Indian Journal of Entomology 83(2021) Online published Ref. No. e20413 DoI No.: 10.5958/0974-8172.2021.00104.8

EFFICACY OF PLANT PRODUCTS AGAINST LARVAE OF GREATER WAX MOTH *GALLERIA MELLONELLA* L.

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ABSTRACT

Laboratory experiment was conducted to evaluate the efficacy some plant products against third instar larvae of *Galleria mellonella* L. at the Agricultural College and Research Institute, Madurai. Among plant products tested citronella oil 3% led to maximum mortality (76.67%), followed by neem oil 3% (73.33%) while garlic extract 3% gave the least mortality (53.33%) at 14 DAT. The weight reduction of comb ranged from 3.21 to 5.36 g and cell damage ranged from 27.88 to 57.45%, respectively in different treatments.

Key words: Plant products, *Galleria mellonella,* third instar, citronella oil, neem oil, garlic extract, mortality, weight reduction of comb,

Currently, India is the one of leading honey producing countries and exports honey to nearly 80 countries amounting to Rs. 633.8 crores (Anonymous, 2020). The apiculture industry suffers due to enemies of honey bees (Vishwakarma et al., 2012; Singh, 1975). Among these, the greater wax moth *Galleria mellonella* L.*,* is a well-known pest, and causes heavy economic loss of 60 to 70% in developing countries (Hosmani et al., 2017; Peddock, 1918). Severe infestations of *G. mellonella* interrupt the brood rearing and foraging of bees which ultimately results in absconding of bees from colonies (Gulati and Kaushik, 2004). Botanical pesticides are important group of naturally occurring, often slow-acting, locally available products (Pavela, 2009). Of the many management practices used for the control of greater wax moth, botanicals and microbial pesticides are safe to honey bees (Bhopale et al., 2013). Further, maximum larval mortality (93.33%) of 3rd instar larvae of greater wax moth in 0.5% *Bacillus thuringiensis kurstaki* (Halt) is well known. But, handling and availability of plant products are better when compared to *Bt*. Hence, this study evaluates some botanicals against *G. mellonella* under laboratory condition.

MATERIALS AND METHODS

The laboratory experiments were carried out at the Department of Agricultural Entomology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during January- February 2020. The neem oil 3% suspension was prepared by mixing 3 ml of neem oil with 1 ml of teepol in 96 ml of water. The suspension was stirred properly. Similarly, 3% clove oil and 3% citronella oil suspensions were prepared. A quantity of 50 g of crushed neem seed kernel was soaked in 500 ml of water for 12 hr. After 12 hr, the suspension was filtered with muslin cloth, 20 ml of teepol and 480 ml of water were added to obtain 5% NSKE suspension. Dried tobacco leaf powder and notchi leaf powder were obtained by grinding of shade dried 100 g leaves using pestle and mortar. A quantity of 5 g of *Bt* var. *kurstaki* (Halt®) WP (Bio-stat India Limited) was weighed and dissolved in 1 l of spray fluid (water) to obtain 0.5% concentration. A quantity of 20 g matured garlic bulbs were mixed with 250 ml of water and grounded in a blender to obtain garlic juice. The juice was then thoroughly mixed with 250 ml of water and cleaned by sieving through wire mesh to obtain a uniform extract.

A quantity of 10 g undamaged wax comb was weighed and the wax comb was placed in glass petri plates (15 cm dia). There were nine treatments, each replicated thrice, and treatment applied at specified concentration (Table 1). These were allowed to dry for 1 hr. The larvae collected from field were brought to laboratory and mass cultured, from which 10 third instar larvae of *G. mellonella* were released in each treatment. Observations on larval mortality were made on 1st, 3rd, 5th, 7th and 14th day. Besides the wax comb weight loss and % cell damage (cells damaged by larvae in treated comb) were calculated on 14th day (Cantwell and Sheigh, 1981). The data on mortality (%) and cell damage (%) were subjected to arcsine transformation

Table 1. Efficacy of plant products against *G. mellonella* (larva)

