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ORIGINAL ARTICLE

Life cycle of a plant parasitic mite, *Tetranychus sayedi* Baker & Pitchard (Acari: Tetranychidae) on two hosts from West Bengal, India

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Abstract The present paper reports duration of different developmental stages as well as fecundity, longevity, oviposition periods, sex ratio, etc. of *Tetranychus sayedi* Baker & Pitchard on two medicinal plants, viz. *Cryptolepis buchanani* Roem & Schult and *Justicia adhatoda* L. under laboratory condition at 27.5 °C and 65% R.H. during February–March, 2016. The two hosts in which the life cycle was studied form two new records of hosts for this mite. It appears that *C. buchanani* is better host among the two hosts as because the life cycle (egg to adult) was completed in shorter time, recording high fecundity and longer longevity.

Keywords Mite · *Tetranychus sayedi* · Two medicinal plant hosts · Life cycle · India

Introduction

Recently medicinal plants are receiving global importance for their manifold uses like preparation of herbal drugs, as food supplements, dyeing and colouring agents, as well as biopesticides. The two plants on which the study was conducted are very important as because *Justicia adhatoda* L. is largely used in cough and cold, bronchial asthma, pyorrhoea, as well as from relieving breathlessness (Singh and Huidrom 2013). The other plant *Cryptolepis buchanani* Roem & Schult is also of medicinal importance as it is used in treating inflammation, arthritis, muscle and joint pain, blood purifier, anti-cough, antibacterial, demulcent, diaphoretic, diuretic properties and in treatment of rickets in children (Laupattarakasem et al. 2006; Sharma et al. 2012). These two plants were found highly infested by *T. sayedi*. This mite caused severe chlorosis of leaves in case of *J. adhatoda* which made the leaf whitish all along its lamina. However, on *C. buchanani,* though the population was reasonably high but the symptom of damage was not noticeable.

Materials and methods

The adult mites were collected from the field and were released on excised leaves kept on wet cotton pad in a Petri dish (10 cm diameter) for allowing those to lay eggs. On the following day, the eggs were encircled with ink and the females were removed. As such the experiment for the life cycle study was started with 30 eggs. The observation was recorded from the egg stage onwards by examining each of the excised leaves with eggs under stereo- binocular microscope for further development in life cycle. When the eggs hatched and the larvae emerged, those were transferred on individual excided leaves in a Petri dish (5 cm in diameter), each having one freshly emerged larva. Observations were recorded after every 24 h. for further development and necessary records were made regarding duration of different stages like incubation, larval, protonymphal, deutonymphal, egg to adult period, fecundity both of fertilized and unfertilized female, preoviposition, oviposition, post-oviposition, longevity, sex ratio, etc. from each of the excised leaf. If mortality was observed on any excised leaf, that data was discarded and not considered for computation. In order to determine pre-oviposition and oviposition periods a separate experiment was designed. In

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that case 10 Petri dishes each of 4 cm in diameter were taken and excised leaf of each of the plant was placed on wet cotton pad and on each of those a newly emerged female deutonymph along with an adult male was placed together allowing them to mate after the female attained adulthood. Observations were recorded after every 24 h. under a stereo-binocular microscope. While taking the observations, the number of newly laid eggs were counted in each Petri dishes and thereafter, the eggs were destroyed by pricking those with a needle. The observations were continued until the cessation of egg laying. The time taken between laying of 1st egg and the last egg was considered as ovoposition period. While the period between attaining adulthood and started laying egg were considered as pre oviposition period and finally the period from cessation of egg laying till the death of the adult female was considered as post oviposition period. The longevity of the adult female was determined by a separate experiment for which female deutonymph was kept and its life cycle continued until its death and in case of male it was done in a similar way but in this case the protonymphal stages was taken and its life cycle as continued till its death as because males omit the deutonymphal stage. The statistical analysis as required was done. All the Petri dishes having excised leaves were kept in a BOD incubator where a constant temperature of 27.5 °C with 65% R.H. was maintained during February–March, 2016.

Results and discussion

The duration of different developmental periods along with preoviposition, oviposition, postoviposition period, fecundity etc. have been presented in Table 1 and those have been discussed as below:

Incubation period

Among the two hosts, the incubation period was shorter in case of *J. adhatoda* where it took 2.7 ± 0.16 days as compared to *C. buchanani*, where the time taken was 3.4 ± 0.17 days (Table 1).

