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ORIGINAL ARTICLE

Ovicidal Activity of Plant Extracts against *Spodoptera Litura* (Fab) (Lepidoptera: Noctiduae)

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ABSTRACT
Chemical and synthetic insecticides used for controlling Spodoptera litura resulted in the development of resistance to several classes of insecticides. In the present study, a total of twenty five plants were screened for their ovicidal activity against Spodoptera litura. Hexane, diethyl ether, dichloromethane and ethyl acetate extract of twenty five plants were studied at 0.1% concentration. Effective plant extracts identified from the preliminary study (0.1%) were further studied at 0.05% concentration. Maximum ovicidal activity was recorded in hexane extract of Cleistanthus collinus (85.16%) followed by Murraya koeingii diethyl ether (83.60%) and Aegle marmelos ethyl acetate (76.14%) extract at 0.05%. Further isolation and identification of bioactive principles responsible for the ovicidal activity is needed.
Keywords: *Spodoptera litura, ovicidal activity, plant extracts.*

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INTRODUCTION

Spodoptera litura (Fab). (Lepidoptera: Noctuidae), is a serious polyphagous pest distributed throughout the tropical and subtropical parts of the world including India, Japan, China and South East Asia causing damage to more than 150 species of host plants [1,2] of which 40 species are known from India [3]. In India, *Spodoptera litura* has been reported as an increasingly important pest causing heavy yield loss throughout India [4] since it is a major polyphagous pest on cotton, groundnut, chilly, tobacco, castor and pulses [5]. To overcome this, large quantities of insecticides have been used for combating infestations on crops [6]. Agricultural pesticides are deliberately released into the environment to control pests that harm crops and use of chemical insecticides to control *Spodoptera litura* has proved futile as the pest has developed resistance to several classes of insecticides [7,8]. The use of synthetic organic insecticides in crop pest control programs around the world has resulted in damage to the environment, pest resurgence, pest resistance to insecticides and lethal effects on non-target organisms [9,10,11]. Moreover, majority of the strains of *Sppodoptera litura* becomes resistant to many commonly used insecticides, particularly pyrethroids and carbamates, resulting in failure of effective controls [7,12,13,14] and hence, it is difficult to manage this pest with synthetic insecticides.

The absence of resistance to *Spodoptera litura* in host plants and the lack of adequate control measures make it difficult to manage this pest in the fields. In order to search an environmentally safe alternative, scientists considered the pesticides of biological origin (biopesticides) in the place of synthetic insecticides. Replacement of synthetic insecticides by bio-rational insecticide is universally acceptable and is a practicable approach worldwide. Throughout history, plant products have been successfully exploited as insecticides. Recent plant protection research, particularly of the last decade revealed the importance of plant products that disrupt normal insect growth and development. Plants are rich sources of natural substances that can be utilized in the development of environmentally safe methods for insect control [15]. Plants contain secondary metabolites that are deleterious to insect and other herbivores in diverse ways; through acute toxicity, enzyme inhibition and interference with the consumption and/or utilization of food [16] and the biomolecules present in phytopesticides act as a feeding deterrent, ovicide, oviposition deterrent and growth inhibition against field insect pests [17,18,19]. Screening of plant extracts for deleterious effects on insects is one of the approaches used in the search for novel botanical insecticides [20,21,22]. Several plant products have been screened and tested against *Spodoptera litura* and some promising plants have been reported [23,24]. However, screening of plant extracts against this pest is still continuing throughout the world to find out different kinds of effects of botanicals on this pest and to obtain an ecofriendly biopesticide. Therefore, the present study focuses on the ovicidal activity of various plant extracts against *Spodoptera litura*.

MATERIALS AND METHODS

Collection of plants

A total of twenty five plants belonging to diverse families and genera were collected from Siruvani Hills (near Coimbatore), Western Ghats of Tamil Nadu, India. The plants were selected based on available literature, abundant availability, medicinal and insecticidal properties. List of plants collected and utilized for the present study are presented in Table 1.

