

Effect of some Vegetable Oils on Insect Infestation during Storage of Dry Cured Fish

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Twelve vegetable oils, viz., gingelly oil, sunflower oil, safflower oil, palm oil, rice bran oil, castor seed oil, mustard oil, groundnut oil, neem oil, hydnocarpus oil and cashewnut shell liquid were studied for their insect repellency in dry cured fish. Gingelly oil, mustard oil, sunflower oil, and hydnocarpus oil were found to possess insect repellency whereas palm oil attracted insects. Gingelly oil, mustard oil and sunflower oil delayed infestation with blowflies whereas hydnocarpus oil was good against both blowflies and beetles. It was observed that blowflies were prevalent during rainy season and beetles during non-rainy season. The preservative treatment for cured fish with a mixture of calcium propionate, butylated hydroxy anisole and chlorine was effective in delaying insect infestation in addition to preventing red.

Insect infestation of dried fish whether salted or not is a major cause of deterioration during their storage. Heat treatment above 50°C followed by packing in insect proof containers and treatment with insecticides of low toxicity are the two methods so far shown to be effective to reduce/prevent insect infestation of cured fish at least under laboratory conditions (Anon, 1978). The insect repellent property of gingelly oil and cashewnut shell liquid has been traditionally utilized by Kerala housewives in preserving pickles. Addition of a few split cashewnut shells to mangoes preserved in brine and covering the mouth of the jars in which pickles are stored with a cloth sprayed with gingelly oil are age old methods, thus followed. There are a few reports on the use of vegetable oils as insect repellents of green gram (Verma & Pandey, 1978, Pandey *et al.*, 1981; Gupta *et al.*, 1988). However there is no report on the use of vegetable oils as insect repellents for dried fish. This paper reports the results obtained when twelve vegetable oils were studied for their probable insect repellency in dried fish.

Materials and Methods

The vegetable oils used in this study were cashewnut shell liquid (CNSL)

coconut oil, neem oil, palm oil, gingelly oil, mustard oil, sunflower oil, safflower oil, castor seed oil, rice bran oil, ground nut oil and hydnocarpus oil. Commercially dry cured silver belly after further drying was used in all experiments, unless otherwise stated. Washed, cleaned and dried second hand gunny bags were the packaging material. The gunny bags were of size 30x30 cm. Each oil (8-10 g on one side of the bag) was sprayed on one or both sides of the bag and also on the fish using a hand sprayer. Unsprayed fish in untreated gunny bags served as the control. In each bag one kg of fish was packed. All the bags were stored in the laboratory and observed for insect infestation at regular intervals. When the total number of insects in different stages of growth exceeded ten in number, that sample was discarded. Cashewnut shell was not sprayed on the fish.

All the vegetable oils mentioned, except CNSL were compared on commercial cured silver belly from the same lot dried to different moisture levels to study the effect of moisture on insect infestation in presence of the oils.

Gingelly oil and sunflower oil were compared on eight species of commercial cured fish namely oil sardines (*Sardinella lon-*

giceps), lesser sardines, shark, mackerel (*Rastrelliger kanagurta*), sole (*Paraplagusia bilineata*) lactarius (*Lactarius lactarius*), Anchovies (*Stolephorus* spp.) and silver belly (*Leiognathus* spp.).

Anti-red and anti-insect treatments were tried in one step by incorporating gingelly oil at 10, 20 and 30 ml per kg of fish in the anti-red treatment solution (Mathen *et al.*, 1990).

The effect of preservative treatment on insect infestation was studied by packing and storing both commercial and preservative treated silver belly in gunny bags sprayed with hydnocarpus oil on the outside. In one case the effect of spraying gingelly oil, mustard oil or hydnocarpus oil on the preservative treated fish and packing them in gunny bags sprayed with hyd-

nocarpus oil was studied. Preservative treatment was done by first refining the commercial dry cured silverbelly by three consecutive washings in three changes of saturated sodium chloride brine. The refined fish was dipped for 2-5 min in a solution of 5% calcium propionate and 0.5% butylated hydroxy anisole in saturated sodium chloride brine containing 100 ppm available chlorine. The dip treated fish was drained overnight and dried in the sun for six and ten hours to get two different moisture levels in the product.

