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Article

Suitability of three eriophyid mites as prey for the predatory mite, *Typhlodromus athiasae* (Acari: Phytoseiidae)

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ABSTRACT
The eriophyid mites, *Aceria kenyae* (Keifer), *A. mangiferae* Sayed, and *Calepitrimerus baileyi* Keifer are important phytophagous pests in Egypt. In this study, the effect of the above-mentioned eriophyids, as natural prey, on the biological and population growth parameters of the phytoseiid mite, *Typhlodromus athiasae* Porath & Swirski was evaluated. This phytoseiid can successfully develop and reproduce on *A. kenyae*, *A. mangiferae*, and *C. baileyi*. Individuals of *T. athiasae* fed on *A. mangiferae* displayed the shortest pre-adult development, while those fed on *A. kenyae* and *C. baileyi* took more time to reach the adult stage. Adult female longevity of *T. athiasae* was longer on *A. mangiferae* (36.79 days) than on *A. kenyae* (31.65 days) and *C. baileyi* (31.18 days). The total number of eggs per *T. athiasae* female was the highest on *A. mangiferae*, followed by *A. kenyae*, and *C. baileyi* (46.29, 37.62, and 34.39 eggs/female, respectively). Presently, feeding of *T. athiasae* on *A. mangiferae* resulted in the maximum intrinsic rate of increase (*r*), finite rate of increase (λ), and net reproductive rate (R_0) as compared to the other prey. In addition, preying on *A. mangiferae* showed the shortest mean generation time (*T*), while *A. kenyae* showed the longest one as prey of *T. athiasae*. In conclusion, the present results showed that the *T. athiasae* population could display a high capacity to increase when preying on the tested eriophyids (especially on *A. mangiferae*). So, this predator may be capable of providing effective management of these eriophyid mites.

KEY WORDS: *Aceria kenyae*; *Aceria mangiferae*; *Calepitrimerus baileyi*; Eriophyidae; life table parameters; phytoseiid mites.

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INTRODUCTION

Typhlodromus athiasae Porath & Swirski (Acari: Phytoseiidae) is a predatory mite presnt in Europe, Africa, and Egypt (McMurtry *et al.* 1970; Nomikou *et al.* 2001; Abo-Shnaf and de Moraes 2014). It is commonly found on mango trees in Egypt (Hussein and Momen 2010; Marei *et al.* 2020). It is a generalist predator (type III) (McMurtry *et al.* 2013), which can prey on various food sources (Momen 2009; Kasap 2011; Basheer *et al.* 2014). It has been recommended as a promising predator for controlling tetranychid mites (Kasap 2011; Barbar 2013).

Eriophyid mites are serious plant pests that cause enormous damage to various crops (Navia *et al.* 2010; Mehri-Heyran *et al.* 2020). Eriophyids are second only to tetranychids in terms of economic importance as phytophagous mites (Lindquist and Amrine 1996; van Leeuwen *et al.* 2010; de Lillo

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et al. 2018). In Egypt, *Aceria kenyae* (Keifer) and *A. mangiferae* Sayed are important phytophagous eriophyid mites on mango (Meyer 1989; Al-Azzazy 2005; Mahmoud *et al.* 2020). *Aceria kenyae* attacks mango foliage causing brown coloration (Abou-Awad *et al.* 2009), chlorophyll loss, and drying of mango leaves which adversely influence the photosynthesis process. In severe infestations, the whole upper surface of the leaf turns black (Neravathu 2019). As for *A. mangiferae*, it attacks mango buds and inflorescences (Jeppson *et al.* 1975; Ochoa *et al.* 1994). Moreover, it may act as a carrier of *Fusarium* spp. which have been documented as the fungal pathogen responsible for mango malformation (Marasas *et al.* 2006; Gamliel-Atinsky *et al.* 2009). The eriophyid mite, *Calepitrimerus baileyi* Keifer attacks apple foliage (Jeppson *et al.* 1975; Abou-Awad *et al.* 2011a), causing brown coloration, partial defoliation and delay or inhibition of apical growth. In addition, it can reach harmful levels in numerous Egyptian apple orchards (Abou-Awad *et al.* 2011a).

In nature, phytoseiid mites may play a significant role in the management of eriophyid mites (Abou-Awad *et al.* 2011b). In previous studies, some predatory mites were successfully developed and reproduced on eriophyid mites such as *Amblyseius denmarki* Zaher & El-Borolosy, *Amblyseius swirskii* Athias-Henriot, *Proprioseiopsis badri* (Yousef & El-Borolossy), and *Typhlodromus transvaalensis* (Nesbitt) (Momen *et al.* 2004, 2014; Momen and Abdel-Khalek 2008; Abou-Awad *et al.* 2010b; Momen and Lamlom 2021). Other studies dealt with the use of predatory mites for controlling eriophyid pests (e.g. Lesna *et al.* 2004; Aratchige *et al.* 2007).

