

HELICOVERPA ARMIGERA ARMIGERA (HUBNER, 1805) : THE COTTON BOLLWORM (LEPIDOPTERA : NOCTUIDAE) INFESTATION IN KITCHEN GARDENS, DEHRA DUN (UTTARAKHAND, INDIA) WITH ITS SYSTEMATICS, HOST PLANTS AND CONTROL MEASURES

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ABSTRACT : The present communication deals with the infestation of *Helicoverpa armigera armigera* (Hubner, 1805), the cotton bollworm, an invasive moth, in kitchen gardens of Hari Vihar-Ranjitpuram residential area (Vijay Park) located in western Dehra Dun city (Uttarakhand), with its systematics, host plants and control measures. Its invasion in kitchen gardens and flower beds has not been noticed earlier and hence taken up its study here for the general awareness of residents/gardeners. It is a highly polyphagous moth and does great harm to the host-plants, especially the important agricultural crops (linseed, maize, paddy, soybean, pulses, tobacco etc.), vegetables (beans, brinjal, capsicum, green-chilli, cucurbits, lemon, okra, peas, potato, tomato etc.) and some flowering plants (*Chrysanthemum*, *Geranium*, *Rosa* etc.).

Key words : Cotton bollworm infestation in kitchen gardens, Dehra Dun.

INTRODUCTION

Helicoverpa armigera armigera (Hubner, 1805), the cotton bollworm is a polyphagous pest moth invading a large number of plants (Matov *et al.*, 2008; Robinson *et al.*, 2010; Paul *et al.*, 2016, Shubhalaxmi, 2018). The larvae feed on a wide range of host plants including many important agricultural crops (cotton, linseed, maize, paddy, pulses, sorghum, soybean, sunflower, tobacco etc.), vegetables (beans, brinjal, capsicum, green-chilli, cucurbits, lemon, okra, peas, potato, tomato etc.) and flowering plants (*Chrysanthemum*, *Geranium*, *Rosa* etc.) and do great harm. It is a major pest of cotton and one of the most widely distributed species and prevalent throughout India. However, studies on its invasion in kitchen gardens are rare and hence taken up here for the awareness of residents. *Helicoverpa armigera* is recognised by two subspecies, viz. *H. armigera armigera* (Hubner, 1805), the forma-typica, widely distributed in Africa, Asia, Caribbean region, Europe and South America and *H. armigera conferta* (Walker, 1857) occurring in Australia, New Zealand and Oceania.

Study site : Vijay Park

Vijay Park is a big residential area near Ballupur crossing, Chakrata road in western part of Dehra Dun city with good green cover of Litchi Mango, Kachnar,

Jamun and ornamental trees. Hari Vihar-Ranjitpuram is a subdivision of it where cotton bollworms were found. Most of the residents maintain kitchen gardens and lawns with flower beds in their dwellings, which attract these invasive moths.

***Helicoverpa armigera armigera* (Hubner, 1805)**

Corn Earworm, Cotton Bollworm

Synonymy

Noctua armigera Hubner, 1805. *Samml. eur. Schm.*: i-iv, 1-194, Noct. 2, pl.79, fig. 370 (type-locality: Europe).

Heliothis obsoleta Fabricius, 1775. *Syst. Ent.*, 2(1): 184-198 (and vide Matov *et al.*, 2008).

Noctua obsoleta sensu auct., nec Fabricius, 1793. *Entomologia Systematica emendate et aucta*, 3 (1): i-iv, 456 (1-487) (type-locality: S America) (also vide Matov *et al.*, 2008).

Noctua barbara Fabricius, 1794. *Secundum Classes, Genera, Species, Adjectis synonymis, Locis, observationibus, descriptionibus*, 3 (2), 111 (1-349) (type-locality: N Africa) (unavailable name, nomennudum, Hardwick, 1965: 91).

Chloridea obsoleta, Duncan & Westwood, 1841 (vide Wikipedia; AgroAtlas).

Heliothis pulverosa Walker, 1857. *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum*, Part XI Noctuidae, **11**(1-4), 688 (493-764) (type-locality: South Africa, Western Cape).

