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Bioactivity of *Jacaranda mimosifolia* and *Bougainvillea spectabilis* Leaves powder against *Acanthoscelides obtectus*

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Abstract
This study evaluated the bioactivity of *Bougainvillea spectabilis* and *Jacaranda mimosifolia* leaves powder against adult *Acanthoscelides obtectus*. The plant powders obtained was weighed into 2.5g, 5g and 10g and placed into three 250 ml conical flasks and mixed. Afterwards, 130 adult bean weevils were introduced and the flasks covered with a muslin cloth. Data was collected after every 24 hours for four days. In all time intervals *Bougainvillea spectabilis* powder showed mortality potential against *Acanthoscelides obtectus* with highest mean mortality being recorded at the 10g concentration. *Jacaranda mimosifolia* first showed mortality potential against the study insects after 48 hours. The study concluded that both plant powders are active against been weevils.

Keywords: Bioactivity, *Bougainvillea spectabilis*, *Jacaranda mimosifolia*, *Acanthoscelides obtectus*

1. Introduction
The global food looses due to insect pests cannot go unnoticed. In Africa an estimated 10% to 30% of all food produced yearly is destroyed by insects [1]. As noted by [2] farmers usually incur great losses resulting from reduced dry weight and nutritional value of stored grains caused by insect pests. Insects and their associated effects on grains before and after harvesting vary between countries and regions [3]. In Rwanda and especially in rural areas insect pest poses a great challenge to famers with major losses caused by insects being experienced during grain storage. A*canthoscelides obtectus* are common insect pests that attack stored beans and brings major looses to farmers. The need for effect control of insect pests before and after harvesting as well as during storage is paramount in ensuring food security.
Globally, farmers largely rely on chemical substances to protect their crops as well as stored agricultural products against pests, insects and diseases [4]. Although chemical method of controlling insects and pests has been found to be most effective, this method has been blamed for affecting non-targeted organisms, development of resistance in pests and insects as well as increasing risks for some non-communicable diseases [5]. Concerns regarding the health implications of continued use of synthetic insecticides have increased lately. In this regard, plants are being considered as an alternative source of insect control agents since they are rich in bioactive chemicals [6].
Research on insecticidal activity of various plants and plant materials against different insect has been conducted and has yielded positive results [7-9]. This has manifested in terms of toxicity, mortality, emergence inhibition, suppression of oviposition repellency and reduction of fertility. A review of plants used in controlling insect pests revealed a significant association between plants extracts and insects mortality [10]. This study aimed at evaluating the bioactivity of leaves powder from *Bougainvillea spectabilis* and *Jacaranda mimosifolia* against adults *Acanthoscelides obtectus*.

2. Materials and methods
2.1 Plant material
Both plants were collected from Kicukiro District and transported to science laboratory, Mount Kenya University, Rwanda for identification and authentication. Later, the leaves were kept under direct sunlight for a period of one week to allow complete drying. The dried leaves were grinded into powder which was then sieved using a 25 mesh sieve to obtain a fine powder. The fine powder was stored in labeled conical flask until use. Descriptions of the plants used in this study are presented in table 1.

Table 1: Plants evaluated for insecticidal activities against *Acanthoscelides obtectus*

Scientific name	Family	Part of Plants used	Common name
Bougainvillea spectabilis	Nyctaginaceae	Leaves	Bougainvillea
Jacaranda mimosifolia	Bignoniaceae	leaves	Jacaranda

2.2 Phytochemical screening
The plants extracts were screened for phytochemical constituents using the procedures outlined by [11-13]. Results of the phytochemical analysis are presented on table 2.

2.3 Insect Rearing
Acanthoscelides obtectus was obtained from a local market in Kicukiro District, Rwanda. The insects were reared in science laboratory at Mount Kenya University under ambient temperature of 30±2°C and 70±5% R.H. The insects were kept in conical flasks containing untreated beans and kept in a dark environment. The mouth of the flask was covered with a muslin cloth to allow air circulation and to prevent the insects from escaping. Adults of both sex aged between 1- 5 days were used for this study

2.4 Treatments
The fine powders obtained was weighed into 2.5g, 5g and 10g and placed into three 250 ml conical flasks respectively. The flasks were then labeled accordingly. 100g of untreated beans was then weighed and added to each of the three flasks containing plant powders. The flasks were then shaken vigorously to completely mix the beans with the powders. One hundred and thirty adult insects were added to each flask containing treated beans. A fourth flask containing 100g of untreated beans and adult insects was set up to serve as the control. All the flasks were covered with muslin to prevent the insects from escaping.

2.5 Data collection
Number of dead insects in all the four set ups was determined and recorded after every 24 hours for 4 days. Insects were considered dead when no response was observed after the insect was probed with sharp objects. The dead insects were removed and recorded while the live insects and the powder were returned on the flasks and covered.

