Effect of Bishkathali (*Polygonum Hydropiper* L.) on Reproductive Potential of C*ryptolestes Pucillus* (Schon.) (Coleoptera: Cucujidae)

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Abstract: *Polygonum hydropiper* (Bishkathali) was tested on different parameters of the life cycle of *Cryptolestes pusillus*. It was found that oviposition rate, hatching rate, percentage of adult emergence, longevity of male and female were decreased with the increase of dose of *P. hydropiper* and the incubation period and developmental period were increased with the increase of doses. The lowest and the highest oviposition rate (0.67±0.236 and 2.22±0.324), hatching rate (12.78±0.465 and 43.56±1.582), adult emergence (9.78% and 29.78%) and longevity (male-59.89±0.935 and 91.44±1.015 and female-62.22±0.596 and 98.78±0.909) were found the doges 552.413 and 163.678 µgmcm^2 whereas in control these were 4.89±0.389, 91.11±0.889, 88.44%, 156.11±1.263 and 169.22±2.437, respectively. But highest and lowest incubation period (8.22±0.547 and 4.44±0.176) and developmental period (75.22±0.465 and 45.67±0.527) were found at the same doses, which in control it was 3.78±0.324 and 33.11±0.484, respectively.

Key ward: *Cryptolestes pusillus*, *Polygonum hydropiper*, reproductive potential, oviposition,

Introduction

Cryptolestes pusillus (Schon.) is cosmopolitan and virtually feeds on all kinds of stored grain and milled cereal products and causes immense damage to the tropical and subtropical countries of the world including Bangladesh [1, 2]. The damage is caused both by the larvae and the adults [3].

Chemical control has been the most efficient and effective means for protection of stored product insect pests, but the over use of the pesticide has led to widespread resistance in insects and other arthropod pests [4]. The irrational and indiscriminate use of insecticides to protect pests in field may cause serious health hazard [5]. The reduces of some of the insecticides remains in field and environment that may cause miserable consequence after consumption of the grain [5]. Sometimes persistent pesticides accumulate in the higher food chain of both wildlife and human and become concentrate by biomagnifications [6]. Adverse efforts of these chemicals on various compound of environment, due to their long persistent nature and bioaccumulation, made it necessary to find alternative and eco-friendly products [7]. One alternative to insecticides is pesticidal plants. Natural compounds of plant origin are biodegradable, often low mammalian toxicity, and pose low danger to the environment and ecosystem. Recent search has focused on natural product

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alternatives for pest control in developing countries [8]. The flora of Bangladesh includes plant species of insecticidal and medicinal properties. However, effective and economical methods for using these plants have not commercially developed. *Polugonum hydropiper* L. is locally known as Bishkathali has powerful diuretic and stimulating properties. It belongs to family Polygonaceae [9]. In the present study the effect of Bishkathali on reproductive potential of *C. pusillus* was observed.

Materials and Method

C. pusillus was collected from Bangladesh Council for Scientific and Industrial Research (BCSIR) laboratories, Rajshahi and successfully reared in the IPM laboratory, Institute of Biological Sciences, University of Rajshahi. The mass culture was maintained in petri dish (12 cm diam.) and sub culture in small petri dish (6 cm diam.) on a standard mixture of whole-wheat flour with powdered dry yeast in ratio of 19:1 food medium and kept into the control room at 30 ± 0.5^0C.

Bishkathali leaves and shoots were collected and washed at running water for removing dust and air dried in a shaded place ensuring sufficient air flow to avoid damping. After drying, the leaves and shoots were chopped. Dust was prepared by electric grinder and sieved through a 60 mesh sieve. The dust was dissolved in acetone at a ratio of 1:15 W/V in a conical flask and allowed to kept for 24 to 72 hours for extraction. The mixture was filtered using filter paper. The solvent extract then allowed to aeration to remove the acetone. Finally the extract was measured and diluted with acetone at different concentration for different doses. Each dose was placed in petri dishes (60 mm diam.) separately and uniformly covered the whole area of the petri dish. They were then kept open for sometimes to allow the solvent to evaporate. Ten pair of adult beetle was released into each petri dish (6cm) containing 5gm of food for each dose. They were allowed 24 hours for oviposition. Then the adults were removed from the Petri dish and eggs were kept in the control temperature (CT) room for development. The incubation period was recorded.

The first instar larvae hatched from both treated and control experiments were counted and kept for adult emergence. The emerged adults were counted and sexed.

Twenty four hour old eggs were kept at each dose. After hatching their developmental period was recorded. Longevity of adult male and female was recorded for each dose separately. Food was changed at 10 days interval for all doses to avoid the interaction of their offspring.

