International Journal of Agriculture and Allied Sciences: January-June; 9 (1) 86-92, 2024
Peer Reviewed

MAJOR INSECT PEST IN CHICKPEA CROP AND THEIR MANAGEMENT

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ABSTRACT: The study was conducted in SHUATS, Prayagraj, India. Chickpea is the most important pulse crop of India. In India it is also known as 'King of pulses', Bengal gram, Chana, Gram. This review has been focused on the major insect pests of this legume crop, those causing significant and frequent yield losses. This study is to bring forward and report the major efforts made in combating insect pest infesting chickpea in South and South-East Asia. Scientists working in various institutions in this region undertook extensive studies and research to develop Integrated Pest Management (IPM) and Integrated Crop Management (ICM) in order to reduce chickpea grain yield losses. This review highlights the IPM efforts on the use of Chemicals, eco-friendly approaches (use of agronomic practices, plants materials, natural pathogens and insect parasitoids etc.). Thus insect pest management options are viewed from a systems perspective to the farming enterprise.

Keywords: Chickpea, *Cicer arietinum* (L.), Insect-pest, Management

Chickpea, *Cicer arietinum* (L.) family Leguminaceae (Fabaceae) is originated in South-eastern Turkey and spread to other parts of the world. According to De Candolle, the fact that gram has a Sanskrit name "Chanaka" which indicates that the crop was under cultivation in India longer than in any other country in the world (Gowda *et al.*, 2007). It is adapted to relatively cooler climates. The largest area of adaptation is in the Indian sub-continent. Gram commonly known as chickpea or Bengal gram is the most important pulse crop of India. In India it is also known as 'King of pulses' India is the largest producer with 75% of world acreage and production of gram. India produces 5.3 MT of chickpea from 6.67 million ha with an average production of 844 kg per ha. Chickpea is used for human consumption as well as for feeding to animals. Its seeds eaten as green vegetable, fried, roasted, as snack food and ground to obtain flour and dhal (Pachundkar *et al.*, 2013).

The Indian agriculture currently suffers an annual loss of about INR 8,63,884 million due to insect pests, in terms of monetary value (Dhaliwal *et al.*, 2010). Among various factors which contribute to low yield in chickpea, damage by insect pests is considered as the most important factor (Bhagwat *et al.*, 1995). Among the prevalent biotic factors about 36 different species of insect pests has been reported to attack chickpea during different growth stages of the crop in India (Nayer *et al.*, 1982).

On chickpea the number of sucking pests are observed by scientist such as Aphids- *Aphis craccivora* Koch*)*, its belongs to order Hemiptera, Aphididae which cause the suck the juice from flower, newly emergence leaves; another pest is jassids (*Empoasca kerri)*, Pea aphids (*Acrythosiphum pisum)*, Thrips (*Megalurothrips usitatus)*, Whitefly (*Bemisia tabaci)*. The region's main biotic stresses are Gram pod borer (*Helicoverpa armigera* Hubner), Gram Semiloper (*Autographa nigrisigna* Wlker), Termites (*Odontotermes obesus* Ramb. And *Microtermes obesi* Heomgr), Cutworm (*Agrotis ipsilon* Hufnagel), Aphid (*Aphis craccivora* Koch). Gram pod borer is a major insect, accounting for twenty one percent of crop yield losses and 50-60 per cent of crop pod losses. The different pest control practices are used and their effectiveness compared by population assessment of each pest. Chemical, biological, botanical pesticides and IPM are the techniques of pest management used compared with farmers' practice and untreated control. https://www.jetir.org/papers/JETIR2101123.pdf

Table: -1 Major Insect Pest of Chickpea

S.N.	Insect Pest	Estimated loss (%)
1	Gram pod borer (*Helicoverpa armigera* Hubner)	10-90 %
2	Cut worm (*Agrotis ipsilon* Hufnagel)	10-30%
3	Termites (*Odontotermes obesus* Ramb. And *Microtermes obesi* Holmgren)	5-20%
4	Gram Semilooper (*Autographa nigrisigna* Wlker)	0-10%

Gram Pod Borer

Gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is considered as a notorious pest of chickpea. It also attacks pigeon pea, moong bean, lentil, soybean, okra, maize, berseem, sunflower, sorghum, tobacco and tomato. Besides gram pod borer, it is also known as cotton bollworm, gram caterpillar, tomato fruit worm and tobacco bud worm. Pod borer is the most serious insect pest of Chickpea. Percent larval survival and pupation were the maximum on chickpea as compared to other host plants (Ullah *et al*., 2015).

