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RESEARCH ARTICLE

BIOPESTICIDAL EFFECT OF NATURAL SAPONIN CONTAINING PLANT EXTRACT OF *ACACIA CONCINNA* ON PULSE BEETLE, *CALLOSOBRUCHUS CHINENSIS* (LINN.) (COLEOPTERA : BRUCHIDAE)

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ABSTRACT

The saponin containing pod extracts of *Acacia concinna* were tested for their effect on egg laying, adult emergence from grains and mortality of the pulse beetle, *Callosobruchus chinensis.* The *Callosobruchus chinensis* L. is the most widespread and a dreadful pests infesting gram, cowpea, beans, lentil and other pulses. The female lay eggs on the seed surface and after hatching larva bores the seed and consumes the seed cotyledons. Among different methanol and ethanol extracts of plant materials, eggs laid on seeds, adult emergence from seeds were reduced and mortality of adults exposed to treated seeds were found after 96 hrs. and the higher concentration of plant material were highly effective against *Callosobruchus chinensis*. The number of eggs laid and the adults emerged from seeds of *Phaseolus aconitifolius* treated with ethanolic extract of saponin containing pod extracts of *Acacia concinna* were 38 and 21 in 3 mg. of concentration while seeds treated with methanol extract were 49 and 29 in 3 mg. respectively. In the present study ethanol extract of plant material were effective as bio insecticidal property to control pulse beetle, *Callosobruchus chinensis.*

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INTRODUCTION

Various synthetic pesticides like DDT, BHC, Toxaphene, Chlordane, Endrin etc. are used to control the pest which may pose serious issues of food poisoning to human and animals by entering the food chain. But in these environmental conscious days there is need to use ecofriendly methods for pest management. Farmers use different plant materials to protect stored grains from pest infestation. Natural products in their crude form or plant extracts provide unlimited opportunities as biopesticides. More than 2000 species of plants are known to have insecticidal activities. In recent years research efforts are reported on development of insecticides of plant origin. Saponin containing plants are interesting class of medicinal plants having insecticidal activities. This paper reports the results of research on the effects of extract of *Acacia concinna* plant on various stages in the life cycle of *Callosobruchus chinensis*. Pande *et al.,* (1986), Islam (1987), Reddy *et al*. (1994), Kamal Mangala (1993), Dwivedi and Bhati (2006), Pardeshi and Zambare (2012) have reported the effects of various plant extract against *Callosobruchus chinensis* and were observed effective results to control pulse beetle. The crude saponins extracted from *Cestrum parqui* injected to the L5 *Schistocerca gregaria* larva increase insect mortality (Barbouche *et al.,* 2001). Aqueous solution of alfalfa saponins when applied on tomato leaves reduces the number of *Tetranychus urticae* mite and *Pharodon sp*. aphids by 85 and 90%, respectively (Oleszek *et al.,* 1999). The present study was directed to assess the bioprospectation of plant extract against pulse beetle, *Callosobruchus chinensis*. The pulse beetles, *Callosobruchus* are economically important pests of stored pulse seeds (Khan *et al.*, 2013; Ahmed *et al*., 2003). It is responsible for an average of 32–64% loss under storage in different parts of Asia and Africa (Demnayk *et al*., 2007). It was reported that only in gram, 55-69% weight loss of seed and 45.6 - 66.3% loss in protein content was recorded by *Callosobruchus chinensis* L. (Ketoh *et al*., 2005).

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MATERIALS AND METHODS

The experiment was carried out as the laboratory, Department of Zoology, Deogiri College, Aurangabad. Legumes of *Acacia concinna* was collected from local areas and were air dried, powdered was prepared with the help of mixer cum grinder. Extraction process was done by Soxhlet method with ethanol and methanol as solvents. 20gm of powder was weighed and placed in arm of apparatus for extraction. Extraction with ethanol and methanol in a Soxhlet apparatus for 24 hours was done.

Table 1. Effect of ethanol extract of legumes of *Acacia concinna* on the mortality and reproductive activity of the store grain pest, *Callosobruchus chinensis*

Dose in mg/100gm	Mortality		Number of Eggs laid	Infected grains	Emergence of Adult up to 40 days	% Emergence	% Inhibition Rate
	24hrs.	96hrs.	Till death of adults	Till death of adults			
Control	____	____	133±1.15	121±0.98	104±0.9	78.19	----------
1.0	____	02	91±0.5	52±0.7	53±0.1	75.82	33.01
2.0	01	03	69±1.5	46±0.5	47±0.5	68.11	54.36
3.0	01	04	38±0.5	25±1.1	21±1.1	59.18	71.84
4.0	02	05	23±0.7	16±0.5	11±1.0	43.75	82.52
5.0	03	05	09±1.15	04±0.1	03±1.15	33.33	88.35
6.0	03	07	00±0.1	00±0.7	00±0.0	00.00	99.11

± Standard Deviation of three observations.

