Asian J Agri Biol, 2013, 1(1):23-28.

HOST PLANTS OF LEAF WORM, *SPODOPTERA LITURA* (FABRICIUS) (LEPIDOPTERA: NOCTUIDAE) IN PAKISTAN

Munir Ahmad[1*], Abdul Ghaffar[2], Muhammad Rafiq[2]
[1]*Pir Mehr Ali Shah, Arid Agriculture University, Murree Road, Rawalpindi, Pakistan*
[2]*Entomology Section, Central Cotton Research Institute, Old Shujabad Road, Multan Pakistan*

ABSTRACT

Spodoptera litura is a notorious leaf feeding insect pest of more than one hundred plants around the Asia-Pacific region. Host plant survey for two years from three different locations in cotton belt revealed 27 plant species as host plants of *S. litura* belonging to 25 genera of 14 families including cultivated crops, vegetables, weeds, fruits and ornamental plants. Major host plants on which it thrived for maximum period were *Gossypium hirsutum* L., *Ricinus communis* L., *Brassica oleracea* var. *botrytis* L., *Colocasia esculenta* L., *Trianthema portulacastrum* L. and *Sesbania sesban* L.. Eggs were also collected from tree plants but larvae did not complete their development. Reliance of *S. litura* on major plant species of cultivated crops necessitates their regular monitoring especially during March to April for their population abundance and early warning for their management on commercial crops like cotton.

Keywords: *Spodoptera litura*, host selection, major host plants, host preference

INTRODUCTION

Large host range is considered important for better chance to survive during evolutionary strategies (Simpson et al., 2002; Raubenheimer and Simpson, 2003; Lee et al., 2003). Host plant range of generalist insect pests like *S. litura* may vary due to their higher level of feeding on different plant species and almost all parts of these plants (Schoonhoven et al., 1998; Suomela, 1996). Host selection may be associated with primary as well as secondary metabolites present in these plants which help them to choose preferred hosts due to nutritional variation (Ehrlich and Murphy, 1988; Rosenthal and Berenbaum, 1992; Simpson et al., 2002; Lee et al., 2003).

In Genus Spodoptera, Spodoptera litura and Spodoptera littoralis are almost similar in their morphological characters and can be differentiated on the basis of male and female genitalia. However, S. litura is native to India and South-East Asia (Waterhouse and Norris, 1987). It is considered as one of the most destructive insect pests in Asia-Pacific region because of its high reproductive rate and heavy losses to crops. Larvae feed gregariously on plant leaves and later eat almost every plant part. The behavior of moving like army from one field to another gave its local name as armyworm in Indo-Pak region (Ahmad et al., 2007a).

**Corresponding author:* e-mail: maqmunir@gmail.com

Eggs are generally laid in batches covered with the tuft of abdominal hair of the moth to protect them from more than 100 species of biocontrol agents (Rao et al., 1993). On hatching, larvae feed in clusters and later disperse through silken threads in third larval instar. Single female moth can lay more than 2000 eggs in her (6-8 days) life span. There may be 3-4 consecutive layers of eggs in a single batch hatching generally in 2-3 days (Waterhouse and Norris, 1987; Hill, 1975, Ahmad, M. personal observations).

Environmental conditions during 2004 and 2005 favored their multiplication and wide spread dispersal on cotton in Punjab and Sindh provinces of Pakistan with heavy losses on cotton. Insecticides were even imported through air freight to manage the shortage of insecticides for its management. On cotton crop, generally 2-3 applications of insecticides at full dose rates are applied to manage this insect pest. Heavy resistance to all conventional and some new chemistry insecticides have also been observed which need proper rotation and wise use of these insecticides for long term benefits in pest management (Ahmad et al., 1997a,b, 2008, 2009; Sayyed et al., 2008, Saleem et al., 2008).

Lack of information on host plants range in the cotton belt urged to conduct a planned study to observe the year-round presence of *S. litura* population on different host plants and its behavior for effective and timely detection

regarding level of insect and to keep under observation its sources of multiplication.

MATERIALS AND METHODS

All plant species found in the cotton growing area with multiple cropping pattern were examined from 2004 to 2006 at fortnightly intervals in a radius of more than 100 km around Multan, Jahanian and Muzaffar Garh districts of Punjab, Pakistan. Depending upon the plant species, the sample size varied from whole plant including leaves, branches, flowers and fruit etc to leaves only because of leaf feeding behavior of *S. litura*. Status of its presence was estimated on per leaf area basis observing egg and larval stages. To make sample size uniform, larval population of *S. litura* was converted into $10cm^2$ leaf area irrespective of shape and size of the leaves of different plant species examined with them.

