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Research Article

Biology of Onion Thrips, *Thrips Tabaci* (Lind.) (Thysanoptera: Thripidae) On Onion *Allium Cepa* (Linnaeus)

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Abstract Study on biology of *Thrips tabaci* (Lind.) on onion showed that the thrips laid singly minute, kidney shape and translucent white in colour inside the leaf tissues with its pointed ovipositor. The average incubation period varied from 4.52 ± 0.51 days. The Larvae passed through two instars. The average larval period varied from 5 to 7 days with an average of 5.93 ± 1.00 days while pre-pupal and pupal period were 1.96 ± 0.76 and 3.56 ± 0.50 days, respectively. The average pre-oviposition, oviposition and post- oviposition period were 3.43 ± 1.10 , 22.98 ± 5.58 and 3.51 ± 1.10 days, respectively. The average fecundity of female was 56.63 ± 11.73 eggs during entire life spam. The average longevity of adult was 27.97 ± 6.01 days. Total life cycle lasted for 38 to 62 days with an average of 49.66 ± 5.79 days.

Keywords: *Thrips tabaci* (Lind.); *Allium cepa* (Linnaeus); Biology (Egg, Larvae, Pupa and Adult)

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetable crops among the various bulbs producing vegetables. It is a member of Amaryllidaceae family, which commercially grown in tropical and subtropical countries. Among the vegetable crops grown in the country, onion assumes significance in the national economy. It grown for consumption as vegetable crop in green immature stage and as

mature bulbs. It has occupied a key role in Indian cookery as vegetables, salads, pickles and sauces etc. Both mature and immature bulbs of onion used as a condiment. The powder is also prepared from dehydrated onion bulbs. It also possesses some nutritional and medicinal properties. It provides important vitamins viz. vitamin-A, ascorbic acid, thiamine and riboflavin. According to Singh *et al.*¹, a 100 g onion contains 86.6 per cent moisture, 1.2 g protein, 0.1 g fat, 11.1 g carbohydrates, 46.9 mg calcium, 50 mg phosphorous and 0.4 g mineral matter. It used as a remedy for various diseases like dysentery, infantile convulsions, headaches, hysterical fits, rheumatic pain, and malarial fever and as a fine demulcent to give relief in piles².

Onion is considered native of western Asia and introduced in India perhaps from Palestine. Its secondary centre of origin is believed to be somewhere in the mediterranean region. In India, its cultivation believed to be pre-historic days, as mentioned in the "Charakasahita" written by the famous vaidya Shri-charaka³. In India, onion grown on a large scale and stands second in productivity next to China. The main onion growing states of India are Gujarat, Maharashtra, Uttar Pradesh, Rajasthan, Karnataka, Bihar, Madhya Pradesh, Punjab and Tamilnadu. Cultivation of onion occupies 634,000 hectares of land with a total production of 12,433,000 metric tonnes. In Gujarat, major onion growing districts are Bhavanagar, Junagadh, Jamnagar, Rajkot, Amreli, Surendranagar, Mehsana, Surat and Kheda having an area of about 43,400 hectares with 1078.6 metric tonnes production having productivity⁴ of 24,900 kg/ha.

Onion thrips, *T. tabaci* is one of the common and the most damaging pest of onion. The species was referred with various scientific synonyms viz.; *T. solanaceorum* Portschinskii; *T. Striatus* Gilette; *T. allii* Sirrine Lowe; *T. flava obsoleta* Uzei; *T. bicolor*. This polyphagous insect occurs worldwide and attacks virtually all *Allium* crops^{5,6}. Both nymphs and adults of the thrips found between leaf sheaths and stem. In case of severe infestation, the bulb remains undersized and gets distorted⁷.

Thrips (*T. tabaci*) belongs to the order Thysanoptera, family Thripidae^{8,9}. Thrips has a wide host range, reportedly feeding on over 300 plants. In Hawaii, 66 plants from 25 families found to support onion thrips¹⁰. It has found to infest such vegetables as asparagus, bean, beet, cabbage, cantaloupe, carrot, cauliflower, celery, cowpea, cucumber, garlic, kale, leek, mustard, onion, parsley, pea, pepper, pigeon pea, potato, pumpkin, spinach, squash, sweet potato, tomato and turnip^{11,12}.

