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Diminution in Overwintering Population of Codling Moth (*Cydia pomonella* L.) via various Disposal Methods of Infested Fruits

Danishta Aziz[1]*, Ishtiyaq Ahad[1], Tarique Hassan Askary[1], Khalid Rasool[2], M. Ashraf Bhat[3], Fehim Jeelani[4], Rehana Akbar[1] and Ishfaq Majeed Shah[1]

[1]Division of Entomology, Faculty of Agriculture, SKUAST-Kashmir, J&K 193 201, India
[2]Division of Horticulture, Faculty of Agriculture, SKUAST-Kashmir, J&K 193 201, India
[3]Division of Plant Biotechnology, Faculty of Horticulture, SKUAST-K, J&K 190 025, India
[4]Division of Statistics, Faculty of Agriculture, SKUAST-Kashmir, J&K 193 201, India

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ABSTRACT

The proper disposal of codling moth (*Cydia pomonella* L.) infested apple fruits/fallen fruits at the time of harvesting was carried out in North Kashmir karewas, Jammu and Kashmir, India for the years 2021 and 2022. Various practices were followed to kill the overwintering larvae present inside apple fruits in order to break the cycle of codling moth and inhibit its regeneration in the next growing season. The mortality percentage was calculated after application of different treatments. All the treatments registered significantly higher mortality percentage than control. However, among different treatments alphamethrin 10 ECwas more superior in causing mortality of bored larvae (80.397 ± 2.795 and 80.497 ± 2.084) followed by malathion 50% EC (77.297 ± 1.553 and 78.893 ± 2.163) and lowest mortality percentage in control (14.370± 0.351 and 13.822 ± 0.902) for consecutive years, respectively. In case of non-insecticidal treatments, feeding of infested fruits to cattle (74.980 ± 0.581 and 73.290 ± 0.604) recorded highest mortality.

Key words : *Cydia pomonella (L.), Apple, Infested fruit and Mortality.*

Introduction

Codling moth, *Cydia pomonella* L. is an insect pest belonging to family tortricidae of order lepidoptera. It has four different stages in its life, among which the destructive and damaging stage is the larva. Codling moth usually attacks and feeds on all type of pome fruits like apple, pear and quince but it predominantly feeds on apple. It can also feed on apricot, plum, walnut and other fruits which may serve as its alternate host. In case of apple, all the cultivars whether native or non-native are infested by this pest with varying degree of damage. This insect pest usually completes 1-3 generations per year but it is carried out to next growing season through overwintering larvae which in spring pupates and then adults lay eggs to complete the cycle and cause damage to fruits in next season. The mature codling moth larvae (5^{th} instar) overwinters in cracks and crevices of tree trunk particularly by forming silken cocoons around them however, sometimes overwintering sites may change like loose soil around trunk region, polythene/cloth/gunny bag wraps on tree trunk or branches. It has been seen that maximum damage to fruit occurs by the overwintering population of codling moth. Therefore, it is necessary to

destroy/ kill the larvae present in infested fruits after harvesting to stop overwintering and inhibit the pest to complete its life cycle. For breaking the cycle, there should be implication of some management tactics to dispose off the fruit safely and killing of larva present inside infested fruits. The present study was thus conducted to frame some management practices for prevention of overwintering by codling moth larvae and inhibition of development of new generation in the next growing season.

Materials and Methods

The experiment was conducted at an isolated apple growing patch in karewas of Nadihal area of Baramulla district, Jammu and kashmir, India situated at an altitude of 1629.7 meters above mean sea level (amsl) between 34°23′ North latitude and 74°39′ East longitude for the years 2021 and 2022. During both the study years, same management module was practiced for proper disposal of codling moth infested fruits and assessment of mortality percentage of overwintering larvae (Table 1). At the time of harvesting (October-November) all the infested fruits were collected from field and then different treatments were done accordingly. Three chemical insecticides Dimethoate 30% EC (T_0), Malathion 50% EC (T_1), Alphamethrin 10% EC (T_2) and two botanicals Artemesia (T_3), Neem (T_4) were used for treating the infested fruits. The insecticide solution in water was prepared and fruits were kept completely immersed in the solution for 10 minutes to kill the larva inside. Other management practices include feeding of infested fruits to cattle (T_5), making compost (T_6) and burying the fruits deep in pits (T_7). The mortality percentage was calculated and was compared to control/untreated (T_8). The data obtained was statistically analyzed by using R software.

