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RESEARCH ARTICLE

SEASONAL AND RELATIVE ABUNDANCE OF HYMENOPTEROUS PARASITOIDS ATTACKING HOUSEFLY PUPAE AT DAIRY FARMS IN CHIDAMBARAM TOWN, TAMIL NADU

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ABSTRACT

A survey was conducted in five selected dairy farms in and around Chidambaram town between April 2004 to March 2005. The aim was to describe the seasonal and relative abundance of Hymenopterous parasitoids that attack puparia of *Musca domestica* Linnaeus. Two species of parasitoids *Spalangia cameroni* Perkins, *Spalangia endius* Walker were observed in different dairy farms. When the proportion of parasitoids recorded from pupae was analysed, *Spalangia cameroni* was recorded as the most prevalent species when compared to *Spalangia endius*. The climatological factors *viz.,* temperature, rainfall and relative humidity had a significant correlation with both *Spalangia cameroni* and *Spalangia endius*.

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INTRODUCTION

Houseflies, *Musa domestica* Linnaeus are the major fly pest in cattle production units in India. High densities of flies during the summer months cause distress to animals and annoy employees and people living near the farms. Furthermore, houseflies may be transmitters of many diseases (Pospischil, 1994). Control of *Musca domestica* is mainly based on insecticides applied as baits, space or residual sprays and larvicides. However, alternative methods of fly management are currently being explored because of the risk of insecticide residues in animal products and manure and the rapid development of resistance to insecticides by flies (Howard and Wall, 1996; Keiding, 1999). Biological control programs aimed at reducing fly population in poultry operations have achieved mixed ratings (Petersen, 1993). Pupal parasitoids in the family Pteromalidae are important natural enemies of muscoid flies on livestock and poultry farms throughout the world (Legner, 1995). The present investigation deals with a survey of pupal parasitoids that attack *Musca domestica* puparia in cattle units in India. This aim was to describe the seasonal and relative abundance of parasitoids that attack *Musca domestica* pupae in selected dairy farms in Chidambaram town.

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MATERIALS AND METHODS

Data on weekly records of parasitoids from manure samples from selected sites were used to analyse their relative abundance and seasonability. The meteorological data on temperature, relative humidity and rainfall were obtained from the meteorological observatory of Annamalai University Experimental Farm, Annamalainagar. Data on weekly collections were pooled together and the density was expressed as number/unit volume in different months following the method of Arellano and Reuda (1988).

The simple linear regression test was performed to find out the relationship between the abundance of host pupae and the parasitoids. The multiple correlation test was performed to find out the relationship between the climatic factors and abundance of the host as well as parasitoids. The increase and decrease of the host and parasitoids population as observed through relative density during the study period was used to determine the intrinsic rate of increase (r_m) by following Odum (1971) who had shown that the intrinsic rate of increase (r_m) can be calculated from measurements of population size at any two times using the following equation.

Table 1. Relative abundance of the host *Musca domestica* pupae and the pupal parasitoids during the study period

