



Life aspects and mode of damage of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) on eggplant (*Solanum melongena* Linnaeus): A review

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Abstract

Brinjal (Eggplant) *Solanum melongena* Linnaeus is the most important vegetable of hot and wet climatic zones. It is commercially very accessible and profitable vegetable to farmers. A wide range of essential biochemicals and minerals belongs to brinjal including vitamins, proteins, calcium, phosphorus. Brinjal Shoot and Fruit Borer *Leucinodes orbonalis* Guenee is the major infectious insect causing a high toll to plants. BSFB generally depends on brinjal but sometimes turns towards other solanaceous field crops and may be on wild hosts. The pest is spreader to wide areas of eggplant cultivation with South of Sahara, Africa and Asia including China and Philippines. Egg-laying occurs during night and incubation period ranges from 3-8 days depending of environmental conditions. Larval period completes in 12-22 days depending upon environmental situations and passes through five instars. Full grown larvae pupate into the soil or under plant debris and dropped dead shoots. Adult of BSFB is a whitish moth which hide during day time and activates from dusk to perform various activities like mating oviposition. It was investigated that environmental factors have a great impact on the life of *L. orbonalis*. Damage of the pest belongs to all parts of the plants like inflorescence, fruits and shoots. Larvae bore into fruits and shoots and in younger plants, caterpillars drill into midrib of large leaves. At the time of maturity, damage of the insect on fruits cause a serious loss in yield.

Keywords: eggplant, *Leucinodes orbonalis* G., life history, nature of damage

1. Introduction

Eggplant, *Solanum melongena* Linnaeus is a standout amongst the most vital vegetables in South and South-East Asia (Thapa, 2010) [45] having tropical-humid agro-climatic zones (Hanson *et al.*, 2006) [20]. It is the most well-known and economically crucial vegetable in Asia, is reachable in Bangladesh during the time as well as among the lean time frame. Proposals of eggplant all through the late gather season provide agriculturists with significant money pay (Alam *et al.* 2003) [1]. It is a prominent vegetable developed in territories having hot-Humid agro-climatic zones (Hanson *et al.*, 2006) [20] like that happening in South-East Asia (Thapa, 2010) [45] where it is the most regularly become solanaceous vegetable (Kantharajha and Golegaonkar, 2004) [22].

It is widely developed in India, Pakistan, China, Philippines, Bangladesh, Egypt, France, Italy, Middle East, Far East and U.S.A. (Unknown, 2010). It is a decent source of supplements, minerals, cancer prevention agents, vitamins, dietary fiber and weight training variables and proteins (Matsubara *et al.*, 2005; Obho *et al.*, 2005) [26][31]. One hundred grams of fruit contains 0.7mg iron, 13.0mg sodium, 213.0mg potassium (Nonnecke, 1989) [29], 12.0mg calcium, 26.0mg phosphorus, 5.0mg ascorbic corrosive and 0.5 International Units of vitamin An and gives 25.0 calories (Tindall, 1978) [46].

The development of eggplant is more than 1,600,000 ha delivering around 50 million Mt all through the world, among which, 90% of generation from five nations, of which china

shares 58 percent of yield, India, 25%, trailed by Iran, Egypt and Turkey (FAO, 2012) [15]. In Pakistan, it involves 9,044 ha zone and its creation is 88,148 tons (FAO, 2012) [15]. Yield of brinjal in Pakistan has been accounted for to be 97,466 kg/ha. The higher yield and longer fruiting and harvesting period draw the grower on eggplant creation (Ghimire *et al.*, 2001) [18]. Be that as it may, eggplant generation is in danger as of late because of expanded cost of management of different pests.

A portion of the imperative insect infestation of brinjal in Pakistan are brinjal fruit and shoot borer, *Leucinodes orbonalis* Guenee (Lep., Pyralidae), brinjal stem borer, *Euzophera perticella* Ragonot (Lep., Pyralidae), leaf roller, *Eublemma olivacea* (Walker) (Lep., Noctuidae), scarab, *Epilachna vigintioctopunctata* Fabr. (Col., Coccinellidae), aphid, *Aphis gossypii* (Homop., Aphididae), Whitefly, *Bemisia tabici* (Genn.) (Hemip., Alerodydidae), thrips, *thrips palmi* Karny (Thysanop., Thripidae) (Sirinavasan, 2009) [43].

