

Biological aspects of *Tetranychus marianae* McGregor (Acari, Tetranychidae) reared on yellow passion fruit (*Passiflora edulis* Sims f. *flavicarpa* Deg.) leaves

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ABSTRACT. The passion fruit plant is a host for several different phytophagous mites, mainly those belonging to the Tarsonemidae, Tenuipalpidae and Tetranychidae families. Among the Tetranychidae species are *Tetranychus mexicanus* (McGregor, 1950) and *Tetranychus desertorum* Banks, 1900. The occurrence of *Tetranychus marianae* McGregor, 1950 was detected on yellow passion fruit *Passiflora edulis* Sims f. *flavicarpa* Degener plants under field and greenhouse conditions at the headquarters of Embrapa Cassava & Fruits Tropical Research in Cruz das Almas County, State of Bahia, Northeast Brazil. Prior records of *T. marianae* on the passion fruit crop in Brazil as well as the biological aspects of this species are unknown. The study on the biology of *T. marianae* on *P. edulis* f. *flavicarpa* was carried out under controlled environmental condition of $25 \pm 1^\circ\text{C}$ temperature, $80 \pm 10\%$ RH and 12 hours photophase. The egg to adult time span lasted 10.73 ± 0.18 days, with a 92% survival figure. The sexual ratio was 81% females. The mean female longevity was 24.53 days and the daily mean oviposition was 3.69 eggs/female. The intrinsic rate of increase (r_m) was 0.172; the finite rate of increase (λ) was 1.187 individuals/female/day; the mean time span of one generation (T) was 22.81 days; and the net rate of reproduction (R_0) was 50.14.

KEY WORDS. Fertility; life table; mite; *Passiflora* sp.

RESUMO. Aspectos biológicos de *Tetranychus marianae* McGregor (Acari, Tetranychidae) sobre folhas de maracujazeiro (*Passiflora edulis* Sims. f. *flavicarpa* Deg.). A cultura do maracujazeiro é hospedeira de ácaros fitófagos pertencentes principalmente às famílias Tarsonemidae, Tenuipalpidae e Tetranychidae. Dentre as espécies de tetrâniquídeos encontram-se *Tetranychus mexicanus* (McGregor, 1950) e *Tetranychus desertorum* Banks, 1900. A ocorrência de *Tetranychus marianae* McGregor, 1950 foi verificada em plantas de maracujá amarelo *Passiflora edulis* Sims. f. *flavicarpa* Degener, em condições de campo e casa de vegetação, na sede da Embrapa Mandioca e Fruticultura Tropical, em Cruz das Almas, BA. O registro de *T. marianae* na cultura do maracujá no Brasil, assim como os aspectos biológicos dessa espécie são desconhecidos. O estudo da biologia de *T. marianae* em *P. edulis* f. *flavicarpa* foi conduzido a $25 \pm 1^\circ\text{C}$, $80 \pm 10\%$ de UR e 12 horas de fotofase. O período de ovo a adulto durou $10,73 \pm 0,18$ dias, com sobrevivência de 92%. A razão sexual foi 81% de fêmeas. A longevidade média das fêmeas foi de 24,53 dias e a oviposição média diária de 3,69 ovos/fêmea. A razão intrínseca de aumento (r_m) foi de 0,172, a razão finita de aumento (λ) de 1,187 indivíduos por fêmea por dia, o tempo médio de uma geração (T) de 22,81 dias e a taxa líquida de reprodução (R_0) de 50,14.

PALAVRAS-CHAVES. Ácaro; fertilidade; tabela de vida; *Passiflora* sp.

Several species of insects and pest-mites, which may cause production impairment, are associated to passion fruit crop. Among the harmful agents, some species of phytophagous mites belonging to *Brevipalpus phoenicis* (Geijskes, 1939) (Tenuipalpidae); *Polyphagotarsonemus latus* (Banks, 1904) (Tarsonemidae); and *Tetranychus mexicanus* (McGregor, 1950) and *Tetranychus desertorum* (Banks, 1900) (Tetranychidae) are prominent.

