



Development of preventive measures against insect infestation in dried fish

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Abstract. The present study was conducted on insect infestation and develops preventive measures of dried fish during July 2017 – June 2018. Six treatments (T₁ as control, T₂, T₃, T₄, T₅ and T₆) were conducted to assess magnitude of infestation and to develop preventive measures to combat the blowfly infestation of the dried punti fish (*Puntius sp.*) by treating with net, salt, chili powder and turmeric powder. Experiments were done in same temperature, humidity and sunlight (within six days). It was observed that two types (1. *Musca domestica* and 2. *Phormia regina*) of flies landed over the fishes after 30-45 minutes kept for drying as there was no dressing of the fishes and no using of nets. After completing the life cycle the blow fly left the fish body and flew away. Finally dry fishes were lost their weight. In this study the protein, lipid, ash and moisture content of *Puntius sp.* in dried condition ranged from 68.90±1.20% (T₆) to 73.20±2.80% (T₅), 6.90±0.80% (T₄) to 8.90±0.80% (T₆), 7.90±0.30% (T₁) to 8.70±0.80% (T₆) and 8.90±0.30% (T₁) to 9.20±0.50% (T₄). Protein and lipid contents were significantly varied from each other and there was no significant difference among the six treatments in case of ash contents and moisture contents. T₅ shows better result on the basis of chemical test.

Keywords: Insect infestation, Dry fish

Introduction

Fish has traditionally been a staple food in Bangladeshi diet, playing a vital role especially in the diet to low-income rural households, accounting for about 60% of animal protein intake (DoF 2018). Dried fish is one of the major fisheries products in Bangladesh. Now a day dried fish are marketed in large quantities in the towns and cities and getting increasing popularity due to its nutrition value and availability round the year. Dried fish is susceptible to infestation by certain species of insects and mites during drying and storage which can cause extensive damage resulting in heavy financial loss (Kalaimoni *et al.* 1987). In Bangladesh, during drying fishes are attacked by several species of blowflies, viz., *M. domestica*, *P. regina* and mite *Necrobia rufipes* (FAO 1981, Nowsad 2005). Some estimates show as high as 50% of the total quantity of dry fish being lost due to insect infestation (Kordyl 1976). Nowsad (2005) stated both insects and insecticides comprise about 60% of total dried product that is unfit for human consumption. In some countries, cheap domestic and agricultural insecticides are used by fish processors and sellers. Frequently, however, extremely hazardous compounds are employed which are dangerous to consume. Some researchers have worked about insect infestations on dried fishery sectors such as Khan and Khan (2002), Nowsad (2007) and Flowra (2013). But there is no such research works has been done particularly on insect infestation and preventive measures in Chalan beel area. Therefore, the present study is designed to study different preventive measures against insect infestation of dried fish (*Puntius sp.*) of Chalan beel area.

Materials and Methods

Species selection and collection of the samples: Based on the previous record of traditional fish drying processes and availability of fishes, Singra Upazila of Natore was considered for the

collection of the species for this study. To carry out the experiments, *Puntius sp.* was selected which is most available and popular dried fish to the people of Bangladesh. Fresh and raw samples were collected from Singra bazar, Natore and bring to the laboratory of Department of Fisheries for the further investigation.

Experimental design: The study was conducted under six treatments. Treatment-1 (T₁) no preservatives were used, fishes were not dressed; net was not used and kept for drying in open air. This treatment was considered as a control. Treatment-2 (T₂) fish were washed with clean water but not gutted and scaled, kept for 1 minute to drain off water. Net was used during drying. Treatment-3 (T₃) fishes were washed with clean water but not gutted and scaled, kept for 1 minute to drain off water. Then mixed with salt (1:0.1) and kept at sunlight for drying. Net was not used during drying. Treatment-4 (T₄) fishes were washed with clean water but not gutted and scaled, kept for 1 minute to drain off water. Then mixed with chili powder and kept at sunlight for drying. Net was not used during drying. Treatment-5 (T₅) samples were washed with clean water, gutted, scaled, and kept for 1 minute to drain off water. Then mixed with turmeric powder and kept at sunlight for drying. Net was not used during drying. Treatment-6 (T₆) fishes were washed with clean water, gutted, scaled, and kept for 1 minute to drain off water. Then mixed with both chili and turmeric powder and kept at sunlight for drying. Net was not used during drying. The experiment was carried out during July 2017 to June 2018.

