AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 02 Issue: 12 December 2021 Article No: 11

Gram Pod Borer *Helicoverpa armigera* (Hubner): Biology, Marks of Identification, Nature of Damage and Integrated Pest Management in Chickpea

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SUMMARY

The Chickpea pod borer, *Helicoverpa armigera*, has been identified as the most damaging insect pest that damages legumes in several parts of India. In roughly 4 to 5 weeks, it goes through the phases of egg, larval, pupae, and adult. The leaves, flowers, tender parts of plant and developing pods of chickpea (*Cicer arietinum* L.) larvae's favorite food of Chickpea pod borer. Chickpea pod borer Integrated Pest Management (IPM) has been demonstrated to be more effective, affordable, sustainable, and environmentally friendly when resistant cultivars are used, suggested cultural techniques are followed, and biological control strategies are used.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is exposed to a wide range of insect pests, of which pod borer [*Helicoverpa armigera* (Hubner)] is most common and critical challenge for chickpea productivity across the world (Luckmann and Metcalf, 1975; Ujjan et al., 2019; Jai et. al., 2020). Chickpea is attacked by 57 insect species but *Helicoverpa armigera* is a key pest that causes heavy economic loss throughout the country, due to its polyphagous nature the pest has attained a national status and is causing devastating damage. *Helicoverpa armigera* belongs to insect order Lepidoptera and family Noctuidae. Tis life cycle involves four major development stages (eggs, larvae,pupae and adult). *H. armigera* completes its life cycle from egg to adult in about 30-34 days at an average temperature of 28^0C (Zalucki et. al., 1986; Fichetti et al., 2009). Management of *H. armigera* is of prime importance to achieve sustainable chickpea yields. Integrated pest management strategies heve been emphasized by several researchers to minimize the pest populations which include use of resistant varieties, adoption of recommended cultural practices, biological and chemical control measures (Navi et al., 2018).

Host range

Helicoverpa armigera is major pests of cotton, pigeonpea, chickpea, sunflower, tomato, maize, sorghum, pearl millet, okra, Phaseolus spp., vegetables, tobacco, linseed, a number of fruits (Prunus, Citrus, etc.), and forest trees. In recent years, *H. armigera* damage has been reported in carnation, grapevine, apple, strawberries, finger millet, etc.

Marks of Identification and Biology or Life cycle

Life cycle of *H. armigera* take about 73 days (in absence of pupal diapause) inn spring or autumn with average temperature of 16- 18^{0}C fromeggs to adults, whereas in summer the life cycle take about 34 days with average temperature of 28^{0}C from eggs to adults (Zalucki et al., 1986) .

Eggs: *H. armigera* females lay eggs singly on leaves, newly laid eggs are characterized by yellowish white in colour. Eggs are spherical shaped with diameter about 0.4 mm to 0.6 mm.

Larvae: Larvae of *H. armigera* undergo 6 or 7 developmental growth stages before developing into pupal stage. The neonate (newly hatched) larvae may grow up to 7 mm long, with yellowish white to reddish brown colour and dark-spotted body. The dark spots on the body is due to the dark coloured spiracles and tuberculate bases. Neonate larvae usually eat soft leaves, flowers or flower buds, moving about their feeding sites. Moulting occurs when larvae are about to develop into following larval stage. Subsequent larval instars may grow up to 40 mm long, showing distinct characteristics: brown head, pale brown prothoracic and supra-anal plates and legs, black claws and spiracles (Reed & Pawar 1982).

Pupae: When the last larval instars are about to become pupae , the larvae will burrow and enter into the soil to pupate. Pupae are characterized with 14-18 mm in length, brown smooth surface, rounded anterior and posterior. The period of pupal diapause varies and highly dependent on temperature and photoperiod (Hackett & Gatehouse, 1982).

Adults: Adults *H. armigera* is characterized with fine hairs antennae, wingspan of 35- 40 mm, tapered thorax with 14-18mm long, orange brown forewings (female) and pale brown hind wings.