Extensive studies had been conducted on the life cycle parameters of different Tetranychid mites and some such are as follows: 5.3–5.8 days in case of *Panonychus citri* on papaya (Maity and Chakrabarti 1978); 2.0–3.0 in case of *Eotetranychus uncatus* on *Bohemia variegata* at 26.60 °C (Lal and Mukharji 1979). In case of *Tetranychus ludeni* on beans, the period was 6.23 days (Puttaswamy and Channabasavanna 1980). Mallikarajunappa and Nageshchandra (1989) observed the incubation period of *Eotetranychus hicoriae* as 6.09 ± 0.57 days on guava leaves. The period was 2.50–3.50 days in *T. neocaledonychus* under green house conditionas was observed by Manjunatha and Puttuswamy (1989). In *Oligonychus tylus* on sorghum, this period was 4.55 ± 0.49 days as observed by Sirsikar and Nagabhushanam (1989). In *O. indicus* on sorghum this period was 4.73 days (Rai et al. 1989). This period was recorded as 5.90 ± 0.12 days in *O. oryzae* on paddy by Nayak et al. (2007); 7.03 ± 0.20 days in case of *O. coffeae* on rose leaves by Haque et al. (2007); 4.80 days in case of *T. chinnabarinus* on *Dianthus caryophyllus* by Tello et al. (2009); 2.71 ± 0.07 days in case of *T. chinnabarinus* on lablab bean by Kaimal and Ramani (2011); 2.5 ± 0.17 days on *Clitoria ternatea* and 2.00 ± 0.45 days on *J. adhatoda* in case of *T. macfarlanei* by Biswas et al. (2013) and 2.47 ± 0.34 days in case of *O. coffeae* on tea leaves by Podder et al. (2014).

Therefore, the duration of protonymphal period observed in the present study was much shorter as compared to duration reported by Maity and Chakrabarti (1978), Puttaswamy and Channabasavanna (1980), Sirsikar and Nagabhushanam (1989), Rai et al. (1989), Nayak et al. (2007) and Tello et al. (2009); but close to those of Lal and Mukharji (1979), Manjunatha and Puttuswamy (1989), Kaimal and Ramani (2011), Biswas et al. (2013) and Podder et al. (2014).

Larval period

This duration was much shorter (2.2 ± 0.14 days) in case of *C. buchanani* as compared to (2.8 ± 0.40 days) in case of *J. adhatoda*. The larvae was light redish in colour and was very slow in their movement. It is a non feeding stage (Table 1).

So far as larval period is concerned, Maity and Chakrabarti (1978) observed 2.2–2.3 days in case of *P. citri* and as per Lal and Mukharji (1979) this period was 1.95–2.70 days in case of *E. uncatus* at 26.60 °C. In case of other Tetranychid mites, the available data are: 2.25 days, in case of *T. ludeni*; 1.37 ± 0.37 days in *E. hicoriae*; 1.00–1.89 days in *T. neocalidonychus*; 1.65 ± 0.33 days in *O. tylus;* 2.23 ± 0.36 days in *O. oryzae*; 2.11 days in *O. indicus;* 2.96 days in *T. chinnabarinus*; 2.13 ± 0.06 days in *O. coffeae*; 1.00 ± 0.00 days in *T. chinnabarinus* on lablab bean; 1.5 ± 0.17 days in *C. ternatea* and 2.5 ± 0.37 days on *J. adhatoda* in *T. macfarlanei* and 5.4 ± 0.34 days in *O. coffeae* (Puttaswamy and Channabasavanna 1980; Mallikarajunappa and Nageshchandra 1989; Manjunatha and Puttuswamy 1989; Sirsikar and Nagabhushanam 1989; Nayak et al. 2007; Rai et al.1989; Tello et al. 2009; Haque et al. 2007; Kaimal and Ramani 2011; Biswas et al. 2013; Podder et al. 2014, respectively).

Therefore, the duration of larval stage found in the present study was higher as compared to duration observed

Table 1 Duration of different life stages of mite *Tetranychus sayedi* Baker & Pitchard on hosts—*Cryptolepis buchanani* Roem & Schult and *Justicia adhatoda* L. under laboratory condition (at 27.5 °C and 65% R.H.)

