Journal of Biological Control, 34(1): 73-81, 2020, DOI: 10.18311/jbc/2020/23249

Research Article

Thermal requirements of *Tuta absoluta* (Meyrick) and influence of temperature on its population growth on tomato

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ABSTRACT: The present study deals with the impact of temperature on development, survival, reproduction and population growth of a recently invaded and the most destructive pest of tomato, *Tuta absoluta* (Meyrick) with the aim to understand its possible expansion in different agro-climatic zones. Though *T. absoluta* was able to develop between 15° and 35°C, temperature around 25°-30°C was more suitable. Survival and fecundity were highest at 25°C and lowest at 35°C. Developmental threshold for different developmental stages of the pest varied from 6.2 to 9.5°C, while the thermal constant required by the insect to complete the development from egg to adult emergence was 500 degree-days. Population growth parameters were also influenced significantly by the rearing temperature. Intrinsic rate of increase, net reproductive rate and finite rate of increase was higher at 25° and 30°C as compared to other temperature regimes. The study concludes that *T. absoluta* can be a serious pest of tomato in mid-hills of north-western Himalayan region and the southern plains of India where temperatures varies between 15-35°C. Furthermore, the developmental threshold values indicate that the pest can develop and survive at temperatures as low as 6-9°C without entering the diapause as long as the food is available.

KEY WORDS: Fecundity, reproduction, survival, temperature, *Tuta absoluta*

(Article chronicle: Received: 24-05-2019; Revised: 15-01-2020; Accepted: 25-01-2020)

INTRODUCTION

Invasive tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is native to South America. Outside its native place the pest was detected for the first time in Spain during 2006 (Urbaneja *et al*., 2008) and since then it has rapidly invaded 80 countries including India (CABI 2018). The pest feeds on leaves, fruits, buds and apical shoots of tomato and is capable of causing 100 per cent crop damage in the absence of control measures (Urbaneja *et al.,* 2012; Ballal *et al.,* 2016). In India, the occurrence of this pest was recorded for the first time on tomato in Pune and Bengaluru during 2014 (Sridhar *et al.,* 2014; Shashank *et al*., 2015), and since then it has spread to almost all parts of the country where tomato is grown (Sridhar *et al*., 2014; Kalleshwaraswamy *et al*., 2015; Kumari *et al*., 2015; Shashank *et al*., 2015; Ballal *et al.,* 2016; Sharma and Gavkare 2017). In Himachal Pradesh, *T. absoluta* was detected for the first time in 2015 on tomato at Nauni, Solan (Sharma and Gavkare, 2017). At present the pest has emerged as a serious threat to tomato in different parts of the state both in open fields and polyhouses. Previous reports indicate that in newly infested areas, *T. absoluta* immediately attained the status of a serious pest inspite of being intensively treated with insecticides (Bielza, 2010; Desneux *et al*., 2010). *Tuta absoluta* control is mainly based on insecticides and some times as high as 14 rounds of insecticide sprays in a growing season were required (Luna *et al*., 2012). The pest is, therefore, very difficult to control with chemicals owing to the fact that the larvae live inside the mines and fruits where insecticides are difficult to penetrate. High biotic potential, exceptional speed of spread and the ability to develop insecticide resistance make this pest further challenging (Desneux *et al.,* 2010; Ingegno *et al*., 2013; Roditakis *et al*., 2013; Roditakis *et al.,* 2015).

The world is experiencing global warming and such changes in climate are expected to seriously affect the population dynamics and status of insect pests (Porter *et al*., 1991; Sharma, 2014). Among climatic factors temperature is the most crucial that directly affects the development, survival, distribution, and abundance of insects (Zhang *et al*., 2008; Ju *et al*., 2011; Karuppaiah and Sujayanad, 2012; Gavkare and Sharma 2017). It is, therefore, important to understand the influence of temperature on the demography of *T. absoluta* to predict the possible expansion of distribution range of the pest. Generally, the effect of temperature on insects is measured in terms of the rate of development (Sreedevi *et al*., 2013; Liu *et al*., 2015). These models, however, do not consider the overall effect of temperature on the biotic potential of insects. In contrast, life table parameters, such as the net reproductive rate (Ro) and intrinsic rate of increase (rm) calculated on the basis of survival, fertility, developmental time, and sex ratio under different temperature regimes, more comprehensively reflect the overall effect of temperature on insects. The present study, therefore, aims to study the thermal requirements and effect of temperature on development and population growth potential of *T. absoluta*.

