INSECT PESTS AND DISEASES OF GREEN GRAM *VIGNA RADIATA* AND THEIR MANAGEMENT

Abstract

This chapter delves into the realm of insect pests and diseases that afflict Green Gram (Vigna radiata), a crucial leguminous crop. Recognizing the nutritional importance and economic significance of Green Gram, the study highlights its vulnerability to a range of pests and diseases that impact its growth and yield. Through detailed exploration of major pests like thrips, whiteflies, and gram pod borers, as well as diseases like anthracnose and yellow mosaic, the paper offers insights into the damage symptoms, bionomics, and effective management strategies. By comprehensively addressing the challenges posed by these threats, the study contributes to the broader efforts of sustaining crop productivity and ensuring food security.

Keywords: Green gram (*Vigna radiata*), Insect pests, Diseases, Integrated pest management, Sustainable agriculture

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I. INTRODUCTION

Pulses, which are edible, low-cost dry seeds from the *Fabaceae* (*Leguminosae*) family, are an important source of nutrition for us. Pulses are a valuable group of food crops that contribute to national food security, nutritional security, and the availability of high-quality proteins for the country's largely vegetarian population. Pulses make for 8.37 percent of all food grains consumed. It is a valuable addition to the diet since they are high in protein (20-25%) and can help with obesity, diabetes, and malnutrition.

Vigna is a well-known and frequently farmed genus, with green gram (mung bean) accounting for a significant portion of global agricultural production. Green gram is most significant legume crop of India from the nutritional viewpoint and suitable for enhancing the soil fertility, grown in tropical and subtropical Asia as a source of nitrogen especially for the vegetarian population (Kumari and Chakraborty, 2017).

In addition, green gram seeds have much medicinal importance to cure edema, diarrhea, headaches and eye problems (Li, 1999). Green gram is a high-protein (23-24%), carbohydrate (54-56%), mineral, and vitamin-rich food. It is fed to babies, convalescents, and the elderly because of its excellent digestibility. It has no flatulent impact in the stomach, unlike other pulses. Pulses currently contribute 117.4 Kcal, 6.9 g, and 1.0 g of energy, protein, and fat, respectively, to India's nutritional supply. According to Anonymous (2004), an adult male and female need 80 and 70 g of protein per capita per day, respectively. According to Singh and Ahlawat (2005), the crop's seeds are consumed as daal while its leaves, green stalk, and dry stalk are utilised as fodder. It fits in crop rotation systems and mixed cropping systems because it has a short growing season (60–65 days) (Timsina and Connor, 2001).

Currently, green gram is cultivated in tropical and subtropical Asia mainly in India, China (Zhang *et al*., 2003) and in some parts of Australia, U.S. (Oklahoma), Africa, and Pakistan (Smýkal *et al*., 2015). Asia produces largest amount (90%) of green gram in the world where India contributes about 50% world’s production (Pandiyan *et al*., 2011). As a rich source of proteins, carbs, minerals, and vitamins for grain-based diets in South and Southeast Asia, it is the third most widely produced pulse crop in India (Afzal et al., 2008). More than 70% of the world's green gramme production, which makes up roughly 10% to 12% of all Indian pulse production, is produced there. (Anonymous, 2014). 10% of the world's pulse production comes from this region, which is farmed on about 4.5 million hectares and produces 2.5 million tonnes at a productivity of 548 kg/ha. 2.64 million tonnes of green gramme would be produced in 2020–21, according to the third advance predictions from the Indian government. Green Gramme consumption was 22.5 lakh tonnes in the marketing year 2020–2021, compared to production of 21.42 lakh tonnes. The remaining gap between supply and demand was addressed by imports totaling about 1.08 lakh tonnes and opening inventories totaling 2.10,000 tonnes.(Green gram Outlook Report, 2021).

Every year, 2.5 to 3.0 million tonnes of pulses are lost to pests. In India, pulses are allegedly impacted by more than 250 bug species. These insects, which number in the dozen, seriously harm crops. An estimated 2–2.4 million tonnes of pulses, worth about Rs. 6,000 crores, are reportedly lost every year by insect pest complexes. With a grain production of 513.67 kg ha-1, the estimated green gramme yield loss from the pod borer complex was 36.41 percent. (Umbarkar *et al*., 2013).The management of insect pests on grain legumes

depends heavily on host plant resilience, which has been a key factor in the creation and introduction of novel cultivars (Soundararajan *et al*., 2013).
Various sucking insect pests attack the green gram, including white fly, green leaf hopper, flower thrips, spotted pod borer, pod bug, stink bug and gram pod borers. Various diseases attack on green gram are anthracnose, leaf spot, yellow mosaic and powdery mildew.

