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RESEARCH ARTICLE

Uji fly, *Exorista bombycis* (Louis) (Diptera:Tachinidae) life-table on bivoltine (NB4D2) silkworm race

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SUMMARY

The life-table of uji fly, *Exorista bombycis* L. was constructed through 16 generation using fourth stage of bivoltine (NB4D2) silkworm race as a host for depositing eggs with the different biotic characters like, mortality at every stage of its life cycle (eggs, maggots, post-parasitic maggots, puparia and adults) in the rearing room. Maximum percentage of mortality at puparia, maggots, eggs, adults and post-parasitic maggots stages was 16.97, 11.01, 10.58, 7.82 and 6.52 per cent, respectively. Similarly, the survivability rate varied at different stages, being minimum at pupal stage (83.03%) compared to maggots (88.99%), eggs (89.42%), adults (92.18%) and post-parasitic maggot stages (93.48%). The number of individuals dying within the age and mortality factors are responsible for every stage of its life cycle have been discussed.

Key Words : Silkworm larvae, Uji fly, Life-table, Mortality, Survivability

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Uji fly, *Exorista bombycis* (Louis.) is an endo-larval parasitoid on silkworm, *Bombyx mori* L. (Jameson, 1922) and causing considerable damage to silkworm rearing in several silk producing countries including India. Scientists and farmers have adopted various control measures to manage uji fly, but these measures are not sufficient to control uji infestation and farmers lose 20-30 per cent cocoon production (Anonymous, 2008). Uji fly prefers to deposit eggs on older silkworm larvae, particularly the fourth and fifth instar silkworm (Siddappaji, 1985). Control of uji fly through biological means (hyperparasitoids) has a social relevance, since the host itself is an insect and insecticidal measures cannot be taken against a pest associated with an insect host (Vikas *et al*., 2010). Therefore, it is important to study life-table of uji fly to know the mortality and survivability percentage at different stages of uji fly. The construction of life-table is essential for description and understanding of population dynamics of insect or it is a concise summary of certain vital statistics of a population (Deevy, 1947).

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MATERIALS AND METHODS

A laboratory experiment was carried out on life-table of uji fly devlopemental stages in 16 generations from August 2009 to November 2010. For preparing the life-table, the uji fly population was maintained in the laboratory by collecting maggots of *E. bombycis* from Ramanagar commercial cocoon market. After emergence the adult flies were kept in 60 x 60 x 60 cm muslin netted cages with a circular muslin sleeve covered passage. Then prepared 10 per cent glucose solution in cotton swab, which served as a food for the uji flies and it was placed in a Petridish and kept inside the cage (Sriharan *et al*., 1980). For studying 16 generation of the uji fly, 100 number of fourth stage bivoltine (NB4D2) silkworm larvae of *Bombyx mori* L. and one pairs of mated female uji flies were kept in a cage for oviposition. After 24 hours of ovipositional exposure, the infested larvae were taken out of the cage and reared with mulberry leaves in tray having wire netted covering. Afterwards recorded mortality and survivability at every stages of the uji fly for every generation, the parasitoid silkworm larvae were examined and total number of eggs oviposited was noted down. Subsequently maggot mortality was assessed on the basis of number of maggots transformed in to post-parasitic maggots and puparia. Similarly, pupal mortality was calculated from the emergence of adult flies and recorded reproductive male and female uji flies. The dead individuals of all the developing stages were examined thoroughly to find out the reasons for mortality.

Preparation of life-tables :

The column headings proposed by Morris and Miller (1954) and Harcourt (1969) have been used in these studies for construction of life-tables. The following headings were furnished in life-tables:

X =Age interval at which the sample was taken
1X =Number of individuals living at the beginning of the stage noted in the 'X' column.
dx =Number of individuals dying within the age interval stated in the 'X' column
D x F =The mortality factors responsible for 'dx'
100 qx =Percentage mortality
sx =Survival rate within the 'X'

RESULTS AND DISCUSSION

The results of investigation on the life-table of uji fly were constructed through successive generations on bivoltine (NB4D2) silkworm races are discussed below (Table 1). Among all the developmental stages of uji fly highest mortality was recorded at pupal (16.97%) stage followed by maggots (11.01%), eggs (10.58%), adults (7.82%) and it was lowest at post-parasitic maggot (6.52%) stage. The data on the mortality at pupal stage over 16 generations, indicated that the hyperparasitoid, *Nesolynyx thymus* caused maximum (6.74%)

Table 1: Life-table of uji fly (*Exorista bombycis* L.) on bivoltine (NB4D2) silkworm race