Results and Discussion

The observations recorded in the experiment provided correct information about the efficacy of different management practices in causing mortality of overwintering larvae present ininfested apple fruits. The results shown in Table 2 revealed that all the treatments behaved significantly more superior in causing mortality of overwintering larvae than control, either by direct killing or by acting as antifeedent which ultimately led to death of larvae. Among different treatments in general, highest mortality percentage was observed in the fruits treated with alphamethrin 10% EC (80.397% ± 2.795 and 80.497% ± 2.084) followed by malathion 50% EC(77.297% ± 1.553 and 78.893% ± 2.163), while least mortality percentage was recorded in control (14.370%± 0.351 and 13.822% ± 0.902) for both years 2021 and 2022, respectively. However, in case of chemical insecticides highest mortality percentage was registered in alphamethrin 10% ECfollowed by malathion 50% EC and then dimethoate 30% EC (72.650% ± 1.164 and 73.690% ± 1.230) in both consecutive years, respectively. Our results are in agreement with Alhaj *et al*. (2018) who found that codling moth can be controlled by spraying insecticides like cypermethrin, alphamethrin and chlorpyriphos. In support of our observations, aphamethrin was found to be 98% effective in controlling codling moth, *Laspeyresia pomonella* (Marinkov, 1989). Bostanian *et al.* (1989) also found codling moth as a key pest to be controlled easily by alphamethrin 10% EC. Our results are also in line with Gratwick (2009)

Table 1. Details of management practices used in the experiment

Treatment	Trade name	Dose	Manufacturer
Chemical insecticide			
Dimethoate 30% EC (T_0)	Rogor	1 ml/l	FMC India Private Limited
Malathion 50% EC (T_1),	Armala	1ml/l	Arbuda Agrochemicals Private Limited
Alphamethrin 10% EC (T_2)	Stop	1ml/l	Biostadt India Limited
Botanical extracts			
Artemesia (T_3)	-	5ml/l	-
Neem (T_4)	Neembaan	5ml/l	Pest control Limited, Mumbai
Other management practices			
Feeding of infested fruits to cattle (T_5)	-	-	-
Composting (T_6)	-	-	-
Burrying infested fruits in pit (T_7)	-	-	-
Control (T_8)	-	-	-

Table 2. Effectiveness of different management practices in controlling overwintering population of codling moth (*Cydia pomonella* L.)

Treatment	Mean Per cent Mortality (%) ± S.E		
	2021	2022	Pooled
T_0	72.650^{cd} ± 1.164	73.690^{c} ± 1.230	73.170^{cd} ± 0.520
T_1	77.297^{b} ± 1.553	78.893^{ab} ± 2.163	78.095^{b} ± 0.798
T_2	80.397^{a} ± 2.795	80.497^{a} ± 2.084	80.447^{a} ± 0.050
T_3	70.780^{de} ± 1.603	71.853^{cde} ± 2.323	71.317^{de} ± 0.536
T_4	68.197^{ef} ± 1.927	69.107^{ef} ± 2.263	68.652^{f} ± 0.455
T_5	74.980^{bc} ± 0.581	73.290^{cd} ± 0.604	74.135^{c} ± 0.845
T_6	66.567^{fg} ± 1.819	67.370^{fg} ± 1.872	66.968^{fg} ± 0.402
T_7	64.980^{gh} ± 1.296	65.737^{fgh} ± 1.325	65.358^{gh} ± 0.378
T_8	14.370^{i}± 0.351	13.822^{i} ± 0.902	14.096^{i} ± 0.274
CD(0.05)	3.034	4.031	2.106

Treatments with same letter are not significantS.E- Standard error

who found 90-100% mortality of codling moth larvae by application of various chemicals including malathion and dimethoate. Apart from synethetic insecticides both botanicals, *Artemesia* (70.780% ± 1.603 and 71.853% ± 2.323) and neem (68.197%± 1.927 and 69.107% ± 2.263) were at par in resulting mortality of overwintering larvae. The findings of Suomi *et al*. (1986) are in support of our results where they tested different plant extracts on neonate stage of codling moth and found *Artemisia absinthium* extracts acting as antifeedent for the said larvae and causing their mortality. Similarly, Durden *et al*. (2008, 2009 and 2011) reported the dose dependent feeding deterent properties of *Artemisia* spp. against codling moth larvae as it contains some chemicals like artemisinin and 1,8-cineole which prevent apple infestation by codling moth. The results of Creed *et al*. (2015) are in resemblance with our observations as they reported the presence of chemical thujone in extracts of *Artemisia* acting as inhibitor for codling moth infestation in apple. Neem was found to be toxic against codling moth larvae in a study by Konecka *et al*. (2019) as it contains a chemical azadirachtin which acts as an antifeedent and is natural insecticide. Among other management practices, highest mortality percentage was seen in fruits fed to cattle (74.980 ± 0.581, 73.290 ± 0.604) and few heavily infested fruits were discarded by cattle. It was followed by both composting and burying fruits in pits which were almost at par in their effect. The highest pooled percent mortality was in case of alphamethrin 10% EC (80.447%± 0.050) followed by malathion 50% EC (78.095%± 0.798), cattle feeding (74.135%± 0.845) and least in case of control (14.096%± 0.274). The observations can be more clearly understood by analyzing the graph given in Figure 1. A number of examples about birds and cattle being acting as predators for destruction of codling moth overwintering larvae have been quoted like Chapman (1973) reported the woodpeckers acting as the agents for destroying overwintering stages of codling moth. Overall these practices could be explored for devising an effective integrated pest management of the notorious pest which has reduced the market value of apple as the larvae remains inside the fruit and finally annoy the consumer.

