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Effect of Methanolic Extract of Achyranthes Aspera Linn on the Larvae of Silkworm, Bombyx Mori L.

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ABSTRACT

Some medicinal plants are widely used in the field of agriculture to protect the crops from the insect pests. In the present study the Achyranthes aspera is used to find out the larvicidal and antifeedants activity on the larvae of silkworm, Bombyx mori. The silkworm B. mori L.is used in the study as an experimental model as an insect larvae.

The crude methanolic extract of Achyranthes aspera Linn. Seeds, foliar spray was used in different concentration on the leaves of mulberry and fed to fifth instar larvae of Bombyx mori. The growth rate, feed consumption index, approximate digestibility, Efficiency of Conversion of Ingestion (E.C.I.), Efficiency of Conversion of Digestion (E.C.D.) of food and the Mortality rate of the larvae are recorded.

The result of plant extract reveals that, there is marked decrease in the Growth rate, E. C. I. and E.C.D. as compare to control group. The feed Consumption rate of the larvae was increased in 25% and 75% concentration; whereas E.C.D. decreased value was observed in 75%. During the overall study period, in experimental group showed less mortality, whereas 30% mortality was observed in 75%concentration. The details are explained in the text.

Keywords : Achyranthes Aspera, Bombyx Mori, Methanolic Extracts, Growth Rate, Mortality, Digestibility

I. INTRODUCTION

India is an agriculture dominated country, over 1012.4 million people are dependent on the agricultural activity (Krishna et al. 2000). To increase the agricultural productivity and the quality of the crops, various chemical insecticides are used in the agricultural field. However the chemically prepared drugs can act quickly and effectively but they have several side effects which can alter the ecosystem. Many chemical pesticides have the potential to cause some serious diseases to the human, like Parkinson`s disease, Alzheimer's, disease, headache, fatigue and depression (David, 2008).

From prehistoric times several medicinal plants have been used in the traditional medicinal practices and agricultural field. The Plants synthesizes several chemical compounds for different functions including defense against insect, fungi, diseases and herbivorous mammals. Some medicinal plants are widely used in the field of agriculture to protect the crop from the insect pests, because of their rich and diverse occurrence of phytochemicals, which has insect repellent or deterrent properties (Vishnubhai, 2011); these phytochemicals do not have any primary functions in the plants, like growth, reproduction or photosynthesis in the plants.

Achyranthes aspera is a species of Amaranthaceae family of plant, it is a weed plant and distributed throughout the India. This plant contains various medicinal properties andin traditional systems of medicine it is used to treat various diseases like, malaria, Hyperlipidemia, estrogenic, leprosy, spasm, cardio tonic, bacterial, and antiviral infectionas well as it is used to treat asthma, tussive and snakebite, hydrophobia, urinary calculi, rabies, influenza, otorrhoea, piles, bronchitis, diarrhea, abdominal pain(Bhosale et al. 2012). In the phytochemical screening of the seeds of Achyranthes aspera L.it has been reported that it contains alkaloids, flavonoids, saponins, glycosides, terpenoids, proteins, amino acids and steroids (Somagari et al. 2014). It is also found that the seeds of A. aspera having higher insecticidal and growth inhibition activities, due to the presence of secondary plant compounds (Jeyasankar et al. 2014).

II. METHODS AND MATERIAL

Rearing of Bombyx mori L.

The eggs of Bombyx moriwere procured from the district Sericulture office, Aurangabad, during August 2018 brought in the laboratory after the hatching, first instar to fourth instars larvaewere reared on fresh Mulberry leaves, fifth instars larvae were taken for experimental study, and they were grouped into five batches. The Rearing was carried out and incubated as per Hiware (2001).

Collection of plant material

Seeds of Achyranthes aspera were collected from fields located at Patoda, Taluka,District Aurangabad. After shade dried the seeds are ground to make fine powder by the electric grinder, and stored into the air tight polythene bags.

Preparation and treatment of crude plant extract

The 40 gram powder of the seeds of Achyranthes aspera was extracted with 400 ml methanol by the Soxhlet extraction apparatus (Lolge et al, 2016). After the completion of extraction the final extract was kept open to evaporate the solvent and remaining as stock solution was kept in refrigerator until use. Three different concentrations was prepared for larval treatment, 15 ml of crude extract was dissolve in 100 ml of distilled water, out of that 25%, 50% and 75% concentrated samplewere prepared by adding required amount of distilled water and sprayed separately by asprayeron mulberry leaf which were air dried and given as food to larvae. The weight of larvae, weight of excreta, weight of provided leaves and the weight of unconsumed leaves were recorded daily for nine days.

Calculations of nutritional indices of Bombyx mori L. have been done according to the equations used by Waldbauer (1968) on the basis of fresh body weight, dry weight of food consumed and dry weight of faeces per larva. Consumption index (C.I.), Growth rate (G.R.), approximate digestibility (A.D.), efficiency of conversion of ingested food (E.C.D) were calculated as follows:

$$(C.I.) = \frac{\text{Weight of eaten food}}{\text{Mean weight of larvae during feeding period} \times \text{Duration of feeding period (day)}}$$

$$(G.R.) = \frac{\text{Gained weight of larvae during feeding period}}{\text{Mean weight of larvae during feeding period} \times \text{Duration of feeding period (day)}}$$

$$\text{Mean weight of insect during feeding period} = \frac{\text{initial weight of insect} + \text{Final weight of insect}}{2}$$

$$(A.D.) = \frac{\text{Weight of ingested food} - \text{weight of faeces}}{\text{Weight of ingested food}} \times 100$$

$$(E.C.I) = \frac{\text{Gained weight of insect}}{\text{Weight of ingested food}} \times 100$$

$$(E.C.D.) = \frac{\text{Gained weight of insect}}{\text{Weight of ingested food} - \text{weight of faeces}} \times 100$$

