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Damage potential and control measures of *Necrobia rufipes* (De Geer) (Coleoptera: Cleridae) on dry fish with plant materials

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Abstract

As a source of high protein content, fish is one of the major categories of foods consumed by human beings. In Bangladesh, fish provides the main and the cheapest source of animal protein in the diet of all walks of people. The process of drying and salting have been practised for fish preservation through centuries. Feeding by the larvae and adults of *Necrobia rufipes* (De Geer) causes quantitative loss of dried or cured fish and also leads to fragmentation and to quality losses and contamination by insects' bodies and cast skins. In our present study, about 20% damage was caused by *N. rufipes* in a storage period of six months (April to September). For preservation of dry fishes, five plant based materials namely Neem, Nishinda, Eucalyptus, Turmeric powder, Mehagoni and ash were evaluated. Each of the plant leaf powder at a concentration of 5 gm was uniformly mixed with 50 gm Punti dry fish and placed in a Petri dish (10 cm diam.). Five newly emerged (0-24 hrs old) larvae and adults of *N. rufipes* were introduced into each Petri dish. Neem leaf powder exerted the best result followed by turmeric powder, Nishinda, ash, Eucalyptus and Mehagoni leaf powders for preventing the larval infestations. Turmeric powder exerted the best result followed by Neem, Euclyptus, Mehagoni, Nishinda leaf powder and mehagoni oil- cake for ceasing infestation of dry fishes.

Keywords: *Necrobia rufipes*; Damage; Control; Dry fish; Plant materials

Introduction

Losses by *N. rufipes* occur in two ways: by the actual feeding activity of larvae and adults and by cross-infestation resulting in a lowering of the value of other commodities in the field (Ashman, 1962). About 40% flesh of the dried fish is lost annually during storage period (Fabian, 1975). A considerable amount of dried fish is lost in Bangladesh due to infestation by hide and copra beetles in storage conditions (Ahmed *et. al.,* 1989). The copra or red-legged ham beetle is a cosmopolitan pest causing considerable damage to stored commodities such as copra (dried coconut), cheese, dried fish, ham and other products rich in protein contents (Nwana,1993). Damage by the feeding of the larvae is a serious problem in the storage of dry fishes for off-season consumption and export purpose. Their presence on high value commodities such as dried fish, copra, ham or processed meat, etc. can lead to produce reduction and serious losses (Hill, 1992). Insect infestation with dry fishes caused an increase in the anti- nutritional factors such as phytic acid, trypsin inhibitor activity and crude fibre as well as a decrease in starch and protein contents of stored produce. Although many synthetic chemicals are effective against the pests of many stored products, the general use of such chemicals to protect stored fish has been hampered due to health hazards, higher costs and less susceptibility of dermestid larvae (Amusan and Okorie, 2002; Odeyemi *et. al.,* 2000). The need to protect smoked fish from pest attack is suggested because dry fish plays a prominent role during the hunger gap period between the first rains and first harvest. Besides, dry fish commodities are the cheapest and most accessible sources of animal proteins in situations of emergency for the distressed people in natural calamities. Thus, this study is aimed at searching for natural preservation methods which are not only safe to consumers but are also cheaper and easily accessible in protecting the highly valuable and popular commodities like dry fishes in the tropics.

Materials and methods

N. rufipes is a noxious insect pest of freshwater dry fishes, namely Punti, Chela, Kholisa, Chanda, Tengra, Kakila, Balia, prawn, Shingi, Taki, Chapila, Mola etc. This insect was collected from different local markets and dry fish stores

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of different regions of Bangladesh. Collection sites were Bhairab Bazar, Kisoreganj, Birishiri, Netrokona, Rajshahi, Rangpur and local markets, *viz*. Kawran Bazar, Hatirpool Bazar and New market of Dhaka city. During this survey temperature, relative humidity, sunshine, rainfall, etc. were recorded.

Insect specimens were collected with the help of an aspirator and also by hand- picking method from the dry fish containers such as bamboomade basket (Tukri) and gunny bags. These specimens were kept in glass vials and Petri dishes.

The initial sources of *N. rufipes* were naturally infested dry fishes and dry fish market at Kawran Bazar. Several males and females of *N. rufipes* thus obtained were mass reared in plastic culture jars covered with muslin cloth at room temperature and relative humidity. The Petri dishes for experimental use were disinfected using the standard procedure by heat treatment in an oven at 70^{o}C for 3-4 hours and then allowed to cool at room temperature. New generations of *N. rufipes* kept in different Petri dishes at an average room temperature of 29 ± 2^{o}C and of 70 ± 5% relative humidity were collected by removing adults of each insect species from a stock culture and placing them on fresh uninfected dry fish parent adults. Water was supplied with pieces of soaked cotton wool on Petri dish to increase relative humidity.