MATERIAL AND METHODS

Raising of insect culture

Tuta absoluta culture was obtained from the stock culture maintained in the Bio-control Research Laboratory of the Department of Entomology, YSP University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India and reared on tomato leaves in insect rearing cages for one generation before using for the experiments. The adults of second generation were transferred to insect rearing cages for mating and provided with 10 percent honey solution in cotton swabs as food and tomato leaves as substrate for oviposition. Eggs laid on a single day were used for the experiments.

Developmental biology at different temperatures:

The experiments were conducted at 15, 20, 25, 30 and 35 ± 0.5°C, 70 ± 5% relative humidity and 12 L: 12 D photoperiod. In each case 45 eggs laid on a single day were transferred carefully with the help of a fine camel hair brush to tomato leaflets in Petri dishes (9cm diameter) and incubated on the respective temperature, relative humidity and photoperiod conditions. These eggs were observed daily for hatching, and observations on egg development time and survival were recorded. Newly emerged larvae were reared individually on tomato leaflets (petiole wrapped with moist cotton) at the respective temperatures in Petri dishes under-lined with moist filter paper towel. The larvae were examined daily for moulting and their food was changed after every 24-48h until the last larva pupated. Observations on the development time and survival of each larval instar were recorded. Pupae thus obtained were sexed (Genc, 2016) and placed individually in glass tubes for adult emergence. Observations on the duration of pupal development, survival and sex ratio were recorded.

Adults developed from the pupae were kept in pairs in glass chimneys containing tomato leaves for egg laying and 10 per cent honey solution in cotton swabs as food. The oviposition substrate was observed for egg laying and replaced daily until the last adult died. The food was also replaced daily. Observations on daily survival, fecundity, adult longevity, pre-oviposition period, oviposition period and post-oviposition period were recorded.

Population growth parameters

Daily survival and fecundity data were used to construct life-fertility tables of the pest at different temperatures separately to calculate the population growth parameters (Birch 1948; Carey 2001) as under:

x = age of the individuals in days (pivotal age), lx = the proportion of females still alive at age x (survival rate), and mx= the number of female eggs laid per female at the age x (fecundity rate). Data thus obtained were used to calculate the following population growth parameters or fertility parameters.

i) The net reproductive rate (R_o): rate of multiplication of the population in each generation, measured in terms of females produced per generation, calculated as $R_o = \Sigma lxmx$.

ii) Intrinsic rate of natural increase (rm): calculated by using the expression $\Sigma(e^{-rmx} lxmx) = 1$.

iii) Mean generation time (T): the mean period elapsing from the birth of parents to the birth of offspring, calculated by the formula: $T = Log_e R_o/rm$

iv) Finite rate of natural increase (λ): the number of times the population increases per unit time, calculated by the formula: $\lambda = antilog_e rm$.

v) The weekly multiplication rate (WM): the number of times the population increases in a week, calculated by the formula: $(WM) = e^{7rm}$.

vi) The doubling time (DT): the time taken in days by a species to double its population, calculated by the formula: $DT= log_e 2/rm$.

The jackknife procedure was used to recalculate the above parameters. The jackknife method removes one observation from the original dataset and recalculates the parameter of interest from the truncated data set. These new estimates, also called as pseudovalues, were further used to calculate the fresh values of each parameter which served as replications for the parameter to calculate mean and standard error (Meyer *et al*. 1986; Maia *et al.,* 2000).

Data analysis

Data on the survival, development, fecundity, and population growth parameters of the pest on different temperatures were subjected to one-way analysis of variance and significantly different (p=0.05) means were separated by Least Significant Difference (LSD). The effect of temperature on development rate was determined using a linear regression model to estimate the lower temperature threshold and the thermal constant (Worner, 1992) as under:

1/D = a + bT, where 1/D is the development rate (1/development time), T is the temperature (°C) and 'a' and 'b' are the linear and angular coefficients of the regression line.