Extraction of plant materials

Plants collected from various families were brought to the laboratory, washed with dechlorinated water, shade dried under room temperature and the plant materials were powdered individually using an electric blender. Each powdered plant material were sieved using a kitchen strainer. One kilogram of each powdered plant material was sequentially extracted with hexane, diethyl ether, dichloromethane and ethyl acetate for a period of seventy two hours and then filtered. The filtered content was then subjected to rotary vacuum evaporator until solvents were completely evaporated to get the solidified crude extracts. The crude extracts thus obtained were stored in sterilized amber coloured bottles maintained at 4^0C in a refrigerator. Standard one per cent stock solution was prepared by dissolving 100 mg of crude extract in 100 ml of acetone.

Establishment of *Spodoptera litura*

Spodoptera litura egg masses were collected from groundnut fields at Vellore and Kancheepuram districts of Tamil Nadu, India. After egg hatching, castor (*Ricinus communis*) leaves were provided for larval feeding till the pupal stage under laboratory condition (28 ±2º C and 80 ±5% R.H.). Sterilized soil was provided for pupation. After pupation, the pupae were collected from the soil and placed inside cage for adult emergence. Ten per cent honey solution mixed with few drops of multi-vitamin was provided for adult feeding to increase the rate of fecundity. Folded filter papers were provided for egg laying. After egg laying, egg masses were collected from the filter paper and was allowed for hatching. This process of culture method was repeated and the culture was maintained throughout the study period.

Ovicidal activity

The egg masses of *Spodoptera litura* were counted with the aid of a hand lens (10x) and egg mass (pre counted – 100) was dipped in 0.1% concentration of each plant extracts for preliminary screening. Based on the preliminary screening, the effective plant extracts were further tested at a concentration of 0.05%. The number of eggs hatched in control and treated were recorded and percentage of ovicidal activity calculated. The experiment was conducted at room temperature 30 ±2˚C and 75 ±5 R.H. A total of three trials were carried with five replicates per trial. The data obtained were subjected to angular transformation. The significant difference within various crude extracts were compared with Least significant difference (LSD) test to differentiate individual mean significant difference at 0.05% level.

$$\text{Per cent ovicidal activity} = \frac{\text{\% of eggs hatched in control} - \text{\% of eggs hatched in treated}}{\text{\% of eggs hatched in control}} \times 100$$

RESULTS AND DISCUSSION

Ovicidal activity of plant extracts is important to control the pest at egg stage itself thereby preventing the damage caused by other stages [25]. In the present study, the ovicidal effect of twenty five plants screened against *Spodoptera litura* at 0.1% concentration are listed in Table 2. Increase in number of plus signs against the extracts of a plant reflects the degree of ovicidal activity. Amongst the twenty five plants tested, *Cleistanthus collinus* hexane (85.16%), *Murraya koeingii* diethyl ether (83.60%), *Aegle marmelos* ethyl acetate (76.14%) and hexane extracts of *Strychnos nuxvomica* (61.00%) and *Vitex negundo* (52.02%) showed maximum ovicidal activity against *Spodoptera litura* at concentration of 0.05% (Table 3).

Sundar *et al*. [26] reported that the lethal concentrations of azadirachtin based proprietary formulations affected egg hatchability in 50-60% of *Spodoptera litura*. The results of the present study were comparable with earlier reports. The ovicidal effect of aqueous extract of *Calotropis* spp. was reported by Sahayaraj [27] at six per cent concentration against *Spodoptera litura*. Manikantan [28] reported that the leaf extract of *Calotropis gigantea* was found to be very effective in causing maximum percentage inhibition (77.66) of egg hatchability when tested on twenty four hours old eggs of *Spodoptera litura*. Raja *et al*. [29] analyzed the effects of plant extracts on *Spodoptera litura* and established that the hexane, diethyl ether, dichlormethane, ethyl acetate, methanol and aqueous extracts of *Artemisia nilagirica* leaves and roots, and the leaves of *Acorus calamus*, *Anisomeles malabarica*, *Cassia auriculata*, *Holoptelea integrifolia*, *Lobelia leschenaultiana*, *Tarrena asiatica*, *Pergularia daemia* and *Wedelia calendulacea* showed significant ovicidal activitiy. Likewise, the hexane, diethyl ether, dichloromethane, ethyl acetate and methanol extracts of *Aegle marmelos* exhibited ovicidal activity against *Spodoptera litura* [30]. The ethyl acetate extract of *Hyptis suavelens* also indicated ovicidal activity against *Spodoptera litura* [31]. Pavunraj *et al*. [32] reported hexane, chloroform and ethyl acetate extracts of *Excoecaria agallocha* to possess ovicidal activity against *Spodoptera litura*. Kumar and Sevarkodiyone [33] also reported that *Annona squamosa* and *Lepidium sativum* reduced the hatching efficiency of *Spodoptera litura* eggs.

