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FEEDING INHIBITION WITH BIOFORMULATIONS IN CUT WORMS *AGROTIS IPSILON* (HUFNAGEL)

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ABSTRACT

Feeding inhibition study of bioformulations viz., *Neemastra*, *Agniastra*, *Brahmastra*, *Dashparni ark* and garlic + ginger + mint mixture was carried out against fourth, fifth and sixth instar larvae of *A. ipsilon*. These bioformulations were observed to be not giving significant mortality in the fourth, fifth and sixth instar larvae but result in feeding inhibition. Concentrations ranging from 1.5% to 24% were evaluated for this action. It was observed that *Dashparni ark* was the most effective causing maximum feeding inhibition to later instar larvae of *A. ipsilon* followed by *Brahmastra*, *Agniastra*, *Neemastra* and garlic+ ginger+ mint mixture. *Dashparni ark* was found 1.35, 1.34 and 1.26x more effective compared to the least effective garlic + ginger + mint mixture against fourth, fifth and sixth instar larvae of *A. ipsilon*, respectively.

Key words: *Agrotis ipsilon*, feeding inhibition, bioformulations, *Neemastra*, *Agniastra*, *Brahmastra*, *Dashparni ark*, garlic + ginger + mint, FI₅₀, 4-6th instars

Cutworms are polyphagous and cosmopolitan pests attacking large number of crops worldwide including India (Ram et al., 2001; Mrowczynski et al., 2003; Napiorkowska and Gawowska, 2004). The larvae usually hide in cracks and crevices in the soil or under the clods or debris around the plants during day time and cut the young plants at ground level and eat only the tender parts (Bhattacharyya et al., 2014). These feed on variety of hosts namely potato, barley, oats, mustard, linseed, cabbage, peas, gram, tobacco etc. However, they prefer gram over pea, potato and cabbage (Ram and Mishra, 2002). In Himachal Pradesh, greasy or black cutworm *Agrotis ipsilon* and common cutworm *A. segetum* are the two major ones (Verma and Verma, 2002). *A. ipsilon* is prevalent in low and mid-hills, whereas *A. segetum* is more abundant in higher elevations (Pathania 2010).

Use of insecticides for the management of cutworms is common practice but it causes many undesirable effects (Sharma and Verma, 2015). Biorational approaches by utilizing botanical preparations, natural products, insect growth regulators and entomopathogenic microorganisms are gaining significance as possible alternatives (Ramesh et al., 2014). The deleterious effects of plant products on insects can be manifested in several manners including toxicity, mortality, antifeedant, growth inhibitor, suppression of reproductive behaviour and reduction of fecundity and fertility, growth inhibition and

perturbation of reproductive behaviour (Sharaby and Nojiban, 2015). *Brahmastra*, *Agniastra*, *Neemastra*, *Dashparni ark* and garlic+ ginger+ mint mixture are few indigenous bioformulations available. These need evaluation for effective management of cutworms, and hence the present study. Feeding inhibition due to these bioformulation on the fourth, fifth and sixth instar larvae of cutworm, *A. ipsilon* has been evaluated under laboratory conditions.

MATERIALS AND METHODS

The experiment was conducted from July 2018 to May 2019 in the Post Graduate Laboratory of the Department of Entomology, CSK Himachal Pradesh Krishi Vishvavidyalaya (CSK HPKV), Palampur (32.11° N, 76.23° E, 1290 masl). The initial culture of *A. ipsilon* was obtained in the form of adult moths collected in light trap installed at the Entomology Farm in CSK HPKV, Palampur and brought to laboratory. The moths were transferred to glass chimneys (20 x 10 cm) for mating and oviposition. In each chimney, one pair was released. A crumpled paper was placed in the chimney as a resting as well as oviposition site for the moths. The top of the chimney was covered with white muslin cloth. A piece of cotton soaked in honey (10%) kept in small petri plate served as food to the moths. The females mostly oviposited on the white muslin cloth and the crumpled paper. The egg masses laid by the moths were collected daily and the paper and muslin

cloth were replaced. The eggs which were laid on the sides of the chimney were moistened before separating them with camel hair brush. Such papers and the muslin cloth bearing the egg masses were then transferred into plastic jars. The jars were then examined daily for egg hatching.

