Evaluation of Fly Population Infesting Dried Fishes at Sonadia Island, Cox's Bazar as a prerequisite for the Practical Application of Sterile Insect Technique (SIT)

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Abstract

Fly population infesting dried fishes at the Sonadia offshore island, Cox's Bazar, were evaluated during October to February (Fish drying season) of the year 2007-2008. The aim of this study was to estimate on the wild fly pests and their seasonal abundance in the target island as part of prelease assessment prior to practical application of Sterile Insect Technique (SIT). Four Dipteran fly pests, *Lucilia cuprina*, *Chrysomya* sp., *Musca domestica* and another ash colour fly species (unidentified) were recorded. Among those the blow fly *Lucilia cuprina* was found as the most dominant and destructive pest in Sonadia fish drying area. Highest density of this fly population was in and around bashas and underneath of fish drying horizontal platforms. The fly abundance was recorded during March, April and May while southern breeze started blowing. On the other hand population declined during the months of December, January and February while northern wind prevailed. Occurrence of fly infestation showed seasonal variation depending on availability of food source i.e. fish drying activities.

Keywords: Estimation, fly pest, dried fish, Sonadia Island and SIT

1. Introduction

Vast marine and fresh water fishes and other fishery resources play a great role on the culture and life style of the people of Bangladesh. Sun drying is a common practice in Bangladesh specifically in the remote coastal depressions and offshore islands where chilling and freezing facilities are not available [1]. Most of the marine fishes are sun-dried in different off shore islands and coastal areas of Bangladesh for both local consumption and export purposes. A considerable amount (over 25%) of fishes and fishery products are either damaged or quality deterioration occur during the process of sun-drying due to fly infestation in Bangladesh [2]. Sonadia, is a offshore island of the Bay of Bengal and it is situated about 7.0 km away towards the western side of the Cox's Bazar town. Local people and native inhabitants of Moheshkhali and Chokoria upozilla primarily use Sonadia for sea fish related trade including fish drying. About 4-5 hundred people, come to Sonadia for fish drying. A number of Dipteran flies are known to damage sea fish during the process of sun drying in this Island. The larval stage of these flies consumes a considerable amount of fish while drying under sun light causing both qualitative and quantitative losses. The farmers usually dip the raw fish into insecticide solutions prior sun drying as a preventive measure against blowfly infestation creating a great threat to public health, natural environment which is reducing consumer's acceptability in both local and international market. Therefore, environmentally safe and effective control of flies is desirable for the production of chemical free dry fish. In this regard application of Sterile Insect Technique (SIT) against blowfly in the fish drying areas could be a better and safer alternative technique to chemical control method. SIT refers to the use of radio-sterilized insects to control a population of certain insect species in defined areas as an environmental friendly novel technique using virtually no insecticides [3]. The sequentially released sterile male flies will mate with wild females of the same species restricting production of fertilized egg and thus, gradually declining target fly population. The Sonadia island has been chosen as the primary target area as geographical isolation is a prerequisite for successful application of SIT to control blow fly, a major pest of dried fish during sun drying. Some investigations on blowfly have already been conducted that prerequisite for practical application of SIT [4-8]. The present investigation was undertaken to expedite the estimation of wildfly pests and observed environmental and seasonal variations of major fly pest populations in the target island as part of prelease assessment prior to practical application of SIT.

2. Materials and Methods

The investigation was conducted at Sonadia marine fish drying yard during October through March in 2007-2008 fish drying season. The estimation of fly pest population was made from 9:00 am to 3:00 pm. The Sonadia marine fish drying yard was divided into three main areas for convenient to estimation of fly population i.e. (i) "basha" or unit area where fish drying and processing activities are accomplished (ii) common passage among groups of bashas necessary for transportation of raw/dried fish and movement of fish driers and (iii) barren land. Each basha or unit area of Sonadia fish drying yard consisting of a thatched house, fish sorting and cleaning zone, horizontal platform primarily use for drying smaller fish, vertical rack use for drying bigger fish and open space use for keeping necessary materials and internal movement. There were 84 basha of fish drying season in March to October 2007-2008. Field observation and collections were made in between 9.00 am to 3.00 pm of every month during study period. Counting of empty pupal cage of fly pest below vertical racks were accomplished through sieving of unit volume of sand ($1 \times 1 \times 0.5$) cubic feet. Flies and pupal cages were collected from selected areas once a month using with handled aerial sweep nets and sieving of unit volume of sand respectively. Thereafter adult flies were killed

immediately by chloroform for minimizing damages of the external organs and brought to the Laboratory for identification of species and estimation of fly pests.

Estimation of area of Sonadia fish drying yard [9].

Total area of fish processing and drying zone =2420ft × (378ft + 425ft +258ft) /3=8,56,680 sq ft.