Ovicidal activity was also noticed in neem azal T/S [26], neem azal [34] and ten medicinal plant oils [35] against *Spodoptera litura*. Elumalai *et al*. [36] noticed ovicidal activity in plant oils of *Zingiber officinale*, *Ocimum bassilicum*, *Cyperus scariosus*, *Pimpinella anisum*, *Nigella sativa*, *Rosmarious officinalis* and *Curcuma longa* against *Spodoptera litura*. Baskar *et al*. [37] also reported that crude and fractions from *Atalantia monophylla* leaves showed ovicidal activity against *Spodoptera litura*. The results obtained from the present investigation suggests that further studies on isolation and identification of the active ovicide present in the promising five plants is needed which might emerge as an alternative method or tool for the control of *Spodoptera litura*.

Table 1. List of plants collected from Siruvani hills, Western Ghats, Tamil Nadu, India

S.No.	Plant name	Family	Vernacular name (Tamil)	Part used
1	*Abrus precatorious* Linn	Papilionaceae	Kundumani	Seed
2	*Aegle marmelos* (L) Corr	Rutaceae	Vilvam	Leaf
3	*Alstomia scholaris* (L) R Br	Apocynaceae	Mukampalai	Leaf
4	*Aristolochia indica* Linn	Aristolochiaceae	Karudakkodi	Root
5	*Cassia fistula* Linn	Caesalpiniaceae	Sarakonnai	Flower
6	*Cinnamomum zeylanicum* Breyn	Lauraceae	Sirunagapoo	Bark
7	*Cleistanthus collinus* (Roxb) Benth	Euphorbiaceae	Oduvan	Leaf
8	*Cymbopogon citrates* (Dc) Stapt	Poaceae	Vasanapullu	Whole plant
9	*Drosera indica* Linn	Droceracea	Azukanni	Leaf
1	*Evolvulus alsinoides* (L) Linn	Convolvulaceae	Vishnukarandi	Whole plant
1	*Garcinia morella* (Gaertn) Desr	Clusiaceae	Makki	Leaf
1	*Hydrocotyle javanica* Thunb	Apiaceae	Malaivallarai	Leaf
1	*Ichnocarpus frutescens* (L) R Br	Apocyanaceae	Palvalli	Leaf
1	*Lantana camara* Linn	Verbenaceae	Unnichedi	Leaf
1	*Leucas aspera* (Willd) Link	Lamiaceae	Thumbai	Whole plant
1	*Memecylon malabaricum* (Cl) Cong	Melastomataceae	Malamthetti	Leaf
1	*Murraya koeingii* (L) Spreng	Rutaceae	Kariveppilai	Leaf
1	*Ocimum americanum* Linn	Lamiaceae	Nayithulasi	Whole plant
1	*Plumbago zeylanica* Linn	Plumbaginaceae	Neelakodaveri	Leaf
2	*Sphaeranthus indicus* Linn	Asteraceae	Kottakkarandai	Whole plant
2	*Strebulus asper* Lour	Moraceae	Pirayam	Leaf
2	*Strychnos nuxvomica* Linn	Loganiaceae	Yetti	Fruit
2	*Syzygium cumini* (L) Skeets	Myrtaceae	Neredom	Leaf
2	*Vitex negundo* Linn	Verbenaceae	Notchi	Leaf
2	*Zanthoxylum limonella* (Roxb) Dc	Rutaceae	Veersingapattai	Bark

Table 2. Screening of plant extracts at 0.1% concentration for ovicidal activity against *Spodoptera litura*

S.No.	Plant	Hexane	Diethyl ether	Dichlormethane	Ethyl acetate
1	*Abrus precatorious*	+	-	+	+
2	*Aegle marmelos*	+++	++	+++	++++
3	*Alstomia scholaris*	-	+	-	+
4	*Aristolochia indica*	+	++	-	-
5	*Cassia fistula*	+	-	+	-
6	*Cinnamomum zeylanicum*	++	+	-	-
7	*Cleistanthus collinus*	++++	+++	++	+++
8	*Cymbopogon citrates*	-	+	++	-
9	*Drosera indica*	-	-	-	-
10	*Evolvulus alsinoides*	-	-	-	+
11	*Garcinia morella*	+	-	+	-
12	*Hydrocotyle javanica*	+	-	+	+
13	*Ichnocarpus frutescens*	-	-	-	+