II. MAJOR PESTS OF GREEN GRAM

1. Thrips*: Megalurothrips Distalis* (Thripidae, Thysanoptera)

- **Damage Symptoms:** Due to insect attack on green gram especially during dry spells, the leaves are spotted with the characteristic silvering. Later, leaves shrivel and drop. Plants with damage do not produce pods. It serves as a disease vector as well.

- **Bionomics:** The developing green gramme flower's buds and calyx are where eggs are placed. A single egg is 0.25 mm in length and 0.1 mm in width. When newly placed, they are white, but as they mature, they turn a pale yellow colour. An typical incubation period lasts between two and three days. The larvae of the first and second instars were translucent to white in colour and changed to a yellow form after two to three days. The yellow form lasted for two to three days before changing into an arranged form that lasted for three to four days until pupation. The second stage larvae actively look for a place to pupate, typically in the soil, while the first two larval stages actively feed on host plant tissue. It takes an average of 4 to 7 days for the pupation process to complete. The pupal stage then gives way to wingless adults. There was a 12- to 14-day life cycle.

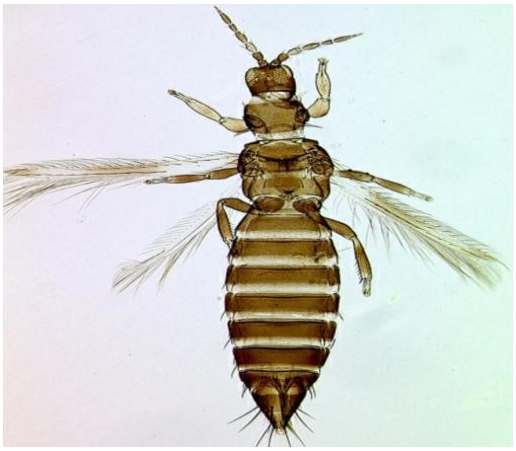

Figure 1: Thrips

- **Management:** Many cultural practises are used to control flower thrips. Pupae in the field can be destroyed by scouring and ploughing before planting. A well-established crop that is better able to endure infection is another benefit of early planting. This is due to the fact that thrips populations are often lower during rainy seasons and higher during dry ones. Deltamethrin, Malathion, monocrotophos, pirimphos-methyl cypermethrin, dimethoate, and lambda-cyhalothrin are appropriate insecticides. The use of numerous techniques, including frequent applications of pricey pesticides, has

been suggested and has resulted in a reduction of roughly 80% of flower bud thrips populations in green gram production.

2. Whitefly: *Bemisia Tabaci* (Aleyrodidae: Hemiptera)

- **Damage Symptom:** The injury is caused by both nymphs and adults, who are numerous. By consuming the plant's sap, they essentially kill it. Early defoliation, the development of sooty mould or honey dew, and the loss of flowers and pods are all symptoms of an acute infection.

- **Bionomics:** Whiteflies normally go through six phases in their life cycle, including the egg, four nymphal instars, and the adult stage. Bemisia tabaci deposits its eggs on the upper and lower leaf surfaces of plants. Eggs are normally incubated for 5 to 9 days, and when they are laid, they are pear-shaped (approximately 0.2 mm in length) and shining white. After hatching, the first instar (crawler) leaves the egg and travels a short distance before successfully probing the leaf to feed on the phloem sap. There are three additional nymphal instar stages after this.

  The second instar stage whitish-yellow nymphs change colour to yellow after feeding and develop a dome-like shape. However, after eating, the third instar nymphs that have just gone through a moult eventually turn dark yellow and take on a flatter shape. The fourth instar, also referred to as the "pupal" stage or "red-eye nymph," is distinguished by large, translucent, yellowish-white eyes.

  B. tabaci fully formed adults emerge from the dorsal surface of the pupal case through an inverted "T"-shaped aperture. The abdomen of a female B. tabaci is broad and rounded, whereas that of a male is pointed. The B. tabaci life cycle lasts 16 to 31 days from egg to adult.

Figure 2

- **Management:** Lacewings, big-eyed bugs, and tiny pirate bugs are among the predators. Whiteflies are consumed by a number of small lady beetles, including the Asian multicoloured lady beetle Harmonia axyridis, scale predators like Scymnus or Chilocorus species, and Clitostethus arcuatus (on ash whitefly). For the control of whiteflies, the insecticides imidachlorpid and diafenthurion are suitable.