Fresh and soft cabbage leaves were placed in such jars after blackening of the eggs, as food to the newly emerging larvae. The larvae of each day hatching were kept separately in individual plastic jars (100 ml) and provided with fresh food for getting the insects of desired age for bioassay purpose. To keep the leaves fresh for longer duration, the leaf petioles were wrapped with wet cotton plugs. The larvae were reared en masse in the early instars. Third instars onward, 10 larvae were transferred to each plastic jar (100 ml) containing a layer of about 5 cm moist soil-sand mixture. These larvae were provided with fresh cabbage leaves as per their requirement. The full fed larvae pupated in soil which were then sexed and kept separately in another plastic jar (100 ml) for further culture. The culture so obtained was used, with $25 \pm 1^\circ\text{C}$ and $75 \pm 5\%$ RH and 16:8 (L:D) photoperiod maintained.

The bioformulations evaluated include *Brahmastra*, *Neemastra*, *Agniastra*, *Dashparni ark* and garlic+ ginger+ mint mixture and their details of preparation are as follows:

Dashparni ark	
Cow urine (5 L)	Known quantity of crushed neem leaves, nirgudi leaves, papaya leaves, custard apple leaves, karanja leaves, karanja leaves, castor leaves, red corner leaves, green chili paste, garlic paste, cow dung, cow urine, water taken in a 500 l capacity drum and ferment for one month. Keep the drum in shade and cover with gunny bag. Shake regularly three times a day. Extract the solution after filtering through cloth.
Cow dung (3 kg)	
Neem (<i>Azadirachta indica</i>) leaves (5 kg)	
Karanja (<i>Millettia pinnata</i>) leaves (2 kg)	
Nirgudi (<i>Vitex negundo</i>) leaves (2 kg)	
Custard apple (<i>Annona reticulata</i>) leaves (2 kg)	
Red corner (<i>Adenantha pavonina</i>) leaves (2 kg)	
Papaya (<i>Carica papaya</i>) leaves (2 kg)	
Green chilli (<i>Capsicum annuum</i>) paste (2 kg)	
Castor (<i>Ricinus communis</i>) leaves (2 kg)	
Garlic (<i>Allium sativum</i>) paste (250 g)	
Water (200 L)	

Agniastra	
Cow urine (10 L)	10 l of cow urine poured in pot; 1 kg tobacco added by crunching it. Crushed 500 g of chilli added in urine. Crushed 500 g of local garlic added in urine and then 5 kg neem leaves pulp added. Boiled this solution well 5 times continuously. Let this solution to fermented for 24 hr. Filtered this by cloth and then used it for presnt investigation.
Tobacco (<i>Nicotiana tabacum</i>) leaves (1 kg)	
Green chili (<i>Capsicum annuum</i>) leaves (500g)	
Garlic (<i>Allium sativum</i>) paste (500 g)	
Neem (<i>Azadirachta indica</i>) leaves pulp (5 kg)	

Neemastra	
Cow urine (5 L)	100 l water taken in pot, 5 l local cow urine added in it and 5 kg local cow dung added in it. Crushed 5 kg neem leaves and added this pulp in water. Let this solution to ferment for 24 h. Stirred this solution twice a day by any stick. Filtered this by cloth and then used it in insect control.
Cow dung (5 kg)	
Neem (<i>Azadirachta indica</i>) leaves pulp (5 kg)	
Water (100 L)	