14	*Lantana camara*	++	-	++	-
15	*Leucas aspera*	-	-	-	+
16	*Memecylon malabaricum*	+	-	-	+
17	*Murraya koeingii*	++++	+++	+++	+++
18	*Ocimum americanum*	+	-	-	-
19	*Plumbago zeylanica*	-	-	+	-
20	*Sphaeranthus indicus*	++	++	-	+
21	*Strebulus asper*	-	-	-	-
22	*Strychnos nuxvomica*	+++	++	++	++
23	*Syzygium cumini*	-	-	-	-
24	*Vitex negundo*	+++	+	+	++
25	*Zanthoxylum limonella*	-	-	-	-

- \- No ovicidal activity
- \+ Ovicidal activity below 25%
- ++ Ovicidal activity between 25-50%
- +++ Ovicidal activity between 50-75%
- ++++ Ovicidal activity above 75%

Table 3. Per cent ovicidal activity of promising plant extracts against *Spodoptera litura* at 0.05% concentration

Plant	Hexane	Diethyl ether	Dichloromethane	Ethyl acetate
Aegle marmelos	57.11 ±6.05^{b} (45.63)	29.54 ±4.82^{c} (32.90)	50.76 ±4.63^{de} (45.40)	76.14 ±2.48^{e} (60.73)
Cleistanthus collinus	85.16 ±2.07^{e} (67.29)	54.06 ±4.44^{d} (47.29)	33.25 ±7.59^{c} (35.18)	60.18 ±2.58^{d} (50.89)
Murraya koeingii	78.07 ±6.65^{d} (62.03)	83.60 ±2.54^{e} (66.11)	52.66 ±4.08^{de} (46.49)	66.18 ±2.34^{d} (54.39)
Strychnos nuxvomica	61.00 ±4.43^{bc} (51.35)	35.01 ±3.24^{c} (36.27)	49.89 ±7.19^{d} (44.89)	38.99 ±8.34^{b} (38.59)
Vitex negundo	52.02 ±2.12^{b} (46.15)	22.38 ±5.93^{b} (28.18)	22.60 ±1.81^{b} (28.39)	46.05 ±5.72^{c} (42.71)
Control	0.0 ±0.0 (0.0)^{a}	0.0 ±0.0 (0.0)^{a}	0.0 ±0.0 (0.0)^{a}	0.0 ±0.0 (0.0)^{a}

Values are mean of five replicates of three trials ±standard deviation; Values in parentheses are angular transformed; Different superscripts within the column indicate statistically significant difference (P<0.05) by LSD.

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REFERENCES

1. Rao, G.V.R., Wightman, J.A. and Rao, R.D.V. (1993). World review of the natural enemies and diseases of *Spodoptera litura* (F.) (Lepidoptera: Noctuidae). I*nsect Science and its Application*, 14: 273-284.
2. Murugesan, K. and Dhingara, S. (1995). Variability in resistance pattern of various groups of insecticides evaluated against *Spodoptera litura* (Fabricius) during a period spanning over three decades. *Journal of Entomological Research*, 19: 313-319.
3. Mallikarjuna, N., Kranthi, K.R., Jadhav, D.R., Kranthi, S. and Chandra, S. (2004). Influence of foliar chemical compounds on the development of *Spodoptera litura* (Fab.) in inter-specific derivatives of groundnut. *Journal of Applied Entomology*, 128: 321-328.
4. Ferry, N., Edwards, M.G., Gatehouse, J.A. and Gatehouse, A.M.R. (2004) Plant– insect interaction: molecular approaches to insect resistance (edited by Sasaki T, Christou P). *Current Opinion in Biotechnology*, 15:155–161.
5. Ayyangar, G.S.G. and Rao, P.J. (1989). Neem (*Azadirachta indica* A. Juss) extracts as larval repellents and ovipositional deterrents to *Spodoptera litura* (Fab.). *Indian Journal of Entomology*. 51: 121-124.
6. Qin, H.G., Ye, Z.X., Huang, S.J. and Li, H. (2000). Research on the damage by tobacco caterpillar (*Prodenia litura* Fabricius) to cotton and the control threshold. *China Cotton*, 27(4): 24–25.
7. Kranthi, K.R., Jadhav, D.R., Kranthi, S., Wanjari, R.R., Ali, R.R. and Russell, D.A. (2002). Insecticide resistance in five major insect pests of cotton in India. *Crop Protection*, 21: 449- 460.
8. Whalon, M.E., Mota-Sanchez, D. and Hollingworth, R.M. (2008). Global Pesticide Resistance in Arthropods, CABI, Cromwell Press, Trowbridge, UK, pp. 1-167.