Eggplant shoot and fruit borer, *Leucinodes orbonalis* Guenee is the key infection of eggplant (Latif *et al.*, 2010; Chakraborti and Sarkar, 2011; Saimandir and Gopal, 2012) [25][12][36] incurring sizeable damage in nearly all the eggplant developing regions (Dutta *et al.*, 2011) [13] and is most damaging, particularly in south Asia (Thapa, 2010) [45]. Because of its devastating effect inside fruit, the fruits wind up noticeably unmarketable and yield misfortunes up to 90 percent (Baral, *et al.*, 2006) [8]. It likewise lessens the

substance of vitamin C in fruit up to 80 percent (Sharma, 2002) [39]. Consequently, numerous growers leaving developing eggplant on account of this infestation (Gapud and Canapi, 1994) [17]. Subsequently, applicable written works were gathered and reviews arranged for the management of the *L. orbonalis* with thought of supporting writing helpful for management.

Among the elements in charge of low yield of brinjal, brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guen. is the most genuine one, which may cause 100% damage if no control measures are connected (Rahman, 2007) [34]. This pest may decrease the product yield up to 60-70% (Singh and Nath, 2010) [42]. The normal yields of brinjal in India are accounted for to be around 200 to 350 quintals for each hectare (AICRP Annual Report, 2006).

2. Viewpoint

A broad audit was done to gather applicable information with conference of diary articles, procedures, yearly reports, theory works and so forth covering fundamentally.

Management parts of the infection and essential part straight forwardly or in a roundabout way supporting to management. Appropriate and applicable data were arranged methodically by condensing with decisive layout.

3. An Evaluated Taxonomy

Leucinodes orbonalis Guenee was portrayed by Guenee in 1854. The favored logical name of the eggplant fruit and shoot borer is *Leucinodes orbonalis* Guenee, 1854. Walker assigned it as the sort types of the class Leucinodes in 1859 (CABI, 2007) [11]. The ordered position as indicated by CABI (2007) [11] is given as:

Phylum	:	Arthropoda
Class	:	Insecta
Order	:	Lepidoptera
Family	:	Crambidae (Syn: Pyralidae)
Genus	:	<i>Leucinodes</i>
Species	:	<i>orbonalis</i>
Scientific name	:	<i>Leucinodes orbonalis</i> Guenee

4. Host Range

L. orbonalis Guenee is essentially monophagous, encouraging mainly on eggplant; in any case, different plants having a place with family Solanaceae are accounted for to be hosts of this pest. In the region of worldwide eggplant development, *L. orbonalis* additionally happens on various host plants. Major recorded are: *Solanum melongena* Linnaeus (eggplant), *Solanum tuberosum* Linnaeus (potato) yet there are a few minor host, similar to *Ipomoea batatas* Linnaeus (sweet potato), *Lycopersicon esculentum* Mill (tomato), *Pisum sativum* var. arvense Linnaeus (Austrian winter pea) *Solanum indicum* Linnaeus, *Solanum myriacanthum* Dunal, *Solanum torvum* Swartz (turkey berry) and wild host *Solanum gilo* Raddi (gilo), *Solanum nigrum* Linnaeus (dark nightshade) (CABI, 2007) [11]. What's more, *Solanum anomalum* Thonn (Singh and Kalda, 1997) [41] and *Solanum macrocarpon* Linnaeus (Kumar and Sadashiva, 1996) [24] are wild has of *L. orbonalis*.

5. Dispersion

The insect is accounted for from areas of eggplant

development in Africa, South of the Sahara and South-East Asia, including China and the Philippines (CABI, 2007) [11]. In Asia, it is the most critical and the primary positioned insect of India, Pakistan, Srilanka, Nepal, Bangladesh, Thailand, Philippines, Cambodia, Laos and Vietnam (AVRDC, 1994) [5]. Its dispersion is for the most part higher in those regions having hot and moist atmosphere (Srinivasan, 2009) [43].

6. Life Cycle

Like different individuals from the order Lepidoptera, *L. orbonalis* experiences four development stages: egg, Larva, pupa and adult. The larval period is the longest, trailed by pupal and larval period.

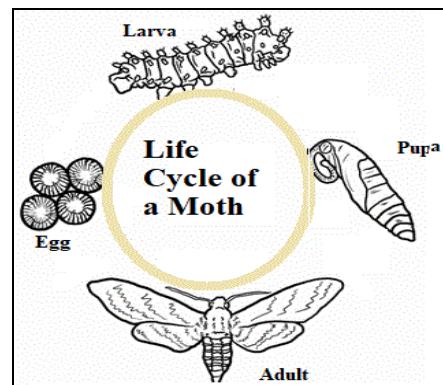


Fig 1

6.1 Egg

Oviposition happens amid the night and eggs are laid independently on the lower surface of the young leaves, green stems, bloom buds, or calyces of the leafy foods of eggs laid by a female shift from 80 to 253 (Taley *et al.*, 1984; Alpuerto, 1994) [44][3], be that as it may, announced as high as 260 (FAO, 2003) [14]. The eggs are laid in the early hours of the mornings separately or in the bunches on the ventral surface of the leaves (CABI, 2007) [11]. They are straightened, curved with 0.5 mm in distance across and shading is smooth white yet change to red before bring forth (Alam *et al.*, 2006) [2]. The egg takes brooding time of 3-5 days in summer and 7-8 days in winter and hatch into dull white larvae. (Rahman, 2006) [33].

