves together, and feed externally. Severely infested fields may appear scorched from a distance (Du Plessis, 2003) [14].

5. Pod borer: *Helicoverpa armigera* (Hübner) (Noctuidae: Lepidoptera)

Dispersion: *Helicoverpa armigera* has a widespread presence across Australia, Asia, Africa, Europe, and the Pacific Islands (Czepak *et al.*, 2013; Tay *et al.*, 2013) [13, 45].

Host Plants: This extremely polyphagous pest infests over 172 species of plants in 68 families, causing significant global economic losses in commodities like beans, sorghum, chickpeas, corn, soybeans, and cotton (Cunningham & Zalucki, 2014) [12].

Identification: The adult *H. armigera* moth has a body length of 14–19 mm and a wingspan of 3.5–4 cm. In contrast to females, which are orange-brown, males are yellowish brown. The hindwings have a black outer border and are creamy white, while the forewings have a characteristic dark kidney-shaped mark. In their final instar, mature larvae, which range in size from brown to light green with dark stripes and a noticeable dorsal line, display color polymorphism (Gaur & Mogalapu, 2018) [18].

Life Cycle: Between 500 to 2000 yellowish eggs are laid by females on tender plant parts; the eggs darken before hatching. It takes two to four days to incubate. The larval stage lasts roughly 20 days, and there are six different instars. Pupae are dark brown and range in length from 14 to 22 mm, and they are born in the earth. With up to eight generations every year, the entire life cycle lasts 38–45 days, with the pupal stage lasting roughly 13.9 days for males and 12.9 days for females (Reigada *et al.*, 2016) [37].

Damage: *H. armigera* seriously harms soybeans during both their vegetative and reproductive phases. Larvae consume fragile plant parts and leaves while in the vegetative phase. They devour seeds throughout the reproductive phase and drill into pods, which significantly reduces production (Azambuja *et al.*, 2015) [5].

C. Sucking Pest Insects:

1. Whitefly: *Bemisia tabaci* (Gennadius) (Aleyrodidae: Hemiptera)

Dissemination: This pest is a significant threat in tropical and subtropical regions and is found globally, mainly due to its role in transmitting various plant diseases (Perring, 2001) [31].

Host Plants: A highly polyphagous pest, it affects around 500 plant species from 74 families (Stansly & Naranjo, 2010) [43]. Major host plants include tobacco, soybean, black and green grams, cotton, okra, tomatoes, cucumbers, chilies, brinjal, radish, watermelon, and okra.

Identification: The adult insect is very small, measuring 1.0–1.5 mm, with white wings coated in waxy powder and a yellowish body. Nymphs are white to light green and remain stationary (Gaur & Mogalapu, 2018) ^[18].

Life Cycle: On the underside of leaves, females deposit 38–106 eggs. After a 3- to 6-day egg stage, there are three 7- to 14-day nymphal instars and an 8- to 14-day pupal period. There are roughly 12 overlapping generations per year, and the entire life cycle takes 13–72 days. Activity stops below 10 °C or over 36 °C, with optimal development taking place between 23 and 30 °C (Verma *et al.*, 1990) ^[50].

Damage: Adults and nymphs consume the sap from the underside of delicate leaves, and the honeydew they produce interferes with photosynthesis and stunts plant growth by forming sooty mold. This pest also spreads the yellow mosaic virus (YMV), which can cause up to 80% of soybean yields to be lost (Ragupathy, 1989) ^[34].

2. Soybean Aphid: *Aphis glycines* (Matsumura) (Aphididae: Hemiptera)

Dissemination: The soybean aphid is native to East Asia, where soybean was first domesticated, and is widely found in regions including North America, Taiwan, Philippines, Thailand, China, Japan, India, Indonesia, Korea, and Malaysia (Ghosh, 2008) ^[19].

Host Plants: Buckthorn (*Rhamnus* spp., particularly *Rhamnus cathartica*) is the principal overwintering host, and soybean is the primary host for the aphid's life cycle completion.

