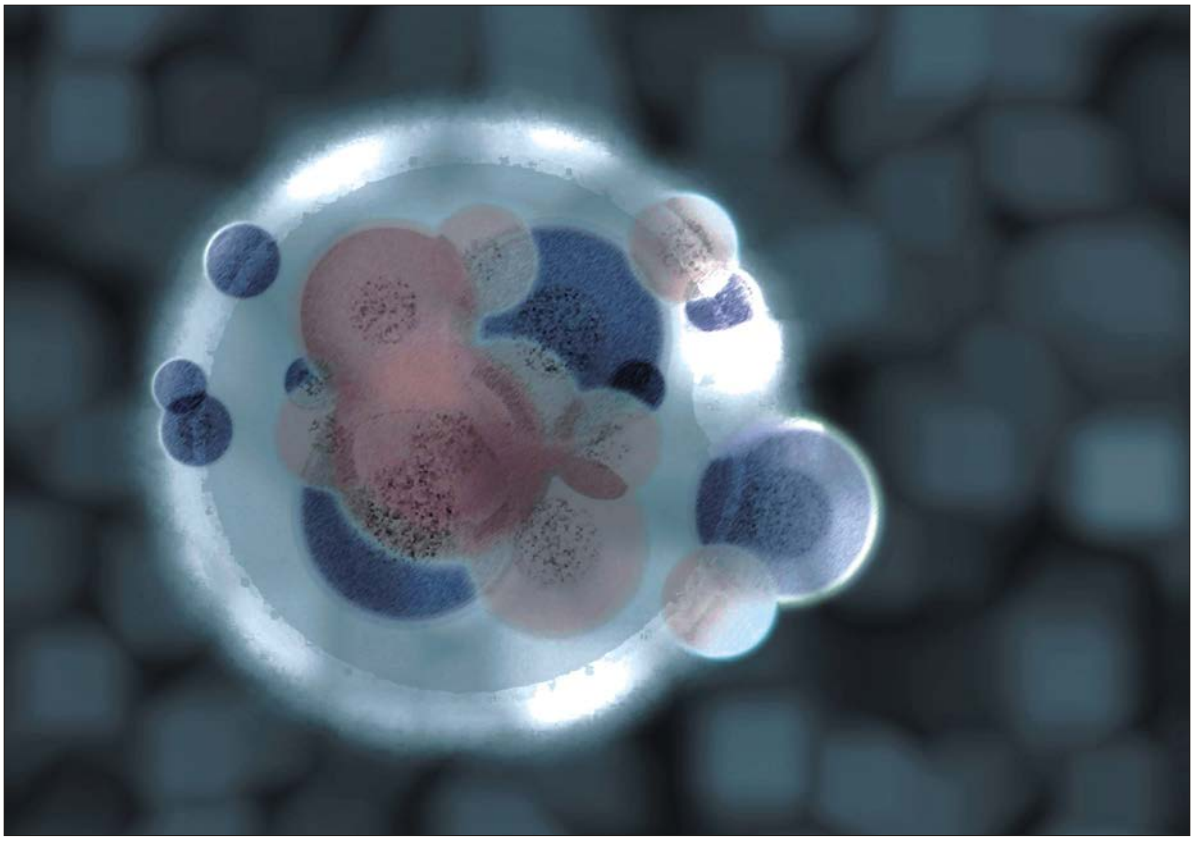

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Leaf Extracts of Shiyalmutra (*Blumea lacera* Dc.) as Botanical Insecticides Against Lesser Grain Borer and Rice Weevil

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Abstract: Two experiments were conducted in the laboratory with leaves of one plant species (*Blumea lacera* Dc.) Shiyalmutra or Kukurshunga for studying their repellency and toxicity test against the lesser grain borer (*Rhyzopertha dominica* F.) and rice weevil (*Sitophilus oryzae* L.; Bastrychidae:Coleoptera) with the attempt for chemical investigation of each extract. In the first experiment petroleum ether extract of dried leaves (1, 2 and 3% by volume) were used on the adult beetle of lesser grain borer and rice weevil to evaluate their repellency for mortality/direct toxicity effects. Results for the two experiments indicated that 1, 2 and 3% petroleum ether extract of leave of *Blumea lacera* Dc. species had repellency as well as direct toxicity, while 3% showed strong repellency and toxicity effects among the other extracts on both lesser grain and rice weevil.