Results and Discussion

Table 1 shows the data on insect repellency of individual vegetable oils when they were tested on separate lots of cured silver belly. The data are not strictly comparable as each oil was tested on a different lot of

Table 1. Comparative insect repellancy of vegetable oils in cured fish

Vegetable oil tested	Period of test	Moisture %	NaCl % (MFB)	Insect control	free shelf Life, weeks treated	Insect repellency coefficient
Cashewnut shell liquid (CNSL)	June-Oct.	38.3	23.4	8	20	2.5
Coconut oil	Oct.-Aug.	27.4	23.7	24	40	1.72
Mustard oil	June-Oct.	31.3	35.0	4	40	10.0
Gingelly oil	June-Aug.	31.3	35.0	4	8	2.0
Neem oil	June-Aug.	29.0	36.3	7	7	1.0
Hydnocarpus oil	June-Oct.	31.3	35.0	4	16	4.0
Palm oil	Nov.-Feb.	35.8	32.7	20	16	0.8
Rice bran oil	Nov.-Apr.	35.5	30.9	14	24	1.7
Sunflower oil	Oct.-Aug.	32.3	30.9	15	40	2.7
Safflower oil	Nov.-Feb.	35.9	18.0	11	14	1.3
Groundnut oil	Nov.-Feb.	34.7	24.0	12	2	1.0

MFB = Moisture free basis

Table 2. *The shelf life in weeks of dry cured silver belly with different moisture levels treated with individual vegetable oil (total number of insects are given in the bracket)*

Moisture %	38	31	28	25	37	35	27	20
Details of samples	A; Shelf life, weeks				B; Shelf life, weeks			
Coconut oil	10(14)	18(26)	16(11)	24(2)	16(11)	12(16)	24(20)	20(31)
Mustard oil	22(1)	12(10)	22(1)	22(8)	24(9)	24(9)	24(17)	16(24)
Gingelly oil	14(10)	14(11)	14(4)	15(11)	24(13)	24(17)	24(16)	20(23)
Neem oil	2(12)	22(0)	16(16)	16(14)	24(4)	16(8)	24(1)	24(22)
Hydnocarpus oil	22(4)	22(0)	12(16)	22(3)	24(2)	24(1)	24(4)	24(10)
Palm oil	10(10)	16(17)	22(11)	12(15)	8(2)	8 (22)	24(20)	8(24)
Rice bran oil	16(14)	12(18)	22(6)	16(10)	24(8)	16(12)	20(8)	12(43)
Safflower iol	10(11)	22(4)	7(29)	12(12)	20(5)	24(17)	24(31)	24(55)
Sunflower oil	10(10)	12(10)	12(13)	12(10)	20(11)	24(27)	24(31)	24(31)
Castor seed oil	10(12)	10(12)	12(10)	10(11)	20(7)	24(13)	14(8)	16(34)
Ground nut oil	12(16)	14(14)	12(12)	14(17)	24(17)	14(15)	24(34)	24(35)
Control	6(11)	10(12)	12(10)	10(10)	24(23)	24(23)	24(23)	16(27)

fish. They are considered here after calculating the insect repellency coefficient, i.e. the maximum insect free period of the treated fish divided by the maximum insect free period of the control. A coefficient of more than one indicates that the oil has some insect repellency. The results show that the insect repellency is the highest for mustard oil followed by hydnocarpus oil, sunflower oil, CNSL, gingelly oil, coconut oil, rice bran oil, safflower oil, castor seed oil and ground nut oil. Only palm oil was negative, i.e. it attracted insects. Rice bran oil attracted ants, mustard oil caused slight discolouration of the treated fish. CNSL delayed red attack by a month and caused odours in the fish.