For the control experiments, ten pair of adult beetle was released into one petri dish (6cm) containing 5gm of food without any extract of Bishkathali and the oviposition rate, hatching rate, incubation period, adult emergence, sex ratio, developmental period and longevity (male and female) were recorded to compare with different doses of Bishkathali.

Results and Discussion

The oviposition rate, hatching rate, incubation period, adult emergence, sex ratio, developmental period and longevity (male and female) are shown in Table 1 and Table 2.

The oviposition rate was decreased with the increase of the concentration of Bishkathali (Fig. 1A). The difference between doses was significant (P<0.01). The lowest oviposition rate (0.67±0.236) was found in 552.413 µgmcm^{-2} dose. The rate of oviposition increases slowly with the decreasing of the concentration of Bishkathali. In control, the oviposition rate (egg/female/day) was highest (4.89±0.389). Mollah *et al.* [10] worked with petroleum sprit and acetonic extract of leaf, stem and root of *P. hydropiper* on *C. maculatus* and found the extracts effectiveness on inhibiting oviposition at all concentrations. No eggs were laid by *C. maculatus*, when black gram seed were tasted @ 0.2g/100seeds.The leaf extracts were most effective than stem and root extracts. Petroleum extract was more effective than acetone. Different plant extract may be used for reduced oviposition of different stored grain pest. The leaves of piper, annona, neem, chilli and peels of lemon significantly reduced oviposition; neem was the most effective followed by annona [11, 12]. Bhuiya *et al.* [13] reported that methanol extract of neem reduced the oviposition rate of *Callosobruchus chinensis*. The number of eggs laying were 0.3 to 2.7 and 1.3 to 2.3 eggs/ 100 seeds in lentil and chickpea seeds whereas in untreated seeds the rate were 6.0 and 22.7 eggs/100 seeds.

Table 1. *Oviposition rate, hatching rate, incubation period and number of adult emergence and percentage of adult emergence of C. pusillus.*

Doses (µgmcm^{-2})	Oviposition rate (egg /female/day)	Hatching rate of eggs (viability %)	Incubation period (days) (Mean± SE)	Adult emergence	
				Number(25) (Mean± SE)	(%)
552.413	0.67±0.236	12.78±0.465	8.22±0.547	2.44±0.242	9.78
368.275	0.78±0.278	23.11±0.389	7.11±0.389	4.78±0.324	19.11
245.517	1.33±0.236	37.44±0.556	5.56±0.242	6.56±0.444	26.22
163.678	2.22±0.324	43.56±1.582	4.44±0.176	7.44±0.377	29.78
Control	4.89±0.389	91.11±0.889	3.78±0.324	22.11±0.351	88.44
F value	34.06	1096.86	26.30	479.90	
*P<0.01					

Table 2. *Sex ratio, developmental period and longevity of male and female C. pusillus.*

Doses (µgmcm^{2})	Developmental period (days) (Mean± SE)	Longevity (days) (%)		Sex ratio (%)	
		Male (Mean±SE)	Female (Mean± SE)	Male	Female
552.413	75.22±0.465	59.89±0.935	62.22±0.596	45.83	54.17
368.275	66.22±0.596	65.44±0.915	71.44±0.801	46.81	53.19
245.517	51.11±0.633	78.89±0.588	81.44±0.988	46.15	53.85
163.678	45.67±0.527	91.44±1.015	98.78±0.909	47.30	52.70
Control	33.11±0.484	156.11±1.263	169.22±2.437	49.77	50.23
F value	937.60	1603.25	1047.63	-	-