6.2 Larvae

The larval period keeps going 12 - 15 days amid summer and 14 - 22 days amid winter season (Rahman *et al.*, 2009) [35]. Larvae go through no less than five instars (Atwal, 1976) [4] and there are reports of the presence of six larval instars (Baang and Corey, 1991; FAO, 2003) [7][14]. Sandanayake and Edirisinghe (1992) [37] contemplated the larval conveyance on develop eggplant. They discovered first instars in bloom buds and blossoms, second instar in all susceptible plant parts, third and fourth instars in shoots and for the most part in fruits. Usually, the extent of the main instar larvae is under 1mm long, the last instar larvae is 15 – 18 mm long however Sandanayeke and Edirinsinghe (1992) [37] announced the span of last instar larvae to be 18 to 23 mm. One fruit contains up to 20 larvae in Ghana (Frempong, 1979) [16].

6.3 Pupa

The full-developed larvae leave the swarmed shoots and

pupate in the dried shoots and leaves or in plant refuse and debris fallen on the ground inside intense luxurious covers. There were confirmations of quality of cases at soil profundities of 1 to 3 cm (Alam *et al.*, 2003) ^[1]. They pupate at first glance they touch first (FAO, 2003) ^[14]. The pupal period keeps going 6 to 17 days contingent on temperature (Alam *et al.*, 2003) ^[1]. It is 7 - 10 days amid summer, while it is 13 - 15 days amid winter season (Rahman, 2006) ^[33]. The shading and surface of the case coordinates the surroundings making it hard to distinguish.

6.4 Adult

The adult is a little white moth with 40-sectioned radio wires (Sexena, 1965) ^[38] and having spots on forewings of 20 to 22 mm spread. Emerging adults are generally found on the lower leaf surfaces following development or covering up under the leaves inside the plant extension (Alam *et al.*, 2003) ^[1]. Amid day, they like to stow away in close-by shady plots however around evening time every real movement, such as bolstering, mating and finding a place for egg-laying occur (FAO, 2003) ^[14].

The adult increases full development in 10 to 14 days. Life span of adults keeps going 1.5 to 2.4 days for males and 2.0 to 3.9 days for females. The pre-oviposition and oviposition periods extend 1.2 to 2.1 and 1.4 to 2.9 days, separately (Mehto *et al.*, 1981) ^[27]. The adult male passes on in the wake of mating and the female moth bites the dust in the wake of laying eggs (Kar *et al.*, 1995) ^[27]. The general life cycle finishes in 22 to 55 days. It gives rise five ages per year and is dynamic consistently.

FAO (2003) ^[14] demonstrated the impact of climatic conditions in the life cycle of the *L. orbonalis* in eggplant. *L. orbonalis* is dynamic in summer months, particularly amid the blustery season and less dynamic from November to February. Pinnacle populaces are frequently announced in June-August. Advancement of the distinctive phases of the pest takes longer amid the winter months. *L. orbonalis* populaces are accounted for to increment with normal temperature, relative humidity and precipitation.