Nature of Damage

Helicoverpa females lay eggs singly on leaves, flowers, and young pods. The larvae initially feed on the foliage (young leaves) in chickpea and a few other legumes (Fig. 1), but mostly on flowers and flower buds (Fig. 2) in chickpea, pigeonpea, etc. The young seedlings of chickpea may be destroyed completely, particularly under tropical climates in southern India. Larger larvae bore into pods/bolls and consume the developing seeds inside the pod (Fig. 3).

Fig: 1. Damage at vegetative stage

Fig: 2. Damage at flowering stage

Fig: 3. Larvae bore in pod

Economic threshold levels (ETLs)
Name of Insect: Gram Pod Borer (*H. armigera*).
Stage of crop: Reproductive.
ETLs: 2 to 3 eggs per plant or 2 to 3 early instar per plants or matured larva per 10 plants.

Integrated Pest Management Strategies
Cultural

- Deep ploughing in summer.
- Destruction of stubbles.

- Apply well decomposed FYM or Neemcake @500kg/ha before one month of sowing.
- Use tolerant/resistant varieties - (Chaffa, C -727, ICCV -7, JG074, JG -130, JG -315, BG -256 , Avrodhi, Vijay, ICPL -88034 and ICCV -10).
- Crop rotation with non-leguminous crop.
- Early and timely sowing and select early maturity varieties.
- Synchronous sowing in village or area.

Mechanical

- Putting of heaps of grasses so that congregated larvae can be killed in the morning.
- Erection of 50-70 birds perchers/ha. Bird perchers should be removed just after maturity/vesting of crop.

Biological

- Conserve Lady bird beetles, Chrysopa, Stinkbugs. Reduviid, Predatory wasps and spiders.
- Spray NPV @ 250 L.E.+ 0.5% Jaggery + 0.1% Tinopal on notching 1st instar larvae or eggs of pod borer (3 spray at weekly intervals in evening hours).
- Spray NSKE 5% at pre-flowering stage at 15 days interval.
- Spray *Bacillus thuringiensis var. krustaki* against Pod borer @ 0.75-1.00 kg/ha.

Chemical

Below given Table: 1 of insecticides and active ingredient for Gram Podborer (*H. armigera*)

Table: 1.Recommende dose of insecticides for effective management of Gram pod borer (*H. armigera*)

Name of Insecticide with strength	Dose (g a.i./ha)
Chlorpyriphos 20 EC	500
Chlorpyriphos 1.5 DP	375
Phenthoate 50 EC	1000
Quinalphos 1.5 DP	350
Fenvalerate 0.4 DP	80-100
Deltamethrin 2.8 EC	10-12.5
Carbaryl 5 DP	1250
Carbaryl 10 DP	2500
Carbaryl 50 WP	750
Endosulphan 20 EC	350

Integrated Pest Management Modules against Gram Pod Borer, *H. Armigera*

Use of Pheromone traps @ 20 ha-1 for the monitoring of moths for estimation of ETL of *Helicoverpa*. Spraying of Profenophos 50 EC @ 2 lt ha-1 followed by Bt. kurstaki @ 1.0 Kg ha-1 with installation of bird perches @ 40 ha1 or Indoxacarb 14.5 SC @ 400 ml ha-1 followed by HaNPV should be sprayed @ 500 LE ha-1. All the spraying will be done based on economic threshold level. ETL on chickpea is 1 larva/m row length at full flowering or podding stage, respectively. The interval between two applications of biorationals will be 10-12 days, whereas the gap between the applications of synthetic insecticides will be of 15 days. The HaNPV will be sprayed @ 500 L ha-1 with 0.1% teepol, 0.5% jiggery. The HaNPV will be sprayed along with adjuvant in the early evening, to avoid the harmful effect of UV rays on HaNPV.

CONCLUSION

A single management strategy may not be so effective against *Helicoverpa armigera* and that will be leads to developing resistance against that particular strategy; therefore IPM strategies based on economic threshold level should be adopted to combat the damage. Chemical spraying operation should be done during evening or such a time that there is no damage to bio- control agents and pollinators.

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