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A STUDY OF DRY FLOWER EXTRACT OF *TAGETES ERECTA* AS HERBAL PESTICIDES ON LARVAL MORTALITY AND EMERGENCE OF *AGROTIS IPSILON*

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Abstract

The use of synthetic pesticides has raised concerns due to their toxic impact on the environment and human population as well. As a result, there is developing interest in exploring alternative pest control methods, such as herbal pesticides derived from natural sources. This study aimed to investigate the efficacy of a dry flower extract of *Tagetes erecta* as an herbal pesticide on larval mortality and emergence of *Agrotis ipsilon*, a common agricultural pest. The experiment involved conducting bioassays using different concentrations of the dry flower extract on Agrotis ipsilon larvae. Mortality rates were recorded at regular intervals, and observations were made on the emergence of adults from surviving larvae. Additionally, the effects of the extract on larval developmental stages were examined. The experiment were perform on infected brinjal and tomato plant to find out the impact of dry aqueous extract of *Tagetes erecta* (marigold) on larval mortality and the emergence of *Agrotis ipsilon*. Finding shows that larval mortality and emergence on brinjal towards *Agrotis ipsilon* (Hufn) varies with five gram (2% to 38%.),10 gram (13% to 63%.), 15 gram (21% to 68%) and 20 gram (29% to 85%.) and on tomato towards *Agrotis ipsilon* (Hufn) with five gram (4% to 26%), 10 gram (12% to 58%), 15gram (16% to 70%.) and 20 gram (28% to 89%). The larvae showed comparative tolerance in route of increasing age and time.

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Keywords: Solanum melongena, Lycopersion esculentum, *Tagetes erecta*, *Agrotis ipsilon*, Cutworms, vegetable.

Introduction

Agrotis ipsilon, commonly known as the black cutworm, is a moth species belonging to the family *Noctuidae*. It is primarily found in the Americas and is known for its agricultural significance as a pest. The black cutworm larvae feed on a wide range of crops, including corn, wheat, soybeans, and various vegetables. The adult black cutworm moth has a wingspan of about 1.5 to 2 inches (3.8 to 5 cm) and has a dark gray or blackish-brown coloration (Ghar et. al. 1996). The forewings often have a distinctive dark mark shaped like a greasy thumbprint, which helps in identifying the species. Female moths lay their eggs on weeds, crop residues, or in the soil near host plants. The eggs hatch into caterpillars, commonly known as cutworms, which begin to feed on the nearby plants (McLeod and Greene 2015). The larvae are dark gray or black, with a greasy appearance and coarse skin. They can grow up to 1.5 inches (3.8 cm) long (Eiseman et. al. 2010).The feeding habits of black cutworms can cause significant damage to crops. The larvae cut off young plants near the soil surface, hence the name "cutworm." They feed generally in the night and hide in the soil or debris during the day (Villanueva 2016). As they grow, they become more destructive and can sever small plants entirely or chew on larger plants, causing significant economic losses for farmers. To manage black cutworm infestations, several approaches can be employed. These include cultural practices such as proper crop rotation, deep plowing to bury overwintering larvae, and removal of weeds and plant residues that serve as host sites (Joshi et. al. 2020). Biological control methods involving the use of natural enemies like parasitic wasps and pathogens can also be effective. In some cases, chemical insecticides may be used, but they are generally considered a last resort due to their potential environmental impact (Holmes et. al. 2016). It's important to note that pest management strategies and specific control measures may vary depending on the region, crops, and farming practices employed (Bonabana 2002). Brinjal *(Solanum melongena*) and tomato *(Lycopersen esculentum*) are the most widely grown vegetables in India and are members of the *Solanaceae* family. Tomato and brinjal are significant due to culinary qualities. In addition to being significant as foods, tomatoes and brinjal also have therapeutic uses. While tomatoes are a good source of several vitamins such as A and C, potassium, minerals, fiber, antioxidants, brinjal also has a lot of fiber and antioxidants, as well as copper, manganese, and vitamins B-6 and A (Ali et. al. 2020; Gürbüz et. al. 2018). The use of chemical insecticides available in the market saves crops from insects, but it destroys the fertility of the land after some time. Not only this, consumption of fruits and vegetables grown in this way is very harmful for the health and life of living beings (Tudi et. al. 2021).

In this sequence, herbal insecticide can prove to be a better option at present. They usually affect or damage a specific part of the insect's body, resulting in loss of coordination, paralysis, and death. These types of herbal insecticides do not have any negative effect as they mostly contain only natural ingredients. Presently Marigold *(Tagetes erecta)* plant belonging to *Asteraceae* family has emerged as a very powerful and effective biopesticide.

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Marigolds contain a high percentage of natural insecticidal chemicals in which sodium and potassium ions disrupt the normal transmission of nerve impulses. Most of these botanical insecticides exert their effects by inhibiting the contact, respiration or metabolism of the target organism. Herbal pesticides are biodegradable, inactivate in a couple of hours or days, and rapidly dissolve by digestive juices in mammals, making them harmless to mankind and other animals. Alternatively, it is cost-effective and beneficial for the environment.

Methodology

The experiment was carried out (2019-2020. 2020-2021 and 2021-2022) within the field of Shuklaganj (Unnao), Uttar Pradesh, India and the laboratory experiments were performed in the departmental laboratories of Institutions. Firstly marigold flower were collected from fields of Dhori Ghat (Ruma, Kanpur, UP) along with nearby temples. All the collected flowers were dried completely under shade and stored properly for further uses when flowers were not available.