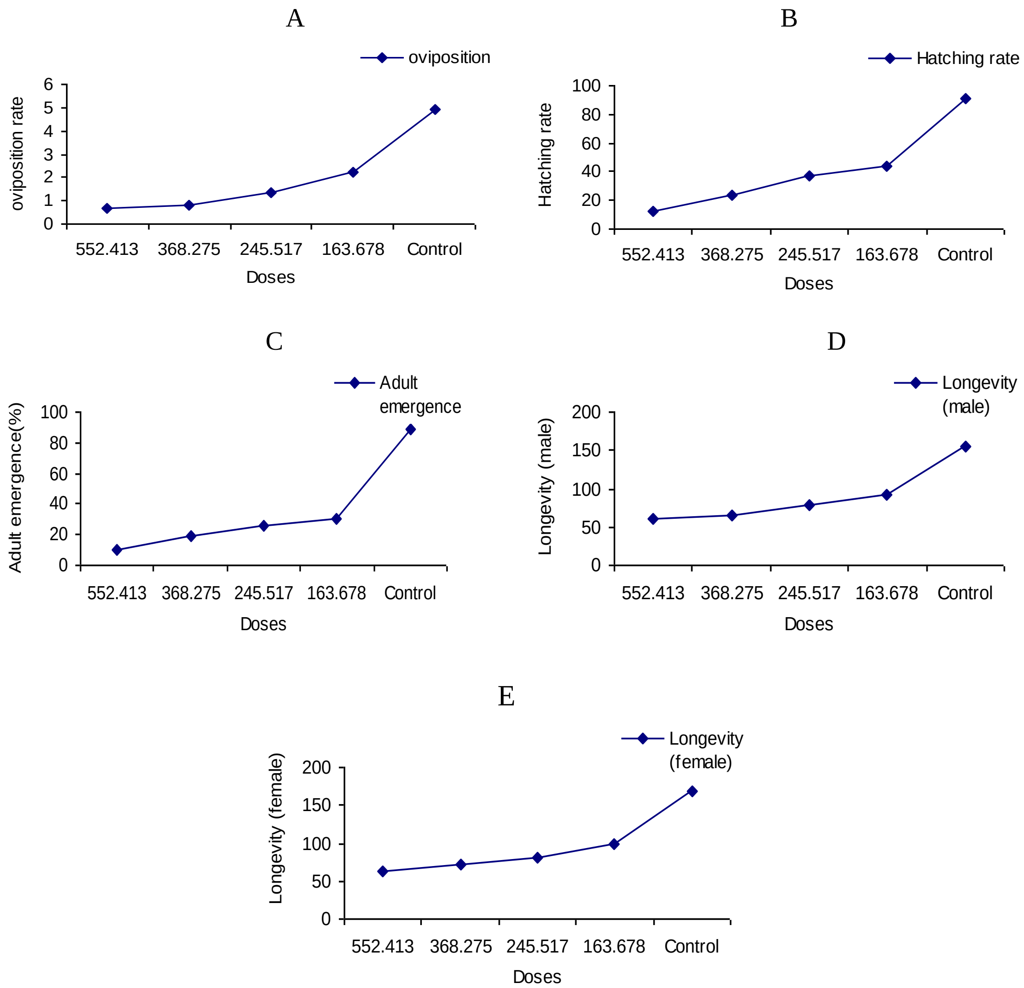

Fig. 1: *(A B C D E). Decrease of oviposition rate, hatching rate, % of adult emergence and longevity of male and female with the increase of Bishkathali comparing with the control.*

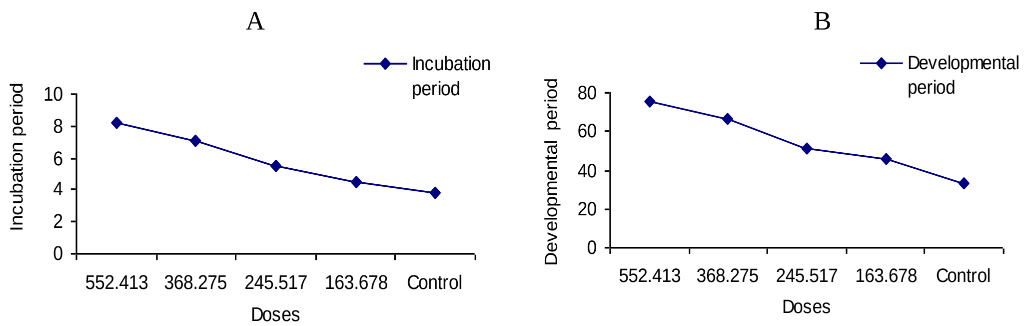

Fig. 2: *(A, B) Increase of the duration of incubation period and developmental period at various doses of Bishkathali compared compared with control*

Bishkathali inhibited egg-hatching rate of *C. pusillus.* The viability rates were decreased significantly with the increase of the concentration of Bishkathali (Fig. 1B). The lowest viability (12.78±0.465%) occurred at 552.413 µgmcm^{-2} dose and in control the rate was found highest (91.11±0.889%).

Mollah *et al.* [10] worked with petroleum spirit and acetonic extract of leaf, shoot and root of *P. hydropiper* on egg viability of *C. maculatus* and got in leaf extract 40.66%, 31.66% and 0% at 0.05, 0.1 and 0.2 g/100g seeds whereas in control the egg viability was 95.33%, shoot and root extract showed more or less similar results. All the plant extracts were effective on inhibiting egg hatching of *C. maculatus.* Ahmed *et al.* [14] worked with neem extracts on *Tribolium continuum* and found similar result.

The incubation period of *C. pusillus* also affected significantly by Bishkathali and increased with the increase of concentrations (Fig. 2A). The longest incubation period (8.22±0.547 days) was found at 552.413 µgmcm^{-2} dose and shortest incubation period (3.78±0.324 days) was found in control. Bishkathali was found to be significantly prohibit adult emergence of *C. pusillus* at all concentrations compared with the control. Adult emergence was found to decrease with the increase of dose (Fig. 1C). The lowest percentage (9.78%) of adult emergence found at 552.413 µgmcm^{-2} dose, whereas in case of control adult emergence was found highest (88.44 %).