3. Green Leafhopper: *Empoasca kerri* (Cicadellidae: Hemiptera)

- **Damage Symptoms:** By sucking plant sap, the nymphs and adults consume fragile leaves and other plant parts. When attacked severely, leaves become dry and brittle. Hopper burn symptoms, such as leaf cupping, emerge. Poor growth may come from the plant losing its vigor.

- **Bionomics:** The gravid female, who is green with a black spot and a black patch on her wings, places 200–300 eggs in groups of 8–16 in the midrib of the leaf blade. Nymphs go through five instars during their 6-7 day egg stage and mature in 25 days. Twenty to thirty days for adults. The population typically starts to rise in August, peaks in September and October, and then starts to fall in November.

Figure 3

- **Management:** Use 12.5 kg of neem cake per 800 m2 of nursery space as a base dose. Apply phorate 10 G @ 1.0 kg, 3 G of carbofuran @ 3.5 kg, or 25 EC of quinalphos @ 80 ml. 3 days after applying the granules, keep the water level at 2.5 cm. Spray any of the insecticides listed below in 500 L of water per hectare: imidacloprid 17.8 SL 100–125 ml, acephate 75 SP 666–1000 g, buprofezin 25 SC 800 ml, and quinalphos 25 EC 1000 ml.

4. Gram pod borer: *Helicoverpa Armigera* (Noctuidae,Lepidoptera)

- **Damage Symptoms:** Early stages of defoliation Larvae with just their heads pushed within the pods and the rest of their bodies hanging out.

- **Bionomics:** The eggs have a ribbed surface and are spherical, measuring 0.4 to 0.6 millimetres (164 to 3128 in) in diameter. Initially white, they eventually turn green. The larvae take 13 to 22 days to mature, and by the sixth instar, they can grow to be up to 40 millimetres (1+12 in) long. They range in colour, but are typically greenish, yellow, or red-brown. The head has numerous dots and is yellow. One pale yellow stripe is located behind the spiracles on the lateral side, while three black stripes run down the dorsal side. Larvae have pale ventral regions. They may even cannibalise one another because they are quite aggressive and occasionally carnivorous. If they are startled, they fall from the plant and curl up on the ground. The pupae form in a silken cocoon over the course of 10 to 15 days, either in cotton or maize ears or in soil that is 4 to 10 centimetres (1 12 to 4 in) deep.

- **Management:** Helicoverpa armigera 12/ha pheromone traps. use 50 bird perches per hectare. Apply teepol (1 ml/lit.) and NPV 1.5 x 1012 POB/ha per hectare.Apply any of the following (625 ml of fluid per hectare). Triazophos 40 EC 780 ml/ha, followed by Dichlorvos 76 WSC 625 ml/ha, Neem seed kernel extract 5% (31.0 kg/ha), and Neem oil 12.5 lit/ha.

5. Pod bug: *Riptortus pedestris, Clavigralla gibbosa* (Coreidae: Hemiptera)

- **Damage Symptoms:** The unripe seeds' juice is sucked from the green pods by the nymphs and adults. When there is a significant infestation, the delicate areas shrivel and then dry out. On the pods, the bugs may be seen grouped together.

- **Bionomics:** The female insect lays an average of 115 eggs each egg on pods close to their base.. There is a 3–4 day egg period. The nymphs are hemispherical, brownish-black, and resemble brown ants. In 16 days, the nymphal stage goes through five instars. The size of *Clavigralla gibbosa* is greater than that of C. horrens. On pods or leaves, it lays eggs in clusters of 3 to 15 eggs. Per female, there are 60–400 eggs produced. A 4-day incubation time is required. The number of nymphal instars is five. Between 7 and 31 days make up the nymphal stage. An adult insect's life span is 150 days. The C. horrens insect is dark, flat, and narrow-bodied, with prominent lateral spines on the prothorax and an enlarged hind femur

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Figure 4

- **Management:** Plants that are afflicted can be physically shaken over containers of oil and water or greasy cloth to help control the population. During the flowering and pod-forming stages, spritz monocrotophos 36sl 1ml/litre of water.

6. Lablab bugs / stink bug: *Coptosoma cribraria* (Coremelanidae): Hemiptera

- **Damage symptoms:** On the delicate stalks, nymphs and adults assemble and drink the sap.Wines with a lot of pests dry up and shed. Plants with a moderate infestation continue to be frail and grow slowly.

Figure 5

- **Bionomics:** Oval-shaped, greenish bugs lay ivory-white, sculptured eggs on the delicate pods in two rows, in batches of 35–50. Around 7 days pass throughout the incubation stage. The duration of the life cycle is around 49 days in South India.
- **Management:** Spray insecticides imidachlorpid, cypermethrin

7. **Termites:** Odontotermes obesus (Termitidae: Isoptera)

- **Damage symptoms:** Damage from termites begins immediately after sowing and lasts until the growth stage. Plants with damage have drooping leaves, which eventually wither and dry. These plants are simple to uproot.