Effect of temperature on pre-oviposition period, oviposition period, post oviposition period, adult longevity and lifetime fecundity was evaluated by polynomial regression, using the following equations:

$$y = a + bT + cT^2 + dT^3$$

$$y = a + (b/T) + (c/T^2)$$

where y is the adult parameter as mentioned above and T is the temperature (°C) and a, b, c and d are the polynomial coefficients.

RESULTS AND DISCUSSION

Development of *Tuta absoluta* at different temperatures

Tuta absoluta was able to complete development on all the tested temperatures between 15 and 35°C. Mean development time of each developmental stage on different temperatures, however differed significantly (egg: F = 1169, df = 4,186, $P < 0.001$; first instar larva: F = 345.2, df = 4,171, p < 0.001; second instar larva: F = 230.2, df = 4, 161, p < 0.001; third instar larva: F = 312.8, df = 4, 156, p < 0.001; fourth instar larva: F = 50.49, df = 4, 141, p < 0.001; total larval period: F = 2490.0, df = 4, 152, p < 0.001; egg-adult emergence: F = 6696, df = 5, 90, p < 0.001). Incubation period was shortest (2.33 days) at 35°C and longest (8.2 days) at 15°C. Larval development of *T. absoluta* was fastest (8.94 days) at 35°C followed by 30°C (11.5 days), 25°C (15.1 days), 20°C (17.1 days) and 15°C (29.22 days). Similarly, the pupal period was shortest (6 days) at 35°C and longest (19.4 days) at 15°C. The pest took 16.72, 22.8, 28.88, 36.72 and 58.92 days to complete the immature development (egg-adult emergence) at 35, 30, 25, 20 and 15°C, respectively (Table 1). Like other lepidopterans, the development time of *T. absoluta* increased with decrease in temperature (Mironidi and Savopoulou-Soultani 2008; Koda and Nakamura 2012; Park *et al*., 2014). This phenomenon can be explained by the ectothermic nature of insects. At high temperatures the metabolism is faster, hence developmental time becomes shorter and vice-versa (Benkova and Volf, 2007; Sgolastra *et al*., 2011; Damos and Savopoulou-Soultani, 2012). The incubation period varied from 2.33 days at 35°C to 8.20 day at 15°C which is nearly same as reported by Krechemer and Foerster (2015). The larval period of the pest reported in the present study is slightly lower than recorded in earlier studies at similar temperature conditions (Estay, 2000; Krechemer and Foerster, 2015). Interestingly Shiberu and Getu (2017) did not find any significant difference in the larval development time of the pest at 20 and 32°C. The differences in the larval development time reported in different studies could be due to the differences in rearing temperature, tomato cultivars and the geographical populations of the insect used in different studies (Bernays and Chapman, 1994; Mohamadi *et al*., 2017). Pupal period of the pest observed in the present study was slightly higher than reported by Coelho and Franca (1987), Haji *et al.* (1988), Erdogan and Babaroglu (2014) and Krecheme and Foerster (2015), but, slightly lower than reported by Gadir *et al*., (2016) when compared at same temperature conditions. In our study, the total immature development of the pest was completed in 58.92 days at 15°C and 16.72 days at 35°C. These results nearly agree with the findings of Coelho and Franca (1987), Bentancourt *et al*. (1996), Krecheme and Foerster (2015) and Silva

Table 1. Mean development time (days ± SE) of different developmental stages of *Tuta absoluta* on tomato at different temperatures

Developmental stage	Temperature (°C)				
	15	20	25	30	35
Egg period	8.20 ± 0.46a	6.83 ± 0.16b	3.30 ± 0.58c	2.50 ± 0.17d	2.33 ± 0.23d
1st Instar	7.97 ± 0.13a	6.20 ± 0.15b	3.23 ± 0.10c	2.40 ± 0.12d	2.90 ± 0.09e
2nd Instar	6.30 ± 0.05a	5.12 ± 0.06b	3.80 ± 0.13c	2.20 ± 0.14d	1.85 ± 0.04d
3rd Instar	7.57 ± 0.03a	5.06 ± 0.09b	4.11 ± 0.13b	3.33 ± 0.09c	2.30 ± 0.22d
4th Instar	6.85 ± 0.24a	5.23 ± 0.034b	2.96 ± 0.17c	2.47 ± 0.03c	2.15 ± 0.04c
Total Larval period	29.22 ± 0.28a	17.1 ± 0.21b	15.10 ± 0.11c	11.5 ± 0.27d	8.94 ± 0.30e
Pupal period	19.4 ± 0.08a	12.8 ± 0.09b	10.40 ± 0.10c	8.80 ± 0.36d	6.00 ± 0.26e
Egg-adult emergence	58.92 ± 0.26a	36.72 ± 0.19b	28.88 ± 0.22c	22.8 ± 0.48d	16.72 ± 0.31e