Identification: There are two types of soybean aphids: wingless and winged. To differentiate themselves from other aphid species, wingless adults are pear-shaped, 1/16 inch long, bright green with red eyes, pale antennae, and dark-tipped cornicles. While winged forms have two sets of wings and a comparable body shape to the adults, nymphs are smaller replicas of the adults. Adult nymphs with wings have broader shoulders with wing pads, and their heads and thoraxes may be orange in colour (Hodgson & Heidel-Baker, 2013) ^[22].

Life Cycle: Soybean aphids reproduce sexually and asexually (parthenogenesis). Females put their overwintering eggs on buckthorn between September and November after mating. These eggs hatch into wingless females in the spring, which produce several generations on buckthorn before migrating to soybean in early summer as winged aphids. They produce wingless females for 15–17 generations on soybeans before winged aphids come to buckthorn in September. Optimal reproduction occurs at 22–25 °C and below 78% relative humidity, with wingless females producing 5–8 nymphs daily (Hodgson & Heidel-Baker, 2013; Hunt *et al.*, 2015) ^[22, 24].

Damage: The phloem of soybean leaves and other delicate plant elements are consumed by both nymphs and adults, which results in leaf deformation and yellowing. Aphids produce honeydew, which encourages the formation of sooty mold, decreasing photosynthesis and causing plants to become stunted. There have been reports of yield losses of 10% to 15%, and they also spread the soybean mosaic virus (Ghosh, 2008; Hodgson & Neal, 2018) ^[19, 23].

3. Southern Green Stink Bug: *Nezara viridula* (Linnaeus) (Hemiptera: Pentatomidae)

Dispersion: Tropical and subtropical regions in the Europe, Australia, Asia, Africa, and the United States are home to *Nezara viridula*, commonly referred to as the southern green stink bug (Panizzi *et al.*, 2000) ^[29].

Host Plants: As a serious polyphagous pest, *N. viridula* targets over 30 plant families, with a strong preference for legumes. Key crops affected include eggplant, rice, corn, cotton, soybeans, tobacco, tomatoes, and sweet peppers (Panizzi *et al.*, 2000) ^[29].

Identification: Adults are green and shield-shaped with dark green edges, reddish or dark eyes, and wings that cover the abdomen with small dark spots. Males generally measure around 12.1 mm, while females are slightly larger at approximately 13.15 mm. Nymphs show distinct colours of green, orange, and yellow, with fifth instar nymphs characterized by short, thick wing pads (Gaur & Mogalapu, 2018) ^[18].

Life Cycle: Females deposit 30–130 cylindrical eggs, ranging in color from white to light yellow, on the undersides of leaves. These eggs turn pink over their five days of incubation before hatching. In their first instar, nymphs are gregarious, light yellow, and have red eyes. They also grow basic antennae and legs. The nymphs undergo several molts, with each instar lasting roughly seven days, with the exception of the fifth, which lasts eight days. The full life cycle spans 65–70 days, or 35–37 days in warmer summer conditions, with ideal development occurring near 30°C. This pest completes four generations annually (Squittier, 2020) ^[42].

Damage: Nymphs (from the second instar onward) and adults damage soybean during the pod-filling stage by injecting digestive enzymes into seeds inside green pods. This feeding causes punctures, discoloration, and reduces seed quality and quantity, resulting in shrivelled, smaller seeds or premature maturation. This process can reduce germination rates and disrupt plant physiology, causing "crazy soybean" disorder. Severe infestations can result in yield losses of up to 46% (Pitan & Odebiyi, 2001) ^[32].

Management of Insect Pests of Soybean

The goal of integrated pest management (IPM), which groups several technologies, is to manage various crops in a way that keeps the agro-ecosystem as close to a biological equilibrium as possible (pests vs natural mortality). A number of factors should be taken into account in order to prevent reaching the economic injury level (EIL) and the resulting yield reduction. These include weather events that may cause delays in the implementation of a control measure and the time required for the control measures to become effective against the pests (Bortolotto *et al.*, 2015) ^[10]. The economic threshold levels (ETL) of different pests are mentioned below in Table 1.

