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[Short Communication]

Antifeedant, Growth Regulatory and Ovicidal Effect of *Sambucus ebulus* L. Extract on *Tribolium confusum* Duv.

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ABSTRACT
Aqueous extract from leaves of *Sambcus ebulus* L. were tested for antifeedant, growth regulation and ovicidal effects against the red floor beetle *Tribolium confusum* Duv. under laboratory condition (29±1ºC, RH 60±5% and 12L:12D). The results indicated a significant deterrence for feeding, and comparatively significant larval, pupal and adult weight decrease in treated vs. controlled insects. Similarly the ovicidal effect of the extract was significant, thus reducing the number of F1 generation of resulting adults.

Key words: Antifeedant, Growth regulation, Ovicidal, *Sambucus ebulus, Tribolium confuum*

INTRODUCTION

The search for new solutions to control of insect pests in agriculture and urban areas is currently influenced by four concerns: (1) the banning of synthetic insecticide use in municipal areas, (2) public perception that natural compounds are better, (3) products that are generally regarded as safe, and (4) the reliance on extracts vs. pure compounds (Scott *et al.*, 2003). Research is again focusing on the plant kingdom for solutions (Berenbaun and Zangeri, 1996). The deleterious effects of certain purified phytochemicals or crude plant extracts on insects are manifested in several ways, including toxicity (Hiremath *et al.* 1997; Sadek, 2003), growth retardation (Breuer and Schmidt, 1995), feeding inhibition (Klepzig and Schlyter, 1999; Sadek, 2003; Senthil Nathan and Schoon, 2005), oviposition deterrent (Dimock and Renwick, Zhao *et al.*, 1998), suppression of calling behaviors (Khan and Saxena, 1986) and reduction of fecundity and fertility (Muthukri Shnan and Pushpalatha, 2001).

Sambucus ebulus L. (Caprifoliaceae), known as dwarf elder is a shrub with compound leaves and flat topped clusters of small white flowers followed by red or purple berries. This plant grows wild around paddy fields in Guilan province in north of Iran (Zargari, 1991; Mozafarian, 1995). The toxicity of *S. ebulus* has already been reported on *T. confusum* (Jalali *et al.*, 2003) and on *Xanthogaleruca luteola* (Jalali *et al.*, 2005). The aim of the present work is to present an evaluation of sub lethal dosages of this plant extract on biological characteristics of *T. confusum*.

MATERIALS AND METHODS

Insect

Adults of red flour beetle *T. confusum* Duv**.** (Col. Tenebrionidae) were laboratory cultureed, and reared on maize and wheat flour mixture (1:1) in glass jars in an incubator set at 29± 1ºC, RH 65± 5% and 12D: 12L regime.

Plant extract

Fresh leaves of *Sambucus ebulus* were rinsed in distilled water and left to dry in shade. Dried leaves were ground and the powders were moistened with distilled water (3- 4 hrs) and extracted by water evaporation.

The extract was 3 times washed with diethyl ether. On removing the water part, the diethyl ether was finally separated in a rotary evaporator.

Bioassay for antifeedant activity

This method was based on the method of Jilani and Saxena (1990). Different concentrations of the extract (100, 500, 1000 ppm) were prepared and 22.5 ml of each concentration was diluted in acetone and mixed with 450 mg of the flour (maize and wheat 1:1). The controls received only 22.5 ml of acetone mixed with the food. After evaporation of the solvent from the treated food (extract treated or control), 75 mg of each were transferred to petri dishes (9 cm in diameter). The test was performed by placing one control and one treated diet with extract (containing 100,500 and 1000 ppm) in the experimental chamber (Jilani and Saxena, 1990) and then the lid was closed. A tube 20×1.5 cm in the lid allowed us to introduce 120 adult insects of two weeks old into the chambers. Hence, all the insects had equal chances for treated as well as control food. For each treatment, there were 6 replicates. The lid was removed after 24 hrs and the number of insects in each petri dish was counted.

Bioassay on growth and egg

This method was based on the work of Jilani *et al.* (1988). For this purpose, 100 g wheat and maize flour (1:1) was treated with 10 µl of acetone having 200, 400, 800 and 1600 ppm of the extract. Every treatment was replicated 4 times with one control, which received acetone alone. Fifteen pairs of adult *T. confusum* were released in the petri dishes covered with plastic sheets and kept in incubators. The insects were removed after 5 days and the number of larvae, pupae and adults in each petri dishes were counted and weighed every 13, 25 and 30 days respectively and then returned to the petri dishes. The number of larvae in petri dishes were counted after 13 days for ovicidal effect and the number of adults after 30 days for evaluation of the number of insects appearing in F1. The larval, pupal and adult weights were used for consideration of the effect of the extract on growth.