Mean values followed by same letter in a row do not differ significantly at $p = 0.05$

et al. (2015). Present results also find support from those of Pereyra and Sanchez (2006), Erdogan and Babaroglu (2014) and Ganbalani *et al*. (2016). Rearing temperature also had significant effect on immature survival of the pest. The per cent survival was highest (83.4%) at 25ºC followed by 30ºC (75%), 20ºC (41%), 15ºC (37%) and 35ºC (22%) (Fig. 1).

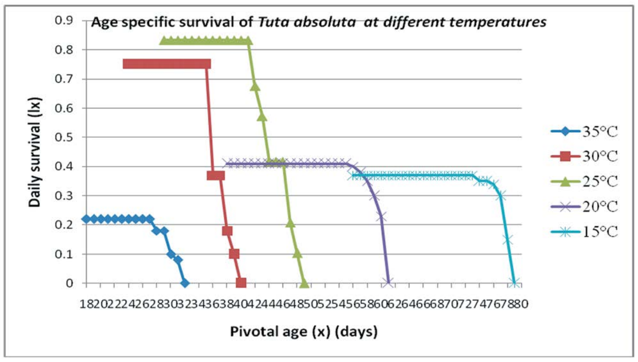

Fig. 1. Age specific survival of *Tuta absoluta* at different temperature

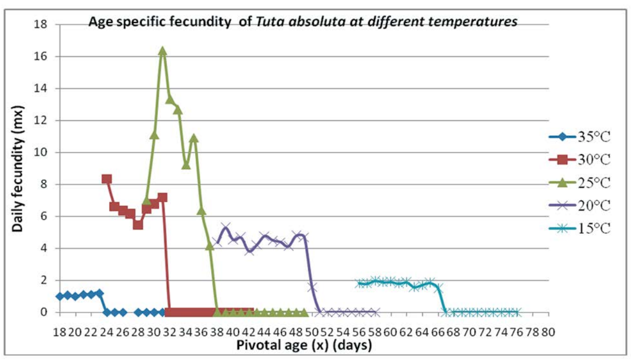

Fig. 2. Age specific fecundity of *Tuta absoluta* at different temperatures

Reproduction and longevity of *T. absoluta* at different temperatures

Reproductive phases of *T. absoluta* were affected significantly by the rearing temperature (Table 2). Both male and female longevity differed significantly (male: F = 52.66, df = 4, 41, P < 0.001; female: F = 64.90, df = 4, 40, P < 0.001) among different temperatures and were shortest (9.0 and 10.80 days, respectively) at 35ºC and longest (19.67and 25.0 days, respectively) at 15ºC (Table 2). Females lived longer than males in each case. Temperature significantly affected both the pre-oviposition period (F = 22.89, df =4, 40, P < 0.001) and the post-oviposition period (F = 86.08, df =4, 40, P < 0.001) of *T. absoluta*. The pre-oviposition period at 15°C was 4.0 days which was significantly longer than other temperatures. The oviposition period ranged from 8.5 days at 30°C to 12.42 days at 20°C (Table 2). Fecundity was highest (175.3 eggs/female) at 25°C followed by 120.88 eggs per female at 30 °C. The polynomial functions provided a good fit to the relationship between temperature and adult parameters namely pre-oviposition period, oviposition period, post-oviposition period, fecundity and adult longevity (Table 5, 6). Like other parameters oviposition period of the miner was longest at 20ºC followed by 25, 30 and 35ºC. Oviposition period of miner not only varied with the temperature but also among different cultivars with in tomato (Erdogan and Babaroglu, 2014; Silva *et al*. 2015; Krechemer and Foerster, 2015; Ganbalani *et al*., 2016). The female longevity at 25ºC recorded in the present study (18 days) was nearly same (18.16 days) to that reported by Erdogan and Babaroglu (2014). Our results also find support from those of Krechemer and Foerster (2015) and Silva *et al*. (2015). According to Andrew *et al*., (2013) adult longevity was longest (40 days) at 10ºC and shortest at (16 days) 19ºC. Similarly, adults reared at 35°C survived for about two third of those reared at 25ºC (Kareim *et al.,* 2016). The fecundity of the pest also varied significantly with rearing temperature. Earlier Krechemer and Foerster, (2015) reported highest fecundity of the pest at 25°C followed by 20, 15, 10 and 30°C. Fecundity of *T. absoluta* on tomato leaves at 25°C (175.38 eggs/female) obtained in the present study falls within the fecundity range (47.54-260 eggs/female) reported in previous studies at same temperature (Erdogan and Babaroglu 2014;

