

Control of Insect Infestation in Dry Fish by Pyrethrum Treatment on Commercial Containers

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An efficient method for prevention/control of insect infestation in dry fish by the application of pyrethrum is described. Three commercial formulations of pyrethrum available in India, namely, Pyrocon E, Pyrethrum EC and Pyrocolloid were found to be equally useful as insect repellants when emulsions of these in water at a concentration of 0.25% pyrethrins were sprayed at the level of 100 ml m^{-2} (250 mg m^{-2}), on the exterior of the commercial containers with a polythene lining inside. The treatment prevented insect infestation in commercial dry fish for about three months, whereas the controls got infested within a month. The insect-free shelf life for refined and preservative treated dry fish was found to be more than six months when stored in pyrethrum-sprayed containers.

Dried fish is susceptible to infestation by certain species of insects and mites which can cause extensive damage resulting in heavy financial loss. Among these, beetles of the family *Dermestidae* namely, *Dermestes frischii* Kug, *Dermestes ater* Deg, and *Dermestes maculatus* Deg and the red legged ham beetle, *Necrobia rufipes* are the most important (Green, 1967; Proctor, 1972 and Kalaimani *et al.*, 1987). Pillai (1957) has reported the following mites (Arachnidae-Acarina) on stored dry fish in India: *Cheyletus muroi* Hughes; *Suidasia medamensis* Oud, *Lardoglyphus konei* (S and A) and *Glycycometus travancoricus* gen et. sp. n. Kalaimani *et al.* (1987) have recorded the presence of mites belonging to the species *Suidasia nesbetti* on commercial dried fish samples in our country. They have also reported the presence of the beetle *Stegobium panicum*, commonly called the drug store beetle in smoked and dried cat fish and in dried mussel meat. Besides, blowflies of various species capable of breeding on fish are also known to cause great concern. These include *Chrysomya marginalis* Wied (Mc Lellan 1963; Proctor 1972) and *Wohlfartia* spp. Green, 1967). *Piophilha casei* L., the cheese fly has been observed infesting dried fish in

Malawi (Anon, 1963). Somme & Gjersing (1963) have reported that blowflies of *Calliphorinae* spp. are causing serious problems to the production of dried fish or stock fish in Norway.

Some estimates show as high as 50% of the total quantity of dry fish being lost due to insect infestation (Proctor, 1976; Kordyl, 1976). Use of insecticides for direct application on dry fish and fish meal for the prevention of infestation by the above mentioned types of insects has been reported by many workers. (Olley, 1961; Mc Lellan, 1963, 1964; Green, 1967; Somme & Gjersing, 1963; Morris & Andrews, 1968; Taylor & Evans, 1982; Golob *et al.*, 1984). Pyrethrum synergised with piperonyl butoxide (POB) has been the only insecticide which has maximum residue limits (MRL) recommended by the FAO/WHO Joint Committee on Pesticide Residues and most of the work has been confined to the application of this insecticide in dried fish industry (Gjerstad, 1989). The prescribed MRL are 3 ppm pyrethrins and 20 ppm POB. The present work describes trials with three pyrethrum formulations commercially available in India and reports the efficacy of these in preventing/controlling

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infestation by application of appropriately diluted formulations on external surfaces of the containers.

Materials and Methods

Pyrethrum formulations were a gift from M/s. Bombay Chemicals Pvt. Ltd. Commercial dry cured silver belly (*Leiognathus* spp) from the local market was used as such (control) or further processed as per Mathen *et al.* (1990) (treated). Three pyrethrum formulations, Pyrocon E 1:10 (1% pyrethrins and 10% POB), Pyrethrum EC (2% pyrethrins as emulsifiable concentrate) and Pyrocolloid (2% pyrethrin colloidal formulation) were sprayed on gunny bags of 1 kg size, internally lined with 150 gauge

polythene, at various concentrations ranging from 0.0156% to 0.25% pyrethrin using 100 ml spray solution per m² gunny bag surface with a household insecticide sprayer and dried in shade. One kg of control and treated dry fish were packed in treated and untreated gunny bags and observed at regular intervals. Optimum concentration of pyrethrum as found by this experiment were applied on the external surfaces of two commercially used dry fish packaging containers, namely, bamboo baskets and palmyrah leaf baskets @ 100 ml m⁻². Ten kg of control and treated dry fish were packed in sprayed and non-sprayed commercial containers either with or without 150 gauge polythene lining. All the samples were

Table 1. Comparative efficiencies of pyrethrum formulations as insect repellents in the storage of dry fish

Storage in weeks	Commercial pyrethrum formulation used at 0.25% pyrethrum level		
	Pyrocon E.1:10 (with 2.5% POB)	Pyrethrum E.C.	Pyrocolloid
0	Acceptable in all respects	Acceptable in all respects	Acceptable in all aspects
2	No insects. Red attack on a few pieces	No insects seen. No red attack	No red attack or insect infestation noticed
4	Red and fungus attack on a few pieces. No insects seen	Red attack on a few pieces. No insects observed	Red attack. No insects seen
6	"	Red attack intensified. No insects present	Intense red attack. Poor smell and appearance. Slimy appearance
8	"	"	No insects seen
10	"	"	"
12	"	"	"
14	"	"	"
16	"	"	"
18	"	Intense red attack. Two insects were seen	Intense red attack. Foul smell. Sliminess. One larva seen
20	"	Intense red attack. No insects were seen	Intense red attack. Foul smell, wet appearance. Insects not seen
22	Yellowish discolouration also, due to fat oxidation. No insects	"	Intense red attack. Foul smell. Wet appearance. A few insects seen
24	Yellowish discolouration also, due to fat oxidation. No insects	No insects seen. Dull appearance. Unacceptable	Intense red attack. Foul smell. Wet appearance. No insects seen
28	A few insects and their larvae	"	"
32	Many insects and their larvae. Too much powdering. Unacceptable. Discarded	Dull appearance. Too much powdering. No insects seen. Discarded	Dull appearance. Foul smell. Much powdering. No insects seen. Discarded