Treatments	Mortality (%)						Weight reduction of comb (g)	Cell damage of comb (%)
	1 DAT	3 DAT	5 DAT	7 DAT	14 DAT	Mean mortality		
T1- Neem oil 3%	0.00* (0.33#)^{b}	23.33 (28.87)^{bc}	40.00 (39.22)^{bc}	56.67 (48.81)^{bc}	73.33 (58.89)^{abc}	38.67 (38.43)^{bc}	3.64 (1.91#)^{c}	33.80 (36.95)^{c}
T2 - Citronella oil 3%	0.00 (0.33)^{b}	26.67 (31.08)^{b}	46.67 (43.07)^{b}	63.33 (52.71)^{b}	76.67 (61.09)^{ab}	42.67 (40.77)^{b}	3.21 (1.79)^{b}	27.88 (31.51)^{b}
T3 – Clove oil 3%	0.00 (0.33)^{b}	20.00 (26.55)^{bc}	33.33 (35.25)^{cd}	53.33 (46.89)^{c}	66.67 (54.71)^{cde}	34.67 (36.06)^{cd}	3.84 (1.96)^{d}	36.98 (38.85)^{c}
T4 – Notchi leaf powder 3g	0.00 (0.33)^{b}	16.67 (24.09)^{c}	26.67 (31.08)^{e}	43.33 (41.15)^{d}	63.33 (52.71)^{de}	29.33 (32.78)^{e}	3.67 (1.92)^{cd}	40.79 (38.34)^{c}
T5- Tobacco leaf powder 3g	0.00 (0.33)^{b}	20.00 (26.55)^{bc}	30.00 (33.20)^{de}	43.33 (41.15)^{d}	60.00 (50.75)^{ef}	30.67 (33.61)^{de}	4.16 (2.04)^{e}	42.72 (39.15)^{d}
T6- Garlic extract 4%	0.00 (0.33)^{b}	16.67 (24.09)^{c}	26.67 (31.08)^{e}	40.00 (39.22)^{d}	53.33 (46.89)^{f}	28.00 (31.94)^{e}	5.36 (2.32)^{f}	57.45 (49.60)^{e}
T7- NSKE 5%	0.00 (0.33)^{b}	20.00 (26.55)^{bc}	36.67 (37.25)^{cd}	56.67 (48.81)^{bc}	70.00 (56.77)^{bcd}	36.67 (37.25)^{c}	3.79 (1.95)^{cd}	36.00 (36.37)^{c}
T8 – *Bacillus thuringiensis* (Halt) 0.5% (standard check)	10.00 (18.43)^{a}	36.67 (37.25)^{a}	73.33 (58.89)^{a}	80.00 (63.41)^{a}	80.00 (63.41)^{a}	56.00 (48.43)^{a}	2.61 (1.62)^{a}	77.00 (62.00)^{a}
T9 – Control (water)	0.00 (0.33)^{b}	0.00 (0.33)^{d}	0.00 (0.33)^{f}	0.00 (0.33)^{e}	0.00 (0.33)^{g}	0.00 (0.33)^{f}	8.07 (2.84)^{g}	74.30 (57.82)^{f}
S.Ed	3.62	2.51	2.42	2.04	2.71	1.20	0.02	0.19
C.D (0.05)	7.60	5.29	5.09	4.29	5.70	2.52	0.04	0.39

*Mean of three replications; # Mortality (%) and cell damage (%) arcsine transformed value; Weight reduction of comb values square root transformed; Mean values followed by same alphabet not significantly different ($p< 0.05$) ; DAT- Days after treatment.

whereas, wax comb weight loss was subjected to square root transformation before ANOVA using AGRES statistical package, to differentiate means based on Least Significant Difference (LSD) at $p= 0.05$.