2.6 Statistical analysis
The collected data were subjected to one way analysis of variance (ANOVA). Further, post hoc test was applied for group comparisons. Means were considered statistically different when the p-value was less than 0.05.

3. Results
The results of the phytochemical analysis for the plants under study are displayed in Table 2. Extracts of both *Bougainvillea spectabilis* and *Jacaranda mimosifolia* showed presence of Alkaloids, flavanoids, tannins, phenols and saponins. The quantity of the phytochemicals however varied with the plants as indicated with plus (+) signs, where ++ means that the phytochemical are moderately present and +++ indicates that the components are highly present

Table 2: Phytochemical Analysis

Photochemical component	Type of plant	
	B. spectabilis	***J. mimosifolia***
Alkaloids	++	++
Flavanoids	++	+++
Tannins	+++	+++
Phenols	+++	+++
Saponins	++	++

++ Moderately present +++ highly present

The treatment with *B*. spectabilis prepared in concentrations of 2.5g, 5g and 10g showed different mortality potential on *Acanthoscelides obtectus*. After 24 hours of powder application, the 10g *B. spectabilis* powder was significantly different from the 5g and 2.5g. And after 72 hours and 96 hours of powder application, 5g and10g powder concentrations were statistically different from 2.5g and the control. Consequently, the highest mean mortality percent was recorded at the 10g concentration while the least was recorded at 2.5g and the control (Table 3).

Table 3: Mortality of different treatments of *B. spectabilis* on *Acanthoscelides obtectus*

Test Compounds	Concentration.	Mortality			
		24 hrs	48 hrs	72 hrs	96 hrs
B. Spectabilis	2.5g	17 ± 0.12^{a}	19 ± 0.21^{a}	20 ± 0.12^{a}	21 ± 0.10^{a}
	5g	18 ± 0.18^{a}	20 ± 0.15^{a}	31 ± 0.13^{b}	32 ± 0.01^{b}
	10g	30 ± 0.14^{b}	31 ± 0.31^{b}	38 ± 0.04^{c}	49 ± 0.01^{c}
Control (Pyrethrin)	0.17g	0.14 ± 0.01^{c}	1 ± 0.11^{c}	1 ± 0.21^{d}	2 ± 0.30^{d}

Means with different superscripts along the same column are significantly different (p<0.05)

Further, treatment with *Jacaranda mimosifolia* powder prepared in concentrations of 2.5g, 5g and 10g showed mortality potential on *Acanthoscelides obtectus*. However the insecticidal activity was more evident after 72 and 96 hours where 5g and 10g of the powder showed significant difference with 2.5g and the control. At 24 hours there was no significance difference between the treatments while a significant difference was recorded after 48 hours between 10g and other concentrations. Highest mean mortality percent was recorded at the 10g concentration after 96 hours (Table 4).

Table 4: Mortality of different treatments of *J. mimosifolia* on *Acanthoscelides obtectus*

Test Compounds	Concentrations	Mortality			
		24 hrs	48 hrs	72 hrs	96 hrs
J. mimosifolia	2.5g	12 ± 0.11^{a}	13 ± 0.18^{a}	13 ± 0.10^{a}	15 ± 0.03^{a}
	5g	14 ± 0.14^{a}	15 ± 0.10^{a}	23 ± 0.23^{b}	26 ± 0.11^{b}
	10g	17 ± 0.16^{a}	20 ± 0.21^{b}	25 ± 0.01^{b}	31 ± 0.21^{b}
Control	0g	0.16 ± 0.01^{b}	1 ± 0.30^{c}	1 ± 0.32^{c}	1 ± 0.27^{c}

Means with different superscripts along the same column are significantly different (p<0.05)

4. Discussion

A considerable percentage of small scale farmers and especially in Africa among other developing countries use unprocessed plant materials to keep off insect pests from damaging stored grains. Findings of this study suggest that powders from dried *Bougainvillea spectabilis* and *Jacaranda mimosifolia* leaves are effective agents against bean weevils. However both plants exhibit different mortality potential. The effectiveness of the powders differs with dosage as well as time of exposure. The considerable mean mortality exhibited by *Bougainvillea spectabilis* and *Jacaranda mimosifolia* indicate that the two plants could be exploited as an alternative control agent against *A. obtectus.* The high mortality of *B. spectabilis* could be as a result of high toxic effect of the plant leaves on adult *A. obtectus* compared to *J. mimosifolia.* Phytochemical screening revealed that the two plants had phenols in large quantities. This might have contributed to the insecticidal activity of the plants. According to [14] plants with phenolic components present strong insecticidal activity.

5. Conclusion

Basing of the findings of this study it can be concluded that powder from *B. spectabilis* and *J. mimosifolia* leaves has insecticidal activity against *A. obtectus.* Additionally comparing the two plants, *B. spectabilis* have a higher mortality effect against the insects. A higher dose of the plant powders is more effective in both plants.

6. References

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