MATERIAL AND METHODS

The study site, Laboratory, Department of Agriculture Entomology, N.M. College of Agriculture, Navsari, Gujarat during the period of January 2010. The study carried at a constant temperature $25 \pm 1^{\circ}\text{C}$ by using B.O.D. incubator.

Laboratory culture of host: The seedlings of onion transplanted in pots and covered with lantern glass. These plants used as food and rearing material for the further study of biology.

Laboratory culture of *T. tabaci*: In order to develop the initial culture of thrips, *T. tabaci* large numbers of adults were collected with the help of aspirator from the onion field, College farm, Navsari Agricultural University, Navsari during January 2010. Ten adults (all were females due to thelotokous parthenogenesis) were collected individually with the help of aspirator and released into glass tube (200 × 40 mm) containing fresh and thick leaves of onion. Open end of the tube closed with the help of cotton plug. The tubes were kept in the B.O.D. incubator adjusted to $25 \pm 1^{\circ}\text{C}$ temperature for oviposition. As soon as the larvae emerged from the leaves, they reared individually in tube (150 × 18 mm) on onion leaves up to adult stage (**Fig.1**). The adults used for further investigations.

Biology of *T. tabaci* on onion: The study on biology of *T. tabaci* on onion carried out in the laboratory, Department of Agriculture Entomology, N.M. College of Agriculture, Navsari, Gujarat during the period of January 2010 at a constant temperature $25 \pm 1^{\circ}\text{C}$ by using B.O.D. incubator. Egg period of *T. tabaci* considered as a period between day of egg lying and day of egg hatching. The colour of eggs was typically observed after dehydrating with alcohol and cleared with clove oil. With a view to determine the number and duration of different larval instars, the newly hatched larva of *T. tabaci* kept individually and fed with onion leaves. The size of eggs and each instar larva measured under microscope with the help of ocular

and stage micrometer. The total larval period was calculated. The pupa, when formed collected and kept individually into glass tubes (150 × 18 mm) for emergence of adults. Observations on pre-pupal and pupal periods recorded. Adults emerged from pupa were observed for their colour, shape and size by examine under microscope with the help of ocular and stage micrometer.



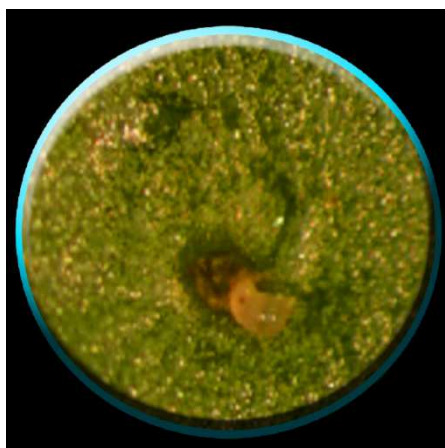
Fig. 1:- Rearing technique of *T. tabaci*

In order to determine the pre-oviposition period, the newly emerged adults of *T. tabaci* kept separately in glass tubes (150 × 18 mm). Fresh leaves of onion e provided as food. The period between the emergence of adult female and commencement of egg lying recorded as the pre-oviposition period. Period between commencement the egg laying and ceasing of the egg laying by individual female recorded as oviposition period and period between ceasing of egg laying to death of female was considered as post-oviposition period. The total number of eggs laid during the life span of the adult female considered as its fecundity. Longevity of adult calculated separately from the date of emergence to death of adults. Total life cycle considered as the period between the dates of egg laying to the death of adults.

RESULT AND DISCUSSION

Eggs: Studies on site of oviposition showed that the female thrusts eggs singly and scatteredly inside the leaf tissues with its pointed ovipositor. The eggs studied under microscope for their shape and size after dehydrating with alcohol and cleared with clove oil. They could be seen as translucent white spot having kidney shape (**Fig.:-2**).

The length and breadth ranged from 0.20 mm to 0.25 mm with an average of 0.23 ± 0.02 mm and 0.06 mm to 0.10 mm with an average of 0.08 ± 0.01 mm, respectively (**Table-1**). Almost similar observations were also reported by Essig¹³ and Fekrat *et al.*¹⁴. Since the eggs embaded in leaf tissues, the incubation period-derived based on number of larvae emerged out from the eggs. The incubation period varied from 4 to 5 days with an average of 4.52 ± 0.51 days (**Table-2**). The incubation period reported to be 4 to 4.5 days on cotton¹⁵, 4.52 days on garlic¹⁶ and 4.97 days on onion¹⁴. Thus, this period not much affected by the host on which the pest reared.