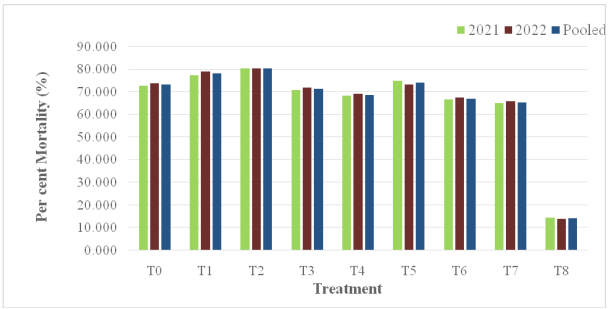

Fig. 1. Year-wise per cent mortality of overwintering larvae of codling moth

References

Alhaj, E.S.I., Basheer, A.A. and Aslan, L. 2018. First Recorder of New Parasitoid on Codling Moth, *Cydia pomonella* L. Belong to Ichneumonidae Family (Hymenoptera) in Syria. *Arab Journal of Arid Environments.* 11(1): 18.

Bostanian, N. J., Vincent, C., Pitre, D. and Simard, L.G.

1989. Chemical control of key and secondary arthropod pests of Quebec apple orchards. *Applied Agricultural Research (USA)*.

Chapman, P.J. 1973. Bionomics of the apple-feeding Tortricidae. *Annual Review of Entomology*. 18(1): 73-96.

Creed, C., Mollhagen, A., Mollhagen, N. and Pszczolkowski, M. A. 2015. *Artemisia arborescens* "Powis Castle" extracts and á-thujone prevent fruit infestation by codling moth neonates. *Pharmaceutical Biology*. 53(10): 1458-1464.

Durden, K., Brown, J.J. and Pszczolkowski, M.A. 2008. Extracts of *Ginkgo biloba* or *Artemisi*a species reduce feeding by neonates of codling moth, *Cydia pomonella* (Lepidoptera: Tortricidae), on apple in a laboratory bioassay. *Journal of the Entomological Society of British Columbia*. 105: 83-88.

Durden, K., Sellars, S. and Pszczolkowski, M.A. 2009. Preventing fruit infestation by codling moth neonates with *Artemisia* extracts. *Pestycydy*. 1: 51-56.

Durden, K., Sellars, S., Cowell, B., Brown, J.J. and Pszczolkowski, M.A. 2011. *Artemisia annua* extracts, artemisinin and 1, 8-cineole, prevent fruit infestation by a major, cosmopolitan pest of apples. *Pharmaceutical Biology*. 49(6): 563-568.

Gratwick, M. 2009. Laboratory assessment of the toxicity of field-weathered deposits of insecticides to larvae of the codling moth, *Cydia pomonella* (L.). *Bulletin of Entomological Research*. 55(1): 35-47.

Konecka, E., Kaznowski, A. and Tomkowiak, D. 2019. Insecticidal activity of mixtures of *Bacillus thuringiensis* crystals with plant oils of *Sinapis alba* and *Azadirachta indica*. *Annals of Applied Biology*. 174(3): 364-371.

Marinkov, P. 1989. Effect of some abiotic factors on insecticide efficiency in controlling the apple codling moth (*Laspeyresia pomonella* L.). *Rasteniev'dni Nauki*. 26(8): 92-95.

Suomi, D., Brown, J.J. and Akre, R.D. 1986. Responses to plant extracts of neonatal codling moth larvae *Cydia pomonella* (L.) (Lepidoptera: Tortricidae: Olethreutinae). *Journal of the Entomological Society of British Columbia*. 83: 12-18.