The predator's life table displays a comprehensive picture of its development, reproduction, and population growth (Basheer *et al.* 2014). Accordingly, gathering life table data of predatory mites is a fundamental step for their mass rearing and utilization in Integrated Pest Management (IPM) strategies. However, no research has been conducted on the life table parameters of *T. athiasae* feeding on *A. kenyae*, *A. mangiferae* and *C. baileyi*, which infest fruit trees. Therefore, this study aimed to evaluate the effect of the above-mentioned eriophyids, as natural prey, on the biological and population parameters of *T. athiasae* to determine its potential as a bio-control agent of these economic eriophyid mites.

MATERIALS AND METHODS

Predatory mite

Individuals of *T. athiasae* were initially collected in the summer of 2020 from mango orchards at Giza Governorate, Egypt. Stock colonies of this predator were maintained separately on the tested eriophyids (*A. kenyae*, *A. mangiferae*, and *C. baileyi*) in rearing units kept in an incubator at 28 ± 2 °C, 70 ± 5% RH, and 16L: 8D hours photoperiod. Each rearing unit was made from the leaf of *Phaseolus vulgaris* L. expanded on a wet cotton layer in a Petri dish. Water-saturated cotton strips surrounded the edges of leaves to prevent mites from escaping. Water was added to the cotton layers when necessary.

Prey sources

In this study, *A. kenyae*, *A. mangiferae* or *C. baileyi* were used as food sources of *T. athiasae*. Due to the difficulty of keeping colonies of these tested eriophyids, outer bract of mango bud infested with *A. mangiferae* or small pieces of mango or apple leaves heavily infested with *A. kenyae* or *C. baileyi*, respectively were directly introduced to the leaf units to feed *T. athiasae*. *Calepitrimerus baileyi* or *A. kenyae* and *A. mangiferae* were collected during the summer of 2020 from infested apple or mango trees, respectively in orchards at Giza Governorate.

Experiments

In these experiments, the influence of the tested eriophyids on the development, oviposition, and life table parameters of *T. athiasae* was investigated. The experimental units were made from leaf discs (3 cm diameter) of *P. vulgaris* placed on wet cotton pads in Petri dishes. Water-saturated cotton strips surrounded the leaf discs to prevent mites from escaping. All experimental units were kept in an incubator at 28 ± 2 °C, 70 ± 5% RH, and 16L: 8D hours photoperiod.

During these experiments, *T. athiasae* individuals were provided with *A. kenyae*, *A. mangiferae*, or *C. baileyi* as food sources. Outer bract of mango bud infested with *A. mangiferae* or small pieces of mango or apple leaves heavily infested with *A. kenyae* or *C. baileyi*, respectively were directly introduced to the leaf units to feed *T. athiasae*. For each eriophyid prey, females of *T. athiasae* were transferred to new leaf units, and left to oviposit for 12-h then the females were removed. A total of 45 newly deposited eggs (0–12 h) of *T. athiasae* per eriophyid prey were transferred individually to the experimental units. Daily observations were made at 12-h intervals for recording the duration of developmental stages until the adult emergence. Each newly emerged female was paired with one male. Since the females of *T. athiasae* were found to require repeated mating to reach their maximum fecundity (Momen 1997), an adult male was introduced weekly to each female for repeated mating. The mated females were daily observed to determine their oviposition periods and longevity in addition to recording the daily and total number of eggs deposited by each female. However, all adult individuals of the predator were daily observed until their death. The number of *T. athiasae* individuals (replications) subjected to the statistical analyses in the case of *A. kenyae*, *A. mangiferae*, and *C. baileyi* were 36, 41 and 38, respectively. To determine the sex ratio of *T. athiasae* offspring, laid eggs by the experimental predatory females (reared on each prey) were collected on separate leaf units and reared on the corresponding prey until they reached adulthood to determine their sex. The sex ratio was expressed as the proportion of females and was calculated as the number of females/(number of females + number of males).

Statistical analyses

The life-history data of *T. athiasae* were analyzed according to the age-stage, two-sex life table model (Chi and Liu 1985) and the method of Chi (1988). The TWOSEX-MSChart statistical software (Chi 2017) was used to calculate the age-stage-specific survival rate (s_{xj}) (where x is age and j is stage), the age-stage specific fecundity (f_{xj}), age-specific survival rate (l_x), the age-specific fecundity (m_x), and the age-stage reproductive value (v_{xj}) as well as the population growth parameters, including the intrinsic rate of increase (r), the finite rate of increase (λ), the gross reproductive rate (GRR), the net reproductive rate (R_0), and the mean generation time (T). The means and standard errors of the duration of developmental stages, adult pre-oviposition period (APOP), total pre-oviposition period (TPOP), oviposition days, fecundity and longevity of *T. athiasae* in addition to the population parameters (r, λ, R_0, T, and GRR) were estimated using the Bootstrap procedure with 100000 re-sampling and the means were compared by the Paired Bootstrap test (Huang and Chi 2013).