9. Abudulai, M., Shepard, B.M. and Mitchell, P.L. (2001) Parasitism and predation on eggs of *Leptoglossus phyllopus* (L.) (Hemiptera: Coreidae) in cowpea: impact of endosulfan sprays. *Journal of Agricultural and Urban Entomology*, 18:105–115.
10. Rodríguez, C., Silva, G. and Djair, V. (2003). Bases para el manejo racional de insecticidas: Insecticidas de origen vegetal. Facultad de Agronomía, Universidad de Concepción, y Fundación para la Innovación Agraria, Concepción, Chile.
11. Regnault-Roger, C., Philogene, B. and Vincent, C. (2005). Biopesticides of Plant Origin. Paris: Lavoisier. pp. 313.
12. Kranthi, K.R., Jadhav, D.R., Wanjari, R.R., Ali, S.S. and Russell, D.A. (2001). Carbamate and organophosphate resistance in cotton pests in India, 1995 to 1999. *Bulletin of Entomological Research*, 91:37–46.
13. Ahmad, M., Arif, M.I. and Ahmad, M. (2007). Occurrence of insecticide resistance in field populations of *Spodoptera litura* (Lepidoptera: Noctuidae) in Pakistan. *Crop Protection*, 26: 809-817.
14. Huang, S.J. and Han, Z.J. (2007). Mechanisms for multiple resistances in field populations of common cutworm, *Spodoptera litura* (Fabricius) in China. *Pesticide Biochemistry and Physiology*, 87: 14-22.
15. Sadek, M.M. (2003). Antifeedant and toxic activity of *Adhatoda vasica* leaf extract against *Spodoptera littoralis* (Lepidoptera: Noctuidae). *Journal of Applied Entomology*, 27: 396-404.
16. Wheeler, D.A. and Isman, M.B. (2001). Antifeedant and toxic activity of *Trichilia americana* extract against the larvae of *Spodoptera litura*. *Entomologia Experimentalis et Applicata*, 98: 9-16.
17. Baskar, K., Maheshwaran, R., Kingsley, S. and Ignacinuthu, S. (2011). Bioefficacy of plant extracts against Asian army worm *Spodoptera litura* Fab. (Lepidoptera: Noctuidae). *Journal of Agricultural Technology*, 7: 123-131.
18. Baskar, K. and Ignacimuthu, S. (2012). Ovicidal activity of *Atalantia monophylla* (L) Correa against *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae). *Journal of Agricultural Technology*, 8: 861-868.
19. Baskar, K. and Ignacimuthu, S. (2012). Antifeedant, larvicidal and growth inhibitory effect of ononitol monohydrate isolated from *Cassia tora* L. against *Helicoverpa armigera* (Hub) and *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae). *Chemosphere*, 88:384-388.
20. Secoy, D.M. and Smith, A.E. (1983). Use of plants in control of agricultural and domestic pests. *Economic Botany*, 37:28-57.
21. Arnason, J.T., MacKinnon, S., Durst, A., Philogene, B.J.R., Hasbun, C. and Sanchez, P. (1993) Insecticides in tropical plants with non-neurotoxic modes of action. In: Phytochemical Potential of Tropical Plants (eds.) Downum, K.R., Romeo, J. and Stafford, H., Plenum Press, New York, pp. 107-131.
22. Isman, M.B. (1995). Leads and prospects for the development of new botanical insecticides. In: Reviews in Pesticide Toxicology, (eds.), Roe, R.M. and Kuhr, R.J., Vol. 3, Toxicology Communications Inc., Raleigh, NC, U.S.A, pp. 1-20.
23. Arivoli, S. and Samuel, T. (2012). Antifeedant activity of plant extracts against *Spodoptera litura* (Fab.) (Lepidoptera: Noctiduae). *American-Eurasian Journal of Agricultural and Environmental Sciences*, 12(6): 764-768.
24. Arivoli, S. and Samuel, T. (2013). Antifeedant activity, developmental indices and morphogenetic variations of plant extracts against *Spodoptera litura* (Fab) (Lepidotera: Noctuidae). *Journal of Entomology and Zoology Studies*, 1(4): 87-96.