Table 2. *Incidence of insect infestation in dry fish packed in pyrethrum treated bamboo palmyrah leaf baskets with or without polythene lining and controls*

Storage in weeks	UNTREATED FISH (CONTROL)				PRESERVATIVE TREATED FISH			
	Unlined unsprayed baskets (1)	Lined unsprayed baskets (2)	Unlined sprayed baskets (3)	Sprayed & lined baskets (4)	Unlined unsprayed baskets (5)	Lined unsprayed baskets (6)	Unlined sprayed baskets (7)	Sprayed & lined baskets (8)
0	Good; but less attractive than the pres. treated ones	Good; but less attractive than the pres. treated ones	Good; but less attractive than the pres. treated ones	Good; but less attractive than the pres. treated ones	Very good in all respects	Very good in all respects	Very good in all respects	Very good in all respects
2	"	"	"	"	"	"	"	"
4	Intense red attack blowflies and their larvae in plenty; Discarded	Slight red attack No insects seen	Intense red attack sliminess No insects seen	Slight red attack No insects seen	"	"	"	"
6		Intense red attack. Blowflies and their larvae, dis- carded	Intense red attack. Poor appear- ance. No insects seen	Intense red attack. Poor appear- ance. No insects seen	"	"	"	"
8			Intense red attack. Foul smell. Many insects seen Discarded	"	A few insects seen. No red attack	"	"	"
10				"	"	"	"	"
12				Intense red attack Many insects seen Discarded	Many insects seen. Very slight red attack	"	"	"
14					"	"	"	"
18					"	"	A few insects seen on the surface	"
22					Slight red attack. Many insects both dead and alive Discarded	No insect seen	A few insects and their larvae seen	No insects
26						No insects seen. Yellowing due to fat oxidation	No. of insects not increased Yellowing due to fat oxidation	No insects Yellowing due to fat oxidation
30						Yellowing intensified No insects seen. Poor appearance	Yellowing intensified A few insects Poor appearance	Yellowing intensified No insects seen Poor appearance
36						"	"	"
42						Poor appear- ance. No insects seen Discontinued	Poor appear- ance. No insects seen Discontinued	Poor appear- ance. No insects seen Discontinued

stored at ambient conditions (25-35°C, 62-98% RH) and observed for insect infestation and other quality parameters.

Results and Discussion

The results of storage studies of dry fish in gunny bag containers are presented in Table 1. It can be seen that all the three commercial formulations of pyrethrum were more or less equally effective in repelling insect infestation. Based on the insect-free shelf life, pyrethrum sprayed at the level of 0.25% was found most suitable for application. This level of concentration in the case of Pyrocon E 1:10 also contained 2.5% POB. Results of the shelf-life studies of dry fish packed in traditional dry fish containers treated with pyrethrum are presented in Table 2. The commercial cured/dried fish lasted for less than 4 weeks in untreated commercial containers. Lining the palmyrah leaf/bamboo baskets with polythene sheets extended the shelf life beyond 4 weeks. By treating the baskets with pyrethrum the dried fish remained insect free for 6 weeks. With both polythene lining and pyrethrum treatment the commercial cured/dried fish were insect free for 10 weeks. However, all the commercial samples were subject to red attack by 4 weeks which progressively worsened with storage. By treating the commercial samples with preservatives and refining, the red attack was almost completely overcome. However, insect infestation appeared by 8 weeks in untreated, unlined containers. Blatchford (1962) had pointed out that insecticidal treatment of containers could taint or contaminate the contents and had suggested that such problems could be avoided by lining the treated containers with polyethylene or similar material. The use of polyethylene lining by itself was found sufficient to deter insect attack, but this benefit would not accrue under commercial conditions where the physical barrier of polythene is easily pierced (Kalaimani *et al.*, 1987).

In this experiment, insect infestation appeared in treated containers without polythene lining by 18 weeks. But lining of

the treated containers eliminated all insect infestation and the samples were finally found unacceptable due to yellow discolouration after 26 weeks. The polythene lining, though not immune to piercing prevents direct contact between pyrethrum in treated baskets and dried fish, thus minimising pyrethrum residues in the samples.

Since the concentration of pyrethrum employed in this study works out to only 0.025 mg. cm⁻² of the outer surfaces of the containers, the chances of the insecticide accumulating in the dried fish through the polythene barrier beyond the maximum residue limits of 0.3 ppm pyrethrum are negligible. Hence, under commercial conditions the bags used for packing dry fish may be lined with polythene and treated with pyrethrum to safeguard against insect infestation.

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