RESULTS

Development and fecundity of T. athiasae *fed on eriophyid mites*

Typhlodromus athiasae can successfully develop and reproduce on *A. kenyae*, *A. mangiferae*, and *C. baileyi*. Individuals of *T. athiasae* fed on *A. mangiferae* displayed the shortest pre-adult development, while those fed on *A. kenyae* and *C. baileyi* took more time to reach the adult stage (Table 1). A significant impact on adult pre-oviposition period (APOP) and total pre-oviposition period (TPOP**)** was observed when *T. athiasae* fed on the eriophyid prey. In addition, *A. mangiferae* resulted in the highest number of oviposition days, whereas the corresponding days were the least on *C. baileyi* and *A. kenyae*. Adult female longevity of *T. athiasae* was significantly longer on *A. mangiferae* (36.79 days) than on *A. kenyae* (31.65 days) and *C. baileyi* (31.18 days). The total number of eggs per *T. athiasae* female was highest on *A. mangiferae* (46.29 eggs/female), followed by *A. kenyae* (37.62 eggs/female) and *C. baileyi* (34.39 eggs/female). The progeny sex ratio of *T. athiasae* on *A. kenyae*, *A. mangiferae*, and *C. baileyi* favored the female (0.57, 0.62, and 0.61, respectively) (Table 1).

Table 1. Developmental periods (days), longevity (days), fecundity, and sex ratio of females of *Typhlodromus athiasae* fed on *Aceria kenyae*, *Aceria mangiferae*, and *Calepitrimerus baileyi*.

Parameter	**Eriophyid mite**		
	A. kenyae* (26)	***A. mangiferae* (28)**	***C. baileyi* (28)**
Egg (days)	1.85 ± 0.07c	1.96 ± 0.11b	2.11 ± 0.06a
Larva (days)	1.27 ± 0.09c	1.32 ± 0.09b	1.39 ± 0.09a
Protonymph (days)	2.15 ± 0.07a	1.82 ± 0.07c	1.93 ± 0.07b
Deutonymph (days)	2.73 ± 0.12a	1.82 ± 0.09c	2.50 ± 0.10b
Pre-adult (days)	8.00 ± 0.12a	6.93 ± 0.15c	7.93 ± 0.14b
APOP (days)	3.31 ± 0.09a	1.79 ± 0.12c	2.18 ± 0.12b
TPOP (days)	11.31 ± 0.14a	8.71 ± 0.21c	10.11 ± 0.18b
Oviposition days	21.73 ± 0.23b	26.21 ± 0.18a	21.68 ± 0.26b
Adult female (days)	31.65 ± 0.40b	36.79 ± 0.31a	31.18 ± 0.31c
Fecundity (eggs/female)	37.62 ± 0.38b	46.29 ± 0.37a	34.39 ± 0.45c
Sex ratio**	0.57	0.62	0.61

APOP: adult pre-oviposition period; TPOP: total pre-oviposition period. Means in a row followed by different letters are statistically different ($P < 0.05$; Paired Bootstrap test with 100000 re-sampling).
* The total number of adult females.
** Number of females/(number of females + number of males).

Table 2. Life table parameters (Mean ± SE) of *Typhlodromus athiasae* fed on *Aceria kenyae*, *Aceria mangiferae*, and *Calepitrimerus baileyi*.

Life table parameter	**Eriophyid mite**		
	A. kenyae	***A. mangiferae***	***C. baileyi***
Intrinsic rate of increase (*r*) (day^{-1})	0.206 ± 0.0015b	0.223 ± 0.001a	0.205 ± 0.001b
Finite rate of increase (*λ*) (day^{-1})	1.229 ± 0.001b	1.249 ± 0.001a	1.227 ± 0.001b
Net reproductive rate (R_0) (offspring)	27.179 ± 0.285b	31.388 ± 0.368a	25.747 ± 0.246c
Mean generation time (*T*) (day)	16.021 ± 0.019a	15.464 ± 0.026c	15.852 ± 0.024b
Gross reproductive rate (*GRR*) (offspring)	27.453 ± 0.280b	31.775 ± 0.360a	26.000 ± 0.240c

Means in a row followed by different letters are statistically different ($P < 0.05$; Paired Bootstrap test with 100000 re-sampling).

The age-stage, two-sex life table

The age-stage specific survival rate (s_{xj}) curves for *T. athiasae* fed on three eriophyid mites are given in Figure 1. The s_{xj} curves displayed the probability that the newborn of *T. athiasae* will survive to age *x* and stage *j*. However, the observed overlapping among the curves was due to the differences in the developmental rates among *T. athiasae* individuals. The probability that the newly deposited eggs of *T. athiasae* will survive to adult stage was 0.72, 0.68, and 0.74 for females and 0.28, 0.32, and 0.26 for males on *A. kenyae*, *A. mangiferae* and *C. baileyi*, respectively (Fig. 1).