Table 2. Mean (±SE) pre-oviposition period, oviposition period, post-oviposition period, adult longevity and fecundity of *Tuta absoluta* on tomato at different temperatures

Parameter	Temperature (ºC)				
	15	20	25	30	35
Pre-oviposition period (days)	4.0 ± 1.1a	2.3 ± 1.2b	1.6 ± 1.0c	1.3 ± 1.03d	2.3 ± 1.1b
Oviposition period (days)	11.7 ± 2.1a	12.3 ± 1.1a	9.3 ± 1.2b	8.5 ± 0.9b	6.1 ± 1.1c
Post-oviposition period (days)	14.9 ± 2.2a	12.7 ± 2.1b	7.25 ± 1.1c	4.8 ± 1.2d	4.0 ± 1.0d
Male longevity (days)	19.7 ± 3.2a	15.4 ± 3.1b	13.6 ± 3.1c	11.4 ± 2.1d	9.0 ± 2.1e
Female longevity (days)	25.0 ± 3.0a	21.7 ± 2.3b	18.0 ± 3.0c	13.57 ± 1.1d	10.8 ± 1.2e
Fecundity (eggs/female)	89.3 ± 8.2d	140.3 ± 8.7b	175.3 ± 7.3a	120.9 ± 6.2c	10.7 ± 3.1e

Mean values followed by same letter in a row do not differ significantly at p= 0.05

Table 3. Developmental threshold (DT) and degree-days (DD) for different developmental stages of *Tuta absoluta* reared on tomato

Stage	DT (°C)	DD	Regression equation 1/D =	R^2
Egg	8.8	58.8	0.021x - 0.248	0.950
1st Instar	9	62.5	0.011x - 0.032	0.962
2nd Instar	9.6	50	0.013x - 0.082	0.938
3rd Instar	6.6	71.4	0.010x - 0.011	0.951
4th Instar	6.9	58.8	0.017x - 0.117	0.946
Total	7.5	200	0.005x - 0.031	0.946
Pupa	6.2	250	0.002x + 0.003	0.943
Egg to Adult	7.5	500	0.001x - 0.007	0.980

Table 4. Population growth parameters of *Tuta absoluta* on tomato at different temperatures

Temperature (°C)	Ro	rm	T	λ	DT	WM
15	19.3 ± 0.8d	0.058 ± 0.002c	60.9 ± 4.4e	1.060 ± 0.001c	11.8 ± 1.8c	1.48 ± 0.02c
20	30.9 ± 0.7c	0.080 ± 0.001b	48.4 ± 3.1d	1.083 ± 0.001b	8.7 ± 1.6b	1.75 ± 0.16b
25	75.6 ± 3.0a	0.132 ± 0.004a	32.8 ± 4.2c	1.141 ± 0.005a	5.3 ± 1.4a	2.51 ± 0.18a
30	39.9 ± 1.4b	0.136 ± 0.003a	27.0 ± 2.7b	1.146 ± 0.002a	5.1 ± 1.0a	2.59 ± 0.24a
35	1.4 ± 0.04e	0.016 ± 0.004d	21.2 ± 2.1a	1.016 ± 0.004d	42.2 ± 7.2d	1.12 ± 0.15d

Mean values followed by same letter in a column do not differe significantly at p= 0.05

Krechemer and Foerster 2015; Silva *et al*., 2015; Sridhar *et al.,* 2015; Ganbalani *et al*., 2016). Effect of temperature on pre-oviposition period has also been reported in earlier studies (Neto *et al*., 1988; Krechemer and Foerster, 2015; Kareim *et al*., 2016). The polynomial functions provided a good fit to the relationship between temperature and adult parameters like pre-oviposition period, oviposition period, fecundity and adult longevity (Table 5, 6).

