

Insecticidal Activity of *Castanospermum australe* against stored Grain Pest *Callosobruchus analis*

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ABSTRACT

The butanol fraction of the leaves of *Castanospermum australe* Cunn. & Fraser., was tested on adult *Callosobruchus analis* (pulse beetle) for its insecticidal activity by impregnation method at concentration of 3, 9, 48, 240 and 354 µg / cm². The result showed that the extract is toxic to *Callosobruchus analis* and the LD₅₀ was found to be 38 µg/cm².

Keywords- *Callosobruchus analis*, *Castanospermum australe*, Grain pest, Insecticidal activity, Saponins.

1. INTRODUCTION

Insect pest management is world widely facing the economic and ecological challenges due to the uses of the synthetic pesticide chemicals. Plants containing active insecticidal phytochemicals are gaining a lot of attention because of having broad-spectrum insecticidal activity, safety, biodegradability and integrated crop management approaches. In addition, globally they are playing a vital role in organic food production. Therefore, phytochemicals can be used in insecticide design with specific or multiple target sites, as well as serve as model compound for the development of chemically synthesized derivatives with enhanced activity. Increasing number of researchers have described the active insecticidal phytochemicals that play an effective role in sustainable pest management [1-6].

Castanospermum australe Cunn. & Fraser., (Family, Papilionaceae) is cultivated as an ornamental tree on the roadside in Pakistan [7]. In traditional medicine, the pods of the plant are reported as astringent [8] and in treatment of post prandial hyperglycemia in diabetic patients [9]. On literature survey it was found that the wood of *Castanospermum australe* contains castanogenin and bayogenin [10] whereas castanogenol from bark [11], castanospermine [12] and australine [13] from seed are reported. Saponins from the fresh leaves of *Castanospermum australe* have also been characterized [14,15].

The present work was undertaken in view of the fact that the leaves of *Castanospermum australe* in particular produce saponins. Since no work on insecticidal activity has apparently been carried out on the saponin constituents of leaves, therefore, the butanol fraction of the leaves of *Castanospermum australe* was investigated for insecticidal activity against an important pest of pulses, *Callosobruchus analis*.

2. MATERIALS AND METHODS

- 2.1. Plant material: The leaves of *Castanospermum australe* Cunn. & Fraser were collected from Karachi in the month of April and specimen was kept in Department of Pharmacognosy for future reference.
- 2.2. Extraction: The fresh leaves 2 kg of the plant were soaked in EtOH and kept at room temperature for one week. The ethanolic extract was evaporated under reduced pressure. The dark green material 45 g so obtained was suspended in water, fractionated with hexane and thereafter with ethylacetate, the aqueous fraction was shaken vigorously with saturated n-BuOH. The n-BuOH layer was evaporated under high vacuum, 14 g of the crude butanol fraction was obtained.
- 2.3. Insecticidal activity: All the insects were obtained from a colony of *Callosobruchus analis* reared in the laboratory under controlled conditions (28°C and 60% humidity), so that the insects of uniform size and age were available. The insects were reared in glass jars and the mouths of jars were covered with muslin cloth, tied by means of rubber bands. Grains of *Vigna mungo* (L.) Hepper (Vern. Mash) were used as food and breeding media. After emergence the new insects were transferred into fresh grains.

2.4. Preparation of samples: A 5% stock solution of the butanol fraction was prepared in distilled water. Different concentrations such as 0.01, 0.04, 0.2, 1.0 and 1.5 % were prepared, and then converted into dose as $\mu\text{g}/\text{cm}^2$ which was 3, 9, 48, 240 and 354 $\mu\text{g}/\text{cm}^2$ respectively.

2.5. Method of treatment: Different concentrations of butanol fraction were applied on filter paper by impregnation method [16]. With the help of pipette, 1.5 ml of each dilution were applied on the filter paper and kept in petri dishes (9 cm dia), whereas 1.5 ml of distilled water was used in the control samples. Twenty adult insects were released in each petri dish. After 24 hours, mortality of *Callosobruchus analis* was noted in each petri dish. Each experiment was repeated five times. The average percent mortality is given in Table.

3. RESULTS AND DISCUSSION

The insecticidal activity of the butanol fraction of *Castanospermum australe* leaves against adult *Callosobruchus analis* was determined by impregnation method in five different concentrations and the result so obtained revealed that the extract is toxic against the test insect (pulse beetle). The mortality was lowest (14 %) at 3 $\mu\text{g}/\text{cm}^2$ and highest (96 %) at 354 $\mu\text{g}/\text{cm}^2$ (Table). The LD_{50} by log-log graph was found to be 38 $\mu\text{g}/\text{cm}^2$.

Table: Insecticidal activity of *Castanospermum australe* (butanol fraction) against *Callosobruchus analis*.

Dose $\mu\text{g}/\text{cm}^2$	Percentage (%) Mortality	\pm SD
3	14	02.72
9	26	03.50
48	64	03.46
240	86	04.17
354	96	03.16

$n = 5$

The multiple mechanisms of action give phytochemicals unique properties that make it very useful in today's agricultural industry e.g. azadirachtin from *Melia azadirachta* L. [17]. The plants secondary metabolites act as a defender against microbial pathogens and invertebrate pests [18]. The saponins are highly toxic when given intravenously to higher animals but their toxic effects are very much lower when they are administered orally [19] and many of the saponins of foods and feeding stuffs are apparently without any significant oral toxicity. However the saponins of *Castanospermum australe* are orally toxic to adult grain pest *Callosobruchus analis*. Saponins have been utilized as molluscicidal activity should also be taken into consideration. Two species of *Swartzia*, *S. madagascariensis* Desv., and *S. simplex* Spreng., contained saponins consisting of glucuronides of oleanolic acid, gypsogenin and gypsogenic acid exhibited molluscicidal activity of the isolated compounds against schistosomiasis transmitting snails *Biomphalaria glabrata* [20,21]. The insecticidal activity of saponins is due to the interaction with cholesterol, disturbance in ecdysteroid synthesis, protease inhibition or cytotoxicity of insects [22]. Similarly saponins of *Castanospermum australe* leaves also contains oleanane type of saponins as bayogenin, medicagenic acid and gypsogenic acid glycosides [14,15], therefore, chemical structure and activity relationship has demonstrated lethal activity saponins against *Callosobruchus analis*.

3. CONCLUSION

It may be said that the saponins of this plant could be utilized as a natural insecticide that could be an effective alternative for insect pest management.

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