Heliothis uniformis Wallengren, 1860. *Wiener entomologische Monatschrift*, **4**(2), 33-46, (6): 171 (161-176) (type-locality: South Africa).

Heliothis armigera fusca Cockerell, 1889 (vide Matov *et al*, 2008).

Heliothis fusca Cockerell, 1889 (vide ftp.funet.fi; Wikipedia).

Heliothis guidellii Constantini, 1922 (vide Matov *et al*, 2008).

Helicoverpa armigera subsp. *communi* Hardwick, 1965. *Memoirs of the entomological Society of Canada* **40**, 101-102 (1-247) (type-locality: Canton Island, Central Pacific) (considered a subspecies of *armigeraby* Hardwick, 1965:101).

Heliothis rama Bhattacharjee & Gupta (1972). *Journal of Natural History* **6**(2), 147 (147-151), figs. 1-3 (type-locality: Nagpur, India).

Classification

Class : Insecta Linnaeus, 1758, order: Lepidoptera Linnaeus, 1758, suborder: Heterocera/Glossata Fabricius, 1775, superfamily: Noctuoidea Latreille, 1809, family: Noctuidae Latreille, 1809, subfamily: Heliothinae Boisduval, 1828; genus: *Helicoverpa* Hardwick, 1965.

Sighting

1 example, 41, Hari Vihar, Vijay Park (western part of Dehra Dun city), Dehra Dun, 30.4.2017 by self (Dr. Akhlaq Husain).

Diagnostic characters

Adult : Line markings and reniform spot diffused, hind-wings lighter, pale yellow with narrow brown band on outer edge and a dark round spot in middle of wing.

Male : Forewings lighter greenish-gray, with slightly darker transverse band near margin.

Female : Forewings yellowish or orange-brown.

Wing-span and body length: 30-40 mm and 12-20 mm (Agro Atlas; Wikipedia).

Larva/Caterpillar : Pale green with dark green line above, colouration variable, mostly greenish and yellow to red-brown, head yellow with spots, three dark stripes above and one yellow light stripe on lateral side, ventral side paler.

Length : 40 mm (Wikipedia).



Fig. 1 : *Helicoverpa armigera armigera* (Hubner, 1805).

Altitudinal range : Sea level to 3300 m (Matov *et al*, 2008).

Distribution : Widely distributed.

India : Uttarakhand : Dehra Dun (DohranKhas, Dehra Dun, 25.11.2016 and 28.11. 2016 (larva), 4.12. 2016, 24.12. 2016 (pupa) and 12.1.2017 (emerged), 12.1.2017 (adult), by S. Sondhi). The present record from Vijay Park residential area located in western part of Dehra Dun city is the first.

Rest of India : Andhra Pradesh, Arunachal Pradesh (Lama Camp, Eagle Wildlife Sanctuary, West Kameng district, 19.4,2015, by P. Roy), Gujarat (New Sama, Vadodara district, 11.8.2019, by R. P. Mahajan), Haryana (Hissar by Madan *et al*, 1996), Himachal Pradesh (Upper Barkota, Dalhousie, Chamba district, 7.6. 2019 by S. Sondhi), Madhya Pradesh (NCBS Field station, Pachmarhi, Hoshangabad district, 24.4.2018 by R. Singh), Maharashtra (Maharashtra Nature Park, Mumbai city district, 28.12.2016 by D. P. Sawant; Dombivili East, Thane district, 15.9.2017 by R. P. Mahajan) and Punjab and Andhra Pradesh (Paul, 2007).

Elsewhere, Temperate Africa (including Madagascar and Reunion; Algeria), Carribean Region, Central (Kazakhstan) and South-east Asia, Egypt (NW Africa-SW Asia), Europe (Albania, Bulgaria, Germany, Greece, Moldavia, Portugal, Nordic countries/Scandinavia, Spain, Ukraine), Indian Subcontinent, Iran, Madagascar, Middle East (Israel), New Zealand, North Caucasus/Ciscaucasia, South Caucasus/Trans-Caucasia, Reunion Island (Indian Ocean), South America (Brazil) and Southern Russia.