Key words: *Blumea lacera* Dc., botanical insecticides, lesser grain borer, rice weevil

INTRODUCTION

With the help of isolation technique, a lot of naturally occurring organic, bioorganic compounds have been isolated from plant and animal sources. Most of them have effective medicinal and pesticidal/insecticidal value. Indigenous plant/weed materials play an important role as medicinal plants and pest control materials. Destruction of stored grains and other stored products by insects/pests is a world wide great problem. There are about 200 or more insects and mites which attack stored grains and stored products[1]. Among these, lesser grain borer *Rhyzopertha dominica* F. (Bostrychidae: Coleoptera) and rice weevil are common and most destructive in the world and specially in Bangladesh. Especially such types of insects are very active in warm and humid areas. It is well known to all that both the adults and grubs are serious pests of stored grains and stored products namely rice, wheat, maize, sorghum, barley, lentil, biscuits, dried potatoes, corn flower, beans, pumpkin seeds, tamarind seeds, millets etc[2]. In some cases they cause severe infestation i.e. a considerable amount of loss and spoil more than what they eat.

The several processes for protection of these pests have been reported, including use of chemical insecticides to control lesser grain borer, rice weevil and others. But synthetically chemical insecticides have created problems of pesticide resistance[3], health hazarded[4] residual effects on stored grain and also in the environment[5]. The farmers of under developing countries are seriously affected by this way.

Scientists are working to protect insect infestation by the indigenous plant materials and weeds. The use of locally available plants/weeds in the control of storage pests is an ancient technology in many parts of the world and is being used by our farmers also. The extracts of plant materials were unique in action and can be easily produced by farmers and small industries[6,7]. Recently Amin *et al.*[8] also reported the use of akanda, biskatali and neem leaves as botanical insecticides against lesser grain borer. Thus there is a great need of further research for uses of indigenous plant materials/weeds as botanical insecticides. Thus due to the unique activity of indigenous plant materials/weeds for pest control and also for greater interest of the farmers the present research was undertaken to study the effect of extract of leaves of shiyalmutra (*Blumea lacera* Dc.) as botanical insecticide against lesser grain borer and rice weevil to determine the repellency rate and direct toxicity with chemical investigation of each extract.

MATERIALS AND METHODS

Two separate experiments were conducted at Agricultural Chemistry and Biochemistry and Entomology Laboratory of Hajee Mohammad Danesh Science and

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Technology University, Dinajpur, Bangladesh during February to December, 2003. Lesser grain borer was rared in the entomology laboratory on wheat grain for obtaining sufficient number of newly emerged adults.

The leaves of shiyalmutra (*Blumea lacera* Dc.) were collected from the surroundings of University campus. Fresh leaves were completely dried in sunlight. It was then grinded using a grinding machine in the Laboratory of Agricultural Chemistry and Biochemistry. Eighty seven grams of powdered leaves were immersed into 500 mL petroleum ether (40-60°C) in 1 L reagent bottle for 72 h with shaking after several intervals. After 72 h, it was then filtered and the residue was again immersed in the same way for another two times. All the filtrate were combined and evaporated under reduced pressure using rotary film evaporator. After evaporation 2.1 g crude extract (by weight) was isolated and stored in a refrigerator. From this 1, 2 and 3% solutions were prepared by dissolving the crude extract in petroleum ether (40-60°C). Thin layer chromatography and Column chromatography for crude extract was performed with silica gel 60F 254 (Merck) and silica gel for column, respectively. The bioassay of the extracts was done for repellency and direct toxicity (mortality) tests. Repellency test was conducted following the method of Talukder and Howse[7], Amin *et al.* [8]. Nine centimeter diameter filter papers (Whatman No. 40) were marked into two portions. One milliliter solution of each extract was applied to one half the filter paper. The treated half disk was then air-dried. Each filter paper was then placed in a petridish and 10 insects were placed there. Number of insects on each portion was counted at hourly intervals up to the fifth hour. The data were expressed as Parentage Repulsion (PR) by the formula PR (%)=(NC-50) × 2.

Where, NC = the percentage of insects present in the control half. Positive (+) values expressed repellency while negative (-) values indicated attractancy. The average values were then categorized according to the following scale:

Class	Repellency rate (%)
0	> 0.01 to 0.1
I	0.1 to 20
II	20.1 to 40
III	40.1 to 60
IV	60.1 to 80
V	80.1 to 100

Direct toxicity test was done following the method of Talukder and Howse[9]. Insects were chilled for a period of 10 min. The immobilized insects were individually picked up by suction tube. One milliliter solutions of different concentrations (1, 2 and 3%) were applied to the dorsal surface of the thorax of each insect using a micro capillary tube. Ten insects per replication were treated. The insects were then transferred into 9 cm diameter petridishes containing food. Insect mortality was recorded at 24, 48 and 72 h after treatment (HAT). Observed mortality was corrected by Abbott's formula[10].

All the two experiments were conducted in completely randomized design with five replications. Data were transformed by square root $Y = \sqrt{percentage}$ and arcsin percentage transformation, respectively before statistical analysis. Finally, the mean values were compared using DMRT[11].