Depending on various density of fly pests, a basha or a fish processing and drying unit of total 10,000 sq. ft. area (100ft x 100ft) could be sub divided as follows:

a. Thatched house (30ft × 40ft) = 1200 sq. ft. i.e.12% of unit basha
b. Fish sorting and cleaning zone (20ft × 50ft) = 1000 sq. ft. i.e.10% of unit basha
c. Horizontal rack (4ft × 50ft × 10 racks) = 2000 sq. ft. i.e. 20% of unit basha
d. Vertical rack (4 ft × 100 ft × 2 racks) = 800 sq. ft. i.e. 8% of unit basha
e. Open space: 5,000 sq. ft. i. e. 50% of unit basha

   Common passage = 350ft × 8ft × 6ft = 16,800 sq. ft.

Surrounding area of fish drying yard:

a. During high tide: Length = (1500 ft + 2420 ft + 1200 ft)/3 =1707ft

   Breadth = (778ft + 825ft + 658ft) / 3 = 754 ft.

   i.e. total area of fish drying yard = 1707ft × 754ft = 12,87,078 sq ft.

   So, total area outside fish drying and processing zone during high tide

   =12,87,078 - 8,56,680 = 4,30,398 sq ft.

b. During low tide: Length = (1600ft + 2420ft + 1300ft)/3 = 1773ft.

   Breadth = (878ft + 1025ft + 858ft) / 3 = 920ft.

   i.e. total area of fish drying yard during low tide

   = 1773ft × 920ft = 16,31,160 sq ft.

   So, total area outside fish drying and processing zone during low tide

   = 16,31,160 – 8,56,680 = 7,74,480 sq ft

3. Results and Discussions

Table 1. Population of flies in Sonadia fish drying yard during maximum fly pest infestation period

Site of drying yard	Total area (unit area × 84 basha in sq. ft)	Average population density per sq. ft	Estimated number of available adult flies			
			Lucilia cuprina	*Chrysomya* sp.	*Musca domestica*	Ash colour Flies (unidentified)
Inside basha (12%) Thatched house	1,00,786	*L. cuprina*- 5 *M. domestica*- 0.1	5,03,930	-	10,079	-
Fish sorting and cleaning zone (10%)	83,988	*L. cuprina*- 4 *Chrysomya* sp.-2 *M. domestica*-0.4	3,35,952	1,67,976	33,595	-
a. Above horizontal rack	1,67,976	*L. cuprina* – 1 *M. domestica*- 0.1	1,67,976	-	16,798	-
b. Soil surface beneath horizontal rack (20%)	1,67,976	*L.cuprina*-3 *M.domestica*-0.1	5,03,928	-	16,798	-
Vertical rack (8%)	67,190	*L.cuprina*-5 *M.domestica*-0.5	3,35,950	-	33,595	-
Open space of a basha (50%)	4,19,940	*L.cuprina*-0.01 Ash col. fly - 0.005	4,199	-	-	2,100
Common passage among basha	16,800	*L.cuprina*-0.01 Ash col. fly - 0.005	168	-	-	84
Open space around fish drying zone (e.g. during high tide)	4,30,398	*L.cuprina*-0.003 *Chrysomya* sp.- 0.002 *M.domestica*-0.005 Ash col. Fly (unidentified) - 0.001	1,291	861	2,151	430
		Total	18,53,394	1,68,837	1,13,016	2,614

Table 2. Population of flies in Sonadia fish drying yard during minimum fly pest infestation period

Site of drying yard	Total area (sq. ft)	Average population density per sq. ft	Estimated number of available fly pests			
			Lucilia cuprina	*Chrysomya* sp.	*Musca domestica*	*Ash col.* Flies (unidentified)
Thatched house (12%)	1,00,786	*L.cuprina*-0.5 *Chrysomya* sp.-0.4 *M. domestica* -0.1	50,393	40,314	10,079	-
Fish sorting and cleaning zone (10%)	83,988	*L.cuprina*-0.4 *Chrysomya* sp.-0.5 *M.domestica*-0.6	33,595	41,994	50,393	-
a. Above horizontal rack	1,67,976	*L .cuprina* -0.1 *Chrysomya* sp.-0.3 *M.domestica*-0.2	16,798	50,393	33,595	-
b. Soil surface beneath horizontal rack (20%)	1,67,976	*L.cuprina*-0.3 *Chrysomya sp*. -0.4 *M.domestica*-0.2	50,393	67,190	33,595	
Vertical rack (8%)	67,190	*L.cuprina*-0.4 *Chrysomya* sp.-0.5 *M. domestica* -0.6	26,876	33,595	40,314	-
Open space of a basha (50%)	4,19,940	*L.cuprina*-0.001 *Chrysomya* sp.-0.002 *M.domestica*-0.005 Ash col. fly - 0.006	420	840	2,099	2,520
Common passage among basha	16,800	*L.cuprina*-0.001 *Chrysomya* sp.-0.003 *M.domestica*-0.006 Ash col. fly - 0.007	16	50	100	118
Open space around fish drying zone (e.g. during high tide)	4,30,398	*L.cuprina*-0.001 *Chrysomya* sp.-0.002 *M.domestica*-0.004 Ash col. Fly (unidentified) -0.003	430	860	1,722	1,291
	Total		1,78,921	2,35,236	1,71,897	3,929