Host plants of *S. litura* were categorized on the availability of larvae for a longer period as abundant if large number were present in the visited areas. Their less availability was termed as fair in density and plant species harbouring very small number were designated as rare host plant. Larval damage only was not considered as a parameter of host plant consideration. Plants harboring egg batches on them were brought in laboratory to verify their host plant status if *S. litura* first instar larvae hatching from the same egg batch laid on the specified host. Plant species carrying both egg batches and larvae of all the instars were designated as true host. Plant species carrying *S. litura* for more than three months were classified as a major host with maximum larval population per $10cm^2$ leaf surface areas and others not satisfying this condition were termed as minor hosts (Arif et al., 2009).

RESULTS AND DISCUSSION

Leafworm, *S. litura* was recorded from 34 hosts including cultivated crops, vegetables, weeds, fodder and ornamental plants. There were two of cultivated crop as cotton and maize, eleven of vegetables, nine of weeds, four of fodders and eight were of ornamentals. Early maximum population was observed on arum where it completes at least three non-overlapping generations which shifted on cotton and cauliflower where it persisted from July to November (Ahmad et al., 2008; 2009). On horse purslane, larvae were found from July to October. Due to drastic decrease in major host plants availability and intensive insecticide application on cauliflower from mid-November, it started shifting from minor hosts like weeds, ornamentals and fodders. Six crops and vegetables were considered as the major hosts of *S. litura* whereas others were recorded as minor hosts (Table 1).

The development/population dynamics of *S. litura* on arum and horse purslane was seen after minimum activity period from November to early April. Interaction between moth catches in light trap coincided with early presence of its larval damage serving as a rich and excessive food resource to multiply (Fig. 1). Weekly observations for moths trapped and field larval infestation data from three different locations revealed that first larval infestation was more than 35% but others were negligence. Moth catches then decreased drastically to a few per day. Later on, second and third moth catches trend was seen after an average of 25–30 days each but moth number in light trap and % infestation in arum fields decreased drastically. This suggests the direct effect of arum crop on moths ultimately helping in its population build up (Fig. 2). Cauliflower being transplanted in early August to end March remains in the cotton adjacent field around the countryside provides an alternate source for it. Vegetable farmers being more concerned to insect control than cotton growers contribute more to limit the *S. litura* population (Ahmad et al., 2009; Khaliq et al., 2007).

Insect herbivore relationship developed with respect to their feeding, survival and multiplication of generation. Such selection of different host plants helps in maintaining their numbers to multiply and maintain their diversity in nature (Raubenheimer and Simpson, 2003; Lee et al., 2003). This insect pest, as important general leaf feeder, utilizes green matter and in severe food shortage feeds on almost all parts of the plants. Such observations were clear when the leaves were either eaten up and transfer of insects to plant fruiting parts like flowers, fruits in different crops (Rosenthal and Berenbaum, 1992; Simpron et al., 2002). Host selection also depends on presence of plant metabolites which either attract or deter the pests (Ehrlich and Murphy, 1988; Hill, 1975). Cotton being the most suitable plant species is selected as a host by different sucking as well as chewing insect

pests including *S. litura*. Presence of plant metabolites may also hinder their development but decrease deleterious effects due to gregarious feeding (Simpson et al., 2002; Lee et al., 2003). Different plant species were observed with egg batches which did not even completed their larval development and died earlier (Table 2). These might have been used for forced egg-laying when suitable hosts were unavailable or near to grow out under these tree species. This aspect further needs to be tested if these mothers select the possibilities of future present of host plants to serve as their progeny development.

It is, therefore, concluded that management of *S. litura* on these hosts plants especially arum crop during the non-cotton growing period may reduce its pressure on cotton crop. Recorded host plants contribute in the maintenance of *S. litura* population abundance and its wide spread management. The pest population and its density largely depends upon the availability of host plants.

