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Toxicity of Blended Plant Extracts of *Embilica officinalis* and *Tagetes erecta* against the Pulse Beetle, *Callosobruchus Chinensis* L.

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ABSTRACT: Evaluation of efficacy of blended acetone extracts of *Embilica officinalis* and *Tagetes erecta* was carried out against the pulse beetle, *Callosobruchus chinensis*. The toxicity of the extracts was found to be moderate and dose dependent. The study revealed percent seed protection over control enumerated for 25%, 50%, 75% and 100% dose levels to be 30.527, 33.457, 46.175 and 55.638, respectively. Fecundity, egg viability and adult emergence were also moderately affected after treatment of cowpea seeds with the blended plant extract in the ratio of 1:1.

KEYWORDS: Toxicity, *Embilica officinalis*, *Tagetes erecta*, *Callosobruchus chinensis*.

I. INTRODUCTION

Humans and humanity cannot exist on the earth for long until the activities of unsustainable development that are bound to deterioration of environment continues unabated. One of the major unsustainable practices in the field of agriculture is injudicious and indiscriminate use of synthetic chemical pesticides. After discovery of synthetic chemicals they were welcome in the field of agriculture which was facing the problem of pests, especially the insect pests. These harmful chemicals have played a major role in the green revolution to meet the ever increasing demands for food grains caused by the global population explosion. Carson [1] tried to draw attention towards the harmful impacts of the synthetic chemical pesticides with the publication of *Silent Spring*. Estimated 954 pest species which include arthropods, weeds and plant pathogens have developed resistance against various types of pesticides viz., insecticides, herbicides and fungicides. Resistance development in pest populations is influenced by biological, genetic and operational factors [2].

One of the ecofriendly approaches to curb the pest problem is use of phytochemicals as pest control measure. Many plant species are known to have insecticidal and phagodeterrent properties. Different products of plants are widely tested against many insect pests [3]. Keeping in view the safer approach to the pest management, present work deals with assessment of blended plant extracts of *Embilica officinalis* and *Tagetes erecta* against fecundity, egg viability, adult emergence and damage caused by the pulse beetle, *Callosobruchus chinensis*.

II. MATERIAL AND METHODS

Rearing of experimental insect

In laboratory, culture of *Callosobruchus chinensis* was maintained in pre-sterilized jars containing disinfested cowpea seeds. The optimum condition of $27 \pm 2^\circ\text{C}$ temperature and 60 ± 10 percent relative humidity was maintained. Freshly emerged adults (0-24 hrs) were taken for experimentation.

Collection and extraction of plant materials

Embilica officinalis fruits and *Tagetes erecta* floral heads were collected from botanical garden of University of Rajasthan and nearby areas which were thoroughly washed with water to remove the dust and dirt particles. Further, plant materials were dried in shade and powdered separately with the help of an electric grinder. The extracts were prepared separately by soxhlet extraction method [4] using acetone as solvent. 30 gm of powder was extracted with 300 ml of acetone keeping the ratio 1:10. The duration of extraction process was kept eight hours. After filtration, the extract was kept in refrigerator as stock solution.

Experimental Design

Fruit extract of *Embilica officinalis* and *Tagetes erecta* floral heads extract were blended in the ratio of 1:1 (by volume). For experiments, desired dose levels (25%, 50%, 75% and 100%) were prepared by diluting it further with requisite volume of the solvent (acetone). Three pairs of newly emerged adults were released in a plastic vial having 5 grams of disinfested cowpea seeds treated with 1 ml of blended extracts. The vials were covered with muslin cloth. Three replicas were run for each dose level along with a control having seeds treated with the solvent only. The number of eggs laid on seeds and the number of adults emerged were recorded. The loss in seed weight was calculated by weighing the damaged seeds separately. The percent corrected mortality of eggs was calculated using Abbott's formula [5].

$$ACM = \frac{\% \text{ killed in treated} - \% \text{ killed in control}}{100 - \% \text{ killed in control}} \times 100$$

ACM = Abbott's Corrected Mortality

III. RESULTS AND DISCUSSION

Table 1 depicts that average number of eggs laid on treated cowpea seeds was 166, 161.66, 158 and 137.33 at 25%, 50%, 75% and 100% dose levels, respectively compared to 201.5 eggs recorded in the untreated control. Hatchability of the eggs of *Callosobruchus chinensis* was gradually mitigated at rising dose level featuring 13.45, 16.49, 25.62 and 28.87 percent egg mortality at 25%, 50%, 75% and 100% dose levels, respectively as compared to hatching inhibited in 4.96 percent egg in control. Percent corrected egg mortality calculated was 8.93, 12.13, 21.73 and 25.15 at the four dose levels, respectively.

The results also indicate that the blended extracts demonstrated highest efficacy at 100% dose level at which only 33.66 adults were counted. At lower dose levels viz. 25%, 50% and 75%, average adult emergence was 64, 61.33 and 47.66, respectively whereas control registered 79.5 adults emergence. Percent grain damage gradually decreased with ascending concentration of the blended plant extracts. The pulse beetle caused 59.76, 57.24, 46.30 and 38.16 percent grain damage at 25%, 50%, 75% and 100% dose levels, respectively whereas with 86.02 percent grain loss control group presented maximum grain damage. C-value calculated for highest dose level was 0.614.

The combination of two plant extracts expressed moderate seed protection depicting 40.24, 42.76, 53.7 and 61.84 percent seed protection at 25%, 50%, 75% and 100% dose levels, respectively as compared to 13.98 percent protection exhibited by the untreated control. 30.527, 33.457, 46.175 and 55.638 percent seed protection over control was enumerated at the four dose levels, respectively.

Toxic properties of different plant species were also observed by Obembe and Kayode [6], Alim [7], Lu and Wu [8] as well as Naik and Dumbre [9] which also support the results of present study. Kunbhar et al. [10] also conducted studies to evaluate the impact of neem *Azadirachta indica*, tobacco *Nicotina tabbaciunum*, trooh *Citrullus colocynthus*, Movanto (*Spirotetramat*) against sucking insect pests of brinjal and their predators. Their results also corroborate role of plant products in pest management. Karani et al. [11] also reported that the botanical pesticides are believed to be safe to the environment and are used in pest control to avoid pesticidal pollution, which is a global problem. The toxicity of blended acetone extracts of *Embilica officinalis* fruits and *Tagetes erecta* floral heads towards the pulse beetle may be attributed to the active ingredients present in the extract.

Table 1 Efficacy of *Embilica officinalis* extract blended with *Tagetes erecta* against *Callosobruchus chinensis*.

S. No.	Dose level	Fecundity	% egg mortality	% corrected egg mortality	Average adult emergence	% grain damage	% seed protection	% seed protection over control
1.	25%	166	13.45	8.93	64	59.76	40.24	30.527
2.	50%	161.66	16.49	12.13	61.33	57.24	42.76	33.457
3.	75%	158	25.62	21.73	47.66	46.30	53.70	46.175
4.	100%	137.33	28.87	25.15	33.66	38.16	61.84	55.638
5.	Control	201.50	4.96	-	79.50	86.02	13.98	-

Weight of treated cowpea seeds – 5 grams
Number of replications – 3
Number of adults in each replication – 6 (3 males + 3 females)

IV. CONCLUSION

The blended plant extracts of *Embilica officinalis*, *Tagetes erecta* showed moderate efficacy against the infestation of cowpea seeds by the pulse beetle, *Callosobruchus chinensis*. The toxicity of the blended plant extract was also found to be dose dependent as it was recorded to slightly increase with the increase in the concentration of the plant extracts.

V. ACKNOWLEDGEMENT

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