Determination of temperature and humidity: Temperature and humidity of the nature during study period were determined. Temperature was determined by thermometer and humidity was determined by Hygrometer.

Organoleptic test: An organoleptic test was drawn by a panel of eight members including teachers and students and all the dried fishes were served to the test panel and appearance, colour, odour, texture were determined by using hedonic scale of 1 to 8 and the dried fishes were rated as 8 for excellent, 7 for good, 6 for acceptable and below 4 for poor or unacceptable.

Determination of proximate composition: Protein content in the fish was determined by the method of Lowry *et al.* (1951). Lipid and ash content of the fish was estimated by the methods of AOAC (1980). Moisture content was determined by standard IUPAC method (1977).

Determination of others particle: Others particles are estimated by the following way. Such as:
Others particle = 100 - % of total proximate composition

Data analysis: All the experimental data were analyzed by using a computer program MS Excel. One-way analysis of variance (ANOVA) was also done and values were presorted as the mean and standard deviation of triplicate determinations. This statistical analysis was performed with the support of the computer software SPSS (statistical package for social sciences 20.0 software) and the significance was defined at $p < 0.05$.

Results and Discussion

Temperature and humidity: In the present study six treatments were carried out for developing effective preventive measures against insect infestation. Experiment was done in same temperature, humidity and sunlight. The temperature of the air in the laboratory of the study period varied from 26.7 ± 0.02 to 33.05 ± 0.03 and the humidity varied from 68.03 ± 0.01 to 91.03 ± 0.01 (Table I) and the drying duration was 6 days.

Table I. Temperature and humidity of the study period

Treatment	Temperature ($^{\circ}\text{C}$)	Humidity (%)
Day-1	26.7 ± 0.02	91.03 ± 0.01
Day-2	28.17 ± 1.03	85.01 ± 0.04
Day-3	28.01 ± 0.11	81.12 ± 0.01
Day-4	27.04 ± 0.01	89.03 ± 0.02
Day-5	30.02 ± 0.01	79.01 ± 0.03
Day-6	33.05 ± 0.03	68.03 ± 0.01

According to Jahan (2015), in the drying period of six freshwater fish, the temperature varied from 26.30 to 34.45°C which is strongly agreed with the present study. In case of humidity it was varied from 84 to 86.25% (Jahan 2015) which is within the range of the present study. The time duration of drying of fishes and small prawns varied from 3 to 6 days (Jahan 2015). Haq (2005) also stated that the duration of time varied from 5-7 days. Those findings are more or less similar with the present study.

Infestations of the dried fish: T1 was used as a control for the comparison with other treatments. observed that different types of flies and beetles landed over the fishes after 30-45 min kept for drying. In that treatment, dressing was not done and net was not used during drying of fish. Mainly two types of flies were identified in the study (Plate 1). Such as: 1. *Musca domestica* (Fig. 1) and 2. *Phormia regina* (Fig. 2).



Plate 1: Blowfly landing over the fish



Fig 1. *Musca domestica* (Ref:
Classification:
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Diptera
| Family: Muscidae
Genus: *Musca*
Species: *M. domestica*



Fig 2. *Phormia regina* (Ref:
Classification:
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Diptera
| Family: Muscidae
Genus: *Phormia*
Species: *P. regina*

In treatment -2, there was no infestation of blowflies as the fishes were washed and covered with net it might be happened due to using net. Sunny weather was also helpful to prevent the insect infestation. But there was no use of any preservatives in that treatment. Better result was found in that treatment comparing to the control (T_1). In T3, no infestation by any fly was observed. The treated fishes did not produce any bad smell during drying. Here, salt might be function as a preservative so that infestation didn't occur. This treatment also showed better result than that of control (T_1). In T4, no infestation was occurred by any insect. The treated fishes also did not produce any bad smell during drying. Here, red chilli might be function as a preservative so that infestation didn't occur. The result of T4 is better than the control (T_1) In T5, no infestation by any insect. The treated fishes did not produce any bad smell during drying. In this treatment, turmeric powder might be function as a preservative so that infestation didn't occur where in control (T_1) no preservative was used and fishes were infested by 2 types of insect. In T6, no infestation by any insect was observed. The treated fish did not produce any bad smell during drying and the dried fishes were glassy and produce normal fishy odour. Here both chilli and turmeric powder might be function as a preservative so that infestation didn't occur. Due to use of two preservative better results were got in this treatment than that of control (T_1).