Table 1 Plants parts examined for leaf worm, *Spodoptera litura* infestation during host plants field survey

Sr. No.	Family	Technical Name	Host status	Local Name	Plant part examined	Pest Status
1	Malvaceae	*Gossypium hirsutum* L.	Abundant	Cotton	Leaf, Flower, Fruit	Major
2		*Abelmoschus esculentus* L.	Fair	Okra	Leaf, Flower, Fruit	Minor
3		*Hibiscus rosa sinensis*	Rare	Gurhal	Leaf	Minor
4	Graminae	*Zea mays* L.	Rare	Maize	Leaf	Minor
5		*Sorghum bicolor*	Rare	Sorghum	Leaf	Minor
6		*Trifolium alexandrium* L.	Fair	Clover (Berseem)	Leaf	Minor
7	Euphorbiaceae	*Ricinus communis* L.	Fair	Castor	Leaf	Major
8		*Sesbania sesban*	Abundant	Jantar	Leaf, Flower	Major
9	Cruciferaceae	*Brassica juncea* Cosson.	Rare	Raya	Leaf, Flower	Minor
10		*Brassicae oleracea botrytis* L.	Abundant	Cauliflower	Leaf	Major
11		*Raphanus sativus* L.	Rare	Radish	Leaf	Minor
12	Umbelliferae	*Daucus carota* L.	Rare	Carrot	Leaf, Flower	Minor
13	Araceae	*Colocasia esculenta* (L.) Schott	Abundant	Arum	Leaf	Major
14	Solanaceae	*Capsicum annuum* L.	Rare	Chillies	Leaf, Fruit	Minor
15		*Solanum tuberosum* L.	Rare	Potato	Leaf	Minor
16	Chenopodiaceae	*Spinacia oleracea* L.	Rare	Spinach	Leaf	Minor
17	Alliaceae	*Allium cepa* L.	Rare	Onion	Leaf	Minor
18	Leguminosae	*Pisum sativum* L.	Rare	Peas	Whole Plant	Minor
19	Chenopodiaceae	*Chenopodium album* L.	Rare	Bathu	Leaf, Fruit	Minor
20		*Chenopodium murale* L.	Rare	Karand	Leaf, Fruit	Minor
21		*Trianthema portulacastrum* L.	Fair	Horse purslane, It sit	Leaf, Flower	Major
22		*Amaranthus blitum*	Rare	Chulai	Leaf	Minor
23		*Cucumis tetragona* Roxb	Rare	Chibbar	Leaf	Minor
24	Capparidaceae	*Cleone viscose* L.	Rare	Chaskoo	Leaf	Minor
25		*Convolvulus arvensis*	Rare	Lehli	Leaf, Flower	Minor
26	Labitaceae	*Ocimum basilicum* L.	Rare	Niaz Boo	Leaf	Minor
27	Compositae	*Dahlia coccinea*	Rare	Dahlia	Leaf	Minor

Table 2 Plants harboring egg batches of leaf worm, *Spodoptera litura* and their survival rate of hatched larvae

Sr. No.	Family	Technical Name	Local Name	Plant part examined	48 h survival	72 hr survival
1	Solanaceae	*Solanum melongena* L.	Brinjal	Leaf, flower, fruit	Low	No
2	Rosaceae	*Rosa indica* Lindle	Rose	Leaf, flower	Low	No
3	Oleaceae	Jasminum sambac (L.) Ait	Motia	Leaf	Medium	No
4	Anacardiaceae	*Mangifera indica* L.	Mango	Leaf, flower stalk	Low	No
5	Rutaceae	*Citrus spp.*	Lemon	Leaf	High	Medium
6	Apocynaceae	Nerium indicum Mill.	Kanair	Leaf	Low	No
7	Moraceae	*Morus alba* L.	Mulberry	Leaf	High	High
8	Tiliaceae	*Grewia asiatica* L.	Falsa	Leaf	Low	No
9	Myrtaceae	*Eucalyptus camaldulensis* Dehnh.	Sufaida	Leaf	Medium	No
10	Meliaceae	*Azadiracta indica* A. Juss	Neem	Leaf	Medium	Low
11	Fabaceae	*Dalbergia sissoo* Roxb.	Sheesham	Leaf	Low	No