The damage caused by *B. phoenicis* on passion fruit plant are very severe when associated to the viral disease known as green spot, as a consequence of the significant defoliation,

which can shortening the profitable life of the plants or even prevent production (SÃO JOSÉ *et al.* 2000, NORONHA *et al.* 2004). The attack of *P. latus* on new shoots causes malformation of nervures and leaves, which become intensely dark green and do not develop completely and consequently fall (FLECHTMANN 1989). *T. mexicanus* and *T. desertorum* form colonies on the leaves, which show whitish or silvery spots that subsequently become dry (FLECHTMANN 1989).

The occurrence of *Tetranychus marianae* McGregor, 1950 (Tetranychidae) was detected on yellow passion fruit *Passiflora*

edulis Sims f. *flavicarpa* Degener plants under field and greenhouse conditions at the headquarters of the Embrapa Cassava & Fruits Tropical Research Center, in Cruz das Almas County, State of Bahia, Northeast Brazil (12°40'39"S, 39°06'23"W). Colonies of this species are found on the abaxial surface of leaves with the presence of scarce or abundant web formation (OCHOA *et al.* 1994). The adult females are red in color (JEPPSON *et al.* 1975, FLECHTMANN 1989). This species has also been described as a pest on cotton as well as occurring on other crops such as castor bean, passion fruit, papaya and cassava, besides other herbaceous plants (JEPPSON *et al.* 1975, MORAES *et al.* 1987, BONATO & GUTIERREZ 1999). It is distributed in the North America and regions of the Pacific. In Brazil, this species has been already reported in the States of Bahia, Ceará, Pernambuco, and São Paulo on *Thunbergia* sp. (Acanthaceae), *Chenopodium ambrosioides* Linnaeus (Chenopodiaceae), *Ipomea batatas* (Linnaeus) Lamark (Convolvulaceae), *Sechium edule* (Jacquin) Swartz (Cucurbitaceae), *Ricinus communis* Linnaeus (Euphorbiaceae), *Glycine max* (Linnaeus) Merrill (Fabaceae), *Hibiscus esculentus* Linnaeus (Malvaceae), *Psidium guajava* Linnaeus (Myrtaceae), *Morus* sp. (Moraceae), *Piper* sp. (Piperaceae), *Capsicum anuum* Linnaeus, *Lycopersicon esculentum* Miller, *Solanum gilo* Raddi and *Solanum melongena* Linnaeus (Solanaceae) (CAVALCANTE *et al.* 1977, MORAES & FLECHTMANN 1981, MORAES *et al.* 1987).

In the State of Bahia FLECHTMANN & ABREU (1973) collected specimens of *T. marianae* on mulberry *Morus* sp., chayote *S. edule*, castor bean *R. communis*, sweet potato *I. batatas*, okra *Abelmoschus esculentus* (Linnaeus) Moench (Malvaceae), and *Thunbergia* sp. plants in the regions of Itabuna, Salvador and Uruçua counties. BOLLAND *et al.* (1998) reported the occurrence of *T. marianae* on *Passiflora biflora* Lamark, *P. edulis*, *P. foetida* Linnaeus and *Passiflora* sp. (Passifloraceae).

BONATO & GUTIERREZ (1999) studied the fecundity and longevity of inseminated and non-inseminated *T. marianae* females. These authors found that the fecundity was approximately two-fold higher in inseminated females and that the mean longevity was reached more rapidly in inseminated females as compared to non-inseminated ones.

Little is known regarding the particularities on the biology of this species (JEPPSON *et al.* 1975, BONATO & GUTIERREZ 1999). Therefore, the study on the biology of *T. marianae* on yellow passion fruit was carried out under laboratory conditions.

MATERIAL AND METHODS

The study was conducted at the Laboratory of Entomology of Embrapa Cassava & Fruits Tropical Research Center under controlled environmental conditions of 25 ± 1°C temperature, 80 ± 10% Relative Humidity and 12 hours photophase.

A colony of *T. marianae* was established on yellow passion fruit leaves starting with mites collected in the field. The rearing was carried out in 14 cm diameter x 2 cm deep Petri dishes containing a passion fruit leaf with its adaxial surface in contact with a layer of nylon foam moistened with distilled

water, which was then surrounded by an also moistened with distilled water layer of cotton.

