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ORIGINAL ARTICLE

Life table of *Macrolophus basicornis* (Hemiptera: Miridae) preying on *Myzus persicae* (Sulzer) and *Macrosiphum euphorbiae* (Thomas) (Hemiptera: Aphididae)

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ABSTRACT: Data obtained in studies on the biology and reproduction of *Macrolophus basicornis* (Heteroptera: Miridae) preying on *Myzus persicae* (Sulzer) and *Macrosiphum euphorbiae* (Thomas) on tomato at 28°C, were used to construct life tables for this polyphagous mirid. When *M. euphorbiae* was preying on *M. persicae,* the net reproductive rate (*Ro*) was 4.75, the intrinsic rate of increase (r_m) 0.02 (hembra/hembra/day), the mean generation time (T) and the doubling time (DT) 73.91 and 32.9 days, respectively. The corresponding values when it was feeding on *M. euphorbiae* were 2.57, 0.01, 1.014 days and 49.35 days, respectively. The results demonstrated that *M. basicornis* could survive and reproduce with *M. persicae* as well as *M. euphorbiae* as preys, although the number of females obtained by generation will be smaller with *M. euphorbiae*. The number of females increased twice in front of *M. persicae,* what demonstrated that this latter prey had greater acceptance by the predator.

Key words: life table, *Macrolophus basicornis*, prey, *Myzus persicae*, *Macrosiphum euphorbiae*, tomato plants.

Tabla de vida de *Macrolophus basicornis* (Hemiptera: Miridae) teniendo como presas a *Myzus persicae* (Sulzer) y *Macrosiphum euphorbiae* (Thomas) (Hemiptera: Aphididae)

RESUMEN: A partir de los datos obtenidos durante los experimentos de biología y reproducción de *Macrolophus basicornis* (Heteroptera: Miridae) se evaluaron las características de las tablas de vida del mirido usando como presa *Myzus persicae* (Zulser) y *Macrosiphum euphorbiae (Thomas),* en plantas a 28°C. Cuando la presa fue *M. persicae* la tasa neta reproductiva (Ro) fue 4,75 hijas hembras por cada madre, la tasa intrínseca de incremento (r_m) fue de 0.02 (female/female/day, el tiempo medio generacional (T) y el doble tiempo generacional (DT) fueron de 73,91 y 32,9 días, respectivamente. Los valores correspondientes para *M. basicornis* cuando se alimenta de *M. euphorbiae* fue de 2,57, 0,01; 1,014 días y 49,35 días. Los resultados han demostrado que *M. basicornis* puede sobrevivir y reproducirse teniendo como presa tanto a *M. persicae* como a *M. euphorbiae,* aunque la cantidad de hembras obtenidas por generación será más pequeña teniendo como presa a *M. euphorbiae*; sin embargo, el número de hembras se incrementa dos veces cuando la presa es *M. persicae,* lo que demuestra que el depredador tiene mayor aceptación por esta presa.

Palabras clave: tablas de vida, *Macrolophus basicornis*, presa, *Myzus persicae*, *Macrosiphum euphorbiae*, plantas de tomate.

INTRODUCTION

Several species of aphids, like *Myzus persicae* (Sulzer) and *Macrosiphum euphorbiae* (Thomas) (Homoptera: Aphididae), are major pests of tomato, eggplant, and sweet pepper crops that are grown either outdoors or in greenhouses (1).

Nowadays, several studies have shown that species of the genus *Macrolophus fieber* (Hemiptera: Miridae),

like *Macrolophus caliginosus* Wagner and *M. pygmaeus* Rambur (Hemiptera: Miridae), are polyphagous predators and considered as extremely important and effective biological control agents for many greenhouses pests (2,3,4,5,6).

M.caliginosus has successfully controlled whiteflies in tomato fields and is now commercially available for controlling whiteflies and aphids in vegetable crops. *M. caliginosus* is a polyphagous predator but feeds mainly on greenhouse whitefly and several species of aphids. It also feeds, to a smaller extent, on thrips and mites (1).

Perdikis and Lykouressis (7, 8) and Lykouressis *et al*. (9) investigated the developmental and survival rates of *M. pygmaeus* nymphs in the presence and absence of prey on several host plants , and they found that *M. persicae* and *T. vaporariorum* were suitable preys.

Recently, Bueno *et al*. (10) found several very promising predatory Hemiptera, which attacked lepidopteran species and others pest in tomato greenhouses. In this studies *M. basicornis* (Stal, 1860) (Hemiptera: Miridae) and other two predator showed high predation rates, which were similar to the very effective European predators used on a large scale for the control of lepidopteran species and several other greenhouse pests (6,11,12). *M. basicornis* and the predator *Nesidiocoris tenuis* Reuter (Hemiptera: Miridae) showed predation rates higher than 30 eggs/ day (6) and 100 eggs/day (13).