25. Jeyasankar, A., Elumalai, K., Raja, N. and Ignacimuthu, S. (2013). Effect of plant chemicals on oviposition deterrent and ovicidal activities against female moth, *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae). *International Journal of Agricultural Science Research*, 2(6): 206-213.
26. Sundar, M.S., Krishnayya, P.V. and Rao, A. (2000). Evaluation of lethal concentrations of azadirachitin based proprietary formulation for larvicidal and ovicidal effect against *Spodoptera litura* (Fab.). *Journal of Entomological Research*, 24(2): 147-150.
27. Sahayaraj, K. (2002). Field bioefficacy of a reduviid predator *Rhynocoris marginatus* and plant products against *Aproaerema modicella* and *Spodoptera litura* of groundnut. *Indian Journal of Entomology,* 64(3): 292 - 300.
28. Manikantan, R. (2003). Studies on the bio-efficacy of *Calotropis gigantea* plant extracts against *Spodoptera litura* Fab. (Noctuidae : Lepidoptera). M.Sc. (Ag.) Thesis, Annamalai University, Annamalainagar, Tamil Nadu, India.
29. Raja, N., Elumalai, K., Jayakumar, M., Jeyasankar, A., Muthu, C. and Ignacimuthu, S. (2003). Biological activity of different plant extracts against armyworm, *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae). *Journal of Entomological Research*, 27: 281-292.
30. Raja, N., Jayakumar, M., Elumalai, K., Jeyasankar, A., Muthu, C. and Ignacimuthu, S. (2004). Oviposition deterrent and ovicidal activity of solvent extracts of 50 plants against the armyworm, *Spodoptera litura* Fab. (Lepidoptera: Noctuidae). *Malaysian Applied Biology Journal*, 33: 73-81.
31. Raja, N., Jeyasankar, A., Jeyakumar, S.V. and Ignacimuthu, S. (2005). Efficacy of *Hyptis suaveolens* against Lepidopteran pest. *Current Science*, 88: 220-222.
32. Pavunraj, M., Subramaniam, K., Muthu, C., Seenivasan, S.P., Duraipandiyan, V. and Pakiam, S.M. (2006). Bioefficacy of *Excoecaria agallocha* (L.) leaf extract against the army worm *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae). *Entomon*, 31: 37-40.
33. Kumar, A.G. and Sevarkodiyone, S.P. (2009). Effect of seed extracts of *Annona squamosa* L. and *Lepidium sativum* L. on the pupal development and reproductive parameters of tobacco cutworm, *Spodoptera litura* (Fabricius). *Hexapoda*, 16(2): 132-135.
34. Subramanian, K., Raja, N. and Ignacimuthu, S. (2006). Feeding performance of *Spodoptera litura* on different cotton cultivars. *Journal of Entomological Research*, 30: 125-129.
35. Elumalai, K., Krishnappa, K., Anandan, A., Govindarajan, M. and Mathivanan, T. (2010). Larvicidal and ovicidal efficacy of ten medicinal plant essential oil against lepidopteran pest *Spodoptera litura* (Lepidoptera: Noctuidae). *International Journal of Recent Scientific Research*, 1: 1-7.

36. Elumalai, K., Krishnappa, K., Anandan, A., Govindarajan, M. and Mathivanan, T. (2010). Larvicidal and ovicidal activity of seven essential oil against lepidopteran pest *Spodoptera litura* (Lepidoptera: Noctuidae). *International Journal of Recent Scientific Research*, 1: 8-14,
37. Baskar, K., Muthu, C., Raj, G.A., Kingsley, S. and Ignacimuthu, S. (2012). Ovicidal activity of *Atalantia monophylla* (L) Correa against *Spodoptera litura* Fab. (Lepidoptera: Noctuidae). *Asian Pacific Journal of Tropical Biomedicine*, 2(12): 987-991.

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