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Insects Infestation and Preventive Measures in Dry Fish Storage of Chittagong, Bangladesh

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Abstract: Six experiments were conducted to assess losses, magnitude of infestation and to develop preventive measures for 12 weeks to combat the beetles infestation on sun dried ribbon fish by treating with pirimiphos-methyl at a concentration dose of 0.12, 0.06 and 0.03%, saturated brine solution and dried 'Bishkatali' (*Polygonum hydropiper*) plants. For comparative studies a batch of ribbon fish was also stored without any treatment as a control. The treatment of 0.12 and 0.06% pirimiphos-methyl showed excellent result against beetles infestation during storage, while the control suffers from effective weight loss of about -25.47% instead of increase due to rise of moisture content. The 0.12 and 0.06% pirimiphos-methyl treated fish showed weight change of +2.94 and -0.96% respectively, which were economic to the traders.

Key words: Insect, infestation, dry fish, storage, Bangladesh

Introduction

Most of the marine fishes, which are caught in remote coastal areas and islands viz. Afatiar char , Dubla, Kutubdia, Khurushkul, Moheshkhali, Rangabali, Sonadia and St. Martins of Chittagong, Bangladesh are simply sun dried and only a small portion is cured. A substantial amount of these fishes are being damaged during processing. This damage mainly occurs due to pest infestation during the process of drying and storage and during transport to wholesale market and retail shop.

It was reported that at least 30% of the fish meat was lost due to 'Maggot' infestation. During heavy infestation, the fishermen spray insecticides injudiciously which causes hazards to human health.

The cured / dried fishes are stored in damp warehouses and particularly during monsoon period when moisture content is high in the weather, the dry fishes absorb moisture so rapidly that the fish becomes favourable for infestation by beetles and mites. Besides, in most cases fishes are not dried properly resulting pest infestation.

Curers apply different types of insecticides namely dichlorovs (Trade name 'Nogos' 100 ec), melathion, gamoxine, endrine, DDT etc. on dried fishes to protect the product from infestation disobeying the recommendation made by Codex Alementarias or FAO / WHO Joint Meeting Pesticide Residue Committee (JMPRC).

The insect infestation that need to combat has long been recognized by the fish processors. A literature survey was conducted to find out the use of insecticides on fresh or cured fish or their products; earlier reviews having been undertaken by Blatchford (1962), Taylor and Proctor (1979), FAO (1981), Taylor and Evans (1982) and Walker (1987). Insects infestation during drying, transportation, storage condition and even in marketing is very scanty. In this regard work of Ahmed *et al.* (1988), Ahmed *et al.* (1989), Bhuiyan and Huda (1981), Bhuiyan (1990) and Rezaur *et al.* (1983) on insect infestation is the end.

In Bangladesh dried fishes are important source of low cost dietary protein. At present total fish production is about 1.2 million tonnes, of which 15% of fishes are cured for mass people consumption at the scarcity of fresh fishes. For retailing the dry fish in rainy season it was found that 10-20% of the stored product lost due to insect infestation. This loss inspired the storers for the addition of unapproved insecticide that will cause health hazard in long run. In order to save the mass people from health hazard approved insecticide as well as some preventive measures have to introduce the research activities.

Materials and Methods

In order to determine the magnitude of beetles infestation and subsequent losses during storage were carried out in a well ventilated and clean store at Asadgonj, Chittagong. The experiments were conducted for 12 weeks and each was treated with pirimiphos-methyl at concentration dose of 0.12%, 0.06% and 0.03%, saturated brine solution and dried 'Bishkatali' plants. For comparative study a batch of fish was stored without any treatment as a control. Five experiments and a control were conducted with 25 dried ribbon fish having a wt. of 2.5 kg in each experiment collected from the local market of Chittagong.

In first three experiments fishes were dipped in 0.12, 0.06 and 0.03% emulsion of pirimiphos-methyl in 10 litres of water each for 15 sec. and suspended to drain off excess water for 30 sec.

In fourth experiments fishes were dipped in the saturated brine solution, allowed for 3 hours just to penetrate salt especially in mouth and gill regions where blowfly generally lay their eggs.

In experiment No. 5 fishes were conducted dried 'Bishkatali' plants at a weight of the treated fish.

In the last and 6th experiment fishes were dipped in coastal water that served as control. After dipping fishes were allowed for 1 min. to drain off excess water. Drying was made by keeping the fish inclined toward the sun for 1 hr. and then finally dried in shade before placed them in store / godown.

After storing of 12 weeks, fishes were weighed for each trial and examined for the presence of larvae and adult, dead and alive, larval casts *Dermestes* and *Necrobia* spp. and individually they were counted. The extent of damage was assessed according to the following grading system:

Code:	Observation
O	No sign of damage.
L	Occasional holes and canal cavity in flesh.
M	Numerous holes and canals but flesh not completely eaten.
H	Flesh completely eaten out remaining bones only.