As Wiedenmann and Wilson emphasized (14), before polyphagous predators can be used effectively as biological control agents, it is important to obtain strong information about their biology.

With this purpose, the determination of the life table characteristics of *M. basicornis feeding* on *M. persicae* and *M. euphorbia* on tomato plants in this study was found important.

MATERIAL AND METHODS

The adults of the predator *M. basicornis* used for the laboratory cultures were collected from an area of tobacco (*Nicotiana tabacum* L.) in Ribeirão Vermelho (21° 08,596 'S and 045° 03,466' W, 808 m altitude), Lavras, Minas Gerais, Brasil. The cultures were maintained in acrylic cages (30x30x60cm) with *Nicandra physalodes* (L.) Gaertn plants infested by large numbers of *M. persicae* and *M. euphorbiae*. All cultures were kept in BIOD at 21 ± 1ºC, RH 70 ± 10% and photoperiod of 12 hours; the plates were changed twice a week.

The data obtained from the development and reproduction of *M. basicornis* with *M. persicae* and *M. euphorbiae* as preys on tomato plants were used to construct life tables for *M. basicornis.* The age-specific survival rate and age-specific fecundity were calculated per day. The net reproductive rate, mean generation time, intrinsic rate of natural increase, doubling time and finally, finite rate of increase were estimated one by one (15,16,17).

RESULTS AND DISCUSION

When *M. basicornis* had *M. persicae* as prey, the population of the predator increased 4,75 times in 73,91 days, what represents that ber each female in the current generation, 4,75 females were born in the following generation. Also, ber each female being present one day, there were 1, 02 females the following day. Therefore, in any moment, the number of the *M. basicornis* female populations would increase at such a rate that a population growth near to 2% could be expected (Table).

TABLE. Parameters of the life table of *M. basicornis* with *M. persicae* and *M. euphorbiae* as preys on tomato plants./ *Tabla de vida de* ***M. basicornis*** *teniendo como presas a* ***M. persicae*** *y* ***M. euphorbiae*** *sobre plantas de tomate*

Biological Parameters	*M. persicae*	*M. euphorbiae*
Net reproductive rate **(R_o)**	4,75a	2,57b
Intrinsic rate of natural increase **(r_m)**	0,02a	0,01a
Mean generation time **(T)**	73,91a	67,37a
Finite rate of increase **(λ)**	1,02a	1,014a
Doubling time **(DT)**	32,9a	49,35a

*Mean values followed by same letter are not significantly different, Square Chi Test p≤0.05

On the other hand, when *M. euphorbiae* was given as prey, the population of natural enemies increased 2,57 times in 67,37 days, making evident that with this prey, the number of females born per day (R_o) and the half time between a generation and the following one (T) decreased. Table shows significant differences in the number of prospective females with both preys. However, no significant differences were observed in the predator´s generational time with the two preys offered.

Similar behavior was shown by the population growth, which diminished to 1% when *M. euphorbiae*

was given as prey, but when *M. persicae* was the prey, no significant differences were observed (Table).

The finite rate of growth, defined as the number of individuals that is added to a population per day, for *M. basicornis* was superior to the unit in front of both preys; a value that was considered as a good indicator for biological control candidates (18).

However, although the double generational time was longer when the predator fed on *M. euphorbiae,* it did not show significant differences when the pray given was *M. persicae*, which could be interpreted as an advantage for the predator´s population increment.

The proportion of individual survivors of *M. basicornis* showed that the probability to live in early ages since the beginning until 28 days was100% when this species was feeding on *M. persicae* (Type I curve). However, at 29 days there was a significant reduction in the survival as the age of the females increased, simulating a Type II curve (Fig. A).

When *M. euphorbiae* was offered as prey, the curve of survival of *M. basicornis basicornis* shortens in the 25 and 26 day, but in the 27 day showing a Type I curve until the 29 days, when the survive probability decreased to describe a Type II curve (Fig. B).

According to Duarte *et al.* (19), the curves of survival allows to describe the pattern mortality that is subject to a population, confirming that they are very sensitive to the environmental conditions, the sex and the individual genotype. Under laboratory conditions, where the nutritious resources are in excess and there is not overcrowding, neither external causes of mortality like parasitoids or predators, it is expected that the organisms express their greatest potential of survival.