To obtain eggs, 50 *T. marianae* females were taken from the stock colony and individually maintained on 2.5 cm diameter passion fruit leaf disks for oviposition. The disks were maintained on top of distilled water moistened nylon foam sections individually placed into 14 cm x 2 cm Petri dishes (NORONHA *et al.* 1995). After 24 h, the females were removed and a single egg was maintained per leaf disk. Daily observations were carried out for stage changes verification. The leaf disks were replaced every two days, except when the mites were in the quiescent stage. After emergence of adults, one male from the stock colony was for each female. In case of death, the male was replaced by another from the same stock colony. The adults were transferred to fresh leaf disks at two day interval and the progenies were reared until the adult phase for sexual rate determination.

The parameters evaluated were: incubation period, time span of the development stages, viability, sexual rate, fecundity, and longevity. Data obtained were used to build the fertility life table (BIRCH 1948).

RESULTS AND DISCUSSION

The mean incubation period for the eggs was 4.63 days and the mean time span from egg to adult was 10.73 days with 92% survival (Tab. I).

Table I. Mean time span and viability of developmental stages of *Tetranychus marianae* on yellow passion fruit *Passiflora edulis* Sims f. *flavicarpa* Deg.

Stages	Time span (days)	Viability (%)
Egg	4.63 ± 0.01	100
Larva	1.37 ± 0.08	98
Protochrysalide	0.95 ± 0.08	96
Protonymph	0.96 ± 0.08	96
Deutochrysalide	0.59 ± 0.05	96
Deutonymph	1.31 ± 0.07	92
Teliophrysalide	0.86 ± 0.04	92
Egg to Adult	10.73 ± 0.18	–

SEM: standard error.

The mean oviposition period was 19.85 days (Tab. II). The daily mean oviposition was 3.69 eggs/female and the interval of variation in the total number of eggs/female was from 3 to 170. The sexual proportion was 81% females.

The maximum daily oviposition rate was reached at the 14th day after emergence of females and the maximum rate of population increase occurred between the first and fifth oviposition days (Fig. 1).

In relation to the parameters obtained by the fertility life table (Tab. III), the net rate of reproduction (R_0) was 50.14

Table II. Mean time span of the phases of the adult stage and daily mean oviposition of *Tetranychus marianae* on yellow passion fruit *Passiflora edulis* Sims f. *flavicarpa* Deg.

Phases	Time span (days)
Preoviposition	1.10 ± 0.44
Oviposition	19.85 ± 10.77
Longevity	
Female	24.53 ± 11.12
Male	8.14 ± 1.70
Oviposition	Number of eggs
Eggs/female	75.46 ± 6.22
Eggs/female/day	3.69 ± 0.15

(SEM: standard error of the mean.

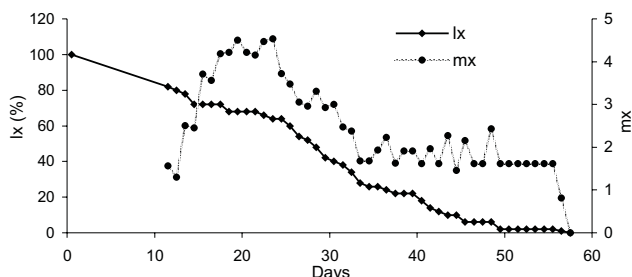


Figure 1. Survival (lx) and specific fertility (mx) of *Tetranychus marianae* on yellow passion fruit *Passiflora edulis* Sims f. *flavicarpa* Deg.

indicating that the mite has a capacity of increase 50.14 times each generation, with a mean time span (T) of 22.81 days. The intrinsic rate of increase (r_m) was 0.172 and the finite rate of increase (λ) was 1.187 individuals/female/day.

