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Efficacy of dodder vine extract as seed protectant against pulse beetle, *Callosobruchus chinensis* (Coleoptera: Bruchidae)

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Abstract

The experiment was conducted to find out the efficacy of dodder vine extract as seed protectant against pulse beetle, *Callosobruchus chinensis* on gram seed in the laboratory of the Department of Entomology, Bangladesh Agricultural University, Mymensingh during the period of February to May, 2009. The concentrations of dodder vine extract were 5, 2 and 1% respectively. Efficacies of these treatments were evaluated by considering oviposition, adult emergence, intensity of damage and seed weight loss done by pulse beetle. Dodder vine extract was found effective in checking oviposition, adult progeny development and severity of seed damage. Seeds treated with 5% concentration of dodder vine extract were less preferred for oviposition, adult emergence and seed weight loss by *C. chinensis* and this conc. might be useful in protection of pulse seed.

Keywords: Dodder vine extract, Fecundity, Developmental performance, Seed weight loss, *C. chinensis.*

Introduction

Pulses are considered as one of the best sources of plant protein and play an important role in the diet of common people of developing countries including Bangladesh. They are designated as poor man's meat since they are rich in protein 20-30% (Sharma, 1984). Gram (*Cicer arietinum* L.) is a popular pulse crop in Bangladesh and its cultivated area was 37000 acres with annual production of 11000 tons (BBS, 2004). This amount is not sufficient to meet up the demand.

The storage of pulses is a matter of great concern. These seeds are more difficult to store than cereals as they suffer a great damage during the storage due to insect pests and microorganisms (Anonymous, 1978). In Bangladesh the pulse crops are mostly stored by the traders. The farmers also store pulse seeds throughout the year for consumption and also these are used as planting material for the next year. Gram seeds stored in godown and farmer houses furnish suitable habitat for growth and multiplication of bruchids. Infestation of pulse beetle causes both qualitative and quantitative losses in legume seeds. The damage in store is more important than field (Yamamoto, 1990). In storage, this pest is controlled by synthetic insecticides, which have got many limitations and undesirable side effects. Chemical pesticides have been used for a long time with serious drawbacks. Indiscriminate use of insecticides to protect pulse beetle in storage may cause serious health hazard and their residual effects remain in the stored grain and also in the environment.

In this condition, search for alternative methods of insect control utilizing botanical products is being used in many countries. These botanicals are biodegradable, relatively specific in the mode of action and easy to use (Das, 1986). Plant products are environmentally safe, less hazardous, economic and readily available (Ahmed *et al*., 1993). The present experiment was undertaken to investigate the efficacy of dodder vine extract against pulse beetle, *Callosobruchus chinensis* a major pest of pulses on gram seed.

Materials and Methods

The research work was conducted on the efficacy of dodder vine extract as a seed protectant against Pulse beetle, *C. chinensis* (L.) was used in this experiment. One hundred gram seeds randomly chosen, weighted and kept in a Petridish. A series of dodder vine extracts having concentrations of 5%, 2% and 1% were prepared for seed treatment. From each prepared concentration 0.5 ml extract was applied on seeds. Four pair of newly emerged pulse beetles was taken in each Petri dish for each concentration. Each concentration was replicated thrice with a control. After 7 days of the release, adult beetles were removed and eggs laid on gram seeds of each treatment were counted individually using hand lens. Data on number of egg bearing seeds and total number of eggs laid per 100 seeds were counted. After completion of larval development inside the seeds adult emergence occurred and the emerged beetles

were counted and removed every day from the Petridishes up to 7 consecutive days with zero emergences. Seeds with hole(s) were counted and recorded. The weight losses of gram seeds caused by feeding of *C. chinensis* larvae were determined and percentage of seed weight loss alculated. Mortality test was done by exposing pulse beetles in each petridish (9 cm dia.) having gram seeds treated with dodder vine extract at 1%, 2% and 5% concentrations. Ten pairs of adult beetles were taken in each petrish for each concentration. Data on insect mortality were recorded daily.

The observed data were statistically analyzed in accordance with CRD. The mean values were compared by DMRT in a computer using MSTAT Programme.

Results and Discussion

Effect of dodder vine extract on oviposition performance of pulse beetle

The female beetles deposited eggs on gram seeds in all treatments including control. Significant variation was observed in mean number of egg bearing seeds using different conc. of dodder vine extract (Table 1). The highest number of egg bearing seeds were found in control (91.67) and the lowest number of egg bearing seeds (44.33) at 5% dodder vine extract treated seeds. Numbers of egg bearing seeds in all treatments were statistically different from each other and also found that number of egg bearing seeds gradually increased with the decrease of concentration of the extract. This result was similar with the findings reported by Rouf *et al*. (1996) indicating that the oviposition was inhibited when stored seeds were treated with some botanicals.