In laboratory trails, tomato and brinjal plants were used from collected samples. Moreover, various spray were made, with different concentration such as the 5 gram dry flower was soaked in 1 liter of water overnight and then boiled for 25 -30 min, after filtration and cooling, it was mixed with 10 gram camphor (1,7,7-Trimethylbicyclo [2.2.1] heptan-2-one) and was sprayed with the help of 1-liter hand compression "Poly Sprayer" on respective tomatoes and brinjal crop plants in laboratory conditions. Four doses 5gm, 10gm, 15gm, and 20gm dry flower of marigold in 1 liter boiled water respectively were applied. The experiment was set up in three replications with one control for each tomato and brinjal plant and observations were recorded at regular intervals of 5 to 45 days following the method Ellis R.H. and Roberts (1980), Nath et.al. (2002). Similarly, 10 gram, 15 gram and 20 gram dry Marigold flower get dissolved in one-liter water respectively to make 2, 3 and 4 protectant spray and the same experiment were performed on respective tomatoes and brinjal crop plants during field trails. Observations were recorded at regular intervals of 5 to 45 days as shown in Table -1 and Table -2. The best results was obtained with 20 gm/lit of dry flower.

Figure 1: Infected brinjal and tomato plant

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Figure 2: After spray of protectant solution on brinjal and tomato plant

Figure 3: Air-dry flower

Figure 4: Over night soaked flower

Figure 5: Aqueous dry extract of marigold flower

Table-1: Efficacy of marigold (*Tagetes erecta*) flower extract on larval mortality on brinjal and emergence of *Agrotis ipsilon* (Hufn)

DOSES		5th day	10th day	15th day	20th day	25th day	30th day	35th day	40th day	45th day
5 gm	M	2%	6%	14%	14%	38%	00%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
10 gm	M	13%	22%	32%	54%	58%	63%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
15 gm	M	21%	39%	49%	59%	65%	68%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
20 gm	M	29%	43%	68%	00%	78%	85%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
Control	M	00%	00%	00%	00%	00%	00%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%

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Table-2: Efficacy of marigold *(Tagetes erecta)* flower extract on larval mortality and emergence on tomato of *Agrotis ipsilon* (Hufn)

DOSES		5th day	10th day	15th day	20th day	25th day	30th day	35th day	40th day	45th day
5 gm	M	4%	8%	18%	26%	00%	00%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
10 gm	M	12%	32%	36%	43%	58%	00%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
15 gm	M	16%	34%	48%	59%	67%	70%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
20 gm	M	28%	46%	63%	78%	86%	89%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%
Control	M	00%	00%	00%	00%	00%	00%	00%	00%	00%
	E	00%	00%	00%	00%	00%	00%	00%	00%	00%

Result and Discussion

It is observed that 5 gram treatment of marigold flower extract on larva caused mortality --- 2%, 6%, 14%, 24%, 38% on 5 days, 10 days, 15 days, 20 days, and 25 days respectively. 10 gram treatment 13%, 22%, 32%, 54%, 58% and 63% on 5 days,10 days, 15 days, 25 days and 30 days respectively. In 15 gram treatment 21%, 39%, 49%, 59%, 65%, and 68% mortality on 5days, 10 days, 15 days, 20 days, 25 days, and 30days, the 20gram treatment mortality 29%, 43%, 63%, 78%, and 85% on 5 days, 10 days, 15 days, 20 days, 25 days and 30 days respectively (Table-1). Finding data shows that the 5 gram dose of marigold flower extract caused 4% mortality on 5 days, 8%, 18% and 26%, mortality on 10 days, 15 days , and 20 days, the 10 gram dose 12%, 52%, 36% , 43%, and 58%, mortality on 5 days , 10 days, 15 days, 20 days, and 25 days respectively in 15 gram dose 16%, 34%, 48%, 59%, 67% and 70% mortality having 5 days, 10 days, 15 days, 20 days, 25 days, 30 days respectively. The 20 gram dose 28%, 46%, 63%, 78%, 86%, and 89% mortality being 5 days, 10 days, 15 days, 20 days, 25 days and 30 days respectively (Table-2). A similar result was recorded by Mallikarjuna et. al. (2004) and Sahayaraj et. al. (2008) and Baskar et. al. (2011). Bioefficacy of products obtained by plants against Asian army worm Spodoptera litura Fab. by Lohar et. al. (2018). Observation of African marigold (Tagetes erecta) varieties for its biochemical and morphological characteristics the similar finding were also concluded by Deepa et. al.(2016). Study on the plant growth and field attributes of marigold plant (Tagetes sps) hybrids. Debprasad et. al. (2000) examine the chemical characterization and antinemic screening of marigold (Tagetes erecta) flower, also supported by the Srivastava and Srivastav (1998) study indicated that toxicity effect of fungus on some medicinal plants and fruit

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pathogens was also noticed. Israilerv et. al. (1991) observed the significance of Myricetin in Tagetes; chemosystematic. Srivastava et al. (2022) proved the use of varied concentrations of buprofezin in food consumption and digestion. The similar analysis was also recorded by Deota and Upadhyay (2005). Rani and Rajasekharreddy (2009) recorded toxic and antifeedant activities of Sterculia foetida (2009), whereas the antifeedant potential and larvicidal activity of three Jatropha species against Spodoptera litura evident by Bhagat and Kulkarni (2012).

Conclusion

A field observation was performed to study the biochemical properties of the aqueous extract of the dry marigold flower. It contains a variety of compounds, among which pyrethrins is an important one. It has attracted much attention because of their excellent insecticidal properties on brinjal and tomato against *Agrotis ipsilon* (Hufn). The major advantages of the given methodology are the use of waste dry marigold flowers. It is readily available, inexpensive, easy to work with, and one of the broad spectrum bio-pesticides. This will play a vital role to find herbal pesticides with a novel mechanism of action that has no cross-resistance with traditional pesticides.

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