RESULTS AND DISCUSSION

Table 1 reveals that there are significant differences in mortality of *G. mellonella* larvae and it was maximum at 14th days after treatment (DAT) ranging from 53.33 to 76.67%; citronella oil 3% resulted maximum mortality (42.67%), while the least mortality was observed in garlic 4% extract (28.00%). Neem oil 3% ranked next with mean mortality (38.67%) which was on par with NSKE 5% (36.67%). In standard check the mean mortality was 56.00%. There exists significant differences in weight reduction in comb, % cell damage and % mortality. Citronella oil 3% led to the least weight reduction in comb (3.21 g) and cell damage (27.88%), with maximum larval mortality (76.67%) at 14 DAT. Garlic extract 4% exhibited maximum weight reduction in comb (5.36g) and cell damage (57.45%), with least mortality (53.33%). The standard check, *Bt* stood first in efficacy compared to all plant products. The present findings on the efficacy of citronella oil 3% and neem oil 3% against third instar larvae are in accordance with the earlier reports of several authors. Mandal and Vishwakarma (2018) reported maximum mortality of greater wax moth in citronella oil 3% (83.3%). Bhopale et al. (2013) observed that that neem oil 3% caused 70% mortality to third instar of *G. mellonella*. Laboratory studies revealed that neem seed extract showed high mortality on third instar larvae (Surendra et al., 2010). Basedow et al. (2012) observed retarded growth and death of larvae and pupae of *G. mellonella* occurred when the bee comb was treated with Neem Azal T/S.

REFERENCES

Anonymous. 2020. Annual report for India`s overall export. Directorate General of Commercial Intelligence and Statistics.

Basedow T, El Shafie H A F, Abo-El-Soad M M, Al Ajlan A M. 2012. Evaluation of *Bacillus thuringensis aizawai* and Neem for controlling the larvae of the greater wax moth, *Galleria mellonella* (Lepidoptera: Pyralidae). International Journal of Agriculture and Biology 14: 629-632.

Bhopale S P, Narasa reddy G, Shinde S R Chopade M B. 2013. Effect of botanicals and microbial pesticides for management of wax moth (*Galleria mellonella* L.) under stored condition. Journal of Biological Control 27(4): 343-349.

Cantwel G E, Shieh T A. 1981. Certan- A new bacterial insecticide against greater wax moth, *Galleria mellonella* L. American Bee Journal 121: 424-426, 430-431.

Hosmani V, Hanumantha Swamy B C, Kattimani K N, Kalibavi C M.

2017. Studies on biology of greater wax moth. International journal of Current Microbiology and Applied Sciences 6(11): 3811-3815.

Gulati R, Kaushik H D. 2004. Enemies of honey bees and their management - a review. Agricultural Reviews 25(3): 189-200.

Mandal S, Vishwakarma R. 2018. Efficacy of plant products against greater wax moth, *Galleria mellonella* larvae. Annual Plant Protection Science 26(1): 45-47.

Paddock F B. 1918. The beemoth or waxworm: Texas Agricultural Experiment Stations. 230-231 pp.

Pavela R. 2009. Effectiveness of some botanical insecticides against *Spodoptera littoralis* Boisduvala (Lepidoptera: Noctudiae), *Myzus persicae* Sulzer (Hemiptera: Aphididae) and *Tetranychus urticae* Koch (Acari: Tetranychidae). Plant Protection Science 45(4): 161-167.

Singh S. 1975. Enemies and diseases of honey bee. Beekeeping in India, ICAR, New Delhi. 166-168 pp .

Surendra N S, Bhushanam M, Reddy M S. 2010. Efficacy of natural plant products, *Azadirachta indica*, *Ocimum sanctum* and *Pongamia pinnata* in the management of grater wax moth, *Galleria mellonella* L. under laboratory conditions. Journal of Applied and Natural Science 2(1): 5-7.

Vishwakarma R, Singh R P, Ghatak S S. 2012. Incidence of insect enemies on honey bee, *Apis mellifera* L. during floral dearth period. Indian Journal of Entomology 74(1): 78-81.

(Manuscript Received: December, 2020; Revised: January, 2021;
Accepted: January, 2021; Online Published: May, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e20413