- **Bionomics:** The female lays its first batch of 100-130 eggs 7-10 days after taking flight. It takes 40-42 days for these eggs to hatch. The female termite eventually matures into the queen, laying up to 30,000 eggs every day. This group consists of social insects such as labourers, soldiers, kings, and queens.

- **Management:** Intercultural practises and irrigation before sowing are common. Field sanitation, as well as crop storage and undecomposed plant parts disposal. FYM, whether composed or not, should not be used. Destruction of termite bunds in and around the field, followed by the elimination of the queen and any other forms that may remain. Seed treatment with chlorpyriphos (4ml/kg seed).

8. **Spotted Pod Borer:** *Maruca testulalis* (Crambidae, Lepidoptera).

- **Bionomics:** Female moths lay their eggs on floral buds, flowers, leaves, leaf axils, terminal shoots, and fragile pods. The larvae are translucent with dark brown spots on each segment, and the larval stage lasts 11 to 21 days, with the entire life cycle lasting 27 to 36 days on different hosts.

- **Management:** Rotate green grams with non-legumes such as maize, cabbages and pumpkin. Install bird perches at 20 perches per acre. Collect infested pods and hand pick and destroy the borers by crushing. Spray neem oil at 40ml/20L of water (Neemroc EC). Apply *Bacillus thuringiensis var. kurstaki* (e.g. Bio T Plus). Spray Lambda-cyhalothrin 50g/L (Pentagon 5% EC at 10ml/20L water). Spray Profenofos 400g/L +Cypermethrin 40g/L (PROFILE 440 EC at 30ml/20L water).

III. MAJOR DISEASES OF GREEN GRAM

1. Anthracnose - *Colletotrichum lindemuthianum*

- **Disease cycle:** The main infection is caused by the seed-borne fungus. It also exists in soil-borne plant tissues from diseased plants. secondary spread by conidia formed on diseased plant components that are airborne. Additionally, rain splash aids in spreading.

Figure 6

- **Symptoms:** Any stage of plant growth and all aerial components are affected by the disease. On leaves and pods, there are round, black, sunken dots with a dark centre and a brilliant red or orange edge. When an infection is severe, the afflicted areas deteriorate. Soon after seed germination, infection causes seedlings to become blighted.

2. **Cercospora Canescens Causes Leaf Spot.**

- **Symptoms:** Small brown specks with a reddish border develop into circular patches 4mm in diameter with an ashy-grey centre. This tissue deteriorates with age, becomes fragile, and frequently falls out, leaving a jagged hole.
  The fungus lives on sick plant detritus as well as seeds. Secondary spread occurs via airborne conidia.

- **Disease Cycle:** The fungus lives on sick plant detritus as well as seeds. Secondary spread occurs via airborne conidia.

Figure 7

3. **Yellow Mosaic Disease - Mungbean Yellow Mosaic Virus (MYMV)**

- **Symptoms:** Young leaves first develop little yellow spots or patches on their green lamina. It quickly transforms into a distinctive golden yellow mosaic or brilliant yellow mosaic symptom. As the yellow tinge gradually becomes worse, the leaves eventually turn entirely yellow. Plants that are infected develop slower and produce fewer flowers and pods. The pods are deformed and tiny. Before the plant can set seed, an early illness kills it.

- **Disease Cycle:** *Bemisia tabaci*, a whitefly, can transmit the disease in favourable circumstances. Virulence whiteflies that feed on plants carry disease. Crops planted in the summer are quite vulnerable. As a reservoir for inoculum, weed hosts including *Croton sparsiflorus, Acalypha indica, Eclipta alba*, and other legume hosts are used.

4. Powdery Mildew - Erysiphe Polygoni

- **Symptoms**: One of the common illnesses of various legumes in green gramme is powdery mildew. On leaves and other green objects, white powdery spots first develop before they turn dull in hue. These round, progressively larger patches cover the lower surface as well. When the infection is severe, white powdery growth fully covers both sides of the leaves. Parts that are severely damaged become deformed and withered. When there are serious infections, the leaf becomes yellow and early defoliation results. The disease also causes the afflicted plants to mature prematurely, which causes significant output losses.

- **Disease Cycle:** The fungus is an obligate parasite and survives as cleistothecia in the infected plant debris. PAscospores from perennating cleistothecia are typically the source of first infection. The secondary spread is accomplished via airborne conidia. The propagation of the disease is further aided by rain splashes.

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