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ABIOTIC FACTORS INFLUENCING DEVELOPMENT AND LONGEVITY OF *TETRASTICHUS PYRILLAE* CRAW. (HYMENOPTERA: FULOPHIDAE), AN EGG PARASITE OF *PYRILLA PERPUSILLA* WALK

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Cumulative effect of two abiotic factors temperature (15-35°) and relative humidity (50-90%) on longevity and total duration of life cycle of *Tetrastichus pyrillae* Crawford, one of the important parasite, parasitizing eggs of *Pyrilla perpusilla* Walker was determined. Influence of temperature both on the longevity and the developmental period of the egg-parasite was highly significant while the relative humidity did not cause any effect. Average longevity of males decreased from 7.06 to 1.58 days and that of females from 12.28 to 1.29 days in respond to corresponding rise in test temperature from 15 to 35± 1.5°. Mean duration of the life cycle also declined from 40.53 to 8.99 days as the rearing temperature was raised from 15 to 30± 1.5° while no development could take place at or above 32.5°

Key words: A biotic factors, pyrillae, sugarcane.

Introduction

Four parasites,*Ooencyrtus papilionis* Ashmead, *Tetrastichus pyrillae* Crawford, *Platygaster* sp. and *Anagyrus* sp. are important parasites of sugarcane leafhopper, *Pyrilla perpusilla* Walker in Pakistan [1,2]. *Tetrastichus pyrillae* was reported to be found all the year round in the Punjab [3]. Longevity of *Tetrastichus pyrillae* was found to be the longest on *Vincea rosea*, followed by honey dew exuded by Pyrillae [4]. This parasite was important on account of its high incidence of parasitism and long period of activity [5]. The parasite completed six generations during Oct. to Feb. with an average life span of 10 to 36 days. This parasite along with *O. papilionis* and *Cheiloneurus pyrillae* Mani and nymphal parasite *Epiricania melanoleuca* Fl. has been reported to play an effective role in the natural balance of Pyrilla [6,- 8]. These parasites also provide effective control of the pest, if released artificially, at an appropriate time [9-11]. Considering the importance of such information and practical utility for augumentation of this parasite, the effect of physical factors such as temperature and humidity on this parasite should be known before introduction in the areas other than where it is not found. The present study was undertaken to determine the effect of two important physical factors like temperature and relative humidity on longevity and developmental duration of *T. pyrillae* and results so obtained were statistically analysed and discussed here.

Materials and Methods

The eggs of *P. perpusilla* parasitized by *T. pyrillae* were separated and kept in jar. Freshly emerged five pairs of adults *T. pyrillae* were kept in rearing glass jars measuring 10x5.5 cm. These were replicated thrice for each treatment. These were placed at different constant temperature viz. 15, 18, 20, 22.5,25, 27.5, 30, 32.5, and 35° ± 1.5° and relative humidity viz, 50, 70 and 90 for study longevity. Similarly adult parasites in two lbs rearing jars were provided with fresh eggs of pyrilla in abundance for parasitising and immediately removed and kept at different temperature and humidity for studying developmental period. The adult parasite were given 20% honey solution as food and was changed daily. Similarly in the jars for developmental period study were renewed daily till the completion of the experiment. Observations on the daily mortality of parasites was made daily and dead ones were immediately removed with fine hair brush. Date of emergence was noted for every individual parasites which gave the duration of the development at different temperatures and relative humidity.

For maintaining constant temperatures line Ambi-Hi-Lo chamber refrigerator were used while desired levels of relative humidity were obtained in dessicators by using different concentration of postasium hydroxide solution as recommended by Solomon [12].

The developmental period was worked out by counting the days from the date of oviposition to complete adult emergence from the eggs, and adult longevity from the date of adult emergence to death of the adult parasites.

Results and Discussion

The statistical analysis of the data showed that temperature effect on longevity of adult males of *T. pyrillae* was significant at 5% level. The adult life got reduced as the temperature increased (Table 1 and 4). The male longevity varied from a maximum of 8-10 days at 15±1.5° to a minimum of 1.33 days at 35 ± 1.5°. There was no significant difference between longevity of male at 15 and 18± 1.5• on the one hand and 32.5 and 35± 1.5° on the other.

The average longevity of adult females compared to males was the highest (15.67 days) at 15±1.5° (Table 2). In

TABLE 1. ANALYSIS OF THE VARIANCE OF THE DATA ON THE EFFECT OF TEMPERATURE, RELATIVE HUMIDITY AND TEMPERATURE AND HUMIDITY COMBINED ON MALES OF *T. PYRILLAE* ADULTS.

S.O.V.	DF	SS	MS	F. Value	Prob
Replications	2	0.63	0.313	0.81	**
Temperature (A)	8	261.95	32.743	84.73**	.000
R. humidity(B)	2	1.39	0.695	1.80*	.175
AxB combine	16	43.38	2.711	7.02*	.000
Error	52	20.09	0.386		

Coefficient of variations = 17.27%

* Non-significant, ** Highly significant.

