

Effect of *Eucalyptus* feeding in the development, survival and reproduction of *Tynacantha marginata* (Heteroptera: Pentatomidae)

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Abstract: The effect of feeding on *Eucalyptus* leaves of *Tynacantha marginata* (Heteroptera: Pentatomidae) was studied in Brazil. The use of this plant as a complementary food source for the predatory bug increased its oviposition period, generation time, and net reproductive rate. *Eucalyptus* leaves apparently had no influence on the survival and development of *T. marginata*.

Key words: Predatory stink bug, biological control, mass rearing, life table, *Eucalyptus urophylla*.

Understanding the interactions among plants, phytophagous insects, and their natural enemies can be helpful to improve biological control of insect pests (Altieri 1989). We cannot understand the predator-prey relationships without knowing the role of plants because they probably affect the third trophic level (natural enemies) (Price *et al.* 1980).

Some predaceous insects may require compounds directly obtained from plants for their development. When leaves are provided to the predator's diet, in most of cases, insects have higher survival and shorter developmental time (Senrayan 1991). *Tynacantha marginata* (Heteroptera: Pentatomidae), mainly in its adult and last nymphal stages, has been reported feeding on perennial soybean leaves (Garcia 1991). It has also been reported that this phytophagous habit improves longevity, weight of nymphs and adults, and the fecundity of predaceous bugs of the subfamily Asopinae (Naranjo and Stimac 1985, 1987, Ruberson *et al.* 1986, Valicente & O'Neil 1993, Zanuncio *et al.*

1993). To determine the influence of complementary feeding on *Eucalyptus* leaves in the growth and development of *T. marginata*, life expectancy and fertility tables were calculated for this predator fed on larvae of *Tenebrio molitor* Linnaeus, 1758 (Coleoptera: Tenebrionidae) and reared in the presence or in the absence of leaves of *Eucalyptus urophylla*.

MATERIALS AND METHODS

This study was done under laboratory conditions of $25 \pm 0.5^\circ\text{C}$, photoperiod of 12L:12D, and $65 \pm 10\%$ r.h. Six groups of 25 fertile eggs (yellow-gold color) were collected from first generation of *T. marginata* reared under these conditions (Teixeira *et al.* 1989). First instar nymphs were provided with distilled water.

After molting, second instar nymphs were collected and placed in 200 ml plastic cups whose central part of their lids were replaced by nylon net of 25 mesh. Water was provided

through an anesthesia tube whose open end was covered with cotton and inserted in the plastic cup lid (Zanuncio *et al.* 1992). For the treatment in which leaves of *Eucalyptus* were also provided, one leaf of *Eucalyptus urophylla* was inserted in the water tube of each plastic cup. One last instar larvae of *T. molitor* was maintained inside each of these rearing cups and the *Eucalyptus* leaves were replaced each couple of days. The molts and insect mortality were daily registered. After the molt to the adult stage, the insects were sexed and coupled.

The results of instar duration, width of head at the eye level, and the weight of nymphs and adults of *T. marginata* were subjected to analysis of variance. The pre-oviposition and oviposition periods for eight females from each treatment, as well as the duration of each instar, the adult longevity, and adult weights were subjected to the Student's *t* test also at 5% of probability to compare both treatments. Survival and life expectancy curves were obtained by regression. Adults of *T. marginata* are kept in the Entomology Museum of the Federal University of Viçosa, in Viçosa, Minas Gerais State, Brazil.

RESULTS

The presence of *Eucalyptus* leaves did not increase significantly the life cycle duration of *T. marginata* (Table 1). There were no significant differences between treatments in adult longevity and pre-oviposition period, but the oviposition period increased more than three times for the predators provided with *E. urophylla* leaves.

T. marginata showed a type IV survivorship curve. It had a sharp decrease in the early developmental stages from egg hatch to the molt to second instar (Fig. 1) after which the mortality rate decreases until the death of all insects.

Life expectancy was higher in the beginning of the life cycle of predators reared on *Eucalyptus* leaves, but from the sixth week on (adult phase) there was an inversion of values for the predators reared without *Eucalyptus* leaves. At the end of the study, the curves of both treatments joined with each other (Fig. 2).