The age-stage-specific fecundity (f_{xj}), age-specific survival rate (l_x), and age-specific fecundity (m_x) of *T. athiasae* preying on three eriophyid mites are displayed in Figure 2. The f_{xj} of *T. athiasae* is the number of eggs laid by its individuals of age *x* and stage *j*/day. The f_{xj} peaks were 2.08, 2.21, and 1.71 eggs/day for *T. athiasae* fed on *A. kenyae*, *A. mangiferae*, and *C. baileyi*, respectively; that occurred on the 23th, 18th and 12th days, respectively. The first oviposition began at the age of 7, 5, and 7 days for *T. athiasae* fed on aforementioned eriophyids, respectively (Fig. 2).

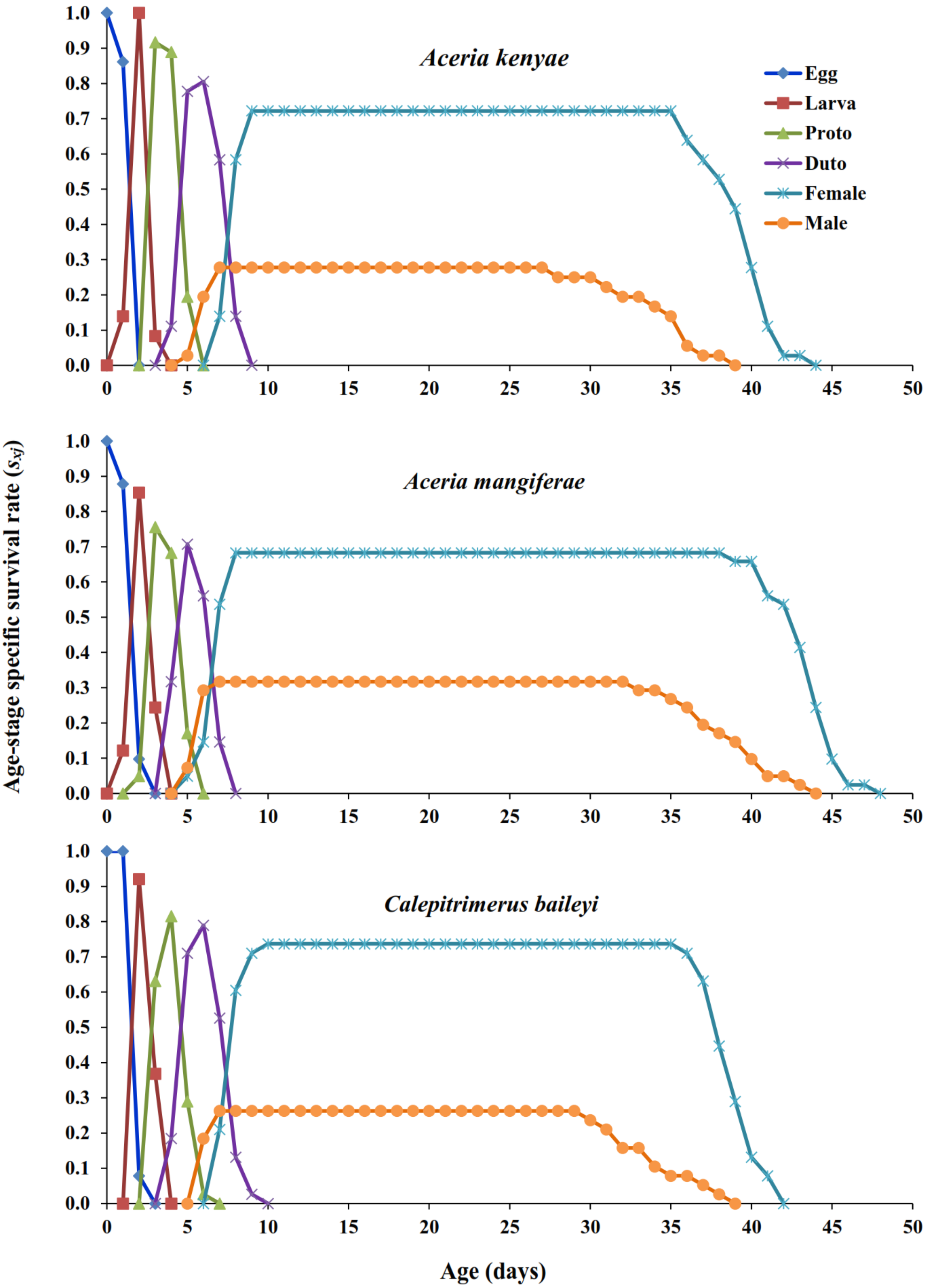

Figure 1. Age-stage specific survival rates (s_{xj}) of *Typhlodromus athiasae* fed on *Aceria kenyae*, *Aceria mangiferae*, and *Calepitrimerus baileyi*.