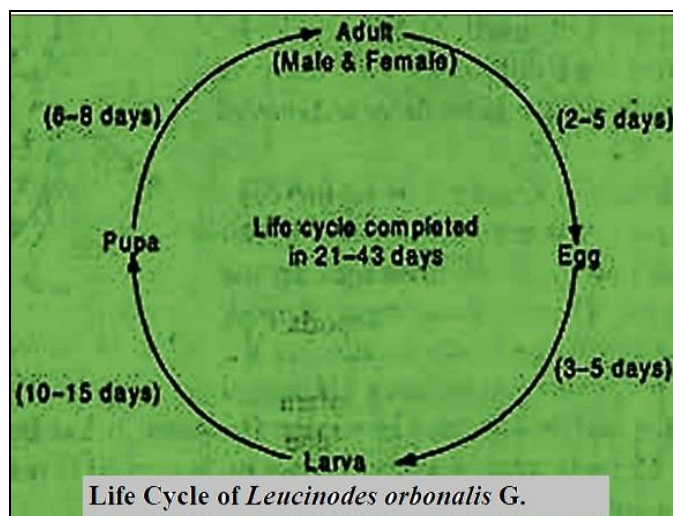


Fig 2

7. Nature and extent of damage

L. orbonalis attacks for the most part on blossoming, fruiting

and vegetative developing stage on fruits/units, developing parts and inflorescence (CABI, 2007) ^[11]. The higher percent of the larvae was in fruits took after by shoots, blossoms, bloom buds and midrib of leaves (Alpuruto, 1994) ^[3]. Inside one hour in the wake of bring forth, *L. orbonalis* larvae drills into the closest delicate shoot, bloom, or fruit. Not long after in the wake of drilling into shoots or fruits, they attachment or stop up the passageway opening (nourishing passage) with excreta (Alam *et al.*, 2006) ^[2]. In young plants, caterpillars are accounted for to exhaust inside petioles and midribs of extensive leaves (Butani and Jotwani, 1984; Alpureto, 1994; AVRDC, 1998) ^{[10][3][6]} along these lines shrivelling, drop off and shrink of the young shoots prompting delay on shoot development, decrease on yield and yield parameter. Larval bolstering inside the fruit brings about pulverization of fruit tissue. In serious cases, spoiling was normal (Neupane, 2001) ^[30]. Larval nourishing in bloom was uncommon, if happen, inability to shape fruit from harmed blossoms (Alam *et al.*, 2006) ^[2]. The caterpillars of *Leucinodes orbonalis* drill into the developing points of young tender shoots and a wilted drooping shoots a run of the mall manifestation, which at last shrivels away. The fruiting beads droop down while the fruits indicate round about openings, which are the leave gaps (Peshwani and Lal, 1964).

Damage to the fruits, especially in harvest time, is exceptionally extreme and the entire yield can be annihilated (Atwal, 1976) ^[4]. *L. orbonalis* is dynamic during the time at places having moderate atmosphere yet its movement is antagonistically influenced by serious chilling, Singh *et al.* (2000), Naqvi *et al.* (2009) ^[28] and Kumar and Dharmendra (2013). They found that BSFB pervasion on brinjal started in August and achieved its crest in October and afterward began declining. Ghosh and Senapati (2009) ^[19] found that this pest causes the most destruction and is most dynamic amid the late spring months, i.e., from May to August. It turns out to be less dynamic amid the winter months, especially in December and January. Varma *et al.* (2009) ^[47], considered the occurrence and plenitude of BSFB in Allahabad, India and watched the most elevated rate on brinjal in December. Patel *et al.* (1988) ^[32] discovered shoot and fruit damage in brinjal by BSFB was higher in May transplanted (spring) crops than that in July and September transplanted (fall) crops. The misfortunes caused by insect change from season to season since direct temperature and high moistness support the populace develop of brinjal shoot and fruit borer (Shukla and Khatri, 2010) ^[40], (Bhushan *et al.*, 2011) ^[9]. At vegetative stage, the recently brought forth larvae bore in to petioles and midrib of huge leaves and young delicate shoots they feast upon the inward tissue causing the shoot hung down and wilted at the regenerative stage the larvae like to drill into blossom buds and furthermore go into the plagued fruits through the calyx. Watching the drilling openings, the pervaded fruits can be distinguished without much of a stretch. Furthermore, the dull shaded excreta can be seen without much of a stretch to the opening of pervaded fruits. Optional pervasions by specific microorganisms may create additional decay of the fruits (Islam and Kairm, 1991) ^[21] and make them at last unfit for human utilization.

The caterpillars of *Leucinodes orbonalis* drill into the developing points of young tender shoots and a wilted

drooping shoots an ordinary side effect, which eventually wilts away. The fruiting beads droop down while the fruits demonstrate round about gaps, which are the leave openings (Peshwani and Lal, 1964). Larval phase of this pest makes genuine damage to shoots and fruits of eggplant. Larvae drill into the young shoots and feast upon interior tissues bringing about shrinking of the shoot, which diminishes plant development in number and size of fruits (Atwal and Dhaliwal 2007) ^[4]. They additionally drill into the plants on inward tissues making crisscross passages. The nourishing passages are frequently stopped up with frass, which makes even somewhat injured fruits unfit for promoting (Alam *et al.* 2003) ^[1].



Fig 3

8. Conclusions

Likewise, other lepidopterans only the larval stage of *L. orbonalis* is the damage causing stage. The adults are moths which feed on nectar of plants. Five to six broods in a year indicates the good reproductive attributes of the pest. As it is discussed above that the brinjal is common in hot and humid climates, therefore the active growth and destruction of the pest confers in summer season particularly in monsoon season when temperature and humidity levels are considerably remains high.

Attack of the pest begins to start approximately just after transplanting and even sometimes before shifting the plants into field. In severe cases, a single part of the plant cannot escape from being damaged. Flowers, shoots, fruits, inflorescence and developing structures are consumed especially fruits which are not remain edible after pest infestation. Larvae bore into fruits and cause the drooping off of fruits which causes high economic loss. Drilling into shoots happens in the form of wilting of plant. In Pakistan, the effect of brinjal shoot and fruit borer infestation was observed in the brinjal sowing areas like plains of Punjab and Sindh. Not only brinjal, *L. orbonalis* is found on a wide range of hosts like most of the solanaceous crops.

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