The fertility tables of *T. marginata* showed that adult females begin oviposition at the sixth week of life when reared without *Eucalyptus*

TABLE 1

Biological parameters of Tynacantha marginata reared on diet of Tenebrio molitor larvae in the presence or absence of Eucalyptus urophylla leaves

Developmental stage	Duration (days) ^a			
	Reared in the absence of <i>Eucalyptus</i> leaves		Reared in the presence of <i>Eucalyptus</i> leaves	
	Females	Males	Females	Males
Egg (incubation)	5.00 ± 0.00 ^b	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00
1st Instar	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00
2nd Instar	5.33 ± 0.21	5.50 ± 0.22	5.67 ± 0.21	6.00 ± 0.45
3rd Instar	5.00 ± 0.26	5.17 ± 0.17	5.00 ± 0.00	5.50 ± 0.50
4th Instar	5.17 ± 0.79	4.83 ± 0.17	5.00 ± 0.00	6.17 ± 0.31
5th Instar	7.00 ± 0.00	6.83 ± 0.17	7.50 ± 0.22	7.00 ± 0.26
Total	32.50	32.33	33.17	34.67
Pre-oviposition period	20.75 ± 2.84	-	14.50 ± 2.99	-
Oviposition period [*]	11.75 ± 3.33	-	32.63 ± 4.75	-
Adult longevity	60.33 ± 8.42	82.83 ± 10.48	64.17 ± 3.30	68.67 ± 11.70
Period from egg to egg ^{c*}	53.25 ± 3.11	-	47.67 ± 2.96	-

^a Non-significant at 5% probability by F statistics

^b Mean ± standard error

^c Period from the oviposition of the egg and the oviposition of its descendent egg

^{*} Significant different at 5% probability by Student's *t* test

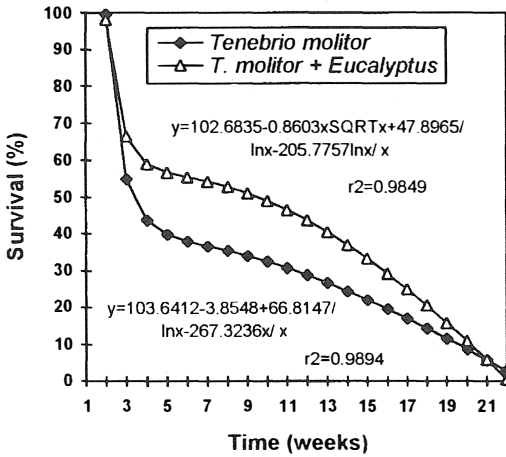


Fig. 1. Survival of *Tynacantha marginata* reared on diet of *Tenebrio molitor* larvae in the presence or absence of leaves of *Eucalyptus urophylla*.

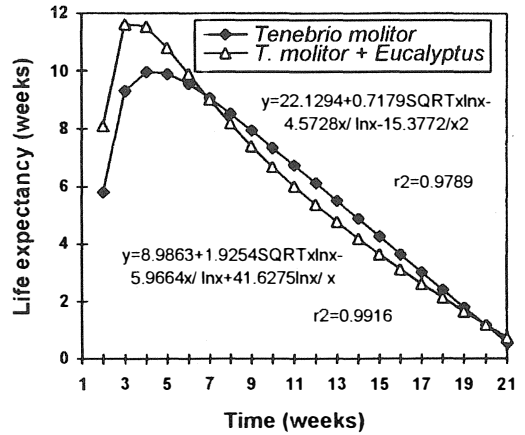


Fig. 2. Life expectancy of *Tynacantha marginata* reared on diet of *Tenebrio molitor* larvae in the presence or absence of leaves of *Eucalyptus urophylla*.

TABLE 2

Life history analysis of *Tynacantha marginata* reared on diet of *Tenebrio molitor* larvae in the presence or absence of *Eucalyptus urophylla* leaves

Treatment	Generation time (G)	Net reproductive rate (Ro)	Infinite rate of increase (r)	Intrinsic rate of population growth (λ)
Absence of <i>Eucalyptus</i> leaves	8.00	21.51	0.3836	1.467
Presence of <i>Eucalyptus</i> leaves	10.37	50.68	0.3785	1.460
Significance by Wilcoxon's statistics	0.04264*	0.01046*	0.28186 ns	0.28186 ns

* Means of the column are significant different at 5% probability

ns Means of the same column are not significant different at 5% probability

leaves and at the seventh week when reared with it but this difference was not significant. In the first case, 63.57 females were produced while in the second one, 109.24 females were produced. The time from the emergence of females until the appearance of their female descendants (generation time, G) was eight weeks for females reared without vegetal matter, and 10.37 weeks for females reared with *Eucalyptus* leaves (Table 2).