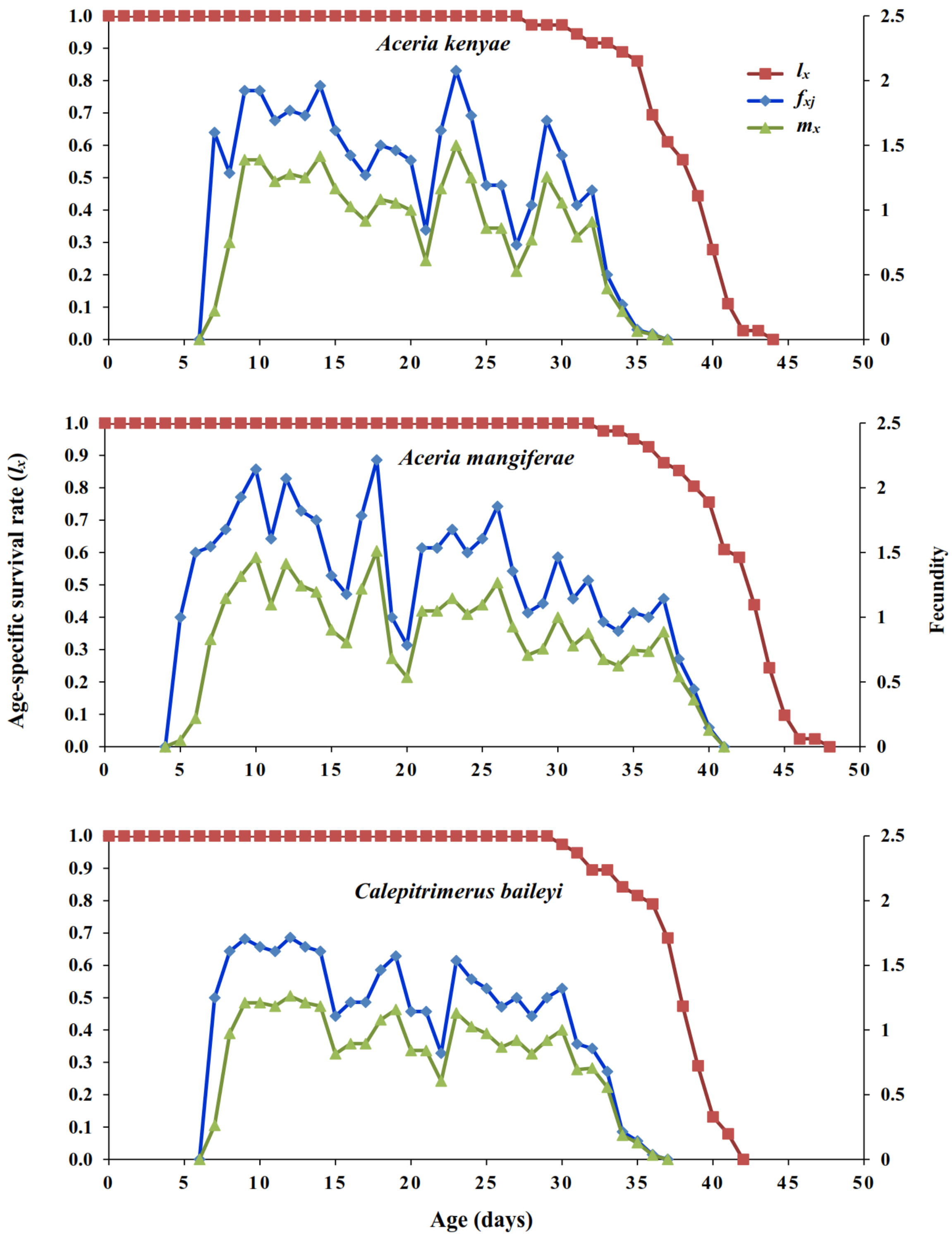

Figure 2. Age-specific survival rate (l_x), age-stage specific fecundity (f_{xj}), and age-specific fecundity (m_x) of *Typhlodromus athiasae* fed on *Aceria kenyae*, *Aceria mangiferae*, and *Calepitrimerus baileyi*.

The age-stage reproductive value (v_{xj}) of *T. athiasae* is the contribution of individuals of age x and stage j to the future offspring (Figure 3). The v_{xj} peaks of *T. athiasae* fed on *A. kenyae*, *A. mangiferae*, and *C. baileyi* occurred at the age of 9, 9, and 8 days, respectively (Fig. 3). Thus, these days elucidated the age at which females showed the maximum contribution to the future population when feeding on the prey mentioned above.

