Revealing the Menace Posed by *Spodoptera Litura* (Fabricius) to Groundnut

Joseph Soren and Uttam Bouri*

Department of Plant Pathology, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

*Corresponding Author: uttambouri757@gmail.com

Groundnut (*Arachis hypogaea*, Linn) is an important Kharif oil seed crop of India cultivated on about 4.56 million hectares, with a total production of 6.77 million tonnes and average yield of 1486 kg/hectare. The area under groundnut constituted approximately 3.3 percent of the net sown area in India and contributed nearly 16 percent of groundnut production to the world during 2016. Groundnut is now in constant threat from polyphagous pests such as *Spodoptera litura* due to its resistance build up and voracious feeding habit, causing up to 47 per yield loss in India. The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is likely to be 0.3 °C–1.7 °C which will bring a large area under the threat of this pest.

Life cycle

Spodoptera litura (F.) belongs to the family Noctuidae and order Lepidoptera, also known as tobacco cutworm or cotton leaf worm is a nocturnal pest with 30-40 days life cycle. Adult is stout having wavey white markings on the brown forewings and white hind wings with a brown patch along its margin. Eggs are laid in groups and covered with hairs on the leaves. The egg period is 4-5 days. Larva is stout, cylindrical, pale brownish with dark markings. The body may have row of dark spots or transverse and longitudinal grey and yellow bands. When fully grown, measures about 35-40 mm in length. The larval period is 14-21 days. It pupates in earthen cells in soil for 15 days.

Damage symptom

First instar of *S. litura* scraps the surface of leaves whereas 2nd and 3rd instars larvae feed by making holes in the leaves. The later stage larvae voraciously feed on the leaves and the field appears as grazed by the cattle. Larvae hide under the plants, cracks and crevices during daytime as the pest is nocturnal in habit**.** Pest incidence can be diagnosed by the presence of faecal pellets on the leaves and on the ground which is the indicator of the pest incidence.

Fig 2: Damage symptom on groundnut leaf

Pesticide resistance

Spodoptera litura is one of the first insect pests of agricultural importance in India to develop resistance to insecticides. The resistance was observed against benzene hexachloride in Rajasthan in 1965 and by the early 1970s, resistance was noted in West Bengal and Haryana to endosulfan and carbaryl. In the early 1980s, populations from Andhra Pradesh and Tamil Nadu exhibited high resistance to various chemicals such as lindane, endosulfan, carbaryl, malathion and synthetic pyrethroids (Kranthi *et al.*, 2002).

Production loss

Field studies on groundnuts revealed the impact of *S. litura* infestation at different stages of plant growth. At the seedling stage, one larva devoured 54.7% of the leaf area per plant, resulting in a pod yield reduction of up to 25.8%. At the flowering stage, one larva per plant consumed 49.1% of the leaf area, causing a 19% reduction in pod yield. During pegging, one larva per plant consumed approximately 38.8% of the leaf area, leading to a yield loss of 5.7%. The hierarchy of ovipositional response of females on leaves followed are Sunflower> Mustard>

Groundnut> Maize when compared between these crops (Singh *et al.*, 2015).

Management

Cultural control is highly recommended to manage *S.litura* in the field. Deep summer ploughing, planting castor, sunflower and marigold as trap crops for egg laying and destroying these eggs helps in the reduction of pest incidence. Early sowing enables the crop to escape insect pest damage. Migration of caterpillars should be checked by digging trenches 30 cm depth and 25 cm wide with perpendicular sides around the infested field. Prolonged mid-season drought should be avoided by providing at least one irrigation. Resistant varieties should be cultivated namely Pratap Mugphali-1, Vasundhara (Dh 101), Co(GN)-5, ICGS-86, GG-14, M45, M28-2, NCAc343, ICGV 91180 (11, 12), ICGv86699, ICGV86031, ICg2271 and ICG1697(13). Among the mechanical control, 12 light traps/ha. can be installed for insect traps. Two hand held or mechanical weeding at 15-20 days after sowing is recommended. Pheromone traps (5 traps/ha) helps to monitor the moth population and subsequently release of biocontrol agents like *Telenomus remus* @50000/ha. four times (7-10 days intervals), *Trichogramma chilonis* @50000/ha. two times (7-10 days intervals), *Bracon hebetor* @5000/ha(two times at 7-10 days intervals) effectively checks the population of pests. The spray of insect pathogenic fungus *Nomuraea rileyi* @10^13 spores/ha proves useful for controlling early instars. Neem seed kernel can be effectively used on need basis. Application of insecticides is to be done only if the insect population crosses ETL. Application of Quinalphos 20%EC 750 ml/ha, Dichlorvos 76%WSC 750 ml/ha, Indoxacarb 14.5%SC 250 ml/ha, Spinosad 45%SC 125 ml/ha, Diflubenzuron 25%WP 300g/ha, Imidacloprid 17.8%SL 125ml/ha is recommended.

Conclusion

Excessive use of chemical insecticides to manage *S. litura* has rendered groundnut cultivation vulnerable to this pest due to the development of pesticide resistance. In this scenario susceptibility of *S. litura* to biocontrol agents has emerged as a boon to sustainable agriculture. In the event of a rise in surface average mean temperature chemical control measures may not seem effective in mitigating this damage and in such conditions, biocontrol can very well help in obtaining optimum plant population and yield.

Table 1: Biocontrol agents applicable in Indian condition

Biocontrol agents	Family	Selected reference
Egg parasites		
Chelonus helipae	Braconidae	Patel *et al.*, (1971)
Trichogramma chilonis	Trichogrammatidae	Joshi *et al.*, (1979)
Trichogramma dendrolini	Trichogrammatidae	Bhatnagar (1981)
Egg-larval parasites		
Telenomus remus Nixon	Seelionidae	Joshi *et al.*, (1979)
Chelonus formosanus	Braconidae	Patel *et al.*, (1971)
Larval parasites		
Apanteles prodeniae viereck	Braconidae	Sathe (1987)
Apanteles spp.	Braconidae	Joshi *et al.*, (1979)
Pupal		
Hybothoracini spp.	Chalcididae	Rao et al. (I98 I)
Sarcophaga albiceps Meigen	Sarcophagidae	Bhatnagar (1981)
Bacteria (Larval)		
Bacillus cereus	Bacillaceae	Kore and Bhide (1978)
Metarhizium anisopliae	Clavicipitaceae	Siddaramaiah *et al.*, (1986)
Micrococcus spp.	Micrococcaceae	Zaz and Kushwaha (1983)
Virus (Larval)		
Granulosis virus	Baculoviridae	Narayanan (1985)
Nuclear polyhedrosis virus	Baculoviridae	Ramakrishnan & Tiwari (1969)
Nematode (Larval)		
Hexamermis spp.	Mermithidae	Bhatnagar *et al.*, (1985)
Pentatomimermis spp.	Pentatomidae	Bhatnagar *et al.*,(1985)

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