Lifecycle

Egg: The four stages of *Helicoverpa armigera* were egg development. Freshly laid eggs are white, turning a light brown colour over the next 1–2 days. Close to hatching, the black head capsule of the developing larva is visible through the eggshell. The eggs that did not hatch within five days (Herald and tayde 2018), reported that the incubation period varied from 4 to 5 days. (Liu *et al*., 2004).

Larva: Larvae develop through six growth stages (instars) and become fully grown in 2–3 weeks. The first and second larval instars were yellowish-white to reddish-brown with dark brown to black head capsule. The third instar larvae was yellowish brown in colour, head was somewhat darker in colour compared to body. In the fourth instar colour turned yellowish white with many black spots from anterior to posterior side of body. In fifth instar change in body colour was apparent having dorsal side pale yellow with grayish longitudinal lines. The prologs were developed in third instar stage on 3rd, 4th, 5th, 6th and 10th abdominal segments and remained until last (sixth) larval instar.

Pupa: Once larvae are fully grown, they crawl to the base of the plant, tunnel up to 10 cm into the soil and form a chamber in which they pupate. The pupa was of obtect type with mahogany-brown color. The surface was smooth and broadly rounded at anterior but tapering at posterior. However, this stage took minimum and maximum period of 13 and 15 days, respectively (Herald and tayde 2018).

Adult: The adult moth was stout bodied with broad thorax. The forewings have a series of dots on the margins and a black comma-shaped marking in the middle underside of each forewing. However, the hind wings were lighter in color with a broad dark-brown border at the apical end; they have yellowish margins and strongly marked veins. There was a distinguished color pattern between male and female moths. Males were recorded greenish-grey in color, whereas, females with orange-brown and were also identified by the presence of tuft of hairs on the tip of abdomen. The females show strong attraction with crops due to the presence of honeydew as well as nectar on plants. It was interestingly noticed that the females emerged two days earlier than males (Baikar and Naik 2016). Reported that total life cycle was found to be completed within 42 to 55 days.

Fig-1.1 Lifecycle of Pod borer (*Helicoverpa aremigera)* Egg, Larva, Pupa, Adult.

Fig 1.2 Damaging symptoms by pod borer on chickpea

Nature of Damage: The first in star larvae of *H. armigera* cause damage by feeding on the tender portion of the green leaves and later on flower buds and pods. Thus, the loss of flower buds and flowers results in a reduction in the yield. Under high pest infestation, the whole crop may get defoliated. After the formation of pods, the third instar larvae make a hole in the pod and move inside to feed on the green grains. A single larva of *H. armigera* can destroy up to 40 pods throughout its larval stage on chickpea crops. (Barwa and Kumar 2022)

Management: Integrated pest management strategies have been emphasized by several researchers in different parts of the world to minimize *Helicoverpa armigera* damage, which includes the use of resistant cultivars. Furthermore, the adoption of recommended cultural practices, such as early sowing with optimum planting density and fertilizer levels, intercropping with trap crops (mustard, coriander, marigold, sunflower, sorghum, and linseed), and installing animated bird perches and T-perches at 2 m distance of predatory zones, in addition to the use of biological agents and the application of biological and chemical control measures.

- ETL: 2 larvae/plant
- Pheromone traps for *Helicoverpa armigera* 15/ha
- Chlorantraniliprole 18.5% SC 0.5ml/lit
- Spinosad 45% SC 0.5ml/lit
- *Bacillus thurenginesis* 5ml/lit
- HaNPV 1ml/lit
- *Beauveria bassiana* 4ml/lit
- Neem oil 3ml/lit
- Bird perches 50/ha
- Predators: *Chrysoperla* spp., *Chrysopa* spp., *Nabis* spp., *Geocoris* spp., *Orius* spp.