Table 2 shows the results on the comparison of the eleven vegetable oils with

respect to their efficacy to retard insect infestation in dry cured silver belly of four different moisture levels. These results show that hydnocarpus oil, gingelly oil and mustard oil afford protection from insects. The experiments in 'A' were carried out in the rainy season from June-September, when blowflies were the major insects observed. The differences in the initial moisture contents levelled off after 2-4 weeks of storage. Experiment 'B' was carried out during the non rainy season from October to April, and the insects were mainly beetles. Beetle infestation was more in the fish with less moisture. The best repellency towards beetles was afforded by hydnocarpus oil followed by neem oil. But neem oil has a nauseating odour which makes its use almost impossible as the odour is picked up by the fish in the gunny bag.

Table 3 depicts the data on the total number of insects in eight species of fish treated with gingelly oil and sunflower oil during storage upto 6 months. Only beetles were encountered. The number of beetles in the treated samples was only slightly less than that in the control samples. Thus the effect of gingelly oil and sunflower oil to repel beetles was only marginal. However these oils were ineffective in lesser sardines and anchovies. In silver belly and oil sardines,

Table 3. *Insect counts in gingelly oil and sunflower oil treated cured fish after six months during test period from January to July.*

Fish species	Control	Gingelly oil	Sunflower oil
Silver belly	28	19	5
Lactarius	16	7	13
Sole	12	6	28
Shark	6	4	4
Lesser Sardines	14	19	15
Oil Sardines	10	5	2
Mackerels	15	5	5
Anchovies	12	20	18
Total	113	85	90

sunflower oil was slightly efficient, whereas in lactarius and sole gingelly oil was superior to sunflower oil. Both the oils had the same effect in mackerel and shark. After 7 months all the control samples were discarded due to blowfly infestation, whereas those treated with the oils were free of blowflies. These results confirm the observation that gingelly oil and sunflower oil repel blowflies, but not beetles to the same extent.

Results in Table 4 show that refining and preservative treatment itself delayed insect infestation probably by removing the ova of insects by the washing process or by the action of the chemicals or both. Spraying the gunny alone with hydnocarpus oil

Table 4. *Insect free shelf life (weeks) of silver belly treated with hydnocarpus oil*

	Commercial		Preservative treated	
Moisture %	36	34	38	33.5
Packed in control	6	12	14	16
Packed in oil sprayed gunny	6	12	14	14
Both fish and gunny sprayed with oil	12	12	18	1

delayed infestation in unrefined samples, whereas refining and preservative treatment afforded additional protection. The insect free storage period can be trebled by the treatment and spraying of hydnocarpus oil on the outside. The observation that refining and preservative treatment extends insect free period is also evident from results in Table 5.

Table 5. *Number of insects in preservative and oil treated dry fish at different moisture levels during the test period November to July*

Moisture %	33.8	27.6	23.1	19.3
Control gunny	2	1	1	0
Gingelly oil on fish/hydnocarpus oil on gunny	1	4	0	2
Mustard oil on fish/hydnocarpus oil on gunny	2	1	0	6
Hydnocarpus oil on fish and gunny	1	2	4	1

Month wise distribution of blowflies and beetles is shown in Table 6. These data show that the least prevalence of insects is during September to December probably due to

Table 6. *Month wise distribution of blowflies and beetles in cured fish*

Month	Blowflies	Beetles (small)	Beetles (large)
January	-	+++	-
February	-	+++	-
March	-	+++	-
April	-	+++	-
May	-	+++	-
June	+++	++	++
July	+++	+	+
August	+++	+	-
September	+	+	-
October	+	-	-
November	-	+	-
December	+	++	-

+++ = many; ++ = some; + = few;

- = not present

the slightly lower atmospheric temperature and relative humidity. During the dry season from January to May beetles are the only insects whereas during the rainy season from June to August blowflies predominate. During June, July and August

a larger size beetle is also observed. They usually appear with the first rains in May. It is also observed that of the insects infesting cured fish blow flies cause extensive damage to the fish. They multiply rapidly and live for only nearly three weeks. Beetles live longer, upto 3 months, multiply slowly and cause less damages to the fish.

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