Table 1: ETL of Soybean Insect Pests

Insect Pest	Crop Stage	ETL
Pod borer	Podding	3 larvae/meter
Tobacco caterpillar	Flowering	4 larvae/meter
Green semilooper	Flowering	2 larvae/meter
Girdle beetle	Flowering	10% infestation

(Source: NCIPM, 2014) ^[28]

Deep summer ploughing can be a valuable control measure for *O. brevis*, *S. litura*, *H. armigera* and *S. obliqua*. Pheromone traps are installed at a 50-meter distance (5 traps/ha), and bird perches are erected @ 50/ha for the control of *S. litura*, *H. armigera* and *S. obliqua* (Patel and Rahul, 2020) [30]. The best way to control pests is to rotate your crops with different crops and use fertilizer sparingly. Several chemicals and biological control agents can also be used to suppress insect populations in addition to these. A few of the chemical and biological control methods are included in Table 2-4.

Table 2: Major Predators of Insect Pests of Soybean

Predator	Target Insect Pest
Pentatomid bug, <i>Eocanthecona furcellata</i>	Lepidopterous caterpillars
Lynx spider and orb weaver spider	Lepidopterous caterpillars, whiteflies, jassids, Spiders
Lady bird beetles (<i>Menochilus sexmuculata</i> , <i>Coccinella septempunctata</i> , <i>Coccinella transversalis</i>)	Whiteflies and jassids

(Source: Ahirwar et al., 2015) [2]

Table 3: Major Parasitoids of Insect Pests of Soybean

Parasitoid Category	Parasitoid	Target Insect Pest
Pupal parasitoids	<i>Encarsia formosa</i> <i>Eretmocerus</i> spp. <i>Lissopimpla excelsa</i>	White fly White fly <i>H. Armigera</i>
Egg parasitoid	<i>Trichogramma chilonis</i> <i>Tetrastichus</i> spp. <i>Telenomus</i> spp.	<i>S. litura</i> and <i>H. armigera</i> <i>S. litura</i> and <i>H. armigera</i> <i>S. litura</i> and <i>H. armigera</i>
Larval parasitoid	<i>Ichneumon promissorius</i> <i>Carcelia</i> spp.	<i>S. litura</i> and <i>H. armigera</i> <i>S. litura</i> and <i>H. armigera</i>

(Source: NCIPM, 2014) [28]

Table 4: List of Insecticides Recommended for Soybean Insect Pests

Insect Pest	Insecticide	Dosage
Defoliators	Dichlorvos 76EC	500 ml/ha
Defoliators and pod borer	Quinalphos 25EC	1500 ml/ha
Defoliators, stem fly and girdle beetle	Chlorantraniliprole 18.5 SC	150 ml/ha
Pod borer	Indoxacarb 15.8EC	333 ml/ha
Girdle beetle	Phorate 10 G	10 kg/ha
Stem fly and girdle beetle	Carbofuran 3 G	30 kg/ha
Sucking pests and girdle beetle	Triazophos 40 EC	800 ml/ha
Sucking pests, stem fly	Thiamethoxam 30 FS (seed treatment)	10 ml/kg
Leaf miner	Carbaryl 50WP	2.0 kg/ha
Sucking pests	Spiromesifen 22.9 SC	600 ml/ha
Leaf miner and sucking pests	Oxydemeton-methyl 25EC	350 ml/ha
Sucking pests	Acetamiprid 20 SP	100 ml/ha
Sucking pests and defoliators	Monocrotophos 36 SL	800 ml/ha
Sucking pests	Imidacloprid 17.8 SL	500 ml/ha

(Source: NCIPM, 2014) [28]

Conclusion

Because of its nutritional and economic benefits, soybeans are a widely grown leguminous and oilseed crop with two uses. In addition to being an important source of oil and protein for consumption by humans and animals, it also fixes nitrogen in the soil, increasing soil fertility. However, a number of arthropod pests, such as insects and mites, use soybeans as hosts, which can result in significant production losses. These pests harm leaves, stems, pods, and seeds by focusing on different plant parts at different phases of growth. Effective infestation management requires knowledge of these pests' identification, life cycle, and behaviour. Farmers can sustainably reduce insect populations by implementing Integrated insect Management (IPM) techniques, which include crop rotation, pheromone traps, biological control agents, and prudent pesticide use. Early identification and a comprehensive knowledge of pest life cycles are crucial components in implementing IPM strategies, allowing for timely interventions and reducing the reliance on chemical controls. This approach not only safeguards soybean yields but also promotes environmental health by minimizing the ecological impact of pest control measures.

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