Duration of different life stages (n = 10)	Host: *Cryptolepis buchanani* Roem & Schult Range (mean ± standard error) [in days]	Host: *Justicia adhatoda* L. Range (mean ± standard error) [in days]
Incubation	3–4 (3.4 ± 0.17)	2–3 (2.7 ± 0.16)
Larva	2–3 (2.2 ± 0.14)	1–4 (2.8 ± 0.40)
Protonymph	1–2 (1.3 ± 0.16)	2–3 (2.5 ± 0.15)
Deutonymph	1–2 (1.6 ± 0.17)	2–3 (2.5 ± 0.17)
Egg-Adult	8–12 (10.0 ± 0.56)	9–14 (12.2 ± 0.58)
Preoviposition	1–2 (1.4 ± 0.17)	1–2 (1.3 ± 0.16)
Oviposition		
Unfertilized	8–14 (10.54 ± 0.63)	7–10 (8.4 ± 0.35)
Fertilized	12–18 (15.4 ± 0.70)	9–12 (11.1 ± 0.36)
Postoviposition		
Unfertilized	2–3 (2.3 ± 0.17)	1–2 (1.6 ± 0.17)
Fertilized	2–4 (3.0 ± 0.15)	2–3 (2.3 ± 0.16)
Female Longevity		
Unfertilized	19–31 (24.5 ± 1.15)	18–28 (20.9 ± 1.10)
Fertilized	23–36 (32.5 ± 1.45)	21–31 (25.1 ± 0.99)
Male Longitivity	10–16 (12.9 ± 0.74)	9–14 (10.5 ± 0.57)
Fecundity		
Eggs laid/day (Unfertilized ♀)	6–8 (7.1 ± 0.33)	4–7 (5.9 ± 0.42)
Eggs laid/day (Fertilized ♀)	7–10 (9.1 ± 0.36)	6–9 (7.8 ± 0.40)
Total number of eggs/Unfertilized ♀	49–114 (92.5 ± 8.07)	29–70 (64.8 ± 4.39)
Total number of eggs/Fertilized ♀	85–180 (155.5 ± 10.72)	54–109 (91.2 ± 5.98)
% Egg hatching	75–80 (78.0 ± 0.60)	60–70 (65.9 ± 0. 94)
Sex ratio [male:female]	1:5	1:3

by Mallikarajunappa and Nageshchandra (1989), Manjunatha and Puttuswamy (1989), Sirsikar and Nagabhushanam (1989) and Kaimal and Ramani (2011) but close to those of Maity and Chakrabarti (1978), Lal and Mukharji (1979); Puttaswamy and Channabasavanna (1980), Rai et al. (1989), Haque et al. (2007), Nayak et al. (2007), Tello et al. (2009) and Biswas et al. (2013).

Protonymphal period

The duration of protonymph of period was more in case of *J. adhatoda,* where it was 2.5 ± 0.15 days as compared to the other host, *C. buchanani*, where it was 1.3 ± 0.16 days. The protonymph was reddish in colour and found actively moving and feeding. The male protonymph directly transformed to adult without passing through deutonymphal stage (Table 1).

According to available data on different Tetranychid mites, this period took: 3.17–3.3 days in *P. citri* on papaya (Maity and Chakrabarti 1978); 1.25–2.45 days in *E. uncatus* (Lal and Mukharji 1979); 1.73 days in T. *ludeni* (Puttaswamy and Channabasavanna 1980); 1.650 ± 1.48 days in *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989); 1.00–2.30 days in *T. neocalidonychus* (Manjunatha and Puttuswamy 1989); 2.00 ± 0.33 days in case of *O. tylus* (Sirsikar and Nagabhushanam 1989); 1.21 days in *O. indicus* (Rai et al. 1989); 1.83 ± 0.06 days in *O. coffeae* (Haque et al. 2007); 2.27 ± 0.26 days in *O. oryzae* (Nayak et al. 2007); 2.36 days in *T. chinnabarinus* (Tello et al. 2009); 0.79 ± 0.07 days in *T. chinnabarinus* (Kaimal and Ramani 2011); 1.00 ± 0.17 days in *T. macfarlanei* on *C. ternatea* and 3.6 ± 0.34 days in the same mite on *J. adhatoda* (Biswas et al. 2013); 6.4 ± 0.21 days in *O. coffeae* on tea leaves (Podder et al. 2014).