Brahmastra	
Cow urine (10 L)	10 l local cow urine taken in pot. Crushed 3 kg of neem leaves and added this pulp in water. Then 2 kg pulp of sitaphal (custard apple) leaves, 2 kg pulp of pomegranate leaves, 2 kg of guava leaves pulp, 2 kg <i>Lantana camera</i> leaves pulp and 2 kg white dhatura leaves pulp added in it. Then boiled this solution for 5 times. Filtered this solution by cloth. Let this solution to ferment for 24 hr and then used it in field.
Neem (<i>Azadirachta indica</i>) leaves (3 kg)	
Custard apple (<i>Annona reticulata</i>) leaf (2 kg)	
Papaya (<i>Carica papaya</i>) leaf (2 kg)	
Pomegranate (<i>Punica granatum</i>) leaves (2 kg)	
Guava (<i>Psidium guajava</i>) (2 kg)	
<i>Lantana camera</i> leaves pulp (2 kg)	
White dhatura (<i>Datura</i> sp.) leaves (2 kg)	

Garlic + ginger + mint mixture	
Ginger (<i>Zingiber officinale</i>) (200 g)	200 g each of ginger, garlic and leaves of mint
Garlic (<i>Allium sativum</i>) (200 g)	taken and added 600 ml of water in it. Grinded
Mint (<i>Mentha</i> sp.) leaves (200 g)	all ingredients with the help of electric mixture.
Water (600 ml)	Stirred this solution for three times in 24 h for two days. Filtered this solution by cloth and used against pest species.

The above were procured from Department of Organic Agriculture, Navsari Agricultural University, Gujarat and garlic + ginger + mint mixture was self prepared in the laboratory. The products procured from NAU, Gujarat were filtered through Whatman filter paper No. 9 and collected in glass bottles. The filtrate of each natural product was considered as 100% stock solution from which the desired concentrations for bioassay purpose were prepared.

Feeding inhibition study with 1.5% to 24% was done with fourth to sixth instar larvae. Cabbage leaves of equal thickness and consistency were cut in to disc of 28.44 cm² size measured with leaf area metre were dip-treated for 2 min in each concentration, shade dried and placed in glass jars. Each test concentration was replicated three times. A control experiment was also run simultaneously with equal number of replication. In each jar 10 larvae, prestarved for 2-3 hr were released in each treatment and allowed to feed for 48 hr after which the leaf area was again measured. A control experiment was conducted simultaneously with equal number of replications. The % feeding inhibition (FI) was calculated as: The FI₅₀ and FI₉₀ values on the basis on feeding inhibition over control was estimated by probit analysis (Finney, 1971) The heterogeneity, FI₅₀ values, FI₉₀ values and their fiducial limits were computed, and lines were plotted and slopes of the regression were determined. The relative feeding inhibition values were worked out as FI₅₀ and FI₉₀ values taking the least toxic compound as unity.

RESULTS AND DISCUSSION

Observations on the feeding inhibition activity of bioformulations against fourth, fifth and sixth instar larvae of *A. ipsilon* were taken by exposing them to treated leaf surfaces for 48 hr and the FI₅₀ was calculated

(Table 1). The results of feeding inhibition studies against the fourth instar larvae revealed *Dashparni ark* as the most effective bioformulation followed by *Brahmastra*, *Agniastra*, *Neemastra* and garlic+ ginger+ mint mixture with FI₅₀ values 5.11, 5.54, 5.76, 6.29 and 6.90 %, respectively. *Dashparni ark* was 1.35x more effective than the least effective garlic + ginger + mint mixture. The feeding inhibition for the fifth instar larvae revealed *Dashparni ark* as the most effective bioformulation followed by *Brahmastra*, *Agniastra*, *Neemastra* and garlic+ ginger+ mint mixture with FI₅₀ values 5.53, 5.76, 6.17, 6.67 and 7.39%, respectively. *Dashparni ark* was 1.34x more effective than the least toxic garlic + ginger + mint mixture.

