Journal of Food Technology 4(3): 213-215, 2006

Spoilage Effects of Insects Infestation on Some Shrimp Species During Storage in Ondo State of Nigeria

Bello-Olusoji, O.A., [1]F. Ajani and M. Omosekeji
Department of Fisheries and Wildlife, Federal University of Technology, Akure, Nigeria
[1]Department of Animal Science and Fisheries Management, Bowen University, Iwo, Nigeria

Abstract: Quantitative spoilage effects of insects infestation on three processed shrimp species; *Parapenaeopsis atlantica, Parapenaeus longirostris and Macrobrachium macrobrachion*, collected from Oba's market in Akure metropolis were evaluated. Fresh oven-dried specimens were weighed and distributed into three groups, each group with three replicates. Adult and larvae of *Dermestes maculatus, Laeloglyphus* sp. and *Necrobia rufipes* were collected from spoilt dried shrimp samples obtained from the same market. *D. maculates* was introduced (two insect adults and four larvae) into the containers containing the freshly-dried shrimps in triplicate and the last container was used as control in each group. Level of insect damage was evaluated on weekly basis for eight weeks. Weight of samples decreased as from the fourth week from the initial mean weight of 15g to 13.63g±1.15, 13.65±1.36 and 14.21±1.08 for *P. longirostris*, *P. atlantica* and *M. macrobrachion,* respectively. On the eighth week, some of the specimens were totally damaged by the insects. The effects of insect activities were very low in *P. longirostris* with a longer shelf life than other shrimp during storage.

Key words: Insects infestation, shrimp species

INTRODUCTION

Many shrimps are found in Nigeria coastal water such as *Farfantepenaeus notialis* (pink shrimps) *Penaeus setiferus* (white shrimps) *Parapenaeopsis atlantica* (guinea shrimps) *Parapenaeus longirostris* (red-shrimps) and *Melicertus kerathurus* (brown shrimps) (Bello-Olusoji and Oke[1] etc. The freshwater prawns consisted of the well known *Macrobrachium* species such as *Macrobrachium vollenhovenii, M. macrobrachion, M. Felicinum, M. dux* etc. Bello-Olusoji *et al.*[2].

In aquaculture, a lot of attention had been devoted to fish and fish products with little emphasis placed on shell fish production. Shrimps and prawns serve as source of income and source of protein to human and livestock[3]. The waste products can also be used as a animal feed ingredients.

Spoilage is one of the major problems in fishing industry. Losses of fish products due to spoilage have been estimated to be up to 50% in some production areas of Nigeria[4]. Insect infestation on dried fish during storage leads to substantial losses at the range of 50%. These insects are *Dermestid maculatus*, *Necrobia rufipes* and *Lardoglypus* sp. *N. rufipes* has its peak during cool-wet season while *D. maculatus* has its peak under warm-dry condition. Shrimps after harvesting, are processed into different forms, such as frozen to canned products. Poor handling, irregular power supply, ineffective processing equipments and poor storage facilities[5] can lead to spoilage and wastage.

A lot of works has been done on fish spoilage at different storage and processing methods, including insects infestation, microbial infestation and pest of fishes in storage, but there is little or no information whatsoever on insect spoilage of shrimps including its bacteria characteristics behaviour.

MATERIALS AND METHODS

Collection site/collection of specimen: Freshly dried shrimps were purchased from Oba's market in Akure, Nigeria in December, 2004 and transported to the Department of Fisheries and Wildlife's laboratory, Federal University of Technology, Akure. The samples were weighed using Mettler balance, (PM 460); shrimps of equal weights were distributed into nine plastic containers (15g per container). The containers were assigned to three groups each with three replicates. Two adult *D. masculatus* and four larvae were introduced into each container, covered with netting materials bounded with the rubber band (for ventilation and to prevent the escape of the insects) and kept at room temperature of 28.5°C. Freshly oven-dried shrimps free from insect infestation in the laboratory were kept at 15 g per container in

Corresponding Author: Bello-Olusoji, O.A.,Department of Fisheries and Wildlife, Federal University of Technology, Akure, Nigeria

triplicates, while insect spoilt shrimps were also kept in triplicate at 15 g/container. The containers were later arranged on a wooding rack in a well ventilated storage room for observation and measurement on weekly bases for eight weeks at room temperature (28.5°C). At the end of the 8th week, adult insect population in each group was estimated using counter along with the larvae. Data were analyzed using Anova test and regression analyses.

RESULTS

The initial weight, final weight and moisture contents of the various shrimp species are shown in Table1. At the end of the experiment, the weight of *P. atlantica* shrimps decreased to 10.95g and the percentage of moisture increased to 16.38%. T *P. atlantica* had the highest weight change of 27.11% decrease with 67.2% damaged level, this was followed by *P. longirostris* with 22.81% weight decrease and 41.5% damaged. The least damaged was the *Macrobrachium species* with 22.7%. At the end of the experiment; the weight of prawn decreased while the moisture content increased resulting into percentage weight change of 12.13% (Table 1).

The number of larvae recorded ranged between 2 and 91, while the number of adult beetle increased from 2 to 47 (Table 1). Adult beetle increased in number from 2 to 5 while that of larvae decreased from 6 to 3 (Fig. 1). The least number was recorded in the prawn specimens. The number of adult beetle did not change at the end of the experiment while that of larvae decreased from 6 to 4, (Table 2). At the end of the storage, the weight of spoilt shrimps increased while moisture content increased giving a percentage weight change of 1.20%, while percentage of damaged shrimp was 98% after storage.