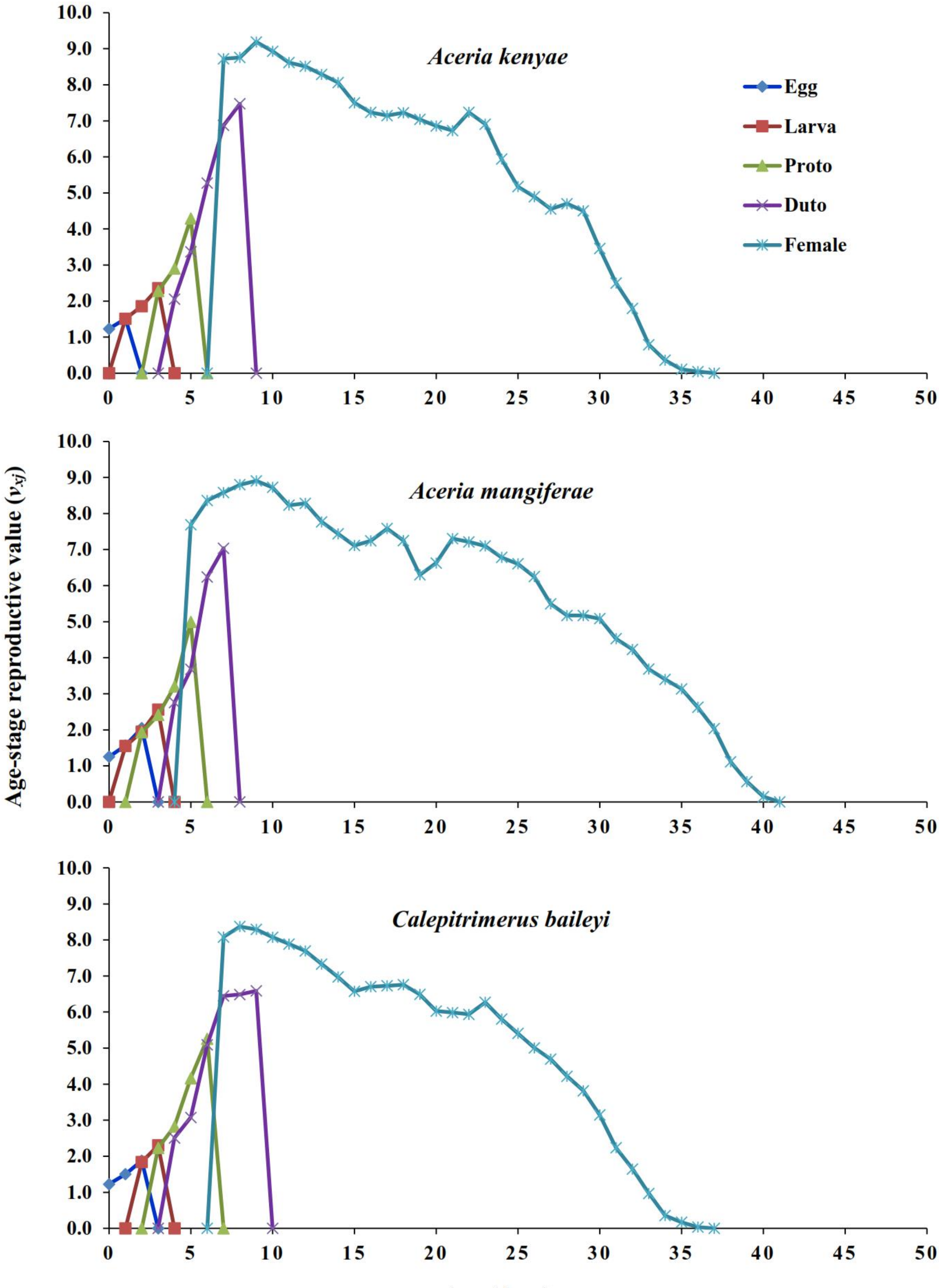

Figure 3. The age-stage reproductive value (v_{xj}) of *Typhlodromus athiasae* fed on *Aceria kenyae*, *Aceria mangiferae*, and *Calepitrimerus baileyi*.

Population growth parameters

Table 2 displayed that feeding of *T. athiasae* on *A. mangiferae* resulted in the maximum intrinsic (r), and finite rates of increase (λ) compared to the other prey. Statistically similar values of r and λ were observed in the case of feeding on *A. kenyae* and *C. baileyi*. The highest net (R_0), and gross reproductive rates (*GRR*) were observed when *T. athiasae* fed on *A. mangiferae*, followed by *A. kenyae* and *C. baileyi*. In addition, preying on *A. mangiferae* showed the shortest mean generation time (T), while *A. kenyae* showed the longest.

DISCUSSION

It has often been difficult to control eriophyid mites with acaricides, although several species are considered to be very important economic pests (van Leeuwen *et al.* 2010). In this regard, the biological control programs of eriophyids are principally based on using the predators (van Leeuwen *et al.* 2010). Our study revealed that *T. athiasae* could feed, develop and reproduce on *A. kenyae*, *A. mangiferae*, and *C. baileyi*.