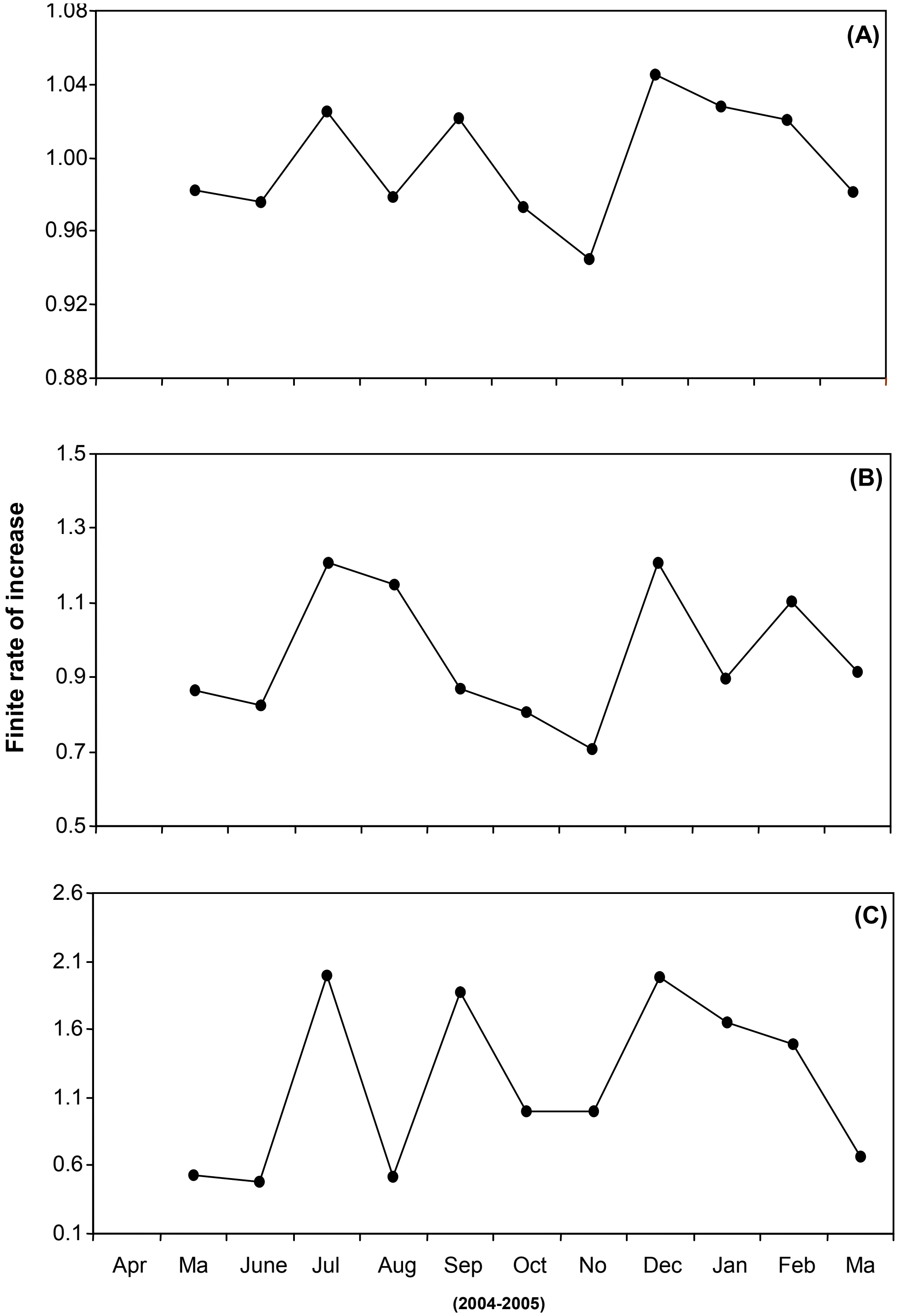
Month	Host pupal density	Number of parasitoids emerged		
		Spalangia cameroni	*Spalangia endius*	Total
April ‘04	55.20	7.60	1.80	9.40
May	54.40	6.20	1.40	7.60
June	29.80	4.40	1.30	5.70
July	52.60	6.40	1.60	8.00
August	39.60	8.20	1.40	9.60
September	54.20	6.40	1.80	8.20
October	23.60	3.30	0.00	3.30
November	12.80	2.50	1.20	3.70
December	36.20	9.80	1.80	11.60
January ‘05	36.60	8.40	2.20	10.60
February	64.20	12.40	2.80	15.20
March	45.20	10.00	2.20	12.20
	Mean ± S.D.	7.13 ± 2.477	1.63 ± 0.685	
	R	0.615	0.634	
	F	6.62	6.71	
	p	0.030	0.027	

R = Simple linear regression test; S.D. = Standard deviation; Relative abundance was calculated by dividing the number of adults by the number of samples recovered at dairy farms.

Table 2. Multiple correlation tests between climatological factor with abundance of host and parasitoids

Parameters	Host pupal density	*Spalangia cameroni*	*Spalangia endius*
Maximum temperature	r = + 0.493 p = 0.103	r = + 0.075 p = 0.816	r = + 0.045 p = 0.809
Minimum temperature	r = + 0.079 p = 0.806	r = - 0.467 p = 0.125	r = - 0.470 p = 0.123
Relative humidity	r = + 0.016 p = 0.959	r = + 0.041 p = 0.899	r = + 0.024 p = 0.941
Rainfall	r = - 0.480 p = 0.114	r = - 0.707* p = 0.010	r = - 0.794** p = 0.002

** Correlation is significant at 0.01 level p = Probability value
* Correlation is significant at 0.05 level – Negative correlation;
r = Pearson’s coefficient of correlation + Positive correlation df = 11


(A)
(B)
(C)
Finite rate of increase
1.08
1.04
1.00
0.96
0.92
0.88
1.5
1.3
1.1
0.9
0.7
0.5
2.6
2.1
1.6
1.1
0.6
0.1
Apr
Ma
June
Jul
Aug
Sep
Oct
No
Dec
Jan
Feb
Ma
(2004-2005)