Host plants : It is a highly polyphagous species hosting over 180 plant species. Its larvae, though capable of developing on host plant leaves, are less commonly

seen doing so in nature. In flowering stage of host, hatchlings enter into the ovary and feed on it, during early stage they feed scraping bracts first and later through ray-florets covering disc florets and finally on immature ovaries with developing seeds (Paul, 2007).

Paul (2007), Robinson *et al* (2010), Paul *et al* (2016), Shubhalaxmi (2018) and others have reported the following host plants. Matov *et al* (2008) recorded the larvae from wide range of herbaceous plants, shrubs and trees belonging to 38 families, mostly crops of cotton and tomato.

Family : Alliaceae (*Allium cepa*, the Onion or *Piyaz*).

Family : Amaranthaceae (*Amaranthus* spp., the Pig-weed or *Jangli Palak*; *Artiplex* spp., the Orache/Salt-bush).

Family : Asteraceae (*Carthamus tinctorius*, the Safflower or *Kusum*; *Chrysanthemum indicum*, the Chrysanthemum or *Guldaudi*; *Guizotia abyssinica*, the Black seed/Niger or *Ramtill/Ramtilla*; *Saussurea acandicans*, *kali ziri* or Murang; *Zinnia elegans*, the Common Zinnia).

Family : Cannabaceae (*Cannabis sativa*, Gallow grass of *Bhang/Ganja*).

Family : Caryophyllaceae (*Dianthus caryophyllus*, the Carnation/Clove pink).

Family : Cucurbitaceae (*Cucumis* sp.).

Family : Euphorbiaceae (*Ricinus communis*, the Castor Bean or *Arandi*).

Fabaceae (*Arachis hypogaea*, the Ground-nut or Moongphali/Chinabadam; *Cajanus cajan*, the Pigeon-pea or *Arhar/Tuar*; *Cicer arietinum*, the Chick-pea or *Kabli-chana*; *mungo*, the Black Gram/*Urad* Bean; *Crotalaria juncea*, the Sunn Hemp or *Jhunjhunja*; *Dalbergia sissoo*, the North Indian Rosewood or *Sheesham*; *Glycine max*, the Soybean or *Soyabean*; *Medicago sativa*, the Alfalfa/Lucerne or *Lusan-ghas*; *Phaseolus vulgaris*, the French Bean or *Rajmah*; *V. radiata*, the Moong Bean; *Pisum sativum*, the Pea or *Matar*; *Vigna mungo*, the Black Gram or *Urad*; *Vigna radiata*, Green Gram or Moong; *V. unguiculata*, the Black-eyed Bean/Cow-pea or *Lobiya*).

Family : Geraniaceae (*Pelargonium hirsutum*, the Geraniums/Stork-bills).

Family : Lamiaceae (*Lavandula angustifolia*, the Lavender).

Family : Linaceae (*Linum usitatissimum*, the Common Flax/Linseed or *Alsi*).

Family : Malvaceae (*Abelmoschus esculentus*, the Ladies Finger/Okra or *Bhindi*; *Alcea rosea*, the Hollyhock or *Gulkhaira*; *Gossypium arboreum*, the Cotton or *Kapas*; *G. hirsutum*, the Mexican or Upland Cotton; *Hibiscus mutabilis*, the Cotton Rose or *Sthalkamal*).

Family : Mimosaceae (*Albizia procera*, the White Siris or SafedSiris; *Senegalia catechu*, the Black Catechu or *Dant-dhavan/Khair*).

Family : Platanaceae (*Platanus orientalis*, the Oriental Plane).

Family : Plantaginaceae (*Antirrhinum majus*, the Dog Flower/Snap-dragon).

Family : Poaceae (*Avena sativa*, the Common Oat or *Jui*; *Oryza sativa*, the Paddy/Rice or *Chawal/Dhaan*; *Pennisetum americanum*, *Sorghum bicolor*, the Sorghum or *Jwar*; *Zea mays*, the Maize or *Makka*).

Family : Rosaceae (*Alchemilla*, *Cotoneaster*, *Crataegus*, *Prunus*, *Rosa*, *Rubus* and *Sorbus* spp).