In case of sixth instar larvae, The feeding inhibition study revealed *Dashparni ark* as the most effective bioformulation followed by *Brahmastra*, *Agniastra*, *Neemastra* and garlic+ ginger+ mint mixture with FI₅₀ values 7.08, 7.29, 7.46, 7.85 and 8.89%, respectively. *Dashparni ark* was found 1.26x more effective than the least toxic Garlic + ginger + mint mixture. The results reveal that all the bioformulations have feeding deterrence against *A. ipsilon* and the results are in confirmation with those of Anees (2018) who reported all the organics viz., cow urine, *Panchagavya*, *Darekastra*, *Agneystra*, *Dashaparni*, NSKE and one biopesticide i.e. Neem Baan 1500 ppm as exhibiting repellent, feeding deterrent and ovicidal activities against third instar larvae of *S. litura*.

Santhosh (2008) observed significantly higher protection (60.36 and 57.49%, respectively) after 48 hr of *Agniastra* and *Brahmastra* treatment against insects pests of soybean. Though no information is available on these products, the antifeedant activity could be because of neem, pongamia or custard apple leaves used in some preparation. Barapatre and Lingappa (2003) reported high antifeedant property of cow urine when combined with pongamia, aloe, *V. negundo* and NSKE against *H. armigera*. Barapatre (2001) observed the antifeedant property of neem oil (2.5%) and garlic (0.5%) + chilli (1%) against *S. litura*. More et al. (1989) and Mathew (1997) observed the antifeedant property of cow urine at 10% against *S. litura*.

Sharaby and Nojiban (2015) showed that the garlic, mint, cumin, caraway and parsley oil had a stomach and contact toxicity through the larval feeding on treated diet, also all the tested oils exhibited antifeedant and starvation effects on *A. ipsilon*.

Table 1. Feeding inhibition due to bioformulations in larvae of *A. ipsilon*

S. No	Bioformulations	FI ₅₀ (%)	Regression equation	Slope (b)	Heterogeneity	Relative feeding inhibition
4 th instar						
1.	<i>Dashparni ark</i>	5.11	Y=4.01 + 1.39 X	1.39 ± 0.27	0.62	1.35
2.	<i>Brahmastra</i>	5.54	Y=3.96 +1.40 X	1.40 ± 0.28	0.42	1.25
3.	<i>Agniastra</i>	5.76	Y= 3.94 + 1.39 X	1.39 ± 0.28	0.29	1.19
4.	<i>Neemastra</i>	6.29	Y=3.90 + 1.38 X	1.38± 0.28	0.32	1.09
5.	Garlic + ginger + mint mixture	6.90	Y= 3.87 + 1.35 X	1.35 ± 0.27	0.28	1.00
5 th instar						
1.	<i>Dashparni ark</i>	5.53	Y=3.97 + 1.39 X	1.39 ± 0.28	0.38	1.34
2.	<i>Brahmastra</i>	5.76	Y=3.96 +1.37 X	1.37 ± 0.28	0.23	1.28
3.	<i>Agniastra</i>	6.17	Y= 3.93 + 1.36 X	1.36 ± 0.27	0.28	1.20
4.	<i>Neemastra</i>	6.67	Y=3.85 + 1.39 X	1.39 ± 0.28	0.30	1.11
5.	Garlic + ginger + mint mixture	7.39	Y= 3.81 + 1.37 X	1.37 ±0.28	0.23	1.00
6 th instar						
1.	<i>Dashparni ark</i>	7.08	Y=3.92 + 1.28 X	1.28 ± 0.27	0.17	1.26
2.	<i>Brahmastra</i>	7.29	Y=3.90 +1.28 X	1.28 ± 0.27	0.22	1.22
3.	<i>Agniastra</i>	7.46	Y= 3.89 + 1.27 X	1.27 ± 0.27	0.16	1.19
4.	<i>Neemastra</i>	7.85	Y=3.85 + 1.28 X	1.28 ± 0.27	0.06	1.13
5.	Garlic + ginger + mint mixture	8.89	Y= 3.78 + 1.29 X	1.29 ± 0.27	0.19	1.00