Organoleptic test of the experimented dried fish product: After drying an organoleptic test was made of different parameters such as appearance, colour, odour and texture for observing the quality of the dried fish. The results of organoleptic test were shown in Table II.

Table II. Average organoleptic parameters of the experimental dried fish

Treatment Parameter	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Appearance	2.93±1.57	6.44±0.50	7.00±0.93	6.38±0.74	8.06±0.94	7.00±0.94
Colour	3.13±1.36	6.39±0.52	6.64±0.52	6.38±0.52	7.50±0.71	6.50±0.53
Odour	2.88±1.64	6.50±0.54	6.75±0.46	6.56±1.18	8.06±0.78	7.50±0.71
Texture	2.88±1.64	6.50±0.54	6.75±0.46	6.55±1.18	8.06±0.78	7.00±0.94

Here, 8 for excellent, 7 for good, 6 for acceptable and below 4 for poor or unacceptable

According to the justification of panel members the results of organoleptic parameters (appearance, colour, odour and texture) were highest in T₅ where the fishes were dressed, covered with net and used turmeric powder. Among all the treatments the highest value of appearance was found in T₁ (turmeric powder were used as preservative). The value of appearance of T₅ (8.06±0.94) was excellent and T₁ (2.93±1.57) was poor or not acceptable, T₂ (6.44±0.50) and T₄ (6.38±0.74) was acceptable and T₃ (7.00±0.93) was good. The colour of experimental dried fishes was found highest in T₅ (7.50±0.71) and lowest T₁ (3.13±1.36), good in T₂ (6.38±0.52) and T₃ (6.64±0.52) but acceptable in T₄ (6.38±0.52). Therefore we can say the colour in T₅ is also higher among the other treatments. The odour of T₅ (8.06±0.78) was excellent. Odour was good in T₃ (6.75±0.46) but acceptable in T₂ (6.50±0.54) and T₄ (6.56±1.18). The texture was excellent in T₅ (8.06±0.78) but unacceptable in T₁ (2.88±1.64) and good in T₂ (6.50±0.54), T₃ (6.75±0.46) and T₄ (6.55±1.18). Here, also T₅ showed better result. Turmeric powder may be more practiced preservative instead of red chili powder. Nowsad et al. (2010) reported that the turmeric powder has pesticide effect. So, the processors should practice the preventive measures.

Proximate composition: Protein, lipid, ash and moisture of the studied species (dry matter basis) were analyzed which is presented in Table III. .

Table III. Proximate composition of the selected species (dry matter basis) in different treatments

Treatments	Protein (%)	Lipid (%)	Ash (%)	Moisture (%)	Others (%)
T ₁	69.50±1.20 ^a	7.70±0.50 ^a	8.40±0.50 ^a	9.10±0.60 ^a	5.3
T ₂	71.60±0.80 ^b	8.10±0.20 ^a	7.90±0.30 ^a	8.90±0.30 ^a	3.5
T ₃	70.70±0.90 ^c	8.80±0.70 ^b	8.20±0.30 ^a	8.90±0.60 ^a	2.5
T ₄	72.10±1.10 ^{ab}	6.90±0.80 ^c	8.30±0.40 ^a	9.20±0.50 ^a	3.5
T ₅	73.20±2.80 ^b	7.10±0.30 ^{ab}	8.40±0.50 ^a	8.90±0.60 ^a	2.4
T ₆	68.90±1.20 ^d	8.90±0.80 ^b	8.70±0.80 ^a	9.10±0.20 ^a	4.4

Data are expressed as mean ± standard deviation. Values (Mean±SD) with different superscripts in columns are significantly different at $p < 0.05$.