Results obtained for development of *T. marianae* are within the variation pattern for Tetranychidae mites. CAREY & BRADLEY (1982) found periods of egg incubation for three Tetranychidae species varying from 4.41 to 4.95 days at 23.8°C. CROOKER (1985) reported that the developmental period from egg to adult in the Tetranychidae may vary from six to 10 days or more depending on the species, temperature, humidity, host plant and other factors. The author also reviewed a series of studies on the development of several Tetranychidae species. MORAES & McMURTRY (1987) reported a period of 13.1 days for *Tetranychus evansi* Baker & Pritchard, 1960, on *Solanum douglasii* Dunal (Solanaceae), at 25°C. NORONHA *et al.* (1995) obtained periods from eggs to adults varying from 12.6 to 13.1 days for *Mononychellus tanajoa* (Bondar, 1938) on four varieties of cassava.

The longevity of *T. marianae* females found in this study was close to that of 30 days reported by BONATO & GUTIERREZ (1999) for females reared at 25°C temperature and 80±10% RH on common beans *Phaseolus vulgaris* Linnaeus (Fabaceae) leaves, and maintained with the males until the third day after emergence. MORAES & McMURTRY (1987) obtained figures of 35.8 days

Table III. Fertility life table of *Tetranychus marianae* on yellow passion fruit *Passiflora edulis* Sims f. *flavicarpa* Deg.

x (days)	mx	lx	mx.lx	mx.lx.x
0.5	—	1.00	—	—
10.5	—	0.92	—	—
11.5	1.56	0.82	1.28	14.72
12.5	1.30	0.80	1.04	13.00
13.5	2.51	0.78	1.96	26.46
14.5	2.45	0.72	1.76	25.52
15.5	3.71	0.72	2.67	41.39
16.5	3.56	0.72	2.56	42.24
17.5	4.19	0.72	3.02	52.85
18.5	4.22	0.68	2.87	53.10
19.5	4.50	0.68	3.06	53.55
20.5	4.22	0.68	2.87	58.84
21.5	4.15	0.68	2.82	60.63
22.5	4.47	0.66	2.95	66.38
23.5	4.53	0.64	2.90	68.15
24.5	3.72	0.64	2.38	58.31
25.5	3.48	0.60	2.09	53.30
26.5	3.06	0.54	1.65	43.73
27.5	2.96	0.52	1.54	42.35
28.5	3.31	0.48	1.59	45.32
29.5	2.93	0.42	1.23	36.29
30.5	3.00	0.40	1.20	36.60
31.5	2.47	0.38	0.94	29.61
32.5	2.38	0.34	0.81	26.33
33.5	1.68	0.28	0.47	15.75
34.5	1.68	0.26	0.44	15.18
35.5	1.93	0.26	0.50	17.75
36.5	2.23	0.24	0.54	19.71
37.5	1.62	0.22	0.36	13.50
38.5	1.91	0.22	0.42	16.17
39.5	1.91	0.22	0.42	16.59
40.5	1.62	0.18	0.29	11.75
41.5	1.97	0.14	0.28	11.62
42.5	1.62	0.12	0.19	8.08
43.5	2.27	0.10	0.23	10.01
44.5	1.46	0.10	0.15	6.68
45.5	2.16	0.06	0.13	5.92
46.5	1.62	0.06	0.10	4.65
47.5	1.62	0.06	0.10	4.75
48.5	2.43	0.04	0.10	4.85
49.5	1.62	0.02	0.03	1.49
50.5	1.62	0.02	0.03	1.52
51.5	1.62	0.02	0.03	1.55
52.5	1.62	0.02	0.03	1.58
53.5	1.62	0.02	0.03	1.61
54.5	1.62	0.02	0.03	1.64
55.5	1.62	0.02	0.03	1.67
56.5	0.81	0.02	0.02	1.13
57.5	0.00	0.02	0.00	0.00
58.5	0.00	0.00	0.00	0.00
Σ		114.56	50.14	1,143.83

and 16.7 days for *T. evansi* females, reared at 25°C and 30°C, respectively.

The accumulated mean fecundity of 141.91 eggs observed in this study was lower than that of 249.50 eggs observed by BONATO & GUTIERREZ (1999).

The identified specimens of *T. marianae* are deposited at the collection of references of mites of the Museu de Ciências Naturais do Centro Universitário UNIVATES (Museum of Natural Sciences of the UNIVATES University Center), Lajeado, State of Rio Grande do Sul, Brazil.

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