



EFFICACY OF EXTRACTS OF *SHOREA ROBUSTA* AND *OROXYLUM INDICUM* AGAINST *CALLOSBRUCHUS CHINENSIS* (L.)

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ABSTRACT

The present study evaluates the efficacy of methanolic plant extracts of *Shorea robusta* and *Oroxylum indicum* against the pulse beetle *Callosobruchus chinensis* (L.). Various phytoactive compounds like alkaloid, terpenoid, flavonoids, saponins, phytosterols, glycoside, phenols and tannins were found in them. The plant extract of *S. robusta* shows 90% repellency followed by 81.5% with *O. indicum* at 12%. It was observed that *S. robusta* shows a potent effect in controlling *C. chinensis* with 78.30% mortality at 12% followed by *O. indicum* with 68.30% mortality at 12% concentration.

Key words: *Callosobruchus chinensis*, *Shorea robusta*, *Oroxylum indicum*, phytoactive compounds, repellency, mortality, methanol extracts

Pulses are annual leguminous crops and contain 20-30% protein which is almost three times higher than that found in cereals (Vikaspedia, 2019). Major pests of pulses include insects like *Rivellia pallida* (Loew), *Agrotis ipsilon* (Hufnagel), *Ophiomyia phaseoli* (Tryon), *Alcidodes spp.* (Olivier), *Helicoverpa armigera* (Hubner), etc. Insects account for 6.5% losses of stored grain in India (Raju, 1984). Among the bruchids, *Callosobruchus chinensis* (L.) and *C. maculatus* (F.) are the most commonly encountered species in Assam and NE India. Using various fumigants and insecticides against these results in resistance, resurgence and contamination of food. With the largescale production of pulses from the districts of Kamrup (R), Nalbari, Barpeta, Nagaon etc. Assam is known to be significant in nation's pulse production. The storage of pulses has always been a problem (Mishra et al., 2017), as their infestation causes economic loss (FAO, 1994). Assam being rich in its biodiversity and plant species, various ITKs are used by farmers for the proper storage of pulses. Study on the effectiveness of various plant extracts for controlling these pests is thus important. The present study evaluates the efficacy of methanolic plant extracts of *Shorea robusta* and *Oroxylum indicum* against *C. chinensis*.

MATERIALS AND METHODS

The adult beetles of *C. chinensis* and insect free healthy seeds of *Vigna radiata* were collected from Assam Agricultural University, Jorhat, Entomology Department. The seeds were also collected from various local farmers. The seeds were heated in oven

at 60°C for 30-40 min and made free from any hidden infestation and then stored in a closed container at room temperature. The culture was maintained on healthy seeds and were kept in plastic containers (12x 8cm) with their mouth tied with muslin cloth, sealed tightly and stored (30±2°C, 70±5%RH). The selected plant leaves were collected and identified in the Department of Botany, Cotton University using the key book (Kanjilal et al., 1938). Collected leaves were washed and dried at room temperature for 5 to 6 days and macerated using a grinder. The powdered material was subjected to methanol extraction using a Soxhlet apparatus for 15-18 hr. The extract was dried using rotary evaporator and residue is scratched out from the petri dish and kept in a clean airtight bottle for use.

Presence of phytochemicals like alkaloids (Wagner's test), glycosides (Borntrager's test), terpenoids (Salkowski test), saponins, flavonins, phytosterols (Liebermann Burchard's test), phenolic compounds (Ferric Chloride test), steroids (Salkowski test) etc. was detected using preliminary phytochemical analysis. Repellency test was conducted as suggested by Talukdar and Howse (1993). Petri dishes of 9 cm dia were used. Filter paper of 9 cm dia was cut in half and 1 ml of each plant extract diluted in methanol was applied to that half with a micropipette. Another half (control) was treated with 1 ml of absolute methanol. Both the halves were then air dried to evaporate the solvent completely. A full disc was remade by attaching the treated half and control with an adhesive tape such that it did not prevent the movement of insects from one half to the