The above regime was taken from the scheme devised and developed for use in Indonesia (Esser *et al.*,1986)and Thailand (Rattagool *et al.*,1988).

Results

The weight and moisture content of the dried fishes treated with 0.12% pirimiphos-methyl were 2550 gm and 19.8% respectively. At the end of storage, the weight was found to

Table 1: Experiment on the effectiveness of the preservation after 12 weeks of infestation in sun dried ribbon fish (*Trichiurus* spp.) stored in godown of Chittagong whole sale dry fish market

Treatment	Weight before storage (gm)	% of moisture content before storage	Weight after storage (gm)	% of moisture content after storage	% of weight change	% of effective weightloss (A) (solid)
Primiphosmethyl 0.12%	2550	19.8	2625	23.3	+2.94	-1.24
Primiphosmethyl 0.06%	2510	20.0	2486	22.9	-0.96	-3.63
Primiphosmethyl 0.03%	2530	18.8	2476	22.6	-2.29	-5.41
Saturated Brine	2610	20.0	2560	24.0	-1.29	-5.46
Dried Bishkatali	2560	18.3	2490	21.8	-2.73	-5.63
Control	2500	18.2	1829	23.0	-26.84	-25.47

(A) Approach to the assessment of losses in Cured fish is given in Appendix

Table 2: Experiment of insects infestation and fish damage after 12 weeks in sun dried ribbon fish (*Trichiurus* spp.)

Treatment	Weight before storage(gm)	Weight after storage (gm)	Number of larvae		Detestes adult		Necrobia adult		% of fish with casts	% of damage fish			
			Dermestes	Necrobia	Alive	Dead	Alive	Dead		O	L	M	H
Primiphos-methyl0.12%	2550	2625	*10	2	2	4	0	1	4	96	4	0	0
Primiphos-methyl0.06%	2510	2486	*28	5	6	6	2	0	16	68	16	16	0
Primiphos-methyl0.03%	2530	2476	53	7	10	4	1	2	64	16	48	24	12
Saturated Brine	2610	2560	30	4	19	1	3	0	52	16	60	20	4
Dried Bishkatali	2560	2490	90	8	13	7	3	0	48	32	20	32	16
Control	2500	1829	*209	19	31	0	9	1	92	0	0	16	84

*Included small larvae likely to have developed from eggs deposited on fish.

O-No damage L-Light damage M-Medium damage H-High damage

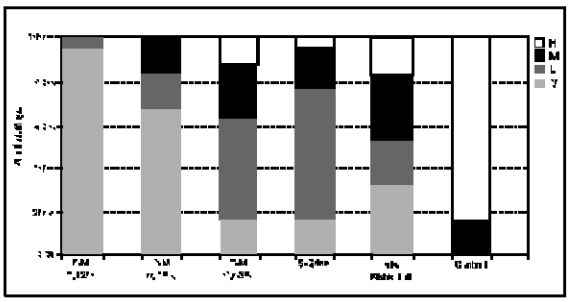

Fig. 1: Fish damage in different treatment (P-M = Pirimiphos-methyl, S-Brine = Saturated brine)

increase 75 gm, consequently the moisture of the fish also increase from 19.8 to 23.3%, which showed a weight change of +2.94% (Table 1). In this treatment two alive and four dead adult *Dermestes* spp. and one dead *Necrobia rufipes* was recorded. The stored fishes under this treatment were very excellent in colour, only 4% fishes with scanty casts (Table 2).

In 0.06% pirimiphos-methyl treated dried fish, the initial weight and moisture content were 2510 gm and 20% respectively, whereas after storage period, the weight and moisture content were found to be 2486 gm and 22.9% respectively (Table 1). Close observation of each dried fish revealed that 16% fishes were light damage and another 16% medium damage (Fig. 1). The combined effect of insects infestation and rising of moisture content leads to a weight change of -0.96% with an effective weight loss (solid) of -3.63%. In this treatment 28 larval *Dermestes* and 5 larval *Necrobia* were found to be present (Table 2).

In 0.03% treatment of pirimiphos-methyl, the initial weight of the dried fishes were 2530 gm and its moisture content was 18.8%. After storage period, the moisture content raised from 18.8 to 22.6%, although the final weight was tended to suffer 64 gm weight loss and the percentage weight change was -2.29% (Table 1). This loss was due to increasing rate of beetles infestation than the above two experiments (0.12% & 0.06% pirimiphos-methyl). The corresponding adult dead and alive were 4 & 10 for *Dermestes* spp. and for *Necrobia rufipes* were 2 & 1 respectively. The degree of damage (Table 2, Fig. 1) 48% were light damaged, 24% medium and 12% were highly damaged. The degree of infestation indicates that the concentration of 0.03% pirimiphos-methyl was ineffective against infestation.