Therefore, the duration of protonymphal period recorded in the present study was much higher as compared to duration reported by Kaimal and Ramani (2011) and shorter as compared to duration reported by Podder et al. (2014) but close to the works of Lal and Mukharji (1979), Puttaswamy and Channabasavanna (1980), Mallikarajunappa and Nageshchandra (1989), Sirsikar and Nagabhushanam (1989), Rai et al. (1989), Haque et al. (2007), Nayak et al. (2007), Tello et al. (2009) and Biswas et al. (2013).

Deutonymphal period

The duration of this stage was 2.5 ± 0.17 and 1.6 ± 0.17 days in case of *J. adhatoda* and *C. buchanani,* respectively. The deutonymph was more reddish and much more active than protonymph and was found actively moving on the leaf surface (Table 1).

As per other workers, this period took 3.4–3.6 days in *P. citri* (Maity and Chakrabarti 1978); 1.00–1.75 days in *E. uncatus* (Lal and Mukharji 1979); 2.27 days in *T. ludeni* (Puttaswamy and Channabasavanna 1980); 1.50 ± 0.50 days in *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989); 1.50–2.10 days in *T. neocalidonychus* (Manjunatha and Puttuswamy 1989); 1.70 ± 0.25 days in *O. tylus* (Sirsikar and Nagabhushanam 1989); 1.56 days in case of *O. indicus* (Rai et al. 1989); 2.42 ± 0.28 days in *O. oryzae* (Nayak et al. 2007); 2.72 days in *T. chinnabarinus* (Tello et al. 2009); 0.71 + 0.07 days in *T. cinnabarinus* (Kaimal and Ramani 2011); 2.0 ± 0.09 days in *O. coffeae* (Haque et al. 2007); 1.5 ± 0.17 days on *C. ternatea* and 2.5 ± 0.22 days on *J. adhatoda* in T. *macfarlanei* (Biswas et al. 2013); 1.8 ± 0.25 days in case of *O. coffeae* (Podder et al. 2014).

Therefore, the duration of deutonymphal period observed in the present study was much higher as compared to duration reported by Kaimal and Ramani (2011), shorter than Maity and Chakrabarti (1978) and more or less close to those of other reports.

Egg-adult period

This period was 10.0 ± 0.56 days in case of *C. buchanani* and it was 12.2 ± 0.58 days on the other host (Table 1). It appeared that the time taken to complete the life cycle (Egg-Adult period) was shorter on *C. buchanani* where it ranged from 8 to 12 days compared to 9–14 days in case of *J. adhatoda* (Table 1).

According to the earlier reports regarding this period on different Tetranychid mites, it took: 12.56–14.00 days in *P. citri* (Maity and Chakrabarti 1978); 7.55–8.30 days in *E. uncatus* (Lal and Mukharji 1979); 12.48 days in *T. ludeni* (Puttaswamy and Channabasavanna 1980); 11.16 ± 1.34 days in *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989); 9.90 ± 0.45 days in *O. tylus* (Sirsikar and Nagabhushanam 1989); 12.64 ± 1.57 days in *O. oryzae* (Nayak et al. 2007); 12.97±0.29 days in *O. coffeae* (Haque et al. 2007);12.84 days in *T. chinnabarinus* (Tello et al. 2009); 7.33 ± 0.13 days in *T. cinnabarinus* (Kaimal and Ramani 2011); 6.4 ± 0.37 days on *C. ternatea* and 10.6 ± 0.56 days on *J. adhatoda* in *T. macfarlanei* (Biswas et al. 2013);16.17 ± 0.37 days in *O. coffeae* (Podder et al. 2014).

Considering the above, duration of Egg-Adult period, as was found, in the present study, was much higher compared to those reported by Lal and Mukharji (1979), Kaimal and Ramani (2011), Biswas et al. (2013) [in case of *T. macfarlanei* on host *C. ternatea*] and lower as compared to those reported by Podder et al. (2014), but close to the works of Maity and Chakrabarti (1978), Puttaswamy and Channabasavanna (1980), Mallikarajunappa and Nageshchandra (1989), Sirsikar and Nagabhushanam (1989), Nayak et al. (2007), Haque et al. (2007), Tello et al. (2009) and Biswas et al. (2013) [in case of *T. macfarlanei* on *J. adhatoda*].