other. Distance was maintained between two halves to prevent diffusion of test samples. Then it was placed in a petri dish with 20 insects released in the middle of each filter paper disc and covered. Three replicates were used. Number of insects on each half portion was recorded for every half an hour up to fifth hour. Percent repellency of each plant extract was calculated using the formula of Abbott (1925): % Repellency = $A-B/A \times 100$, where A=Average number of insects present on untreated portion & B= Average number of insects present on treated portion. The percentages of repellency were then categorized according to the scale suggested by Roy et al. (2005). Direct toxicity test of the adults was done by chilling the insects for few minutes, and the immobilized insects were kept in petri dish and 10 microliter solution of different concentrations (2, 4, 6, 8, 10, 12%) of plant extract were applied on the dorsal side of each insect with a micropipette. After treatment, 20 insects were transferred/ petri dish containing equal amount of food, examined daily and those did not move or respond to gentle touch were considered as dead. Insect mortalities were recorded at 24, 48 and 72 hr after treatment (HAT). Statistical analysis of data for mean and standard deviation was done with Microsoft excel software.

RESULTS AND DISCUSSION

The methanolic plant extracts of *Shorea robusta* and *Oroxylum indicum* showed presence of various phytoactive compounds. The preliminary phytochemical screening showed that *S. robusta* contains high concentration of terpenoids followed by alkaloids, saponins, phytosterols, phenols and tannins. *O. indicum* contains high concentration of flavonoids and phytosterol followed by alkaloids, glycoside, phenols and tannins. Earlier studies show that terpenoids can act as repellent and also can reduce the oviposition and larval feeding by herbivores (De Boer et al., 2004; Laothawornkitkul et al., 2008). Alkaloids are known to have antibacterial, antiviral and antifungal property. Alkaloids play an important role in chemical defense of plants against herbivores and predators (Wink, 2007). Flavonoids and phytosterols can act as detoxifying agents, antimicrobial compounds and can protect the plant from various biotic and abiotic stress (Samanta et al., 2011, Valitova et al., 2016). Saponins, glycoside and phenols show deterrent activity, toxic nature to various pest of crops and stored grains (Singh and Kaur, 2018; Lattanzio et al., 2006). Tannin also shows deterrence and toxicity towards various insect herbivores and can decrease protein digestion (Barbehenn, 2011).

The presence of all these phytochemicals in the studied samples of plant extract shows promise in controlling *C. chinensis*. The repellency test of both the plant extracts against *C. chinensis* showed that they are able to repel the insect in varying degree; *S. robusta* showed 73% repellency at 10% and 90% repellency at 12% concentration; while *O. indicum* showed 66.5% repellency at 10% and 81.5% repellency at 12%. Joshi et al., (2019) also found repellency of neem against *Tribolium castaneum* and *Rhyzopertha dominica*. Talukdar and Howse (1994) found that crude extract and seed volatiles of *Aphanamixis polystachya* have strong repellency to *C. chinensis* and *T. castaneum*. Rahman et al., (2007) showed that the repellency of ethanolic extract of *Macaranga postulate* against *Sitophilus oryzae* is dose dependent.

The mortality rate of *C. chinensis* is found to be dose dependent when treated with methanolic plant extract of *S. robusta* and *O. indicum* at various concentrations. The mortality (%) when treated with extract of *S. robusta* at 2%, 4%, 6%, 8%, 10% and 12 % concentration was 27%, 35%, 46.65%, 56.65%, 73.33% and 78.30%, respectively. With extract of *O. indicum* at 2%, 4%, 6%, 8%, 10% and 12% concentration, mortality was 21%, 26.60%, 38.30%, 41.65%, 53.33% and 68.30% respectively. This shows the plant extract of *S. robusta* is more potent in controlling *C. chinensis* followed by *O. indicum*. Bright et al. (2001) found that methanolic and ethyl acetate crude extract of *Andrographis paniculata* on *C. chinensis* shows a significant mortality rate, total egg output and emergence of F₁ adults. Ahmed et al. (2001) and Zafar et al. (2018) revealed that neem oil, neem powder and turmeric has effect on mating and oviposition behavior of *C. chinensis* and decrease its mating frequency, copulation duration, fecundity and survivorship of next generation. Saxena et al. (1992) found that extract of *Lantana camara* also has insecticidal, antiovipositional and antifeedent property against bruchids. The essential oils of *Cinnamomum verum* has significant repellent action, reduced fecundity and decreased egg hatchability against *C. chinensis* as studied by Kalita et al., (2014).

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