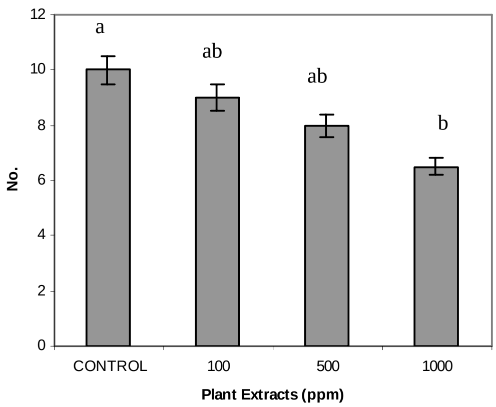

Fig 1. Number of adult insects attracted to different concentrations of *S.ebulus* extract.

Data analysis

Collected data were subjected to statistical analysis of variance test for significant differences in the measured parameters of the control and treated groups of insects. For all analysis of variance the Duncan's multiple range test in SAS software was used.

RESULTS AND DISCUSSIONS

The antifeedant effect

The presented data in Fig 1 clearly shows that 1000ppm treatment repelled insects compared to control (1.5± 0.67 and 10± 1.22 respectively). However this difference was not significantly different in other treatments compared to either control or 1000 ppm (p<0.05). Antifeedant substances are customarily classified into repellents, which repel an insect without making contact with the material, suppressants which suppress biting activity after contact or deterrents, which deter an insect from further feeding after ingestion of the material (Chapman, 1974; Schoonven, 1982). Based on these definitions, the crude extract of *S. ebulus* leaves had deterrent properties.

The effect on growth

The larval and pupal weight was significantly reduced in all treatments compared to control and remained in different ranks of DMRT. However, in case of adult treatment this effect was only observed in case of 800 and 1600ppm treatments hence 200 and 400 ppm treatments remained in the same rank as control (Table 1). Lower growth inhibition observed in higher concentrations of the test material in the present study is in confirmation with other studies (Senthil

Nathan *et al*., 2005). Since the food intake is lower as expected therefore the weight decreases. However the plant material did not form intermediates or other adverse effects in morphology of resultant stages.

The ovicidal effect and the effects on F1

The ovicidal effect was more pronounced in 1600ppm treatment. However other treatments could significantly reduce the number of hatched larvae compared to control and remaining in different DMRT ranking. Similar results as it was expected were obtained by number of adults appearing in F1 generation of resulting treatments where maximal effect was obtained in 1600ppm and the least in controls (Fig 2).

The observation of reduced egg hatchability was similar to other studies where Rebellos (1994) showed a reduction in egg viability for the cabbage webworm *Crocidolomia binontalis* Zeller, by neem treatment. Similar studies have shown reduced eclosion after neem treatment (Chinwada and Giga, 1993; Reddy and Singh, 1998). However, some studies (Prabhakar *et al*., 1999) indicated that the plant extract (neem) did not have any effects on hatching. It may be inferred that some insect eggs may be more sensitive to plant extracts (like the present study) and some may not be so sensitive. The obvious results of reduced egg hatching was observed in lower number of adults appearing in F1 generation.

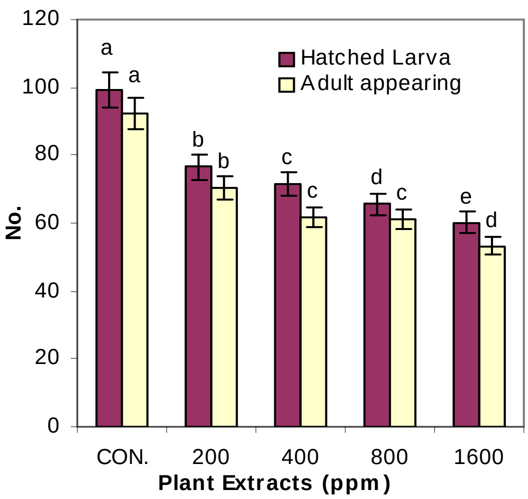

Fig 2. Number of hatched larvae and number of adults appearing in F1 generation after treatment of with *S. ebulus*. Means with different letters in each group are significantly different

Results of recent and previous study indicate that *S. ebulus* extract is a potent insecticide, growth retardant or ovicide for the control of *T. confusum* (Jalali *et. al*., 2003 and Jalali *et al*., 2005). For practical use of this plant extract as insect control agent, further research is required particularly on safety issues for human health.

Table 1. The weight of larva, pupa and adult resulted from various concentrations of *S. ebulus* extract

Dose (ppm)	Larva	Pupa	Adult
Control	0.9±0.002[a]*	306±0.016a	*0.009[a] ± 2.39*
200	0.83±0.003[b]	3.31±0.018[b]	2.26±0.044[a]
400	0.74±0.003[c]	3.21±0.018[c]	2.31±0.046[a]
800	0.64±0.003[d]	2.61±0.01[d]	1.77±0.047[b]
1600	0.56±0.003[e]	2.5±0.02[e]	1.7±0.05[b]

*Means with different letters in each column are significantly different (P<0.05)

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