Five indigenous plant materials or biopesticides were collected for preservation of dry fishes in order to minimize insect pest infestation. The collected plant materials were whole and powdered leaves of Neem (*Azadirachta indica* L); Nishinda (*Vitex negundo* L.); Mehagoni (*Swietenia mohagoni* L) (Mehagoni seed oil, Mehagoni seed dust and Mehagoni seed oil); Eucalyptus (*Eucalyptus parallelus*), turmeric powder (*Curcuma longa* L.). The plant leaves were collected and sun dried. Sun-dried leaves were grounded in a blender to make them powder. The dry fish preservation was done by using powdery form of the desired plant leaves and using liquid Mehagoni seed oil in different proportions to dry fish. Ash also was used to preserve dry fishes. Burnt paddy husk was the source of ash.

Each of the plant leaf powder at a concentration of 5 gm was uniformly mixed with the body of 50 gm punti dry fish and placed in a Petri dish (10 cm diam.). Five newly emerged (0-24 hrs old) larvae of *N. rufipes* were introduced into each Petri dish.

On the other hand, five newly emerged (0-24 hrs old) larvae of *N. rufipes* were introduced into each Petri dish. This experiment determined the effect of plant materials on the longevity of larvae and adults of *N. rufipes.* Wet cotton wool was supplied in each Petri dish to prevent dehydration. A control experiment was maintained consisting of the same number of insects exposed to the untreated dry fishes. Each treatment was replicated for 3 times. Longevity of the treated insects was recorded every 24 hrs for 31 days. Daily regular observations were made until adult mortality completion.

Another experiment was conducted using mehagoni seed oil on adult *N. rufipes*. Mehagoni seed oil at concentrations of 0.25, 0.5 and 1 ml was thoroughly sprayed onto the body of 50 gm of punti dry fish, air dried for 2-3 hrs and placed in a Petri dish (10 cm diam.). Fifteen newly emerged adults (0 - 24 hrs old) of *N. rufipes* were introduced into each Petri dish and mortality was recorded.

All the experiments were conducted in the laboratory at 28 ± 2°C and of 85 ± 5% R.H. The effect of treatments on larva and adult *Necrobia rufipes* was analyzed by Duncan's Multiple Range Test (DMRT). ANOVA was done using Microsoft Excel Programme.

Result and discussion

About 20% damage was caused by *N. rufipes* in a storage period of six months (April to September). The names, location and pest occurrence of popular fresh water dry fishes during survey period are given in Table I.

Effect of plant materials and ash on longevity of larva N. rufipes

Each of the plant leaf powder at a concentration of 5 gm was uniformly mixed with the body of 50 gm punti dry fish and placed in a Petri dish (10 cm diam.). Five newly emerged (0-24 hrs old) larvae of *N. rufipes* were introduced into each Petri dish. Wet cotton wool was supplied in each Petri dish to prevent dehydration. A control experiment was maintained consisting of the same number of insects exposed to the untreated dry fishes. Each treatment was replicated for 3 times. Longevity of treated insects was noted every 24 hrs for 31 days. Daily regular observations were made until larval mortality completion (Table II).

The effect of treatments on adult *N. rufipes* was statistically analyzed (ANOVA, LSD and DMRT).

Table I. Pests of popular dry fishes of Bangladesh

Sl.No.	Name of the dry fishes collected.	Locality	Dominant insect pests recorded	Rate of infestation	Part infested
1	Punti (*Puntius ticto*)	Hatirpool Bazar, Dhaka.	*N. rufipes*	Severe	Head and thorax
2	Chanda (*Pampus* sp.)	New market, Dhaka.	*N.rufipes*	Severe	Head
3	Prawn (*Penaeus monodon*)	Kawran Bazar, Dhaka.	*N. rufipes*	Severe	Head, thorax and abdomen.
4	Mola (*Amblypharyngodon mola*)	Netrokona (Birishiri)	*N. rufipes*	Medium	Head and abdomen.
5	Khalisha (*Colisa fasciatus*)	Bhairab Bazar, Kishoregonj	*N. rufipes* & *D. maculatus*	Severe	Head and thorax
6	Chapila (*Gadusia chopra*)	Kawran Bazar,Dhaka	*N. rufipes* & *D. maculatus*	Severe Head	and thorax
7	Chela (*Rohtea* sp.)	Bhairab Bazar	*N. rufipes*	Medium	Head & thorax.
8	Taki (*Channa punctatus*)	New Market, Dhaka	*N. rufipes* & *D. maculatus*	Severe	Head
9	Tengra (*Mystus cavasius*)	Rangpur	*N. rufipes* & *D. maculatus*	Medium	Head & thorax
10	Shole (*Channa striatus*)	Natore, Rajshahi.	*N. rufipes*	Minimum	Head & thorax
11	Kakila (*Xenentodon cancila*)	Rangpur	*N. rufipes*	Medium	Head & thorax
12	Balia (*Glossogbius giuris*)	Natore, Rajshahi.	*N. rufipes*	Medium	Head
13	Tara Baim (*Macrognathus aculeatus*)	Kawran Bazar, Dhaka.	Nil	-	-