Table 2. Effect of methanol extract of legumes of *Acacia concinna* on the mortality and reproductive activity of the store grain pest, *Callosobruchus chinensis*

Dose in mg/100gm	Mortality		Number of eggs laid	Infected grains	Emergence of adult up to 40 days	% Emergence	% Inhibition rate
	24hrs.	96hrs.	Till death of adults	Till death of adults			
Control	____	____	133±1.15	121±0.98	104±0.9	78.19	---------
1.0	____	01	94±1.6	73±1.7	69±1.1	56.38	33.63
2.0	____	03	77±1.0	58±1.0	49±1.1	55.84	51.81
3.0	01	03	49±1.7	29±1.1	23±1.7	55.26	70.00
4.0	02	04	32±1.1	18±1.0	13±1.0	47.82	78.18
5.0	03	05	19±0.3	06±0.5	04±0.5	44.44	88.18
6.0	04	05	04±0.2	03±0.1	01±1.0	25.00	95.45

± Standard Deviation of three observations.

Table 3. Amount of plant extract in grams and % saponin in ethanol and methanol solvent

Legumes of *Acacia concinna*	Solvent	Extracts in grams.	Saponin	% Saponin
In 20 gms. Powder	Ethanol	4. 770	Present	8.7
In 20 gms. Powder	Methanol	4. 210	Present	7.2

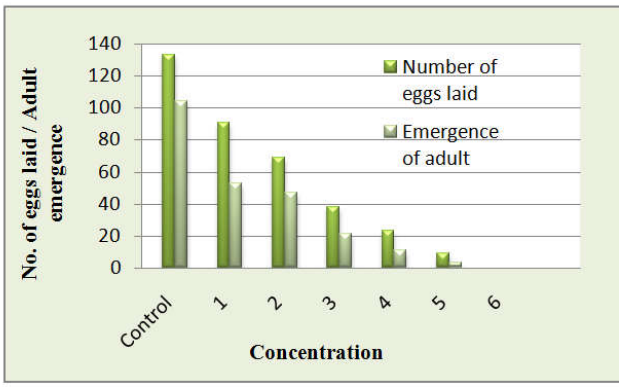

Figure 1. Effect of ethanol extract of legumes of *Acacia concinna* on the mortality and reproductive activity of the store grain pest, *Callosobruchus chinensis*

After 24 hours the mixture was filtered using Whatman's filter paper and the solvent from the filtrate was allowed to evaporate. Obtained extract after evaporation was kept in glass sample bottle on freezing temperature. From above extracts by using analytical method (Edeoga *et. al.*, 2005). Saponin was separated with the help of n-butanol. The extracts were tested for their effects on three life cycle stages of *Callosobruchus chinensis*: oviposition (number of eggs laid), percent adult emergence and mortality. For screening 30gms.of *Phaseolus aconitifolius* seeds were shaken thoroughly with various concentration of extracts 1, 2, 3, 4, 5, 6 mg/100gms in each jars. Control seeds were mixed with the same amount of methanol or ethanol extract. After mixing all seeds were allowed to dry leaving a film of extract. Into glass jars containing 100gms seeds coated with each extract, five pairs of insects were released. Jars were closed by muslin cloth and sealed with rubber band. Four replication were recorded. The mortality of adults was observed in each of the treated and control jars. Number of eggs was counted weekly until the adult emergence. After adult emergence, the numbers of adults were counted weekly.

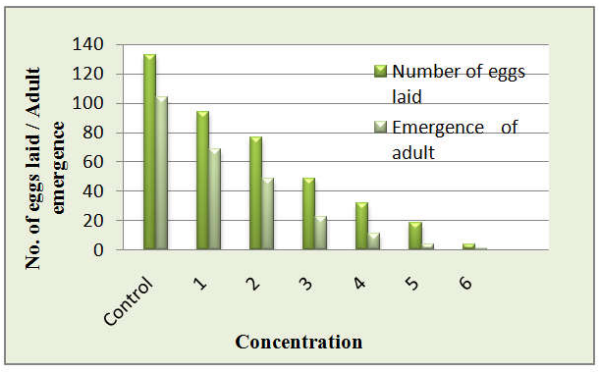

Figure 2. Effect of methanol extract of legumes of *Acacia concinna* on the mortality and reproductive activity of the store grain pest, *Callosobruchus chinensis*