Fig. 2:-Eggs of *T. tabaci*Table-1: Measurements of different stages of *T. tabaci*

Sr. No.	Stages	No. observed	Length(mm)			Breadth(mm)		
			Minimum	Maximum	Avg. \pm S. D.	Minimum	Maximum	Avg. \pm S. D.
1.	Eggs	20	0.20	0.25	0.23 ± 0.02	0.06	0.10	0.08 ± 0.01
2.	I instar	20	0.34	0.68	0.55 ± 0.10	0.10	0.19	0.15 ± 0.03
3.	II instar	20	0.86	1.14	0.99 ± 0.10	0.17	0.27	0.22 ± 0.03
4.	Pre-pupa	20	0.78	1.03	0.90 ± 0.09	0.20	0.29	0.23 ± 0.03
5.	Pupa	20	0.78	1.13	0.94 ± 0.11	0.21	0.32	0.27 ± 0.04
6.	Adult	20	0.89	1.28	1.07 ± 0.13	1.31	1.86	1.62 ± 0.17

Table-2: Duration of various stages of *T. tabaci*

Sr. No.	Stages	No. observed	Duration (Days)		
			Minimum	Maximum	Avg. \pm S. D.
1.	Incubation	50	4	5	4.52 ± 0.51
2.	I instar larva	46	2	3	2.52 ± 0.51
3.	II instar larva	46	3	4	3.41 ± 0.50
4.	Pre-pupal	41	1	3	1.96 ± 0.76
5.	Pupal	41	3	4	3.56 ± 0.50
6.	Total developmental period (egg to pupa)	41	14	20	17.29 ± 1.55
7.	Adult	37	18	38	27.97 ± 6.01
8.	Pre-oviposition	37	2	5	3.43 ± 1.10
9.	Oviposition	37	12	33	22.98 ± 5.58
10.	Post-oviposition	37	2	5	3.51 ± 1.10
11.	Fecundity	37	34	71	56.63 ± 11.73
12.	Total life period	37	38	62	49.66 ± 5.79

Larvae: An investigation carried out to study the number of larval instars, instar duration and entire larval period of this pest. Newly hatched larvae reared individually up to pupation in separate glass tubes containing onion leaves. The larvae moulted once and passed through two larval instars. The first instar larva was small. It was semi transparent and dull white in colour, but later on it changed to yellowish white. The larva was tiny and looked like a segmented worm with red eyes (**Fig.-3a**).

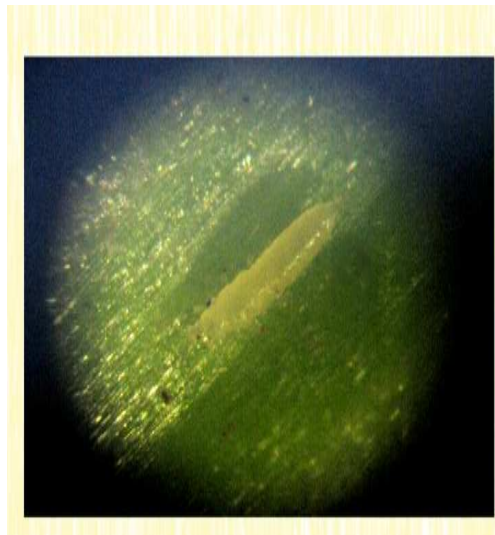


Fig. 3a: First instar larvae of *T. tabaci*

There were no wing buds. The length and breadth ranged from 0.34 mm to 0.68 mm with an average of 0.55 ± 0.10 mm and 0.10 mm to 0.19 mm with an average of 0.15 ± 0.03 mm, respectively (**Table-1**). The first instar larval period varied from 2 to 3 days with an average of 2.52 ± 0.51 days (**Table-2**). The second instar larva resembled with the first instar in general appearance except body size and colour. The body colour of the second instar larvae was yellow (**Fig.3b**).



Fig. 3b:- Second instar larvae of *T. tabaci*

The abdomen divided into 8 distinct segments and a large segment, which was conical in shape. There were 3 pairs of leg. The length and breadth ranged from 0.86 mm to 1.14 mm with an average of 0.99 ± 0.10 mm and 0.17 mm to 0.27 mm with an average of 0.22 ± 0.03 mm, respectively (**Table-1**). The second instar larval period varied from 3 to 4 days with an average of 3.41 ± 0.50 days (**Table-2**). Similar result were also observed by Fekrat *et al.*¹⁴ and Changela¹⁶.