Table II. Effect of different plant materials on the longevity of larva *N. rufipes* (days)

Treatment	Weight of plant material (gm)	Longevity of adult				Mean ±S.D.
		Control	R1	R2	R3	
Neem leaf powder	5	27	9	10	12	10.33 ± 1.53
Nishinda leaf powder	5	27	16	15	17	16.0 ± 1.0
Eucalyptus leaf powder	5	27	18	19	20	19.0 ± 1.0
Turmeric powder	5	27	17	16	15	16.0 ± 1.0
Mehgoni leaf powder	5	27	30	30	30	30.0 ± 0.0
Ash	5	27	16	17	16	16.33 ± 0.58

Effect of plant materials on longevity of adult N. rufipes

Each of the plant leaf powder at a concentration of 5 gm was uniformly mixed with the body of 50 gm Punti dry fish and placed in a petri dish (100 mm diam.). Five newly emerged (0-24 hrs old) adults of *N. rufipes* were introduced into each Petri dish. Wet cotton wool was supplied in each Petri dish to prevent dehydration. A control experiment was maintained consisting of the same number of insects exposed to the untreated dry fishes. Each treatment was replicated for 3 times. Longevity was recorded every 24 hrs for 31 days. Daily regular observations were made until adult mortality completion (Table III).

es have been given in Table I. Treatments had significant effects on various parameters of *N. rufipes* (Tables II, III and IV).

The powders of Eucalyptus, Neem, Nishinda, and Mehagoni leaves, Turmeric powder, Mehagoni oil-cake, Mehagoni fruit powder, and ash more or less worked as surface protectants against *N. rufipes*. Reduced oviposition by the beetles on the treated dry fishes and the consequent lower larval and adult emergence reported in the studies might be as a outcome of high adult mortality caused by the botanicals. It is evident from the statistical analysis that turmeric powder exerted the best result in terms of control followed by Neem

Table III. Effect of different plant materials on the longevity of adult *N. rufipes*

Treatment	Weight of plant material (gm)	Longevity of adult				Mean ±S.D.
		Control	R1	R2	R3	
Mehgoni oil cake	5	31	23	23	22	22.67±0.58
Mehgoni seed dust	5	31	17	17	16	16.67±0.58
Neem leaf powder	5	31	17	8	12	12.3±4.51
Nishinda leaf powder	5	31	26	16	21	21.0±5.0
Eucalyptus leaf powder	5	31	6	24	15	15.0±9.0
Turmeric powder	5	31	3	8	7	6.0±2.65

The effect of treatments on adult *N. rufipes* was statistically analyzed (ANOVA, LSD and DMRT).

Effect of mehagoni seed oil on the adult N. rufipes

Mehagoni seed oil at concentrations of 0.25, 0.5 and 1 ml was thoroughly sprayed onto the body of 50 gm of punti dry fish, air dried for 2-3 hrs and placed in a petri dish (10 cm diam.). Fifteen newly emerged adults (0 - 24 hrs old) of *N. rufipes* were introduced into each Petri dish and mortality was recorded (Table IV).

The impact of leaf powders and ash on the longevity of larval *N. rufipes* was analyzed by ANOVA . Pests of dried fish

leaf powder, Eucalyptus leaf powder, Nishinda leaf powder and Mehagoni oil cake.

Sowunmi (1982) reported that insect infestation caused an increase in the anti-nutritional factors such as phytic acid, trypsin inhibitor activity and crude fibre as well as a decrease in starch and protein contents of stored produce. It is evident that the application of the plant materials and other ingredients prevented pest occurrence during storage. Unprotected fish (control) became unhygienic and therefore unfit for human consumption. The results obtained in the study are indicative of the potentials of plant materials in preserving the quality and quantity of freshwater dry fishes. Much more comprehensive research is very much to be solicited in this regard.

Table IV. Effect of Mehgoni seed oil on adult *N. rufipes*

Concentration (ml)	Weight of dry fish (gm) m	Initiation of ortality after treatment (minutes)	No. of *N. rufipes* treated	Completion of mortality after treatment (minutes)
0.25	50	5	15	15
0.5	50	5	15	20
1	50	1	15	5

*Data based on 15 observations

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