Intrinsic rate of increase (r_m) = $\frac{\ln Nt_2 - \ln Nt_1}{(t_2 - t_1)}$

where,

In = Natural log

Nt_1 = Population at time t_1

Nt_2 = Population at time t_2

The finite rate of increase *i.e.,* the number of times a population multiplies in a unit time is computed from the formula as follows (Andrewartha and Birch, 1954). The finite rate of increase $\lambda = e^{r_m}$ where,

e = Base of Naperian log

r_m = Innate capacity to increase

The λ values of 1 indicates that the population is stable and the value above or below 1 indicates the positive or negative growth of population, respectively. The changes in the host as well as parasitoid populations were observed from the finite rate of increase of their population.

RESULTS AND DISCUSSION

The density of *Musca domestica* puparia ranged between a maximum of 64.2 (Feb. 2005) and a minimum of 12.8 (Nov. 2004) during the study period. The density of *Musca domestica* puparia fluctuated widely without any clear trend in different months. The density of *Spalangia cameroni* ranged between a maximum of 12.4 (Feb. 2005) and a minimum of 2.50 (Nov. 2004) and the density of *Spalangia endius* ranged between maximum of 2.8 (Feb. 2005) and minimum of 0 (Nov. 2004). Similarly the total parasitoids recorded during the different months the percentage of *Spalangia cameroni* has shown reduction during June, October and November 2004 followed by increase in December 2004 and January, February and March 2005. *Spalangia endius* also shown similar trend by increasing during January, February and March 2005 by decreasing during June, October and November 2004 (Table 1).

When the monthly abundance of parasitoid species between different dairy farms a significant variation was not obtained in all dairy farms *Spalangia cameroni* constitute the major proportion followed by *Spalangia endius*. During post rainy months and summer month the population of *Spalangia cameroni* and *Spalangia endius* are increased and exhibits periodic decrease during rainy months. Similar findings of Srinivasan and Balakrishnan (1989) and Balakrishnan (1992) reported that highest density of *Spalangia cameroni* and *Spalangia nigroaenea* in summer months.

The climatological factor *viz.,* temperature, rainfall and relative humidity influence the population of both host as well as parasitoids the mean maximum temperature and host pupal density had a positive correlation with *Spalangia cameroni* (r = 0.075, p = 0.816) and *Spalangia endius* (r = 0.045, p = 0.809). But the mean temperature exhibit negative correlation between *Spalangia cameroni* (r = -0.467, p = 0.125) and *Spalangia endius* (r = -0.470, p = 0.123). Relative humidity had a positive correlation with abundance of *Spalangia cameroni* (r = 0.041, p = 0.899) and *Spalangia endius* (r = 0.024, p = 0.941). The rainfall and host pupae had significantly negative correlation with the abundance of *Spalangia cameroni* (r = -0.707, p = 0.01) and *Spalangia endius* (r= -0.794, p = 0.002) (Table 2). The maximum temperature and host pupal density, *Spalangia cameroni* and *Spalangia endius* had positive correlation but did not exhibit any significance. So this clearly indicated the activity of *Musca domestica* increased the abundance of *Spalangia cameroni* and *Spalangia endius*. The relative humidity which showed positive correlation with host and parasitoid did not have any influence over the abundance. However, the fly density was influenced by rainfall showed negative correlation with host pupal density and significant negative correlation with *Spalangia cameroni* and *Spalangia endius*. This shows the host and parasitoids population have exhibited a marked fluctuation in different months due to the rainfall during the study period. This may be attributed to increase of the population of natural enemies resulting in the reduction and such phenomenon has also been reported from a similar study by Legner *et al.* (1973) in California. The population analysis was done from the relative density to find out the dynamics of population growth. The finite rate of increase of the host *Musca domestica* puparia was more than one during July, September, December (2004), January and February (2005) and this indicated the population of *Musca domestica* was on the increasing trend. This might be due to favourable climatic conditions during these months. Accordingly the finite rate *Spalangia cameroni* showed increasing during the months of July, August, December (2004), February (2005) and *Spalangia endius* showed increasing during July, September, December (2004), January and February (2005) (Fig. 1). This might be due to obligatory association of housefly with the parasitoids for its survival and propagation. Non-haematophagous feeding habit, highest rate of parasitism, stinging capacity, ability to survive in various climate and to recycle in natural environment may be its potential for use as a biological agent.

Balakrishnan (1992) stated that the host and parasitoids population have exhibited a marked fluctuation in different months of the study period. The host population fluctuated on alternate months of the study period which may be attributed to the increase of the population of natural enemies.

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