The net reproductive rate (Ro) of *T. marginata* shows that the addition of *Eucalyptus* leaves increased 2.5 times the population growth when compared with *T. marginata*

reared without vegetal matter. The intrinsic rate of increase (r) and the finite rate of population growth (λ) were similar for both treatments (Table 2). Females were always heavier than males (Table 3) and the weight of males and females were similar for both treatments. The head width at the eye level and the nymphal development were also similar in both treatments.

The habit of complementary feeding on *Eucalyptus* leaves by *T. marginata* does increase the net reproductive rate of this species, but has no significant effect in its rate of population growth due to the increase in

TABLE 3

Body weight of adults of Tynacantha marginata reared on diet of Tenebrio molitor larvae in the presence or absence of Eucalyptus urophylla leaves

Treatment	Body weight (mg) \pm standard error	
	Females	Males
Absence of <i>Eucalyptus</i> leaves	79.58 \pm 6.75 Aa *	50.89 \pm 3.73 Ab
Presence of <i>Eucalyptus</i> leaves	93.74 \pm 2.65 Aa	42.81 \pm 3.21 A

* Means followed by the same capital letter in a column or by the same low case letter in a row do not differ significant at 5% probability by Student's t test

generation time. Therefore, while the presence of *Eucalyptus* in the field can be advantageous to *T. marginata* (allowing it to remain in the field for a longer period of time even without its prey and favoring its action as a biological control agent), there is no advantage in mass rearing this predaceous species with *Eucalyptus* leaves because the increase in labor is not compensated by an increase in insect production.

DISCUSSION

Eucalyptus feeding did not have any influence on males of *T. marginata*, however it did affect females in their reproductive parameters. This complementary feeding habit had no effect on the longevity of adult males and females of *T. marginata*, but they lived more than the specimens reared on different diets by Zachrisson (1987) and Teixeira *et al.* (1989). This may be due to the higher protein contents of *T. molitor* larvae in comparison to larvae of Lepidoptera in general (Southwood 1973). Additionally, the survivorship curve of this predatory species was not influenced by the presence of *Eucalyptus* leaves and its shape resembles the survivorship curve of *Triatoma infestans* (Klug., 1834) (Heteroptera: Reduviidae) presented by Rabinovich (1978). These results are different from those of other species of Asopinae that had their development, survival and weight increased with plant leaves (Senrayan 1991, Zanuncio *et al.* 1993).

Positive effects of the phytophagous habit in the fertility of predaceous bugs other than *T. marginata* have been reported by Rabinovich

(1978), Naranjo and Stimac (1985) and Ruberson *et al.* (1986). In *T. marginata* antagonistic effects of the phytophagous habit neutralizes their impact in the rate of population growth. Despite the long generation time (G) for *T. marginata* reared with *Eucalyptus* leaves, the high net reproductive rate (Ro) observed in this condition compensates its negative effect in the population growth of this predator. Adult females of *T. marginata* reared with *Eucalyptus* leaves are able to lay more eggs; this leads to the high net reproductive rate (Ro) reported here for this condition in comparison with females reared without the presence of *Eucalyptus* leaves.

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RESUMEN

Se estudió el efecto nutricional de hojas de *Eucalyptus* sobre *Tynacantha marginata* (Heteroptera: Pentatomidae) mediante tablas de vida y fecundidad. El uso de esta planta como fuente alimenticia complementaria para el depredador incrementó su período de oviposición, tiempo de reproducción y la tasa neta reproductiva. Las hojas de *Eucalyptus* no tienen influencia en la supervivencia y desarrollo de *T. marginata*; solamente los parámetros reproductivos fueron influenciados, pero sin cambios significativos en la tasa de crecimiento de la población.

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