TABLE 2. ANALYSIS OF THE VARIANCE OF THE DATA ON THE EFFECT OF TEMPERATURE, RELATIVE HUMIDITY AND TEMPERATURE AND HUMIDITY COMBINED ON FEMALES OF *T. PYRILLAE ADULTS*

S.O.V.	DF	SS	MS	F. Value	Prob
Replications	2	4.96	2.479	4.69	.013
Temperature (A)	8	1173.73	146.716	277.82**	.000
R. humidity(B)	2	47.27	23.636	44.76*	.000
AxB combine	16	114.23	7.140	13.52*	.000
Error	52	27.46	0.528		

Coefficient of variations = 15.80%

*Non-significant, * Highly significant

TABLE 3. ANALYSIS OF THE VARIANCE OF THE DATA ON THE EFFECT OF TEMPERATURE, RELATIVE HUMIDITY AND TEMPERATURE AND HUMIDITY COMBINED ON LIFE CYCLE OF *T. PYRILLAE ADULTS*

S.O.V.	DF	SS	MS	F. Value	Prob
Replications	2	0.62	0.309	1.45	.247
Temperature	6	8652.43	1442.071	6745.65**	.000
R. humidity(B)	2	5.66	2.831	13.24*	.000
AxB combine	12	22.56	1.880	8.79*	.000
Error	40	8.55	0.214		

Coefficient of variations = 2.26%

*Non-significant, * Highly significant.

TABLE 4. MEAN LONGEVITY (DAYS) OF MALES OF *TETRASTICHUS PYRILLAE* CRAWFORD AT DIFFERENT COMBINATIONS OF TEMPERATURE AND RELATIVE HUMIDITY

Temperature (± 1.5)	Perecent 50	Relative 70	Humidity 90
15.00	8.80a	7.27b	5.13c
18.00	7.47a	6.67b	4.33cd
20.00	3.33defg	4.33cd	5.27c
22.50	2.87defgh	2.93defgh	3.67de
25.00	3.53def	2.73defgh	3.60de
27.50	2.73efgh	2.53efgh	2.87defgh
30.00	2.00fgh	2.26efgh	2.13efgh
32.50	1.87h	1.93gh	2.13efgh
35.00	1.33h	1.73h	1.73h
	Temperature (A) 7.02	Relative humidity (B) NS	Interaction (a)x(b) NS

Treatment means shown in a common letter do not differ significantly at 5% level.

TABLE 5. MEAN LONGEVITY (DAYS) OF FEMALES OF *TETRASTICHUS PYRILLAE* CRAWFORD AT DIFFERENT COMBINATIONS OF TEMPERATURE AND RELATIVE HUMIDITY.

Temperature (± 1.5)	Percent 50	Relative 70	Humidity 90
15.00	15.67a	11.20b	10.00bc
18.0	15.40a	8.53cd	8.13d
20.00	5.20e	4.74ef	3.20fgh
22.50	3.46fg	3.27gh	3.00fghi
25.00	3.53fg	3.40fg	3.00fghi
27.50	2.60ghi	2.40ghi	2.33ghi
30.00	2.00ghi	2.33ghi	2.20ghi
32.50	1.67ghi	1.67ghi	1.33i
35.00	1.26i	1.26i	1.36hi
	Temperature (A) 13.59	Relative humidity (B) NS	Interaction (A) x (B) NS

**Non significant. Treatment means shown in common letter do not differ significantly at 5% level.

TABLE 6. MEAN DURATION OF LIFE CYCLE (DAYS) OF *TETRASTICHUS PYRILLAE* CRAWFORD AT DIFFERENT COMBINATIONS OF TEMPERATURE AND RELATIVE HUMIDITY

Temperature (± 1.5)	Precent 50	Relative 70	Humidity** 90
15.00	41.67a	39.93b	40.00c
18.0	35.93d	36.07cd	37.00c
20.00	19.07e	16.67f	18.47e
22.50	14.53gh	15.40g	15.13g
25.00	14.93g	12.73i	13.53hi
27.50	10.26k	10.53jk	11.40j
30.00	8.731	9.131	9.131
	Temperature humidity NkS**	Percent relative (A) 8.73	Interaction (A) x (B)NS**

Treatment means shown in common letter do not differ significantly at 5% level.

this case too, the effect of temperature was highly significant whereas the relative humidity showed no marked effect (Table 2, 4).

Duration of life cycle for *T. pyrillae* reacted to the changes in the temperatures but it did not respond to variations in the relative humidity of 50 to 90% independently or in combination with different temperatures (Table 3, 6). The average duration of life cycle varied from 41.67 days at 15±1.5° to 8.73 days at 30± 1.5°. While development could not be completed at or above 32.5°.

The above results showed that the females of *T. pyrillae* lived longer than males at all the temperatures irrespective of the levels of relative humidity. The difference in their longevity was however, relatively wider at a lower temperature. The adults of both sexes survived longer at lower temperatures and their life span was not influenced by the variations in the relative humidity. The conclusions can be drawn that this

parasite seemed to be sensitive to changes in the temperature whereas it possessed ability to survive over a wide degree of relative humidity. Similarly as the duration of life cycle of *T. pyrillae* is concerned, it was also effected by the changes in the temperature but no effect was shown by different levels of relative humidity. Therefore, this parasite can be recommended for augumentation for temperature ranging between 15-30°, the temperature on lower side being better for its longevity and on upper side for faster rate of development.

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