RESULTS AND DISCUSSION

Repellency: Among the extracts 1% leaf extract of shyialmutra (*Blumea lacura* Dc.) showed the lowest repellency 37.37% in case of lesser grain borer and 38.26% in rice weevil, while the repellency rate in 2% showed 48.72% in lesser grain borer and 44.52% in rice weevil. The highest repellency (55.71%) in lesser grain borer and (55.34%) in rice weevil was observed with 3% extract. (Table 1 and 2). The repellent action increased with the increase in concentrations of the extract applied. Amin *et al.*[8] reported that strong repellent effect was observed with 4% leaf extract of biskatali in lesser grain borer among akanda and neem.

Direct toxicity effect: Average mortality percentage indicated that 3 % concentration resulted higher toxicity (57.41%) in lesser grain borer and 56.71% in rice weevil (Table 3 and 4). It is also notable that, 1% concentration showed following toxicity 27.30% in lesser grain borer and 31.01% in rice weevil, where as 2% concentration showed average toxicity 42.3 and 45.54%, respectively. Mortality at 24, 48 and 72 h after treatment (HAT) indicated that 3% extract showed the highest toxicity. The order of toxicity of three different concentrations were indicated that 3% extract showed the highest toxicity. The order of toxicity of three different concentrations were 3>2>1%. The highest toxicity was observed in lesser grain borer compared to rice weevil. Observed mortality percentage increased with increase in time intervals after treatment. Mortality percentage at 24, 48 and 72 HAT indicated that 3% solution showed the highest mortality (57.41%) in lesser grain borer at 72 HAT compared to rice weevil (56.71%). Considering the time intervals and doses, the order of toxicity of the three different concentrations were 3>2>1%. Mortality percentage showed parallel response to the level of concentrations at different time intervals after treatment (Table 3 and 4). Amin *et al.*[8] reported the direct toxicity of the three plant extracts with the following sequence biskatali > neem> akanda in lesser grain borer. Talukder and Howse[9] have also noted similar

Table 1: Repellency rate of different concentration of plant extract on lesser grain borer

Extract conc. (%)	Average repellency rate (%) 1 HAT	2 HAT	3 HAT	4 HAT	5 HAT	Mean repellency rate (%)	Repellency class
1	39.47b	41.62b	37.00a	34.27b	34.48a	37.37	II
2	46.68ab	51.30ab	55.02a	46.44ab	44.16a	48.72	III
3	56.15a	58.70a	58.55a	53.84a	51.32a	55.71	III
Sx	4.35	4.36	6.49	3.88	5.17		

Table 2: Repellency rate of different concentration of plant extract on rice weevil

Extract conc. (%)	Average repellency rate (%) 1 HAT	2 HAT	3 HAT	4 HAT	5 HAT	Mean repellency rate (%)	Repellency class
1	31.96c	41.62a	41.62a	39.31b	36.81a	38.26	II
2	41.62b	48.75a	43.95a	44.14ab	44.16a	44.52	III
3	51.30a	54.08a	56.15a	63.84a	51.32a	55.34	III
Sx	2.42	4.47	5.87	3.98	7.03		

Table 3: Direct toxicity effect of different concentration of plant extract on Lesser grain borer

Extract conc. (%)	Percentage of insect mortality at 24 HAT	48 HAT	72 HAT	Mean mortality
1	15.21c	31.82b	34.88c	27.30
2	32.61b	45.45a	48.84b	42.30
3	45.65a	56.82a	69.77a	57.41
Sx	3.55	3.82	2.92	

Table 4: Direct toxicity effect of different concentration of plant extract on rice weevil

Extract conc. (%)	Percentage of insect mortality at 24 HAT	48 HAT	72 HAT	Mean mortality
1	21.74b	34.09b	37.21b	31.01
2	32.61ab	50.00a	51.16b	45.59
3	43.48a	54.55a	72.09a	56.71
Sx	5.61	3.14	4.45	

Within column values followed by same letter(s) did not differ significantly at 5% level by DMRT

direct toxicity effect of pithraj on red flower beetle. Dohary[12] observed direct toxicity of neem extract on pulse beetle. De-Pedro and De-Pedro[13] studied the effect of neem bark extract against corn weevil and obtained high mortality percentage of the weevil.

Thin layer chromatography of crude petroleum ether extract of leaves of shiyalmutra (*Blumea lacera* Dc.) showed that it contained five to six compounds at hexane: ethyl acetate 5:1, 4:1 and 2:1 v/v, respectively. Due to interesting repellency and toxicity I e. insecticidal effect of this extract, now it is a great challenge for us that for why or which compound is responsible for this activity. That's why we are way to purify this crude extract by column chromatography for the study of their chemistry, which will be reported in due course. It is very difficult to draw a definite conclusion from this small scale study. However it was observed that the tested three concentrated extracts had repellency and direct toxicity effects on insects. This research idea may be suggestible to the farmers for using this weed as repellent and killer of insects.

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