Preoviposition period

The preoviposition period was 1.4 ± 0.17 days in *C. buchanani* and it was almost of same duration in case of the other host (Table 1).

According to Maity and Chakrabarti (1978), the preoviposition period of *P. citri* was 2.35–2.89 days in case of unfertilized female and 2.15–2.23 days in case of fertilized female. This period was 2.33 ± 0.47 days in case of fertilized female of *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989). Moreover, this period was 0.65 ± 0.24 days in fertilized female of *O. tylus* (Sirsikar and Nagabhushanam 1989); 1.80 ± 0.62 days in fertilized female of *O. indicus* (Rai et al. 1989); 1.23 ± 0.41 days in fertilized female of *O. oryzae* (Nayak et al. 2007); 1.32 ± 0.11 in case of fertilized female of *T. chinnabarinus* (Tello et al. 2009); 0.5 ± 0 days in fertilized female on lablab beans (Kaimal and Ramani 2011); 1.0 ± 0.00 days in case of fertilized female and *C. ternatea* and 1.0 ± 0.00 days in case of fertilized female *J. adhatoda* in *T. macfarlanei* by (Biswas et al. 2013); 3.00 ± 0.60 days in fertilized female of *O. coffeae* (Podder et al. 2014).

Therefore, the duration of preoviposition period as recorded in the present study was much shorter as compared to duration reported by Maity and Chakrabarti (1978), Mallikarajunappa and Nageshchandra (1989), Podder et al. (2014) and much higher as compared to duration reported by Sirsikar and Nagabhushanam (1989), Kaimal and Ramani (2011), but close to the works of Rai et al. (1989), Nayak et al. (2007), Tello et al. (2009) and Biswas et al. (2013).

Oviposition period

This period was of shorter duration 10.54 ± 0.63 and 15.4 ± 0.70 days in case of unfertilized and fertilized females respectively on *C. buchanani* while the corresponding periods were 8.4 ± 0.35 and 11.1 ± 0.36 days in case of unfertilized and fertilized females, respectively on *J. adhatoda* (Table 1).

According to other workers the oviposition period was: 27.41 days in fertilized female of *T. ludeni* (Puttaswamy

and Channabasavanna 1980); 21.34 ± 1.63 days in fertilized female of *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989); 13.50 ± 0.43 days in fertilized female of *O. tylus* (Sirsikar and Nagabhushanam 1989); 4.7 days in fertilized female of *O. indicus* (Rai et al. 1989); 11.5 ± 2.55 days in of fertilized female of *O. oryzae* (Nayak et al. 2007); 16.28 ± 1.31 days in fertilized females of *T. chinnabarinus* (Tello et al. 2009); 8.05 ± 0.14 days in fertilized female of *T. chinnabarinus* (Kaimal and Ramani 2011); 7.4 ± 1.00 days in unfertilized female and 12.4 ± 1.6 days in fertilized female of *T. macfarlanei* on *C. ternatea* and 10.00 ± 1.15 days in unfertilized female and 14.67 ± 0.63 days in fertilized female of *T. macfarlanei* on *J. adhatoda* (Biswas et al. 2013); 4.25 ± 0.88 days in fertilized female of *O. coffeae* (Podder et al. 2014).

Therefore, the duration of oviposition period observed in the present study was much higher as compared to duration reported by Rai et al. (1989) and Biswas et al. (2013) [in case of *T. macfarlanei* on *J. adhatoda*]; Podder et al. (2014) and much shorter as compared to duration reported by Puttaswamy and Channabasavanna (1980) and Mallikarajunappa and Nageshchandra (1989), but close to the reports of Sirsikar and Nagabhushanam (1989), Nayak et al. (2007), Tello et al. (2009), Kaimal and Ramani (2011) and Biswas et al. (2013) [in *T. macfarlanei* on *C. ternatea*].

Postoviposition period

Unlike in case of oviposition period, the postoviposition period was 2.3 ± 0.17 days in unfertilized females on *C. buchanani* compared to 1.6 ± 0.17 days in *J. adhatoda.* But this period was longer 3.0 ± 0.15 in case of fertilized females on *C. buchanani* against 2.3 ± 0.16 days on *J. adhatoda* (Table 1).