Cut Worm: Cutworms are important insect pests of pulse crops and regular scouting in the early stages of crop development is necessary to prevent stand loss and yield loss. The behavior of cutworm species varies from feeding primarily below the soil surface on roots to above ground feeding on foliage. Because cutworms are active at night, they can be difficult to detect during the day. To help producers with pest management decisions, nominal thresholds based on the number of cutworms per square meter are commonly used to prevent unnecessary insecticide applications (Knodel and Shresta. 2018).

Lifecycle:

Egg: Adult females are laid eggs on earth clods, chickpea stem bases and on both sides of leaves. Eggs are small (less than 1 mm diameter) and typically spherical, and vary in structure.

Larva: Larvae (cutworms) are typically brown to gray with variously colour markings. Cutworm larvae are about 25–50 mm in length when mature. Larvae have five pairs of abdominal prolegs and three pairs of thoracic legs, with five to six larval instars.

Pupa: Cutworms form obtect pupae and pupate in earthen cells in the soil. Pupae remain in the soil until they emerge as moths in late summer and into autumn.

Adult: Adult Cutworms are typically gray, brown, or black moths with variable dark or light wing markings. Size is variable depending on species and wingspan can range from 32 to 38 mm. Moths are most active during the evening hour, and feed on pollen or nectar. (Knodel and Shresta 2018) Mostly cutworms required 55-60 days for completing their life cycle.

Nature of Damage:

The larvae of cutworm cause damage by feeding on the tender plants at the base on roots, branches, stems and leaves of growing plants. (Pande *et al*., 2011)

Fig-2.1 Lifecycle of Cutworm

Fig- 2.2 Damaging symptoms by cutworm on chickpea

Management:

- Deep ploughing
- Crop rotation
- Intercropping with wheat or linseed or mustard
- Grow marigold on bunds
- Use Light traps for the control of adults
- Spray Endosulfan or aldrin @ 2 ml/L and Chlorpyrifos 20% EC
- Spray Metarhizium anisopliae or NPV

Termites:

Termites are polyphagous insects that damage chickpea, wheat, maize, barley, sugarcane, groundnut, pigeon pea, sorghum etc. Termites are more prevalent in relatively drier parts of the country, especially in light sandy or sandy loam soils. Termites usually live in groups in the soil. Termites appear soon after sowing and damage the emerging young seedlings. The damaged plants wither away and die, whereas the damaged grown-up plants die slowly. Damaged plants show yellowing, therefore can be spotted easily in standing crop. Such plants, if uprooted, show the presence of termites and their galleries on damaged plants. (Minh *et al*., 2023)

Life cycle: The life expectancy of worker and soldier termites is up to 10 to 14 months. But the reproductive adult termites live for more than four years; especially the reproductive females or queen termites can live for more than 25 years. The termite life cycle is generally divided into three groups of individuals: the worker caste, soldier caste, and the reproductive caste. Thus, each caste will take on tasks to maintain the development of a colony. The life cycle is a typical of social insects allowing for proper division of labour. King and queen are only active reproductive individuals within a colony; they perform no other function. A queen can lay thousands of eggs each year. During the two-week incubation period, the termite worker takes care of the eggs. The nymphs hatch directly from the egg and can become one of three castes: the worker caste, the soldier caste, and the reproductive caste that are in charge of the following tasks:

Worker: Termite workers represent 70% to 80% of the total number of insects in the colony. Workers undertake most of the work within the colony, being responsible for foraging, 22 food storage, and brood and nest maintenance.

Soldier: The soldiers account for 20% to 30% of the number of insects within the colony. Their 25 sole purposes is to protect the colony and attack intruders if they feel threatened. To 26 perform this task, they stay close to the nest and do not move too far from their colony.