DISCUSSION

All the specimens during storage showed a decrease in weight which was attributed to the effect of insects infestation only. Spoilt shrimps gave a negative weight change due to lack of flesh remaining for the beetles to consume the products absorbed moisture from the environment which caused an increase in its moisture content, thus slightly increases the weight of the shrimps. The adult insects were identified as *D. maculatus* from all the replicated containers, while *D. maculatus*, *Lardoglyphus spp* and *N. rufipes* were collected from the containers with spoilt insect infested specimens collected from the market, with *D. maculatus* having the highest frequency of occurrence of 63.67%. Khan (2001) similarly recorded the damage done by insects infestation on nontreated products was 25.47% while the treated ones were lower or unchanged due to the chemicals applied to control them. The damage from the insects in this study indicated that the conditions for growth, development and reproduction of these insects were favourable.

FAO[6] noted that in an atmosphere with>60% humidity, the dry fish will tend to pick up moisture with consequent risk of spoilage. In this study, the increase in moisture content made the shrimps susceptible to spoilage and also creating a suitable condition for insects to thrive. Osuji[7] work on the nature of infestation of dried

Table 1: Changes in weight, moisture content and insect population of shrimps during storage

Specimens	Initial weight (g)	Final weight (g)	(%) Weight change	Initial moisture Content (%)	(%) MC	Number of Larvae (range)		Number of adult (range)		Damaged (%) after experiment
P. longirostris	15.04	11.61	22.81	15.35	17.17	9	86	7	31	41.5
P. atlantica	15.02	10.95	27.11	14.90	16.38	7	91	4	47	67.2
M. macrobrachion	15.07	13.82	7.30	15.73	17.97	4	29	4	18	22.7
Non-infected M. macrobrachion	15.01	15.19	-0.18	16.14	17.85	-	-	-	-	0.00
Spoilt M. macrobrachion	15.03	15.21	1.20	14.93	17.61	2	8	1	3	98.0

Table 2: Population of collected Insects and larvae during storage from different shrimp species

	P. longirostris			*P. atlantica*			*M. macrobrachion*			Noninfected *M. macrobrachion*			Spoilt *M. macrobrachion*		
	Adult	Larvae	Av. Weight (g)	Adult	Larvae	Weight lost (g)	Adult	Larvae	Weight lost (g)	Adult	Larvae	weight lost (g)	Adult	Larvae	Weight lost (g)
Wk 1	7	23	15.04±1.02	4	18	15.02±1.87	4	18	15.07±1.20	4	12	15.02±1.81	3	8	15.03±1.33
WK 2	11	14	15.08±1.22	6	14	15.12±1.54	6	14	15.01±2.11	6	14	15.04±1.21	3	6	15.00±1.03
WK 3	10	36	14.32±1.41	11	9	14.75±1.31	11	9	14.81±1.87	6	14	15.01±1.13	3	4	13.00±1.29
WK 4	10	86	13.63±1.09	8	7	13.65±1.36	8	7	14.21±1.40	7	21	15.00±1.01	2	-	12.62±0.97
WK 5	31	56	12.31±2.01	12	21	12.03±1.24	12	21	14.01±1.02	21	46	15.01±1.54	1	-	10.76±1.69
WK 6	28	32	12.01±1.21	16	19	11.51±1.09	16	19	13.92±1.31	6	51	15.11±1.08	2	3	9.88±2.01
WK 7	41	20	11.93±1.44	17	7	11.11±1.42	17	7	13.86±1.02	26	8	15.16±1.91	1	2	8.92±1.22
WK 8	27	9	11.60±1.09	13	11	10.95±1.23	13	11	13.82±1.78	18	8	15.19±1.23	1	2	8.21±1.24
	165	276		87	106		87	106		94	174		16	25	

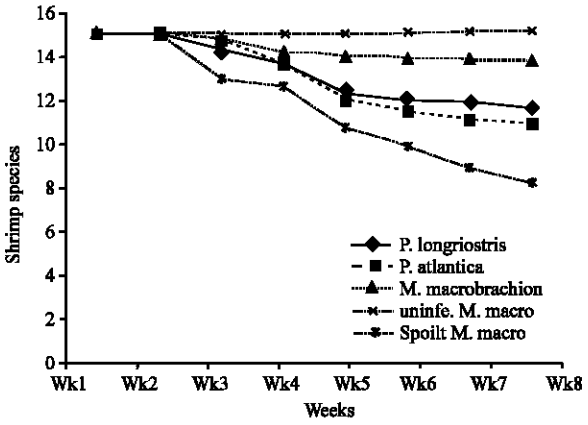

Fig. 1: Weight loss (g) during storage

fish by *N. rufipes* and *D. maculatus* noted how different larvae instars appeared to prefer different parts of fish and that beetle infestation is more severe during the "warm dry" season than during cool wet season. The developing larvae tunneled to the flesh or body causing purifications and extensive damage as observed this study which invariably led to economic loss due to quality reduction. The appearance of the shrimps could be unattractive, resulting in quantitative loss of the smaller fragments.

Shrimps and prawns are exposed to insect activity during processing, drying untill the stage of storage to prevent this spoilage and to the safety of consumers. Shrimps storage must be in an air tight container and the old stock of shrimps must not be mixed with new stock. In addition, shrimps must be well dried up to 75% moisture content before storage. A free humidity dry storage room is needed to prevent the products from absorbing moisture which may aids insect's development.

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