III. RESULTS AND DISCUSSION

The crude methanolic extract of Achyranthes aspera sprayed in different concentration on the leaves of mulberry plantwas used and fed to fifth instars larvae

of Silkworm Bombyx moriL. In the present study, the growth rate, consumption index, approximate digestibility, Efficiency of digested food, and the Efficiency of conversion of ingested food and the mortality of the larvae have recorded. The results of the nutritional indices of fifth, larval instars of Bombyx mori L. has shown in Table 1. Nutritional indices of the fifth instars larvae of B. mori were significantly different in different concentration of the plant extracts. Growth rate shows how much nutrients increased in the body of insect per day per gram of body weight. The growth rate can alter the speed of development of insect, which depends onavailability of food and also on abiotic factors like temperature and humidity (Jasjinder, 2013). Growth rate of the larvae was noticeably decreased in the all group of larvae reared on treated leaves of mulberry with extract of Achyranthes aspera. Lowest value of growth rate was observed in 25% (0.090) followed by 50% (0.114) concentration of plant extract.

Consumption index shows the rate at which nutrients enter into the digestive system of the insect. In the present study the consumption index is almost same or there are not considerable changes in the consumption index of larvae those fed on 25% and 75% concentration of plant extract containing food, as compare to the larvae of control group. The larvae fed on 5% methanol (control II) sprayed food had the highest CI (*0.867*) value. However, the lowest CI (0.638) value was observed on 50% concentration of the plant extract.

Efficiency of conversion of ingested food is the general index which measure insect's ability to utilize the ingested food for its growth and development. The larvae reared on 50% concentration of plant extract showed the highest value of ECD (26.5) and ECI (*17.8*) compared with the other group of larvae. However, the lowest value (14.6) of ECD was on 75% concentration of plant extract.

Table no. I : Nutritional indices of Fifth instar larvae of Bombyx mori L. on the different concentration of Achyranthes asperaseed extracts.

Treatment groups		G.R.	C.I.	A.D. %	E.C.I. %	E.C.D. %	Mortality (In %)
Control		0.124	0.803	69.4	15.5	22.4	00
Control (M)		0.117	0.867	69.8	13.5	19.4	00
A. aspera	25 %	0.090	0.846	71.3	11.4	16.1	10
	50 %	0.114	0.638	67.3	17.8	26.5	10
	75 %	0.119	0.818	70.5	14.5	14.6	30

G. R. = Growth Rate, C. I. = Consumption Index, A. D. = Approximate Digestibility, E. C. I. = Efficiency of Conversion of Ingested Food, E.C.D. = Efficiency of Conversion of Digested Food.

The lowest CI value observed in the 50% concentration of plant extract, but it had the highest values of ECI and ECD (Table 1) and it also had lower growth rate than control group, indicating that larvae feeding on this concentration could not grow faster than the normal larvae of silkworm but they were more effective in converting ingested and digested food to biomass. The growth of insect is depending on the efficiency of conversion of food material to the body matter, result is indicating that the larvae fed with 25% and 75% was less effective to convert ingested and digested food into the body matter. Jadhav et al(2016) reported that the efficiency of conversion of ingested food (ECI) and efficiency of conversion of digested food (ECD) of all the medicinal plant extract were superior over the control group due to the presence of some medicinal growth stimulants.

In the present study the decreased ECI and ECD value of seed extract of *Achyranthes aspera* was observed than the control group.

Insecticidal activity of plant extract

The effect of crude seeds extract of *Achyranthes aspera*has been studied on the 5th instars larvae of silkworm *Bombyx mori L.* with different concentrations. The mortality of larvae was calculated after the treatment of plant extract and the result showed in the table no. 1 revealed that the larvae fed with 75% concentration had the higher mortality and both of the control group there was no mortality observed.In the previous study, the supplementation with phytoecdysone containing extract of *Achyranthes aspera,*showed moderate mortality in the silkworm *Bombyx mori*observed in the triple treatment of 70% concentration of the plant extract (Pandey and Upadhyay, 2013). The significant mortality and antifeedants activity also observed by the treatment of leaves extract of *Achyranthes aspera* on the cauliflower borer, *Hellulaundalis* and *Spodoptera litura (*Girija and Valarmathy, 2008). It was previously demonstrated that, the dietary supplementation with the 20-hydroxyecdysone hormone,degenerate or disrupt the midgut of the larvae of *Bombyx mori L.*due to which the premature death of the larvae was observed*(*Tanaka and Yukuhiro, 1999). Thus, the seed extract of the *Achyranthes aspera*may have some toxic components which affect the physiology of the insect. In the present study the affected larvae shown slow growth, stunted body and the consumption of mulberry leaves was also reduced.

Figure: dead larvae by the different concentrations of seeds extract of Achyranthes aspera.

FIGURE 1: 75% CONC.

FIGURE 2: 50% CONC.

FIGURE 3: 25% CONC.

IV. CONCLUSION

Thus, it is concluded that the seed extract of *Achyranthes aspera* has the highly insect deterrent and have insecticidal activity. The seed extract of *Achyranthes aspera*can be used as a natural insecticide (larvicide) in 75% concentration with the detailed study on the particular larval pests occurring on different crops, and have the future scope to use at farmer level.

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