Family : Resedacaceae (*Reseda odorata*, the Mignonett).

Family : Rutaceae (*Citrus* plants).

Family : Salicaceae (*Populus euphratica*, the Desert Poplar; *Salix tetrasperma*, the Indian Willow).

Family : Solanaceae (*Capsicum annum*, the Capsicum or *Shimla Mirch*; *Datura stramonium*, the Devil's Apple/Thorn-apple or *Dhatura*; *hyoscyamus niger*, the Henbane/Stinking Night-shade or *Khurasani Ajwain*; *Lycopersicon esculentum*, the Tomato or *Tamatar*; *Nicotiana tabacum*, the Tobacco or *Tambaku*; *Solanum nigrum*, the Black Nightshade or *Makoi*; *S. tuberosum*, the Potato or *Aaloo*; *S. melongena*, the Brinjal/Egg-plant or *Baigan*).

Management

Biological Method : It is done through entomophagous insects like *Habrobra conhebetor*, minute ectoparasitoid wasp (Hymenoptera : Braconidae) and *Trichogramma* spp (Hymenoptera : Trichogrammatidae) wasp endoparasitoids (Upadhyay *et al*, 2001; Knutson, 2005) and *Campoletis chloridae* (Hymenoptera : Ichneumonidae) (Pawar *et al*, 1989).

Trichogramma spp are used for the control of pests (*Helicoverpa armigera* and other moths) on numerous plants (cotton, sugar-beets or *chukandar*, sugar-cane, vegetables, orchards and forests) (Hassan, 1993).

Neem-based Pesticides : Pesticides made from various parts of Neem tree (*Azadirachta indica*) are also very effective in controlling insects that have become resistant to synthetic pesticides and in this regard the

apprehension that their large-scale use may lead to resistance in pests has not been proved correct, they rather have no residual effect on agricultural/vegetable produce and hence the best reliable substitute to hazardous pesticides (Boeke *et al.*, 2004). Paul (2007) also included *Neem*-based pesticides in his list of pesticides.

Chemical pesticides

Singh *et al.* (2015) reported that, the treatment Flubendiamide 480 SC @ 75 ml/ha was found best with minimum population of *H. armigera*. Sreekanth *et al.* (2014), Chowdary *et al.* (2010), who reported that chlorantraniliprole was effective against okra fruit borer, *H. armigera*. Shinde *et al.* (2015) reported that indoxacarb 0.01% treatment was found most effective (Kumar and Sarada, 2015). Pod damage due to pod borer, *H. armigera* was lowest in plots treated with Spinosad 45% SC (1.53%), Flubendiamide 20% WG (2.46%), chlorantraniliprole 20% SC (2.60%) and Emamectin benzoate 5% SG (2.85%) with 88.8, 81.9, 80.9 and 79.1 per cent reduction over control, respectively. Indoxacarb and Flubendiamide were found next best treatment after Rynaxypyr (Chlorantraniliprole). Rynaxypyr followed by Indoxacarb and Flubendiamide and this was in agreement with the Shan *et al.* (2003), Gowda *et al.* (2007) and Kumar and Shivaraju (2009). As per finding of Bhosale *et al.* (2009), Chlorantraniliprole was the most effective in controlling gram pod borer. Anandhi *et al.* (2011) observed Novaluron as one of the better treatment followed by Indoxacarb. However, the excessive use of pesticides is not advisable for being hazardous to health of consumers and even dealing farmers, which can be avoided by the use of bio-pesticides. Many a times, the side effects of chemical pesticides are more serious than problems themselves.

Remarks : It comprises two subspecies: *H. armigera armigera* (Hubner, 1805), widespread in Africa, South America, Asia, Caribbean countries and Europe and *H. armigera conferta* (Walker, 1857), found in Australia, Oceania and New Zealand: type-locality (vide Wikipedia). Earlier, Hardwick (1965) recognised three subspecies, forma typica occurring throughout most of the range, *H. a.conferta* (Walker, 1857) in Australia and the Pacific and *H. a.commoni* Hardwick, 1965 in south-east China.

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