As per other workers, the postoviposition period period was: 3.52–4.07 days in unfertilized female and 3.02–3.63 days in fertilized female of *P. citri* (Maity and Chakrabarti 1978); 3.30 days in case of fertilized female of *T. ludeni* (Puttaswamy and Channabasavanna 1980); 2.75 ± 0.96 days in fertilized female of *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989); 1.40 ± 0.51 days in fertilized female of *O. tylus* (Sirsikar and Nagabhushanam 1989); 2.47 ± 1.45 days in fertilized female of *O. indicus* (Rai et al. 1989); 2.50 ± 0.85 days in fertilized female of *O. oryzae* (Nayak et al. 2007); 7.20 ± 0.28 days in fertilized females of *T. chinnabarinus* (Tello et al. 2009); 0.65 ± 0.07 days in fertilized female of *T. chinnabarinus* (Kaimal and Ramani 2011); 1.6 ± 0.24 days in unfertilized female and 1.00 ± 0.0 days in fertilized female of *T. macfarlanei* on *C. ternatea* and 1.00 ± 0.0 days in unfertilized female and 1.4 ± 0.24 days in fertilized female of *T. macfarlanei* on *J. adhatoda* (Biswas et al. 2013); 1.88 ± 0.30 days in fertilized female of *O. coffeae* (Podder et al. 2014).

Considering the above, duration for the postoviposition period recorded in the present study was much higher as compared to those of Kaimal and Ramani (2011) and much shorter as compared to duration reported by Maity and Chakrabarti (1978), Puttaswamy and Channabasavanna (1980) and Tello et al. (2009), but close to the duration reported by rest of the workers.

Fecundity

During the present study, the daily fecundity in unfertilized females was more on *C. buchanani* where it was 7.1 ± 0.33 compared to 5.9 ± 0.42 eggs in case of *J. adhatoda.* Almost similar was observation made on the fecundity of fertilized females, where this period was 9.1 ± 0.36 eggs on *C. buchanani* compared to 7.8 ± 0.40 eggs on *J. adhatoda.* So far as total fecundity was considered, the similar observation was made as was evident from the fact that the total fecundity in case of unfertilized and fertilized females was more on *C. buchanani* where it was 92.5 ± 8.07 eggs and 155.5 ± 10.72 eggs, respectively. The corresponding data in case of *J. adhatoda* it was 64.8 ± 4.39 and 91.2 ± 5.98 eggs (Table 1).

From this it is clear that the daily and total fecundity of this mite was more in case of *C. buchanani* as compared to those on *J. adhatoda.*

Maity and Chakrabarti (1978) recorded the total fecundity as 24.7–30.0 eggs in unfertilized female and 30.0–36.5 eggs in fertilized female of *P. citri.* According to Lal and Mukharji (1979), the daily fecundity as 10–15 eggs in unfertilized female and 17–26 eggs in fertilized female of *E. uncatus*. Puttaswamy and Channabasavanna (1980) observed the daily fecundity was 4.73 eggs in unfertilized female and 7.83 eggs in fertilized female and the total fecundity was 132.00 eggs in unfertilized female and 165.86 eggs in fertilized female of *T. ludeni*. The daily fecundity was 10.55 ± 3.59 eggs in fertilized female of *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989). Rai et al. (1989) reported the total fecundity as 30.8 eggs in fertilized female of *O. indicus*. The total fecundity was 30.70 ± 9.26 eggs in fertilized female of *O. oryzae* on paddy by Nayak et al. (2007). Tello et al. (2009), observed the daily fecundity as 3.92 ± 0.21 eggs in unfertilized female and total fecundity was 67.12 ± 7.07 eggs in unfertilized female of *T. chinnabarinus*. Kaimal and Ramani (2011), reported 37.2 ± 1.5 eggs in unfertilized female and 47.8 ± 1.9 eggs in fertilized female of *T. chinnabarinus* as the total fecundity. Biswas et al. (2013) observed the total fecundity as 80.0 ± 21.64 eggs in unfertilized female and 91.6 ± 11.61 eggs in fertilized female of *T. macfarlanei* on *C. ternatea* and 19.8 ± 3.90

eggs in unfertilized female and 39.0 ± 2.85 eggs in fertilized female on *J. adhatoda* of *T. macfarlanei*. The daily fecundity of the fertilized female of *O. coffeae,* was 6.12 ± 1.14 as recorded by Podder et al. (2014).