During this study period four fly species viz, *Lucilia cuprina*, *Chrysomya* sp., *Musca domestica* and another ash colour fly (unidentified) were recorded from Sonadia fish drying yard. Among the four identified species, total 18,53,394 of *L. cuprina* was recorded from different selected areas and it occupied 86.70% of total fly population in Sonadia fish drying yard. Total 1,68,837 (occupied 7.90%) of *Chrysomya* sp; 1,13,016 (occupied 5.29%) of *Musca domestica* and 2,614 (occupied 0.12%) of ash colour flies were recorded during high infestation period (Table 1). In contrast, the estimated fly population of identified species in Sonadia commercial fish drying yard during low infestation period was total 1,78,921 (occupied 30.33%) of *L. cuprina*, 2,35,236 (39.87%) of *Chrysomya* sp., 1,71,897 (29.14%) of *M. domestica* and 3,929 (0.67%) of ash colour fly (Table 2). Results of the Table 1 revealed that highest and dominated fly pests was *L. cuprina* with 86.70% occupied at fly communities and lowest population was found ash colour fly they occupied only (0.12%) in study areas. The order of fly population during high infestation period being *L. cuprina* > *Chrysomya* sp. > *M. domestica* > ash colour fly. However, results of the Table 2 revealed that the maximum (2,35,236) adults fly population was recorded for *Chrysomya* sp. and they occupied 39.87% of total fly population in Sonadia fish drying yard. The minimum population was observed ash colour fly and they occupied only (0.67%). The order of fly population during study areas during low infestation period being *Chrysomya* sp > *L. cuprina* > *M. domestica* > ash coloured fly. It is also mentioned from Table 1 and 2 that pest population reduction become apparent primarily for decrease of *L. cuprina* population from 18,53,394 to 1,78,921 (90.35%) as total population of *Chrysomaya* sp., *Musca domestica* and ash colour fly sp. even increased from 1,68,837 to 2,35,236 (39.33%), 1,13,016 to 1,71,897 (52.10%) and 2,614 to 3,929 (50.31%) respectively during from maximum fly pest infestation period to minimum fly pest infestation period.

The population of *L. cupr*ina has been dominating in Sonadia Island with occasional prevalence of *Chrysomaya* sp. *M. domestica* was recorded as around 29.14% of total fly population during low fly infestation period. *M. domestica* was pre-dominant in the tea stall and adjacent areas than those of on the fish drying area. Population of *Chrysomya sp.* was occasionally increased in huge number posing threat to sun dried fish in minimum infestation period. The puparium collected through sieving of 6 inches deep sand in 1 sq ft. area beneath the horizontal fish drying platforms also shows predominance of empty pupal cage of *L. cuprina* in Sonadia Island representing about 96.77% population in maximum infestation period. On the other hand, empty pupal cage counting from sieving of surface soil also revealed occurrence of around 44.44% *Chrysomya sp.* and 33.33% in low infestation period at Sonadia fish drying yard. These results suggesting that the blowfly (*Lucilia cuprina*) is regarded as the most dominating and destructive pest for fish drying yard in Sonadia. Blowfly infestation of fish during sun drying was also reported as main cause of damage of salted dried fish [10]. It was reported that around 30% of fish was infested by fly maggots during application of traditional sun drying in tropical countries like Bangladesh [11-13].

The fly pest, *L. cuprina* were everywhere in the fish drying area of Sonadia Island. Variation of *L. cuprina* and other species densities were recorded in bashas, common passages and surrounding areas. Even, differences in fly population intensity were also found in the thatched house, fish sorting and cleaning zone, horizontal platforms, vertical racks and open space of a basha. Highest density of this fly was found in and around basha and soil surface below fish drying horizontal platform.

Fly pests could hardly be seen in fish drying areas of Sonadia in presence of reasonable quantity of sea fish at various stages of sun drying. Low population incidence is desirable for fish driers requiring low or no use of costly insecticide and reducing loss due to pest infestation. The present study provides a gross distributional estimation of the fly population density and total number of different flies especially of *L. cuprina* of the fish drying yard that could be helpful for the optimum number of sterile flies (*L. cuprina*) to be sequentially released in the target areas for suppressing/controlling fly pest by the application of sterile insect technique (SIT).

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