OBSERVATION AND RESULTS

Number of Eggs laid

The number of eggs laid on grains in each jar was recorded up to 40 days of experimental period (Table-1). Observations shows that the number of eggs laid on grains treated with

extracts in ethanol was lower than methanol treatment. The mean number of eggs laid was the lowest for the treatment 6.0mg/100gms. of saponin containing *Acacia concinna* extract being 4 and 1 from five pairs of adult beetles in methanol and ethanol extracts respectively. Grains treated with 1, 2, 3, 4, 5, 6 mg/100gms. of concentration, the number of eggs were 94 and 91, 77 and 69, 49 and 38, 32 and 23, 19 and 9, 4 and 0 in methanol and ethanol extract respectively. The seeds treated with solvent only (control), the number of eggs laid on seeds were 133 (methanol) and 133 (ethanol).

Adult emergence

Adult emergence was recorded in every jar each jar for 40 days, after which no adult emergence was found. Results show that adult emergence was found to be lowest in ethanolic extract as compared with methanolic extract. Grains treated with 1, 2, 3, 4, 5, 6 mg/100gms of concentration of extract and the number of adult emergence were 69 and 53, 49 and 47, 23 and 21, 13 and 11, 4 and 3, 1and zero in methanol and ethanol extract respectively. The number of eggs laid and adult emergence in ethanol extract were comparatively less than methnol solvent plant extract. The mean number of adult emergence given in Table-2.

Insect Mortality

The cumulative percentage mortality of the adult insects released into the jars containing seeds treated with methanol and ethanol based plant extracts are shown in Table-3. At 6mg/100gms. Concentration 100% mortality was recorded in ethanolic extract and 90% mortality in methanolic extract. At 3mg/100gms.of concentration 50% mortality in ethanolic extract and 40% mortality in methanolic extract.

DISCUSSION

Saponin exhibits high toxicity against insects. Biopesticidal activity of *Acacia concinna* pod ethanolic extract was tested against *Spodoptera littura* Fabrius on Glycine max Linn. Various dose levels were applied to explore larvicidal potential of phytoextracts. Percentage mortality for various concentrations proved that *Acacia concinna* has effective potential with 85.2% mortality at 50 ppm dose level. Probit analysis gave median dose i.e. LC_{50}, 25.37 ppm (Patil *et al.* 2010). Toxicity of *Acacia concinna* was tested against *Spodoptera littura*. Mortality was recorded along with repellency of larvae (Robinson *et al.,* 2006). The methanol and ethyl acetate extract of the seeds of *A. concinna* and the ethyl acetate extract of the leaves of *A. concinna* were the most effective among all the extracts causing 100% larval mortality even with least concentration (0.25%). All the extracts of the seeds of *A. concinna* showed 100% egg hatch inhibition at lowest concentration (0.5%), whereas all the extracts of the leaves of *A. concinna* were ineffective as ovicides except petroleum ether extract which exhibited 40% egg hatch inhibition at highest concentration (2%) (Deepa *et al.,* 2011). The antifungal properties of saponin are generally due to the ability to complex with sterols and cause membrane permeability in fungi. The triterpene glycoside, patagonicoside A of the sea cucumber *Psolus patagonicus* exhibited considerable antifungal activity against the pathogenic fungus, *Cladosporium cucumirinum* (Murray *et al*., 2001). Reddy *et al.,* (1988) reported insecticidal activity of *A. concinna*. The dried seed powder and methanol seed extract of *A. concinna* reduced oviposition of the brown plant hopper, *N. lugens* at 2% and 5% concentrations of solution when sprayed on 40-day-old rice seedlings. Ethyl acetate and methanol extracts of the leaf, seed and stem of *A. concinna* were found active against the larvae of *An. stephensi* and *Culex quimquefasciatus*. Saponins are well known for their toxicity to harmful insects. Saponins extracted from *Ilex apocea* showed antifeeding activity which inhibits the food uptake of *Limantria dispar* (Barbosa *et al.,* 1990).

Conclusion

The result obtained from above study showed the insecticidal activity of *Acacia concinna* legumes extract against *Callosobruchus chinensis.* The present result also suggest that the plant *Acacia concinna* legumes containing saponin which results in the mortality of the pest insect and therefore could be a potent source for checking the population build up by *Callosobruchus chinensis*. The recent research reports have shown the importance of natural plant products, not only the human health (Omolara *et al.,* 2007) but also in a agricultural, as a resource of pesticide substances that could be used in a crop protection (Mollah and Islam, 2007, Ambang *et al.,* 2007; Wink, 1993). Biopesticides can be cheaper than chemical pesticides. Biopesticides also allow to growers and maintain beneficially for populations in their fields, reducing the grower dependence on conventional chemical insecticides.

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