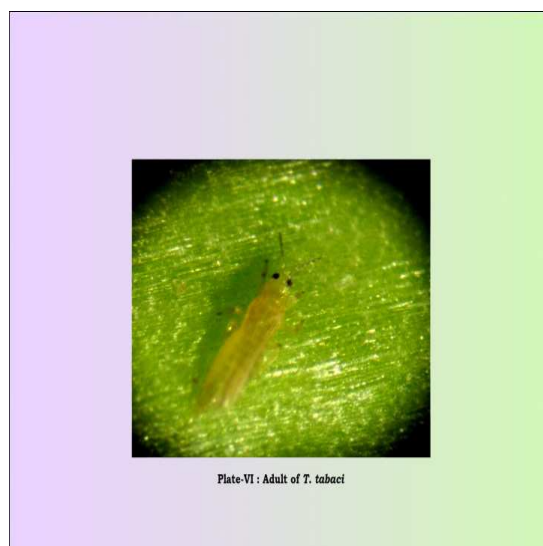
Pupa: Pupation normally takes place inside the soil but under laboratory condition the larva easily pupate on the side of the rearing glass tubes. It also observed that before pupation, the second instar larva become sluggish and entered into pre-pupal stage, which was whitish yellow in colour. The length and breadth of pre-pupal ranged from 0.78 mm to 1.03 mm with an average of 0.90 ± 0.09 mm and 0.20 mm to 0.29 mm with an average of 0.23 ± 0.03 mm (**Table-1**). The larvae remained as pre-pupae for about 1 to 3 days with an average of 1.96 ± 0.76 days (**Table-2**). The pupa, when completely formed the antennae folded back over the head and wing pads were well developed. Both the stages have showed slight movement, when they were disturbed. The colour of pupa was yellowish white but before adult emergence, the colour changed to yellowish (**Fig.-4**). The length and breadth of pupa ranged from 0.78 mm to 1.13 mm with an average of 0.90 ± 0.11 mm and 0.21 mm to 0.32 mm with an average of 0.27 ± 0.03 mm, respectively (**Table-1**). The pupal period varied from 3 to 4 days with an average of 3.56 ± 0.50 days (**Table-2**). These findings are similar to the results of Changela¹⁶ on garlic and Fekrat *et al.*¹⁴, on onion.



Fig. 4:- Pupa of *T. tabaci*

Adult: It observed that the adult thrips immediately after the emergence from the pupa, climbed up on the wall of glass rearing tube. The colour observed to be pale yellow to grey with darker transverse bands across the abdomen. The fore wings and hind wings were fringed and pale in colour. Segmented antennae also observed. The eyes were grey coloured (**Fig.-5**).

Jones and Mann¹⁷, Butani and Jotwani¹⁸ and Changela¹⁶ have also given all similar description. The body length of adult thrips ranged from 0.89 mm to 1.28 mm with an average of 1.07 ± 0.13 mm and breadth ranged from 1.31 mm to 1.86 mm with an average of 1.62 ± 0.17 mm (Table-1). Adult thrips lived for 18 to 38 days with an average of 27.97 ± 6.00 days (**Table-2**). Changela¹⁶ reported the adult longevity of 16 to 42 days on garlic. According to Fekrat *et al.*¹⁴, adult lived to 12 to 30 days when reared on onion.

Plate-VI : Adult of *T. tabaci***Fig. 5: Adult of *T. tabaci***

The pre-oviposition period was around 2 to 5 days with an average of 3.43 ± 1.09 days. The egg laying (oviposition) continued for 12 to 33 days with an average of 22.98 ± 5.58 days. The post oviposition period varied from 2 to 5 days with an average of 3.51 ± 1.10 days (Table-2). Rahman, Batra¹⁹, and Changela¹⁶ also made similar types of observations. The number of eggs laid by female during its entire life span ranged from 34 to 71 eggs (mean 56.63 ± 11.73 eggs) which similar to the reports of Changela¹⁶. Developmental period of this pest varied from 14 to 20 days with an average of 17.29 ± 1.55 days and entire life span of female varied from 38 to 62 days with an average of 49.66 ± 5.79 days (Table-2). Results obtained through the present investigation are near to the results of Changela¹⁶.

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