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REFERENCES

- Anees M M. 2018. Bioefficacy of some organic products against *Spodoptera litura* (Fab.). M Sc thesis, Department of Entomology, CSK HPKV, Palampur. p.79.
- Anonymous. 2011. Annual Report. Department of Entomology, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh. 63 pp.
- Barapatre A, Lingappa S. 2003. Larvicidal and antifeedant activity of indigenous plant protection practices for *Helicoverpa armigera* (Hub.). Proceedings. National symposium frontier areas of entomological research, IARI, New Delhi. pp. 335-336.
- Barapatre A B. 2001. Evaluation of indigenous technology for management of *Helicoverpa armigera* (Hubner.) and *Spodoptera litura* (Fab.). M Sc Thesis, UAS GKVK, Bangalore. p. 115.
- Bhattacharyya B, Pujari D, Bhuyan U, Baruah A A L H. 2014. Management of potato cutworm, *Agrotis ipsilon* (Hufnagel) in Assam. Pesticide Research Journal 26: 82-85.
- Finney D J. 1971. Probit analysis. Cambridge University Press, Cambridge, London 318 pp.
- Kumar M, Tiwary S K. 2009. Variability of varietal resistance of potato against cutworm, *Agrotis ipsilon* Hufn. Proceeding of the Zoological Survey of India 8: 111-114.
- Mathew M M. 1997. Evaluation of indigenous products against insect pest of groundnut. M Sc (Agri.) thesis, PDKV, Akola.
- More G N, Kadu N R, Sakhare S D. 1989. Evaluation of indigenous plant extracts against *Spodoptera litura* (F.). Nagpur Agricultural College Magazine 56: 49-51.
- Mrowczynski M, Wachowiak H, Boron M. 2003. Cutworms- a dangerous pest in the autumn of 2003. Ochrana Roslin 47: 24-26.
- Napiorkowska K J, Gawowska J. 2004. Increase of harmfulness of caterpillars of Hadeninae and Noctuidae (Lepidoptera: Noctuidae) on cabbage and other cole crops. Progress in Plant Protection 44: 978-980.
- Pathania V. 2010. Distribution of biology of cutworms infesting potato in Himachal Pradesh. M Sc thesis. Department of Entomology, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. p. 69.
- Ram G, Misra S S. 2002. Impact of planting and harvesting dates on the incidence of cutworm, *Agrotis* spp. damaging potato. Proceedings. International conference on vegetables, USA. p. 252.
- Ram G, Misra S S, Dhamayanthi K P M. 2001. Relative susceptibility of advanced hybrids and promising cultivars of potato, *Solanum tuberosum* L. to greasy cutworm, *Agrotis ipsilon* (Hufnagel) in North-eastern plains. Journal of Entomological Research 25: 183-187.
- Rameash K, Kumar A, Kalita H, Avasthe R K. 2014. Ecofriendly management of cutworm, *Agrotis ipsilon* and cabbage butterfly,

- Pieris brassicae* in cabbage. Indian Journal of Plant Protection 42: 349-353.
- Santhosh M N. 2008. Evaluation of ITK components against major insect pests of soybean (*Glycine max* (L.) Merrill). M Sc thesis. Department of Entomology, University of Agricultural Sciences, Dharwar. pp. 63-72
- Sharaby A, Nojiban A E. 2015. Evaluation of some plant essential oils against the black cutworm, *Agrotis ipsilon*. Global Journal of Advanced Research 2(4): 701-711.
- Sharma, N. and Verma K S. 2015. Evaluation of new chemistry insecticides against *Agrotis segetum* (Denis & Schiffermuller). Journal of Insect Science 28: 264-268.
- Specht A, Angulo A O, Olivares T S, Fronza E, Specht V F R, Valduga E, Albrecht F A F, Poletto G, Barros N M. 2013. Life cycle of *Agrotis malefida* (Lepidoptera: Noctuidae): a diapausing cutworm. Zoologia 30: 371-378.
- Thakur A S, Vaishampayan S M, Shukla A. 1997. Evaluation of some soil insecticides against cutworm, *Agrotis ipsilon* (Hufnagel) in sunflower. Crop Research 14: 477-480.
- Verma K S, Verma A K. 2002. Cutworm species associated with different crops in Himachal Pradesh. Insect Environment 8: 23.

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