Previous studies indicated that *T. athiasae* preying on *Eutetranychus orientalis* (Klein), *Tetranychus urticae* Koch, and *Aceria dioscoridis* (Soliman and Abou-Awad) reached adulthood in a longer period than when preying on *A. mangiferae,* but in a shorter time when preying on *A. kenyae* and *C. baileyi* (Momen and El-Borolossy 1999; Momen 2009). The pre-adult development of *T. athiasae* fed on *Oligonychus mangiferus* (Rhaman and Sapra) was shorter than our study (Fahim and Momen 2022). The period of pre-adult development reported by Momen and Abdel-Khalek (2008) for *T. athiasae* fed on *Aculops lycopersici* (Massee) was comparable to our results when fed on *A. kenyae*. However, shorter pre-adult development was reported for other phytoseiids fed on *A. kenyae* (e.g. *Typhlodromus mangiferus* Zaher and El-Brolossy, *Euseius finlandicus* (Oudemans), and *P. badri*) or *A. mangiferae* (e.g. *Proprioseiopsis lindquisti* (Schuster and Pritchard)) (Abou-Awad *et al.* 2010a; Abou-Elella *et al.* 2014; Momen *et al.* 2014; Abdel-Khalek and Momen 2022). As compared to the present results, *T. transvaalensis* exhibited longer pre-adult development when fed on *C. baileyi* (Momen and Lamlom 2021).

Female longevity reported for *T. athiasae* fed on *E. orientalis* (Momen and El-Borolossy 1999) and *A. dioscoridis* (Momen 2009) was shorter than that in our study, while a longer one was reported by Basheer *et al.* (2014) for *T. athiasae* preying on *T. urticae*. The longevity of *T. athiasae* preying on *O. mangiferus* was shorter than that presently observed against *A. kenyae* and *A. mangiferae* (Fahim and Momen 2022). When other predatory mites such as *P. badri*, *T. transvaalensis* and *P. lindquisti* were evaluated against *A. kenyae*, *C. baileyi*, and *A. mangiferae*, respectively, the female longevity was found to be shorter than that in the present study (Momen *et al.* 2014; Momen and Lamlom 2021; Abdel-Khalek and Momen 2022).

Our findings demonstrated that all the tested eriophyids are suitable food sources, resulting in higher oviposition and R_0 value than those reported with a diet of *A. lycopersici* (Momen and Abdel-Khalek 2008). However, greater oviposition and R_0 were reported for *T. athiasae* fed on *E. discoridis* and *T. urticae* (Momen 2009). The fecundity of *T. athiasae* fed on *O. mangiferus* was lower than those currently recorded on *A. kenyae* and *A. mangiferae* (Fahim and Momen 2022). When *P. badri*, *T. transvaalensis*, and *P. lindquisti* fed on *A. kenyae*, *C. baileyi*, and *A. mangiferae*, respectively, they showed lower total fecundity and R_0 values than those observed for *T. athiasae* fed on the corresponding prey types (Momen *et al.* 2014; Momen and Lamlom 2021; Abdel-Khalek and Momen 2022). When *A. kenyae* was offered as prey, a comparable oviposition rate was observed for *E. finlandicus* (Abou-Elella *et al.* 2014) and *T. athiasae* (the present study). Herein, sex ratio of *T. athiasae* was female-biased; this was consistent with the results of other studies for many phytoseiids (Momen 2009; Basheer *et al.* 2014; Momen *et al.* 2014; Fahim and El-Saiedy 2021; Momen and Lamlom 2021).

Using predatory mites is a useful tool in the management of many pests on different crops in IPM systems (McMurtry *et al.* 2013). The *r* value of predator population is important to evaluate its potential as a bio-control agent against pests. The *r* and *λ* values of *T. athiasae* preying on the tested eriophyids were higher than those reported for the same predator fed on *A. lycopersici* (r = 0.167 day^{-1}, λ = 1.182 day^{-1}) and *T. transvaalensis* fed on *C. baileyi* (r = 0.168 day^{-1}, λ = 1.184 day^{-1}) (Momen and Abdel-Khalek 2008; Momen and Lamlom 2021). In addition, lower *r* and *λ* values were reported for *P. lindquisti* fed on *A. mangiferae* (r = 0.21 day^{-1}, λ = 1.23 day^{-1}) in comparison to our results on the same prey (Abdel-Khalek and Momen 2022). On the other hand, higher values of *r* and *λ* were estimated for *E. finlandicus* against *A. kenyae* (r = 0.23 day^{-1}, λ = 1.26 day^{-1}) and for *T. athiasae* against *O. mangiferus* (r = 0.238 day^{-1}, λ = 1.269 day^{-1}) (Abou-Elella *et al.* 2014; Fahim and Momen 2022). Compared to the population parameters of *T. athiasae* against the tested mites, higher *r* and *λ* in addition to lower *T* values were recorded when it fed on other food sources such as *A. dioscoridis* and *T. urticae* (Momen 2009; Basheer *et al.* 2014). When *T. mangiferus* was provided with *A. kenyae* or *A. mangiferae* as food, lower total fecundity, *r*, R_0, and *λ* as well as longer mean generation time were recorded as compared to our results for the corresponding prey (Abou-Awad *et al.* 2010a). This suggested that *T. athiasae* appeared to perform better against *A. mangiferae* and *A. kenyae* than *T. mangiferus.*

