JBiopest 7(Supp.):160-163 (2014)

Studies on efficacy of certain neem products against *Spodoptera litura* (Fab.)

T. Abdul Razak, T. Santhakumar, K. Mageswari and S. Santhi

ABSTRACT

A laboratory study was conducted to test the efficacy of certain neem products *viz*., neem oil (NO), neem seed kernel extract (NSKE), neem cake extract (NCE), neem leaf extract (NLE) and one commercial product *Vijaya neem* against third instar larva of tobacco caterpillar *Spodoptera litura*. The food indices Consumption Index (CI), Efficiency of Conversion of Ingested Food (ECI) and Growth Rate (GR) were derived. NSKE five per cent recorded the lowest CI of 0.428 and GR of 0.130. NO three per cent showed the lowest ECI of 26.04. *Vijayaneem* exhibited the highest antifeedant index (64.75) followed by NSKE five per cent (48.7). Among the neem products tested, NSKE five percent showed the highest larval mortality of 40 per cent. Insect growth regulatory (IGR) effect was recorded both in the NSKE five per cent and NO three per cent treated insects and it was more pronounced in NSKE.

MS History: 1.7.2013 (Received)-11.03.2014 (Revised)-21.04.2014 (Accepted)

Key words: *Spodoptera litura*, Neem oil, Neem seed kernel extract, Neem cake extract, Neem leaf extract, Vijaya neem.

INTRODUCTION

Spodoptera litura (Lepidoptera: Noctuidae) (Fab.) commonly known as tobacco caterpillar is an economically important polyphagous pest of seasonal crops in many countries including India, Japan, China and Southeast Asia (Sahayaraj *et al*., 2007). It attacks more than 200 different species of plants, of which 40 species are grown in India. The main host plants are crucifers, cucurbits, groundnut, maize, castor, tea, tobacco and various ornamentals. It has developed resistance to a number of synthetic insecticides. In various species of lepidopteran pest management, increasing failures of chemical pesticides and the problems posed by their indiscriminate use in the field have created a momentum to develop environment friendly methods of pest control with minimal residual effects.

Botanical pesticides are an important group of naturally occurring, often slow-acting crop protectants that are usually safer to humans and they contain mixtures of biologically active substances, no resistance is developed in pests and pathogens. Therefore the use of plant pesticides has been recommended ever more as a suitable alternative of plant protection with minimum negative risks (Isman, 2006; Pavela, 2007).

Spraying of neem seed kernel suspension (NSKS) at 0.5 per cent concentration effectively protected the tobacco crop from the tobacco caterpillar *Spodoptera litura* F. under field condition (Joshi *et al.*, 1984). Koul (1987) reported that neem oil at two per cent level had significant feeding deterrent and growth inhibition in third instar larvae of *S.litura* under laboratory condition. Das *et al.,* (2006) reported that neem based insecticide, Nimbicidine® significantly inhibited the hatching, pupation and adult emergence of the red flour beetle *Tribolium castaneum.* Botanical pesticides are widely used for the control of insect pests (Curzio *et al*., 2009; Abdullah *et al*., 2011).

An attempt has been made in the present investigation to find out the efficacy of certain neem products against *S. litura* larva under laboratory conditions. Hence, the proposed work has following objectives: to find out efficacy of some neem products on antifeedent activity and larval mortality of *S. litura*.

MATERIALS AND METHODS

Second instar larvae of *S. litura* were collected from near by banana field and they were brought to our bio-control laboratory at Agricultural College and Research Institute Killikulam. The larvae were given castor leaves as food and they were reared up to adult stage in plastic buckets. The adult moths after emergence were allowed to lay egg masses on castor leaves kept inside oviposition cage (50×50×65 cm^3). Ten per cent sugar solution was given as adult food and the entire setup was protected from ant damage by keeping ant pans all around. The adult moths started laying egg masses on 4-5 days after emergence. The egg masses were carefully removed and placed with the help of camel hair brush on castor leaf bits which were kept inside Petri dishes lined with absorbent cotton inside.