Reproductive Caste (Queen-King): There is only one pair of reproductive individuals in a colony, a fertile female and male, 29 known as the queen and king. The queen is responsible for egg production for the colony 30 and the king mates with her for life. (Minh *et al*., 2023)

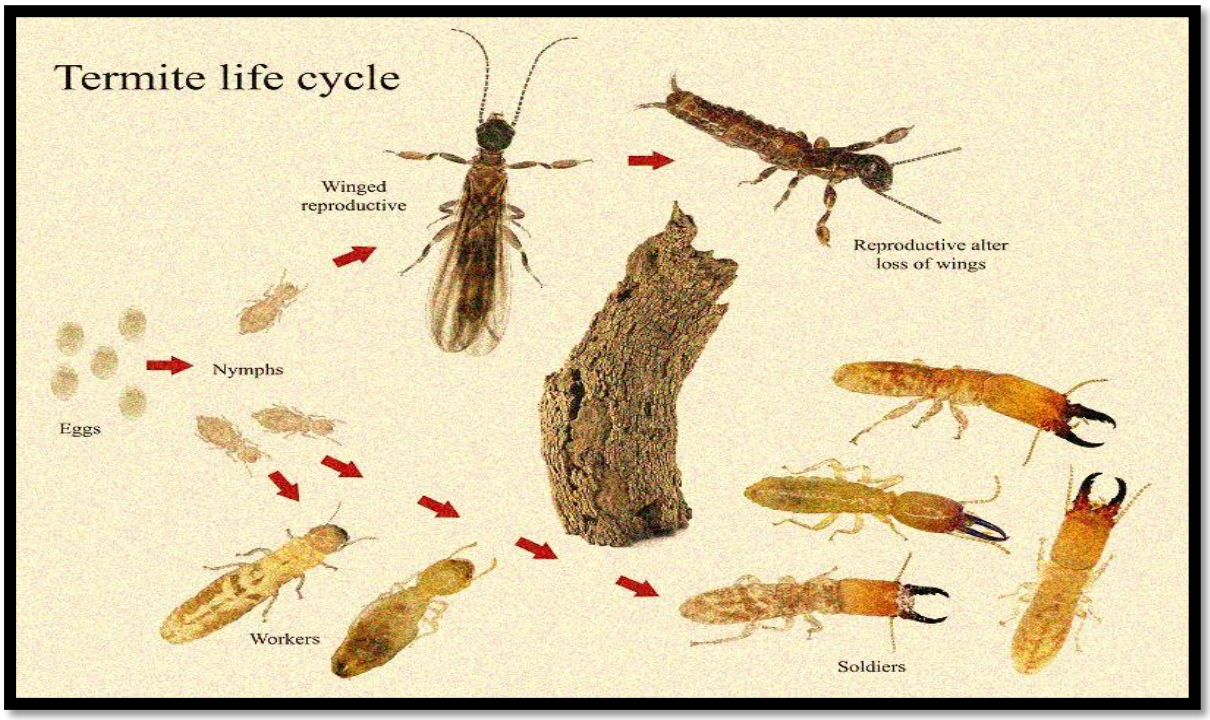

Fig- 3.1 Lifecycle of Termite worker, soldier and queen-king

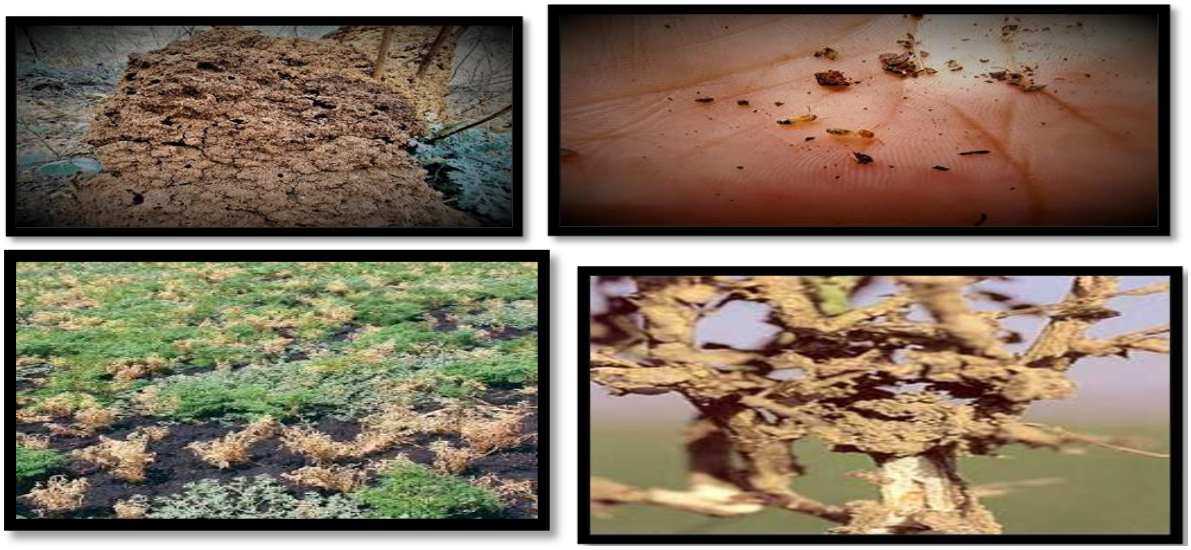

Fig- 3.2 Damaging symptoms by Termite on chickpea

Nature of Damage: Termite bores into the roots and stem. Due to the bore the plants soon dries. Attack may continue to the standing crop also especially during the period of drought.

Management:

- Frequent intercultural operations and irrigation before sowing.
- Field sanitation, timely disposal of crop stables and undecomposed plant parts.
- Undecomposed FYM or composed should not be used

- Three to four deep ploughing could also help control this pest.
- Destroy the termite bunds in and around the field.
- Seed treatment with chlorpyriphos @ 4ml/kg of seed.
- Drenching of root areas of infested plants with 0.05% Chlorpyriphos or application of 4 1 Chlorpyriphos 20EC/ha with irrigation water.

1. Gram Semilooper:

Gram semilooper (*Autographa nigrisigna*), commonly known as semilooper, is widely distributed pest of chickpea in India. In northern India, the damage is relatively high. The caterpillar of the pest form a loop at the centre of the body when it moves. The green colour larvae of this pest can be spotted easily near the damaged plants. The larvae feed on tender leaves, bud's flowers in the beginning and later on tender pods also. It eats the whole pod including the seeds, leaving only a small part of attached to pedicel. In situation where, Immediate plant protection measures need to be followed if 2 larvae of this pest per 10 plants are observed.