The lower *r* value of mite population is due to the higher value of *T* and the lower R_0 value of its population (Fahim *et al.* 2020). This may be the reason for the lower *r* values of *T. athiasae* population when fed on *A. kenyae* and *C. baileyi* as compared to *A. mangiferae* as prey. Therefore, it seems that *A. mangiferae* is more accepted as prey than *A. kenyae* and *C. baileyi*. This may be attributed to the ease of consumption and the differences in nutrients of the tested eriophyid species. Also, Abou-Awad *et al.* (2010a) ranked *A. mangiferae* as the most appropriate prey for *T. mangiferus* followed by *A. kenyae*. According to Lindquist (1996) the body structures in vermiform eriophyids facilitated their consumption compared to the fusiform species. In this regard, the vermiform eriophyid mites (e.g. *A. mangiferae* and *A. dioscoridis*) appear to be more appropriate prey than the fusiform ones (e.g. *Aculus fockeui* (Nalepa and Trouessort), *A. kenyae*, and *C. baileyi*) for stigmaeid and phytoseiid mites (Momen 2012; Momen and Lamlom 2021; the present study).

CONCLUSION

In conclusion, the present results showed that the *T. athiasae* population could display a high capacity to increase when preying on the tested eriophyids (specifically on *A. mangiferae*). Therefore, this predator may be capable of providing effective management of these eriophyid mites. However, although *T. athiasae* showed successful development and reproduction on the tested prey, it responded differently to them. This different response must be considered to enhance the role of this phytoseiid in IPM tactics. Nevertheless, the successful utilization of *T. athiasae* as a bio-control agent still requires additional studies under field conditions to better understand its potential for controlling the tested eriophyids.

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مناسب بودن سه کنهٔ اریوفید به عنوان طعمه برای کنهٔ شکارگر *Typhlodromus athiasae* (Acari: Phytoseiidae)

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چکیده

کنه‌های اریوفید، *Aceria kenyae* (Keifer)، *A. mangiferae* Sayed و *Calepitrimerus baileyi* Keifer از آفات مهم گیاهخوار در مصر هستند. در این مطالعه، تأثیر اریوفیدهای فوق به عنوان طعمهٔ طبیعی بر آماره‌های زیستی و رشد جمعیت کنهٔ فیتوزئید *Typhlodromus athiasae* Porath & Swirski مورد بررسی قرار گرفت. این کنهٔ فیتوزئید می‌تواند با موفقیت با تغذیه از *A. kenyae*، *A. mangiferae* و *C. baileyi* رشد و تکثیر کند. افراد *T. athiasae* تغذیه شده از *A. mangiferae* کوتاه‌ترین رشد پیش از بلوغ را نشان دادند، در حالی که آنهایی که با *A. kenyae* و *C. baileyi* تغذیه شده بودند زمان بیشتری برای رسیدن به مرحله بلوغ صرف کردند. طول عمر مادهٔ کامل *T. athiasae* با تغذیه از *A. mangiferae* (۳٦/۷۹ روز) بیشتر از *A. kenyae* (۳۱/٦۵ روز) و *C. baileyi* (۳۱/۱۸ روز) بود. تعداد کل تخم در هر مادهٔ *T. athiasae* بیشترین میزان را در *A. mangiferae* داشت و پس از آن *A. kenyae* و *C. baileyi* (به ترتیب ٤٦/۲۹، ۳۷/٦۲ و ۳٤/۳۹ تخم در ماده) قرار گرفتند. در حال حاضر، تغذیهٔ *T. athiasae* از *A. mangiferae* منجر به بیشترین میزان ذاتی افزایش (r)، میزان متناهی افزایش (λ)، و میزان خالص تولید مثل (R_0) در مقایسه با طعمه‌های دیگر شد. افزون بر این، تغذیه از *A. mangiferae* کوتاه‌ترین میانگین زمان تولید (T) را نشان داد، در حالی‌که *A. kenyae* طولانی‌ترین زمان را به عنوان طعمه *T. athiasae* نشان داد. در نتیجه، نتایج حاضر نشان می‌دهد که جمعیت *T. athiasae* می‌تواند ظرفیت زیادی برای افزایش در هنگام شکار اریوفیدهای آزمایش شده (به ویژه با تغذیه از *A. mangiferae*) نشان دهد. بنابراین، این شکارگر ممکن است قادر به مدیریت موثر این کنه‌های اریوفید باشد.

واژگان کلیدی: *Aceria kenyae*؛ *Aceria mangiferae*؛ *Calepitrimerus baileyi*؛ Eriophyidae؛ آماره‌های جدول زیستی؛ کنهٔ فیتوزئید.

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