Table 5. Polynomial model ($Y=a+bT+cT^2+dT^3$) describing relationship between the adult parameters of *Tuta absoluta* and temperature

Parameter	Regression equationY=a+bx	R^2
Pre-oviposition period	$-0.000x^3 + 0.020x^2 - 0.392x + 2.625$	0.987
Oviposition period	$2E\text{-}06x^3 + 9E\text{-}05x^2 - 0.004x + 0.124$	0.957
Post-oviposition period	$-5E\text{-}05x^3 + 0.004x^2 - 0.093x + 0.718$	0.999
Male longevity	$1E\text{-}05x^3 - 0.000x^2 + 0.016x - 0.083$	0.999
Female longevity	$-2E\text{-}06x^3 + 0.000x^2 - 0.005x + 0.072$	0.998
Fecundity (eggs/female)	$-3970.x^3 + 2107.x^2 - 404.4x + 33.36$	0.999

Developmental threshold and degree-day requirement of *Tuta absoluta*

Developmental thresholds and degree-day requirements of different stages of *T. absoluta* reared on tomato were calculated by regressing the rate of development (1/D) on temperature (X) and the results obtained are presented in Table 4. Eggs required 58.8 degree-days to complete the development with developmental threshold of 8.8°C. The developmental thresholds for first, second, third and fourth instar larvae were 9.0, 9.6, 6.6, and 6.9°C with thermal constants of 62.5, 50.0, 71.4 and 58.8 degree-days, respectively. Total larval development was completed after acquiring 250 degree-days with lower thermal threshold of 7.5°C. In order to develop from egg to adult *T. absoluta* required 500 degree-days with a developmental threshold of 7.5°C. The lower developmental threshold temperature (7.5°C) estimated for the egg-adult cycle of *T. absoluta* was slightly lower than (8.0-9.8) obtained in previous studies (Barrientos *et al*., 1998; Bentancourt *et al*., 1996; Mahdi *et al*., 2011; Mahdi and Doumandji, 2013). The lower base temperature estimated for the larval stage (7.5°C) in our study was slightly higher than reported by Bentancourt *et al*., (1996) (6.0°C) and Mahdi and Doumandji (2013) (6.2°C). The mean thermal constant required for development of *T. absoluta* eggs, larvae and pupae was 58.8, 250 and 200 degree-days, respectively. While, Barrientos *et al.* (1998) found that the thermal constant for the development of egg, larvae and pupa were 103.8, 238.5 and 117.3 degree-days, respectively. Slight

Table 6. Polynomial model (Y= a+b/T+c/T2) describing the relationship between the adult parameters of *Tuta absoluta* and temperature

Parameter	Regression equationY= a+b/x	R^2
Pre-oviposition period	$-441.4x^2 + 33.41x - 0.041$	0.631
Oviposition period	$104.8x^2 - 11.81x + 0.408$	0.938
Post-oviposition period	$191.3x^2 - 23.16x + 0.760$	0.996
Male longevity	$44.96x^2 - 5.711x + 0.233$	0.961
Female longevity	$55.41x^2 - 6.578x + 0.233$	0.983
Fecundity (eggs/female)	$134.9x^2 - 15.15x + 0.509$	0.800

variations in developmental thresholds and thermal constants of the insect reported in different studies could be due to the variations in the geographical populations of the insect and food used in different studies (Honek, 1996; Kipyatkov and Lopatina, 2010).