X	1X	D x F	Sixteen generation (Aug. 2009 to Nov. 2010)		
			dx	100 qx	sx
Eggs	372.00	1. Infertility	36.00	9.68	
		2. Unknown causes	3.33	0.89	
		3. Total	39.33	10.58	89.42
Maggots	332.67	4. Failure of maggot emergence from host	14.99	4.50	
		5. Failure of maggot emergence from superparasitised host	8.33	2.50	
		6. Parasitized host died due to muscardine	2.00	0.60	
		7. Parasitized host died due to grassarie	1.33	0.40	
		8. Parasitized host died due to flacherie	7.00	2.10	
		9. Ants	1.00	0.12	
		10. Unknown causes	1.99	0.60	
		11. Total	36.64	11.01	88.99
Post parasitic maggots	296.03	12. Ants	6.99	2.36	
		13. Lizards	2.33	0.79	
		14. Cockroaches	0.66	0.22	
		15. Unknown causes	9.33	3.15	
		16 Total	19.31	6.52	93.48
Puparia	276.72	17. *Nesolynyx thymus*	18.66	6.74	
		18. *Trichopria sp.*	8.66	3.12	
		19. Putrification	5.00	1.81	
		20. Desiccation	6.60	2.41	
		21. Ants	3.00	1.08	
		22. Cockroaches	0.99	0.36	
		23. Unknown causes	4.00	1.44	
		24. Total	46.97	16.97	83.03
Adults	229.75	25. Deformed wings	9.33	4.06	
		26. Deformed legs	4.66	2.03	
		27. Sclerotization	3.99	1.74	
		28. Total	17.98	7.82	92.18
		Reproductive adults	=211.77 (104.77 M + 107.00 F)		
		Total mortality	=43.07 per cent		

mortality followed by *Tricopria* sp. (3.12%). The mortality due to desiccation and putrification was found to be 2.41 and 1.81 per cent, 1.44 per cent was due to unknown causes followed by ants (1.08%) and predation by cockroaches (0.36%). The total mortality was found to be 16.97 per cent over 16 generations. Similar results have been reported by Nrayanaswamy (1991). *Nesolynyx thymus* and *Tricopria* sp. are the key mortality factors at pupal stage (10.68%) over 18 generations. According to Arun and Manjunath (2009) *Nesolynyx thymus* recorded maximum parasitisation of uji pupae, which is conformity with the present findings. The mortality of maggots due to failure of maggots emergence from the host was 4.50 per cent followed by superparasitised of the host (2.50 %), parasitized host died to muscardine (0.68%), unknown causes (0.60%), grasserie (0.40%) and flacherie disease (2.10%). The predation by ants caused 0.12 per cent, respectively. The total mortality of maggots was 17.62 per cent over 16 generation. Similar results were also reported by Narayanaswamy (1991). Overall failure of maggots emergence over 18 generations was 5.65 per cent.

The egg mortality was recorded 9.68 per cent due to infertility and 0.89 per cent due to unknown causes with a overall total being 10.58 per cent. According to Narayanaswamy (1991) recorded overall egg mortality 14.06 per cent was observed over 18 generations and Siddappaji (1985) observed infertility of eggs 39.29 per cent, which are in close conformity with the present findings. The major mortality factor at the adult stage was deformation of wings (4.06%) followed by deformation of legs (2.03%) and sclerotisation (1.74%). The overall mortality was 7.82 per cent over 16 generation. The present study was comparable with Narayanaswamy (1991) recorded the adults with deformed wings and legs were considered as key mortality factors and they were unable to reproduce.

Similarly, the mortality during post-parasitic maggot stage was maximum (3.15%) due to unknown causes followed by ants (2.36%), lizards (0.79%) and cockroaches (0.22%). The overall total mortality during post-parasitic maggot stage was 6.52 per cent over 16 generations. This lowest mortality due to maggots become hard at post-parasitic stage.

The survivability rate varied at different stages and minimum at pupal stage (83.03%) compared to maggot (88.99%), eggs (89.42%), adults (92.18%) and post-parasitic maggot stages (93.48%). This findings is in line with the findings of Chakraborty *et al.* (1996) who reported minimum survivability at adult stage (33.33%) followed by eggs (39.47%), larvae (57.77%), pupa (83.34%) and maximum at maggot 92.31%) stage, which is contradictory to the present findings, probably due to variation in the climatic condition.

Conclusion :

Control of uji fly through biological means (hyperparasitoids) has a social relevance, since the host itself is an insect and insecticidal measures cannot be taken against a pest associated with an insect host. Therefore, it is important to study life-table of uji fly to know the mortality and survivability percentage at different stages of uji fly and its weakest stage of uji fly for management. The construction of life-table is essential for description and understanding of population dynamics of insect.

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