*Survival Rate: Low: 30%; medium: 50-60%, High: 80-90%; No: all dead

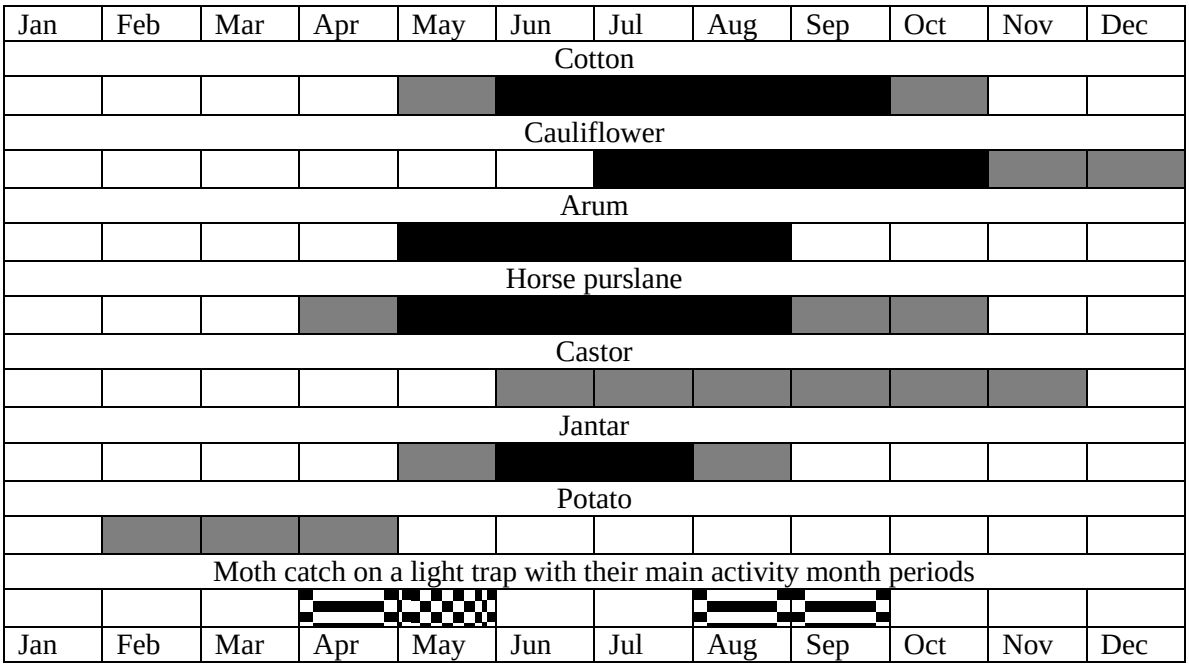

Figure 1 Calendar of some major host plants harbouring *Spodoptera litura* populations in the cotton belt of Multan, Pakistan during 2006

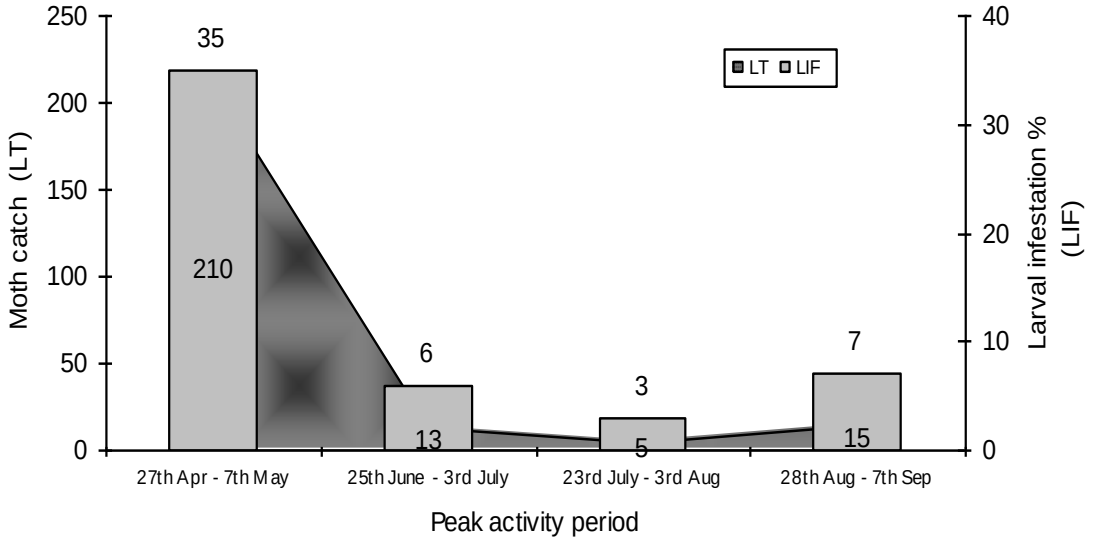

Fig. 2 Comparison of *S. litura* mean moth catch with larval infestation on arum crop during 2005-06

ACKNOWLEDGEMENTS

Authors are thankful for two anonymous reviewers to improve the manuscript. We are also thankful for Director, CCRI, Multan for providing facilities for conduct of this field survey and laboratory insect rearing.

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