Table 1. Effect of different concentrations of dodder vine extract on number of egg bearing seeds, number of eggs laid and adult emergence

Concentration (%)	Number of egg bearing seeds (Mean ± SE)	Number of eggs laid (Mean ± SE)	Adult emergence (%) (Mean ± SE)
5	44.33 ± 0.66 d	94.00 ± 1.52 d	41.51 ± 0.57 c
2	62.33 ± 3.17 c	103.70 ± 2.90 c	49.26 ± 0.57 b
1	73.00 ± 2.30 b	111.70 ± 1.20 b	52.69 ± 0.57 b
Control	91.67 ± 2.33 a	149.30 ± 0.66 a	67.83 ± 0.88 a
LSD	7.53	5.80	3.57

Values followed by different letter(s) with in the column are significantly different at 5% level of probability.

Effect of dodder vine extract on fecundity of pulse beetle

The total number of eggs per 100 seeds differed significantly among the treatments (Table 1). The highest number of eggs were recorded in control (149.30) and followed by 1% dodder vine extract treated seeds (111.70). The lowest numbers of eggs were recorded in 5% dodder vine extract treated seeds (94.00). This finding was in agreement with the report of Islam (2005) who observed that treatment of gram seed with leaf extract reduced the number of eggs.

Effect of dodder vine extract on adult emergence of pulse beetle

Adult emergences in all treatments were statistically different from each other (Table 1). The highest adult emergence was recorded in control (67.83%) followed by 1% conc. of dodder vine extract treated seeds (52.69%). The lowest adult emergence was recorded in 5% conc. of dodder vine extract treated seeds (41.51%). Adult emergence of pulse beetle increased gradually following the decrease of concentration of dodder vine extract. This finding was in agreement with Singal and Chouhan (1997) where they reported that some botanicals (neem seed karnel powder, dodder vine extract and neem seed oil) reduced the adult emergence.

Effect of dodder vine extract on number of damaged seeds caused by pulse beetle

Effect of different concentrations of dodder vine extract on seed damage caused by pulse beetle was presented in Table 2. The highest number of damaged seeds were recorded in control (64.33) followed by 1% conc. of dodder vine extract treated seeds (52.00). The lowest numbers of damaged seeds were found in 5% conc. of dodder vine extract treated seeds (35.67) and in 2% extract treated seeds (49.00). This result was in agreement with findings of Chowdhury (2005), who reported seeds treated with dodder vine extract, nimbicidine, bishkatali and pithraj reduced the number of damaged seeds.

Table 2. Effect of different concentrations of dodder vine extract on number of damaged seeds and weight loss

Concentration (%)	Number of damaged seeds (Mean ± SE)	Weight loss (%) (Mean ± SE)
5	35.67 ± 1.20 c	5.20 ± 0.35 c
2	49.00 ± 1.15 b	7.99 ± 0.32 b
1	52.00 ± 1.15 b	7.78 ± 0.17 b
Control	64.33 ± 2.02 a	25.84 ± 0.25 a
LSD	4.67	1.47

Values followed by different letter(s) within the column are significantly different at 5% level of probability.

Effect of dodder vine extract on seed weight loss caused by pulse beetle

Amount of weight loss in all the treatments were statistically different from each other (Table 2). The highest amount of weight loss was found in control (25.84%) followed by 2% concentrations of dodder vine extract treated seeds (7.99%). The lowest amount of weight loss was found in 5% dodder vine extract treated seeds (5.20%). This result was in agreement with Ahmed *et al*. (1999), who found that neem and sesame oil were effective protectants of seeds against pulse beetle in storage. Miah *et al.* (1993) also observed that nishinda leaf powder and dodder vine extract were the most effective reducing number of eggs laid, adult emergence and seed weight loss in case of *C. chinensis* on chickpea seeds.