Population growth parameters

Temperature had significant impact on the population growth parameters namely, net reproductive rate (Ro): $F = 84.6$; $df = 4, 40$; $p < 0.001$), intrinsic rate of natural increase (rm): $F = 60.09$; $df = 4, 40$; $p < 0.001$), mean generation time (T): $F = 181.9$; $df = 4, 40$; $p < 0.001$), finite rate of increase (λ): $F = 4{,}929.4$; $df = 4, 40$; $p < 0.001$), doubling time (DT): $F = 3.8$; $df = 4, 40$; $p = 0.0106$) and weekly multiplication rate (WM): $F = 37.9$; $df = 4, 40$; $p < 0.001$) of *T. absoluta* (Table 4). The net reproductive rate was highest (75.6 females/female/generation) at 25°C and lowest (1.42 females/female/generation) at 35°C. The intrinsic rate of natural increase, also called as specific growth rate was 0.0164, 0.1364, 0.1316, 0.0799 and 0.0586 females/female/day at 35, 30, 25, 20 and 15°C, respectively. The mean generation time of *T. absoluta* was minimum (21.28 days) at 35°C and maximum (60.97 days) at 15°C. The finite rate of increase of *T. absoluta* was 1.148, 1.203, 1.349, 1.273 and 1.129 at 15, 20, 25, 30 and 35°C, respectively. *Tuta absoluta* is expected to double its population in 11.8, 8.7, 5.3, 5.1 and 4.7 days with a weekly multiplication rate of 1.48, 1.75, 2.51, 2.59 and 1.22 at 15, 20, 25, 30 and 35°C, respectively. Previous, studies have evaluated the effects of temperature on *T. absoluta* by considering the biological characteristics such as development, survival or reproduction (Barrientos *et al*., 1998; Vercher *et al*., 2010; Cuthbertson *et al*., 2013; Van Damme *et al*., 2015). However, these studies did not study the effect of temperature on the population growth parameters. Population parameters especially intrinsic rate of natural increase (rm) combines the development time, survival and fecundity into a single value and can be a better indicator of the effect of any abiotic factor on growth and development (Southwood and Henderson, 2000). The intrinsic rate of increase (rm) reached its maximum at 30 and 25 °C, indicating that temperature around 25-30°C was optimal for highest population growth of *T. absoluta*. Even though, the net reproductive rate of *T. absoluta* was significantly higher at 25°C than at 30°C, the population growth parameters like intrinsic rate of natural increase (rm), finite rate of increase (λ), doubling time (DT), and weekly multiplication rate (WM) were on par at both the temperatures, probably due to the shorter generation time at 30°C. Present study reveals that the population growth parameters were significantly impacted by the rearing temperature. Extreme temperature had negative impact on the population growth parameters such as intrinsic rate of natural increase (rm), finite rate of increase (λ), Doubling Time (DT), and Weekly Multiplication rate (WM). In the present study, the values of intrinsic rate of increase, finite rate of increase of were highest at 25 and 30°C and lowest at 35°C followed by 15°C. The intrinsic rate of natural increase of *T. absoluta* recorded in the present study at 25°C (0.1316) was nearly similar to that reported (0.1046-0.1606) in the previous studies (Pereyra and Sanchez, 2006; Erdogan and Babaroglu, 2014; Silva *et al*., 2015). Besides temperatures, population growth parameters can also influence by the nature and quality of the food (Pereyra and Sanchez, 2006; Chen *et al*., 2010; Farahani *et al*., 2012; Golizadeh *et al*., 2017). Present study provides information on the effects of temperature on *T. absoluta* and highlights how it affects the development, fecundity, survival and hence the biotic potential of this insect. The data can, therefore, be used to establish predictive models of occurrence of *T. absoluta* over time and space and will also be useful in understanding the demography and population dynamics, and for forecasting outbreaks of *T. absoluta* in the agroecosystems (Roy *et al*., 2003). In addition, the data can be used for projections of the potential geographic dispersal of *T. absoluta* because they provide information on the limiting effects of temperature extremes on biological parameters of *T. absoluta*. These parameters are important for determining not only the geographic distribution, but also the invasive potential of the species (Desneux *et al.,* 2010; Ponti *et al.,* 2015a, b). The results of this study will also help in taking up advance biological control strategies in the indicated vulnerable areas.

ACKNOWLEDGEMENTS

The authors are thankful to the Indian Council of Agricultural Research, New Delhi, India, for providing funds through All India Coordinated Research Project on Biological Control of Crop Pests and Weeds and the Professor and Head, Department of Entomology, YSP University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India, for providing necessary facilities.

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