Therefore, the total fecundity found in the present study was much higher as compared to duration reported by Maity and Chakrabarti (1978), Rai et al. (1989), Nayak et al. (2007), Tello et al. (2009) and Kaimal and Ramani (2011). Again, the daily fecundity observed in the present study was much shorter as compared to duration reported by Lal and Mukharji (1979). Lastly, both in the case of the total fecundity and daily fecundity the present study was found close to the data of rest of the workers.

Longevity

This period was 24.5 ± 1.15 days and 32.5 ± 1.45 days in case of unfertilized and fertilized females, respectively on *C. buchanani* and the corresponding figures on *J. adhatoda* were 20.9 ± 1.10 and 25.1 ± 0.99 days respectively. In case of males, the longevity was more on *C. buchanani* where it was 12.9 ± 0.74 days and the corresponding figure for *J. adhatoda* was 10.5 ± 0.57 days (Table 1).

According to the reports of others, this period was: 8.25–10.0 days in case of fertilized female and 4–5 days in case of males of *E. uncatus* (Lal and Mukharji 1979); 25.55 ± 1.49 days in case of fertilized female of *E. hicoriae* (Mallikarajunappa and Nageshchandra 1989); 15.60 ± 3.71 days in case of fertilized female and 8.81 ± 1.25 days in case of male of *O. oryzae* on paddy by (Manjunatha and Puttuswamy 1989); 15.55 ± 0.23 days in fertilized female and 10.66 ± 0.14 days in male of *O. tylus* (Sirsikar and Nagabhushanam 1989); 10.67 ± 2.38 days in fertilized female of *O. indicus* (Rai et al. 1989); 12.10 ± 2.47 days in fertilized female *O. oryzae* on paddy by Nayak et al. (2007); 9.1 ± 0.19 days in unfertilized female and 9.3 ± 0.2 days in fertilized female of *T. chinnabarinus* (Kaimal and Ramani 2011); 8.6 ± 2.32 days in unfertilized female and 16.4 ± 1.44 days in fertilized female and 7 ± 0.55 days in males of *C. ternatea* and 11.0 ± 0.86 unfertilized female and 16.0 ± 0.37 days in fertilized female and 11.0 ± 0.86 days in males on *J. adhatoda* in *T. macfarlanei* (Biswas et al. 2013) and 28.67 ± 2.12 days in fertilized female of *O. coffeae* (Podder et al. 2014).

Therefore, the longevity as recorded in present study was found close to the works of Mallikarajunappa and Nageshchandra (1989) and Biswas et al. (2013) [in case of male *T. macfarlanei* on *J. adhatoda*] and Podder et al. (2014), but longevity period was much higher as compared to that reported by rest of the workers.

Percentage of egg hatching

In the present study the percentage of egg hatching was more in *C. buchanani* (78.0 ± 0.60)% compared to (65.9 ± 0. 94)% in *J. adhatoda* (Table 1).

As regards percentage of egg hatching, not much information is available and the one which is available indicated 93.75% of egg hatching reported by Rai et al. (1989) in *O. indicus.* Therefore, the percentage of egg hatching was much lesser in the present study on both the host plants as compared to the report of Rai et al. (1989).

Sex ratio (♂:♀)

Sex ratio in the present study was recorded more in *C. buchanani* where it was 1: 5 against 1: 3 *on J. adhatoda* (Table 1).

As per Mallikarajunappa and Nageshchandra (1989) the sex ratio of (♂:♀) *in E. hicoriae* was 1:4. According to Nayak et al. (2007) it was 1:2.7 in *O. oryzae* and Biswas et al. (2013) reported the sex ratio in of *T. macfarlanei* as 1:6 on *C. ternatea* and 1:4 on *J. adhatoda.* Therefore, from these comparative data it is apparent that the sex ratio which was observed in the present study was in conformably with those of earlier workers.

Considering the different durations of different stages in two hosts, viz. *C. buchanani* and *J. adhatoda,* the former appeared to be more favorable host for this mite as on this host, the life cycle (egg to adult period) of the mite was completed in shorter duration, and fecundity and female longevity were higher as compared to the other host.

Several works regarding new host records, taxonomic descriptions of *Tetranychus sayedi* have been recorded worldwide (Gutierrez and Bonato 1994; Yousuf and Chouhan 2009). Since no information is available regarding life cycle of this mite, an attempt was made to study the same on both the hosts as mentioned earlier and the present paper embodies the result of that study.

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