The eggs hatched after 2 or 3 days and the neonate larvae were fed by tender castor leaves till they reach third instar. The treatments [Vijaya Neem @ 2ml / litre-T1, Neem oil (NO) 3%- T2, Neem seed kernel extract (NSKE) 5%- T3, Neem cake extract (NCE) 10%-T4 and Neem leaf extract (NLE)10%-T5] suspensions were prepared with tap water and teepol 0.1 per cent was added as wetting agent. Simultaneously untreated control (T7) and a chemical insecticide (T6- Curacron (profenofos 50 EC) @ 2ml/ litre) treatment were maintained for comparison.

The third instar larvae were taken in plastic containers @ five larvae per container and they were given castor leaves dipped in different treatmental suspensions after shade drying. The experiment was replicated four times. The weights of larvae, fecal matter and leaves were taken periodically to workout the following food indices:

Consumption index (CI) = F / TA
Efficiency of conversion of ingested food
(ECI) = G * 100 / F
Growth rate (GR) = G / TA
Where
G = weight gained by during the insect period
A = mean weight of insect during feeding period
F = food consumed
T = duration of feeding period

The antifeedant index was also calculated using the formula of Isman *et al.* (1990)
Antifeedant Index (AFI) = (C – T) / (C+T) * 100
Where
C = Consumption of control disk,
T = Consumption of treated disk

The laboratory experiment was conducted in completely randomized design. The raw data were subjected to square root transformation and the means were separated through ANOVA.

RESULTS AND DISCUSSION

Consumption index (CI)

Among all the botanical formulations of neem used, the consumption index was low in NSKE five per cent and it was followed by neem cake extract ten percent. The consumption index recorded in NO three percent and neem leaf extract (NLE) 10 percent was in the range of 0.67-0.69. The commercial formulation *Vijaya neem* had the highest consumption index of 0.79 which was slightly lower than that recorded in the untreated control (Fig.1).

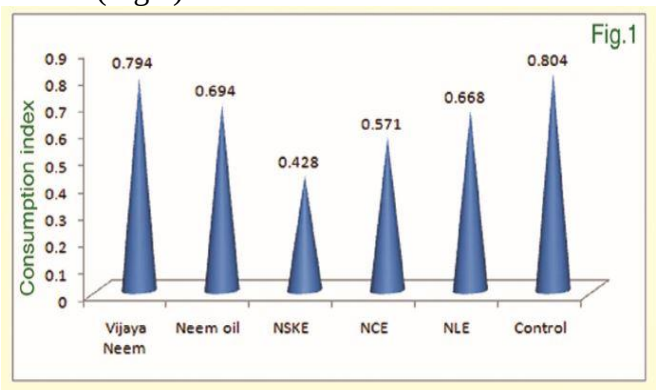

Fig.1. Effect of neem products on the consumption index of *S. litura* larva

Efficiency of conversion of ingested food (ECI

The efficiency of conversion of ingested food was low (26.04) in neem oil three percent and it was 27.7 in neem leaf extract ten percent. The commercial formulation *Vijaya neem* and NSKE five percent were statically on par by showing ECI in range of 30.54 -30.62. The NCE five percent was found to be less effective against *S. litura* larva as this treatment recorded ECI value of 37.55 which

was slightly higher than that recorded in untreated control (Fig 2).

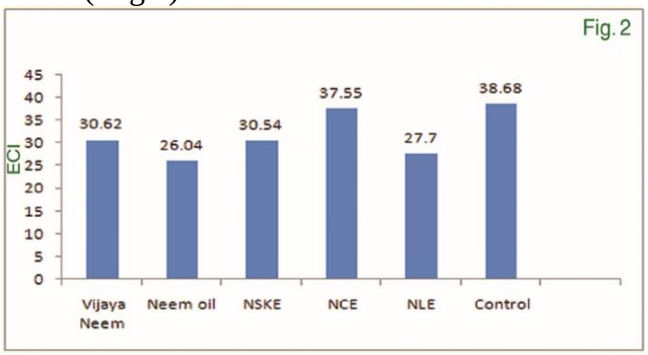

Fig.2. Effect of neem products on Efficiency of conversion of ingested food of *S. litura* larva.