Protein: In this study in terms of protein content of *Puntius sp.* in dried condition ranged from 68.90±1.20% (T₆) to 73.20±2.80% (T₅). According to Qudrat-i-khuda *et al.* (1962) the range of protein content varied from 44 to 71% and 55% to 74.18% in Indian different dried fish species, which is more or less similar with the present study. Hoq (2004) reported that sun dried fish contains up to 60-80% of protein. Nowsad (2007) studied bio-chemical assessment of

fourteen selected dried fish and observed that protein content 40.46-68.09%. In this study the protein content among six experiments, lowest was found in at 'Treatment 6' which is $68.90 \pm 1.20\%$ was done with both turmeric and chili powder and highest in 'Treatment 5' which is $73.20 \pm 2.80\%$ was done with only turmeric powder. T₅ showed better result. Protein contents of different treatments were significantly varied from each other. It may be happened due to use of different types preservatives.

Lipid: In this study it was noticed that lipid content of *Puntius sp.* in dried condition ranged from $6.90 \pm 0.80\%$ (T₄) to $8.90 \pm 0.80\%$ (T₆). De (1967) reported that the proximate composition of sun dried and beheaded fresh water fished was found to be 6.8% of fat respectively which is more near with the present study. Islam (1982) studied the proximate composition of traditionally dried Rohu fish and observed the lipid 5.27%. In this study the, lowest lipid content was found in 'Treatment 4' ($6.90 \pm 0.80\%$) which was done with chilli powder and highest in 'Treatment 6' ($8.90 \pm 0.80\%$) which was done with both chilli and turmeric powder. Lipid contents of different treatments were significantly varied from each other. This result may be due to the use of different types of preservatives.

Ash: In this study in terms of ash content of *Puntius sp.* in dried condition ranged from $7.90 \pm 0.30\%$ (T₁) to $8.70 \pm 0.80\%$ (T₆). De (1967) reported that sun dried fresh water fishes contains 5.2% ash respectively. Hussain *et al.* (1992) stated that the ash content varied from 1.4 to 21.6% in 23 different dried species. Kalaimani *et al.* (1988) conducted an experiment at four fish drying yards on the species used, drying practices and the quality of the dried products Ash (1.4% to 21.6%) content varied widely over the 23 species analyzed. The ash content of those different six experiments, lowest was observed in 'Treatment 1' ($7.90 \pm 0.30\%$) which was done without any preventive measure and highest was in 'Treatment 6' ($8.70 \pm 0.80\%$) which was done with both chili and turmeric powder. Ash contents of different treatments were not significantly varied from each other.

Moisture: In this study the Moisture content of *Puntius sp.* in dried condition ranged from $8.90 \pm 0.30\%$ (T₁) to $9.20 \pm 0.50\%$ (T₄). Rahman *et al.* (1978) reported that the moisture content of sun dried Rohu fish was 9.8% which is almost similar with the present study. According to Mansur *et al.* (2013) the moisture content of *C. striatus* was 19.17%. Nurullah (2005) reported that the moisture content of the dried fishes ranged from 14.38 to 18.48%. Mollah *et al.* (1998) studied the seasonal variation of the proximate composition of dried *Rita rita* and found the highest amount of moisture was 17.84%. In this study lowest moisture content was varied from 'Treatment 1' ($8.90 \pm 0.30\%$) which was done without any preventive measure and highest was found in 'Treatment 4' ($9.20 \pm 0.50\%$) which was done with only chili powder. Moisture contents of different treatments were not significantly varied from each other.

The result shows that *M. domestica* and *P. regina* are the most common insects which done infestation in fish during drying. On the basis of the organoleptic test and result of protein it is indicated that turmeric powder (T₅) shows better result where fishes are dressed and covered with net during drying and turmeric powder used as preservatives among six treatments against insect infestation. Some of the treatments are significantly differ and some of them are not significantly differ from each other. It can be also concluded that the processors will inspire to use preservatives as preventive measure against insect infestation and the result of the research work also will act as baseline data from researchers who would be interested in processing dried

fishes in home as well as industrial atmosphere and consumer can get hygienic, safe and quality dried fish.

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