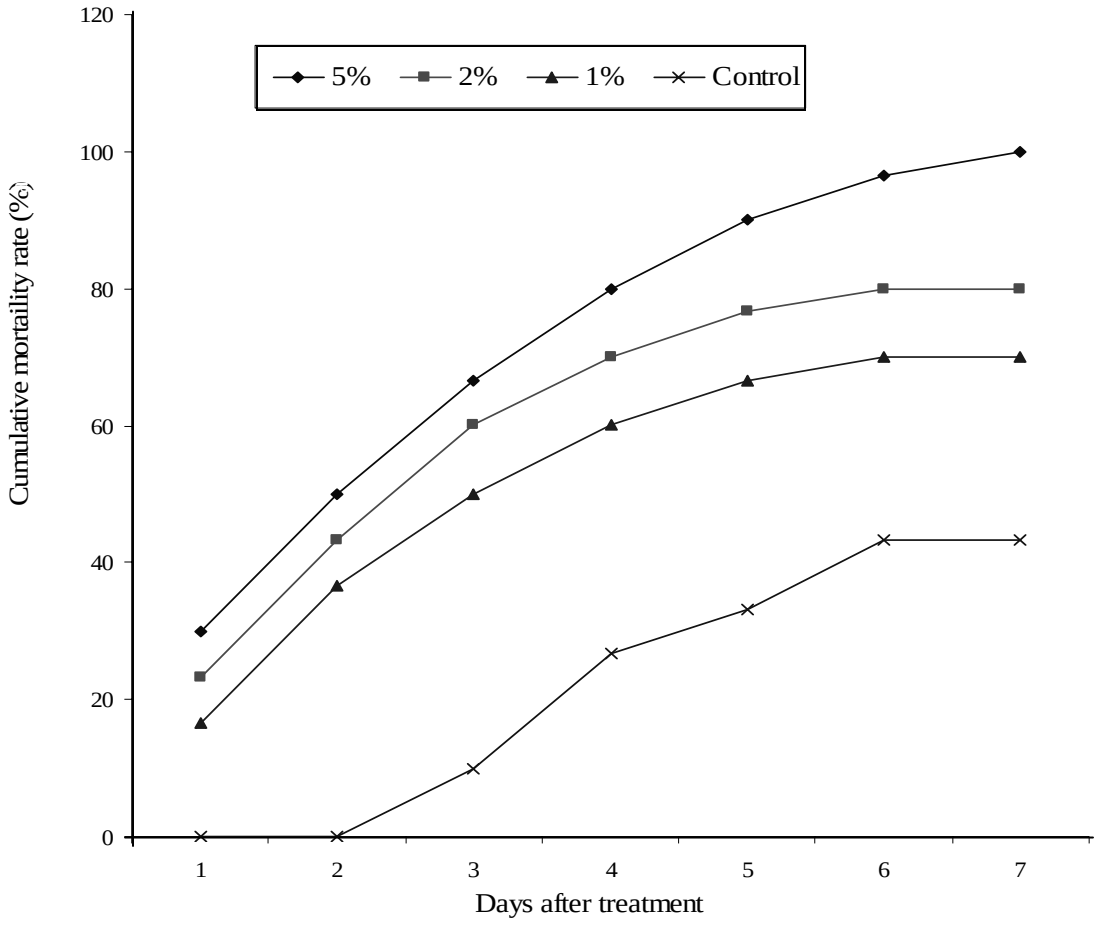

Fig. 1. Cumulative mortality rate of *C. chinensis* L. at different concentrations of dodder vine extracts at different days after treatment.

Effect of dodder vine extract on adult mortality of pulse beetle

Mortality of pulse beetle, *C. chinensis* (L.) adult at different days after treatment (DAT) have been evaluated at 1%, 2% and 5% concentrations of dodder vine extract that have been shown in the figure 1. It was found that the percent mortality was increased proportionately with the increase of concentrations of dodder vine extract and exposure time. Cumulative mortality rate of *C. chinensis* with different concentrations of dodder vine extract showed that at 1 DAT 16.6%, 23.33% and 30% beetles died at 1%, 2% and 5% concentrations. In control none died at 2 DAT. But at 7 DAT all insects died at 5% concentration, whereas up to 2% and 1% concentrations, mortality rate were 80% and 70% respectively at the same exposure period, whereas only 43.20% insect died in control. The result showed that adult mortality was significantly different at different concentrations. Cent percent adult mortality was observed only at the highest concentration (5%) at 7 DAT. This indicates that dodder vine extract have some toxic effect to adult pulse beetle. Dhakshinamoorthy and Selvanarayanan (2002) reported that the mortality of the beetle *C. maculatus* at 7 days after treatment was highest in castor oil followed by dodder vine extract and neem leaf powder. They also found that the effect of oil was dose dependent and varied with exposure time.

From the above discussion, it may be concluded that dodder vine extract can be used for controlling pulse beetle at 5% concentration; however, it needs further investigation to make more concrete decision.

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