Growth Rate (GR)

NSKE five percent had adversely affected the growth rate of *S.litura* larva as the index value was the lowest in this treatment whereas it was 0.247 in the untreated control . The other neem products were statically not significant and their growth rate index was in the rage of 0.176 – 0.244. (Fig 3)

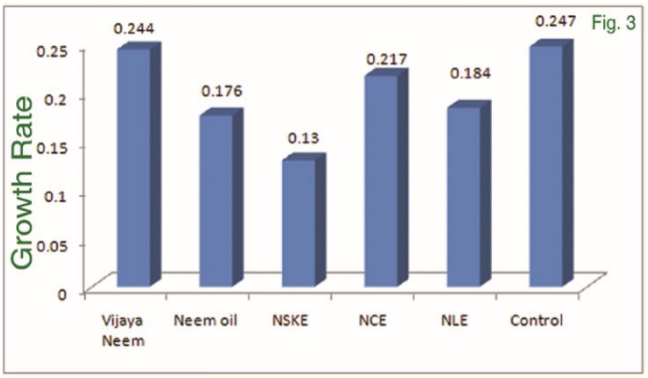

Fig.3. Effect of neem products on Growth Rate of *S. litura* larva.

Antifeedent index (AFI)

Among different neem products tested, the commercial product *Vijaya neem* exhibited the highest antifeedant index of 64.75 and it was followed by the AFI value of 48.7 in NSKE five percent. Neem oil three percent was the least effective one which had the AFI value of 22.62. NLE 10 percent and NCE five percent showed the intermediate values of 36.17 – 36.85. Pavunraj *et al.* (2012) observed an antifeedant activity of 78.94 per cent against *S. litura* in neem oil + karanj oil formulation (Fig 4).

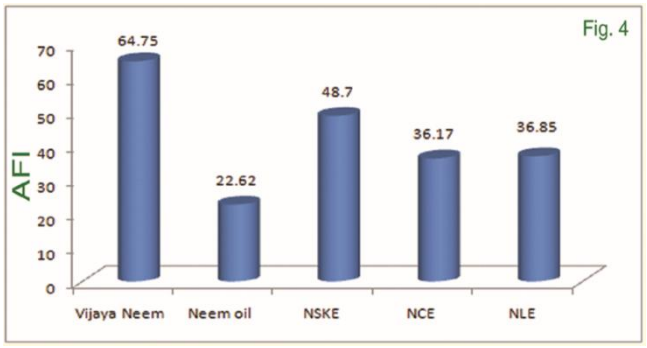

Fig. 4. Effect of neem products on antifeedant index of *S. litura* larva.

Larval Mortality

Larval mortality was recorded on fifth day after treatment and the results show that the chemical treatment profenofos 50 EC inflicted cent per cent mortality whereas in the untreated control, the larval mortality was nil throughout the experiment period. Next to the insecticide treatment, NSKE five per cent inflicted 40 per cent larval mortality and in this treatment, all the dead larvae exhibited the larval pupal mosaic pattern (Fig 6). Neem oil three per cent caused 20 per cent mortality on *S. litura* larva and in this treatment also some of dead larvae showed the larval pupal mosaic. Nil mortality was noticed in Vijaya Neem upto fifth day after treatment but cent per cent larval mortality was observed in this commercial product on the sixth day after treatment. Similar findings on larval mortality and lethal failure in larval pupal ecdysis on cabbage moth, *Mamestra brassicae* was reported by Metspalu *et al.*(2010) and Eziah *et al.* (2011) in warehouse moth, *Ephestia cautella.* In *S. litura*, Econeem a commercial product on neem caused 62.4 to 90.3 per cent larval mortality (Thankapandian *et al.*, 2011) (Fig 5).

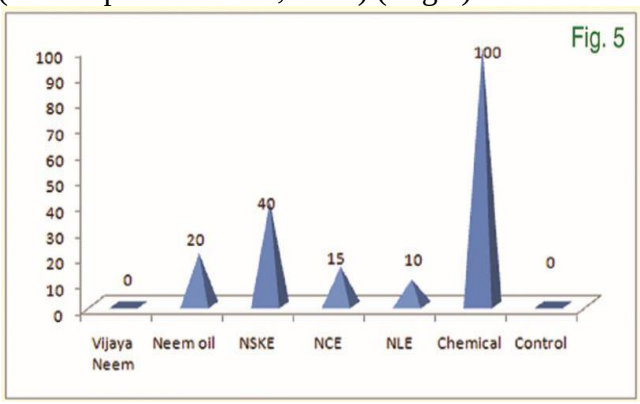

Fig .5. Effect of neem products on larval mortality in *S. litura.*

Fig 6. Larval Pupal Mosaic (Larval Pupal intermediary); **H**-Healthy; **T**-Treated