Mollah *et al.* [15] found that extraction of leaf, shoot and root of *P. hydropiper* with petroleum sprit and acetone were effective and significantly inhibit the adult emergence of *C. maculatus* at all concentrations compared with the control. No adults of *C. maculatus* were emerged at the dose of 0.2g/100g seeds of all plant extracts. The leaf extracts were more effective than stem and root extracts.

Rajapakse *et al.* [12] recorded the highest reduction of the adult emergence of *C. maculatus* with *Azadirachtin indica* leaf powder. Keita *et al.* [8] reported that the adult emergence of *C. maculatus* were dropped to zero per cent with *Ocimum basilicum* and 4% with *O. gratissimum*, when the control was 97%.

The Bishkathali did not deviated sex ratio from the typical 1:1 ratio in both treatment and control (Table 2). Ahmed *et al.* [14] worked with *P. hydropiper* extracts on *C. maculatus* and found that the sex ratio was not different from the typical 1:1 ratio in both treated and control. Rahaman *et al.* [16] worked with *Datura* and *Azadirachta indica* on *Tribulam castanium* and got similar 1:1 ratio.

The Bishkathali prolongated the developmental period and prolongation was increased with the increase of doses significantly in *C. pusillu*s at all the doses (Fig. 2B). The developmental period of *C. pusillus* was highest (75.22±0.465 days) at 552.413 µgmcm^{-2} dose, whereas, in the control it was 33.11±0.484 days.

The Bishkathali strongly reduced the longevity in both male and female of *C. pusillus* (Fig. 1D, 1E). The lowest longevity of male (59.89±0.935 days) and female (62.22±0.596 days) were found in 552.413 µgmcm^{-2} dose, whereas in control it was (156.11±1.263) and (169.22±2.437) days (Table 2). The oviposition rate, hatching rate, percentage of adult emergence and longevity of male and female were decreased with the increase of doses (Fig. 1 A, B, C, D, E) and incubation and developmental period was increased with the increase of doses (Fig. 2 A, B). A number of workers [17, 10, 15, 4, 11, and 12] worked on mortality and different biological aspects of different stored grain insect pests by *P. hydropiper* and got significant result.

Conclusion

The Bishkathali was found to be toxic to the reproductive potential and developmental period of *C. pusillus* and can be used for the control *C. pusillus* effectively and safely.

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References

1. Kirkpatrick R. L. and Cagle A., 1978, *J. Kansas Entomol. Soc.* 51, 386-393.
2. Hossain M., Verner P. H. and Rezaur R., 1986, *Zool B. J.,* 14, 139-148.
3. Cotton R .T., 1963, Pests of stored grain and grain products. Burgess Co., Pp-333.
4. Keita C. Vincent S. M., Schmit J. P., Ramaswamy S. and Belanger A., Stored Prod J., 2002, Res. 36, 355-364.
5 Y. P. Singh and K. P. Sharma, 2000, *J. Aphidol.* 16, 77-88.
6. Metcalf R.I., 1975, Introduction to Insect pest management (eds. R. I. Metcalf and W. Luckman) Wiley-InterScience, NewYork, pp235-273.
7. Mokabel A.N. M. and Gowda G., 2000, *J. Ecobiology,* 12(1), 3-8.
8. Keita S. M., Vincent C., J, Schmit P., J, Amason T. and Belanger A., 2001, *J. Stored Prod. Res.* 37, 339-349.
9. Kirtikar K. R. and Basu B. D., 1987, Indian Medicinal Plants. Vol. 3. 2100-2101, International Book Distributors, Dehra Dun, India.
10. Mollah J. U. and Islam W., 2002, *J. bio-Sci.* 10, 113-116.
11. Rajapakse R. H. S., 1996, *Entomon,* 21, 211-215.
12. Rajapakse R. H. S., Senanyake S. G. J. N. and Ratnasekera D., 1998, *J. Ent. Res.* 22, 1-6.
13. Bhuiyah M. I. M., Karim A. N. M. R., Islam B. N. and Alam M. Z., 2003, *B. J. Ent.* 13(1), 59-69.
14. Ahmed I., Shamshad A. and Tabassum R., 1999, Pakistan Cong. *Zool.* 19, 51-56.
15. Mollah J. U. and Islam W., 2005, *B. J. Zool.* 33 (1), 81-87.
16. Rahaman A. S. M. S., 1992, Ph.D Thesis, Department of Zoology, University of Rajshahi, Bangladesh.
17. Amin M. R., Shahjahan M., H, F, El Taj, T, Iqbal M. T. and Hossain M. A., 2000, *B. J. Ent.* 10, 1-13.