There is not much information available about the performance and biological characteristics of *M. basicornis* as natural enemy, but information on other mirids, like *M. caliginosus* and *M. pygmaeus,* used in biological control of aphids and other pests in greenhouses is abundant.

For example, Hansen *et al.* (20) evaluated the life table characteristics at 22ºC of *M. caliginosus* preying on various stages of *Tetranychus urticae* Koch with tomato as host plant, and they estimated the net reproduction rate (*R*o) as 6,15; the intrinsic rate of increase (r_m) as 0,031 days; the finite rate of increase as 1,032; the mean generation time as 58,17 days; and doubling time (*T*2) as 22,2 days.

Perdikis *et al.* (7) showed that the intrinsic rate of increase of *M. pygmaeus* was similar on eggplant with *M. persicae* and tomato with *T. vaporariorum* at different temperatures. Therefore, both prey species were more or less equally suitable for the population increase of *M. pygmaeus*. They attributed a possible favorable effect on eggplant with *M. persicae* to a better adaptation because the culture of *M. pygmaeus* had been kept on that host plant - prey combination. *M. pygmaeus* is well adapted to temperatures between 25 and 30ºC, consequently, this mirid could be an efficient biological control agent in a range of countries.

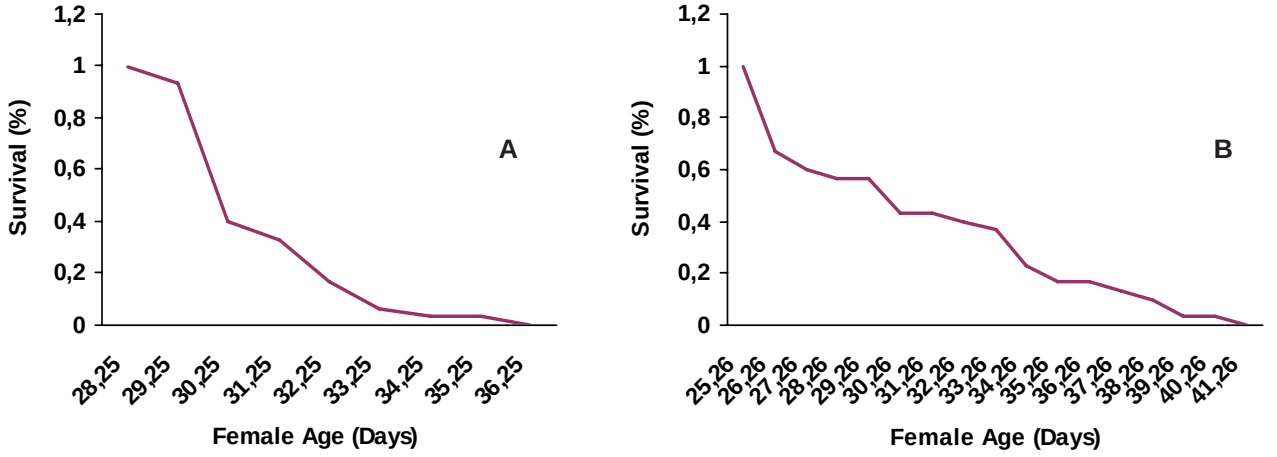

FIGURE. Survival of *Macrolophus basicornis* preying on *Myzus persicae* (A) and *Macrosiphum euphorbiae* (B) on tomato plants./ *Sobrevivencia de* ***Macrolophus basicornis*** *teniendo como presa a* ***Myzus persicae*** *(A) y* ***Macrosiphum euphorbiae*** *(B) en plantas de tomate.*

The low rate of population increase of *M. basicornis* observed in this work does not preclude this predator to be used in biological control, which may be achieved by adopting preventive introductions or by using a 'Keep-Down-Strategy' as Hansen *et al.* (20) proposed for *M. caliginosus*.

Some generalist predators have been reported to perform better on a mixed diet (21), and the same could be true for *M. basicornis*. Because the majority of glasshouse crops are infested with a number of different pests, more research is needed to assess the nymphal mortality rate, as well as the adult longevity and egg-laying capacity of this predator when fed on these aphids or a mixed diet. Equally important is to continue the research on the preference and switching capacity of *M. basicornis* preying on different species and their life stages offered simultaneously.

The survival, fecundity, progeny per female, biological characteristics and biological parameters changed when the *Macrolophus* species fed on eggs (10); this corroborated that aphids were a low quality prey for this predators.

M. basicornis can survive and reproduce with *M. persicae* as well as *M. euphorbiae as preys,* although the number of females obtained by generation will be smaller with *M. euphorbiae*; nevertheless, the number of females increased twice in front of *M. persicae*, what demonstrated that this prey had greater acceptance by the predator.

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