REFERENCES

Abdullahi, N., Majeed, Q. and Oyeyi, T. I. 2011. Studies on efficacy of *Vitallaria paradoxa* seed oil on the oviposition, hatchability of eggs and emergence of *Callasobruchus maculates* (F.) (Coleoptera: Bruchidae) on treated cowpea seed. *Journal of Entomology*, **8**: 391-397.

Curzio, L.G., Hernandez-Velazquez, V.M., Leon-Rivera, I., Guevara-Fefer, P. and Aranda-Escobar, E. 2009. Biological activity of methanolic extracts of *Ipomoea murucoides* Roem et Schult on *Spodoptera frugiperda* J. E. Smith. *Journal of Entomology*, **6**: 109-116.

Dipali Rani Das, Selina Parween and Saiful Islam Faruki. 2006. Efficacy of commercial neem-based insecticide, Nimbicidine® against eggs of the red flour beetle *Tribolium castaneum* (Herbst). *Universal Journal of Zoology Rajshahi University*, **25:**51-55.

Eziah, V.Y., Sackey, I. Boateng, B. A. and Obeng-Ofori, D. 2011.Bioefficacy of neem oil (Calneem™), a botanicalinsecticide against the tropical warehouse moth, *Ephestia cautella*. *International Research Journal of Agricultural Science and Soil Science*, **1**(7):242-248.

Isman, M. B., Koul, O. Luczynski, A. and Kaminki, J. 1990. Insecticidal and antifeedent bioactivities of neem oil and their relationship to azadirachtin content. *Journal of Agriccultural and Food Chemistry*, **38**: 1406 – 1417.

Isman, M.B. 2006.The role of botanical insecticides, deterrents and repellents in modern agriculture and an increasingly regulated world. *Annual Review of Entomology*, **51**: 45-66.

Joshi,B.G., Ramaprasad, G.and Nageswara Rao, S. 1984. Neem seed kernel suspension as an antifeedant for *Spodoptera Litura* in a planted flue-cured Virginia tobacco crop. *Phytoparasitica*, **12**(1): 3-12.

Metspalu, K. Jogar, A. Ploomi, K. Hiiesaar, I. Kivimägi and Luik, A. 2010. Effects of biopesticide Neem EC on the *Mamestra brassicae* L.(*Lepidoptera, Noctuidae*)L. *Agronomy Research* **8** (Sp 2): 465–470.

Opender Koul. 1987. Antifeedant and growth inhibitory effects of calamus oil and neem oil on *Spodoptera litura* under laboratory conditions. *Phytoparasitica*, **12** (3):169-180.

Pavela, R. 2007: Possibilities of botanical insecticide exploitation in plant protection. *Pest Technology*, **1**: 47–52.

Pavunraj, M., Baskar K. and Ignacimuthu, S. 2012. Efficacy of *Melochia corchorifolia* L. (Sterculiaceae) on feeding behavior of four Lepidoptera pests. *International Journal of Agricultural Research*, **7(2)**:58-68.

Saharaj, K., Selvaraj P. and Balasubramanian, R. 2007. Cell mediated immune response of *Helicoverpa armigera* Hubner and *Spodoptera litura* Fabricius to farn phtoecdysteron. *Journal of Entomology***, 4**: 289–298.

Thangapandian, K., Muthusamy, M. and Vimal, P. 2011. Efficacy of the plant products *Acorus calamus*, *Piper longum*, and Econeem against the Larvae of Tobacco Caterpillar *Spodoptera litura* Fab. (Lepidoptera: Noctuidae). *Journal of Research in Biology*, **7**: 490-493.

T. Abdul Razak, T. Santhakumar, K. Mageswari, and S. Santhi

Department of Agricultural Entomology, Agricultural College and Research Institute,

Killikulam, Vallanad-628 252, Tuticorin District, Tamil Nadu State, India

E-mail:agriento66@yahoo.com,

agrisanthakumar@gmail.com.