Life cycle:

Egg: Freshly laid eggs are white, creamish and Tiny reddish in color. Adults laid eggs on margin of tender leaves. Eggs hatch in under 5 days.

Larva: Young caterpillars have reddish tinged body, thin but when grown become greenish in colour, but yellowish individuals may also be found. Larvae is 25 mm long. Larvae complete their stage with five instars. Under 15-17 days

Pupa: The pupae are formed in silken cocoons on plants. this stage took minimum and maximum period of 7-8 days, respectively.

Adult: Moths have typically patterned forewings. Adult moth tooks maximum period of 5-7 days. Total life cycle is 35-40 days.

Fig.- 4.1 Life cycle of semilooper

Nature of Damage: Skeletinization of leaves and the plant becomes whitish. The larvae feed on leaf buds, flowers, tender pods and developing seeds. Ragged and irregular pod. (This is in contrast with the neat, and round hole, characteristic of pod borer damage.)

Management:

- Deep summer ploughing
- Collect larvae and adults and destroy them
- Bird perches @ 50/ha.
- Use light traps (1 light trap/5 acre)
- Install pheromone traps 5 traps/ha.
- Releas *Trichogramma chlionis* to control semilooper
- Conserve green lacewing, predatory stink bugs, spider, ants
- Apply NPV 250 LE /ha. (10 – 15 days interval)
- Spray Carbaryl 50 WP 2.0 kg/ha. In 1000 L of water (or) Quinalphos 25 EC @ 1000 ml/ha
- Apply neem seed kernel extract 5%+Neem oil 2%

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