In saturated brine treated dried fish, the initial weight and moisture content were 2610 gm and 20% respectively. At the end of the experiment, moisture content was found 24%, which was higher than the above experimented fish. The brine treatment gave little protection against beetles infestation. So the final weight was lower than the initial which leads to a weight change -1.29% and corresponding effective weight loss (solid) was -5.46% (Table 1). After thorough inspection, the fishes were graded as per degree of damage i.e. 60% were light damaged, 20% medium damaged and 4% were highly damaged (Fig. 1). Here 52% fishes were contaminated with dead skin and casts (Table 2). The excellent rise of moisture content was probably due to the hygro-scopic nature of sodium chloride (NaCl).

The last batch of dried fishes treated with dried 'Bishkatali' herbal plants. The philosophy of this treatment adopted consid ering the indigenous preserving dry Chelli by the rural people. The initial weight of the fish at 18.3% moisture content was 2560 gm. After scheduled storage period, moisture content was found 21.8% and the actual weight was 2490 gm. The insects infestation leads to a weight of -2.73% and an effective weight loss (Solid) of -5.63% (Table 1). The preserving effect of dried 'Bishkatali' against beetles infestation was more or less similar with the dose of 0.03% pirimiphos-methyl treatment.

The untreated control dried fishes were placed in the same premises to find out the comparative degree of control measure of each treatment against insect infestation and also to determine the perpectuation of insect infestation that are

faced by the 'Arothdar' at storage. This control fishes were severely infested and most of the fishes were completely hollowed out by the beetles larvae and some of the larvae have left for pupation. The total appearance of the fishes suggested that the infestation had passed its peak one week previously. All the fishes (92%) had numerous casts (Table 2). Among all the treatment 0.12 and 0.06% pirimiphos-methyl treated fish showed comparatively good result against beetles infestation during storage. The 0.12% pirimiphos-methyl treated fish showed weight change of +2.94% which was economic to the traders. The treatment of 0.12% and 0.06% pirimiphos-methyl may be suggested as a dose of proper treatment.

Discussion

During storage, the untreated ribbon fish suffered due to infestation by *Dermestes* spp. and *Necrobia rufipes* (Table 2). The degree of infestation was reflected in the extent of damage (Fig. 1). The treatment of 0.03% pirimiphos-methyl, saturated brine and dried 'Bishkatali' (*Polygonum hydropiper*) showed more or less same preserving action where effective weight losses were around 5%. In case of untreated control the effective weight loss was of about 25.47%. The treatment of 0.12% and 0.06% pirimiphos-methyl gave better protection against beetles infestation. The damage was less and the larvae were apparently newly hatched. Except 0.12% pirimiphos-methyl treatment, all other treatments showed negative weight change i.e. weight loss due to beetles infestation instead of rising moisture content in storage. The 0.12% pirimiphos-methyl treatment showed positive weight change (+2.94%) due to control effect of 0.12% pirimiphos-methyl and the addition of moisture during storage. Indonesian code of practice, for fresh and cured fish (Walker, 1984b), it was stated that when the air relative humidity is greater than 75% rehydration of dried fish will be obviously happened if the product is not wrapped with polythene or other. This statement is in close agreement with the present finding. FAO (1981) stated the same opinion that in an atmosphere having humidity greater than 60%, the dry fish will tend to pick up moisture, with consequent risk of spoilage.

Walker (1984a) stated that in Malawi, traditional treatment included the use of pepper and powdered leaves of *Bossia senegalensis* and this gave some degree of protection against beetles infestation. In the present storage, experiment with dried 'Bishkatali' plants more or less showed some preserving action against beetles attack. The philosophy to use this plant is that the rural people preserve dried pepper with dried 'Bishkatali'and control some insects infestation.

Rattagool *et al.*(1988) stated that in Thailand, infestation of *Dermestes maculatus* and *Dermestes ater* resulted heavy damage and physical loss of approximately 25% in smoked *Arius* spp. when left in store over 15 weeks. The 0.03% pirimiphos-methyl dip reduced dermestid beetles infestation of salted dried fishes and in both 0.06% pirimiphos-methyl and 0.003% Deltamethrin dip resulted complete protection against beetles infestation for the same period and the moisture content of fish at the end of the experiment was found to be reduced abruptly except in 0.003% Deltamethrin treatment which showed an increment of weight (about 1%) instead of light and medium infestation of 10% and 8% respectively. The present weight loss (25.47%) of untreated control was higher than the above authors and this was due to salt avoiding.

In this study the beetles *Dermestes* spp. appeared as a major insect infesting on dried fish, although *Necrobia rufipes* and mites, *Lardoglyphus* spp. were considered as minor pest. The work of Cole (1963) in Aden, Green (1987) in South Arabia, Aref *et al.* (1965) in Mali, Proctor (1972) in Zambia and Osuji (1973) in Nigeria left little doubt that under present commercial conditions, cured loss of dried fish during the final stage of drying but especially during storage and distribution of the infestation of *Dermestes* spp. was higher. The present observation closely agrees with the authors.

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