Development and longevity of the polyphagous mirid bug *Dicyphus tamaninii* WAGNER (Het., Miridae) with different ages of *Aphis gossypii* GLOVER as a prey

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Abstract: Entwicklung und Lebensdauer der polyphagen Wanze *Dicyphus tamaninii* WAGNER (Het., Miridae) mit *Aphis gossypii* GLOVER verschiedenen Alters als Beute.

Obwohl die räuberische Wanze *Dicyphus tamaninii* WAGNER (Het., Miridae) als erfolgversprechender Gegenspieler von einigen Schädlingen bezeichnet wird, ist ihre Biologie bisher nur sehr wenig erforscht worden. Das Ziel der vorliegenden Arbeit ist es daher, die Entwicklung, Mortalität und Lebensdauer dieses Räubers bei Fütterung mit 1-2 und 4-5 Tage alten *Aphis gossypii* GLOVER (Hom., Aphididae) als Beute unter Laborbedingungen zu untersuchen. Die Ergebnisse zeigten, dass die Embryonalentwicklung von *D. tamaninii* im Durchschnitt 12,1 Tage dauerte. Die Entwicklung der Nymphstadien, die über fünf Stadien verlief, dauerte 21,2 bzw. 29,2 Tage mit 1-2 bzw. 4-5 Tage alten *A. gossypii* als Beute, was signifikant unterschiedlich war. Die Mortalität während der Entwicklung bei 1-2 Tage alten Beutetieren war 20% und erhöhte sich mit 4-5 Tage alten Aphiden auf 25%. Die Lebensdauer der adulten Wanzen zeigte beachtliche Schwankungen, wobei sie 29,0 (&&), 26,2 (%%) Tage bzw. 44,1 (&&), 31,4 (%%) Tage betrug, wenn *D. tamaninii* mit 1-2 bzw. 4-5 Tage alten *A. gossypii* gefüttert wurde.

Key Words: *Aphis gossypii*, *Dicyphus tamaninii*, development, longevity, biological control, predator, natural enemies.

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The melon/cotton aphid, *Aphis gossypii* GLOVER (Hom., Aphididae), is a polyphagous and cosmopolitan pest with cucurbit crops and cotton as main host plants (YORK 1992). In northern temperate region *A. gossypii* is often a pest on glasshouse-grown crops (VAN STEENIS 1992). In Germany, it had been noticed on cucumber grown under glasshouse for the first time in 1987 (DENGLER 1991) and developed to be a serious pest since 1990 (BÜNGER 1996).

In integrated pest management in glasshouses aphids have usually been successfully controlled by using the selective insecticide Pirimicarb (VAN STEENIS 1992). However, reports that *A. gossypii* developed resistance against this chemical (ALBERT & MERZ 1995), have stressed the need to develop new possibilities of biological control against this pest.

Many species of the predatory Heteroptera are being used in the biological control programmes of agricultural pests (COLL & RUPERSON 1998). Among which, the predatory mirid bug *Dicyphus tamaninii* WAGNER (Het., Miridae) was reported to be an effective predator of the greenhouse whitefly *Trialeurodes vaporariorum* WESTWOOD on field-grown tomatoes (ALOMAR et al. 1994) and also of the western flower Thrips *Frankliniella occidentalis* PERGANDE (GABARRA et al. 1995). Furthermore, *D. tamaninii* has shown a promising capability as a predator of the aphids *A. gossypii* and *Macrosiphum euphobiae* (THOMAS) (ALVARADO et al. 1997, SALEH & SENGONCA 2000).

As sufficient biological knowledge of *D. tamaninii* is still lacking in the literature, the purpose of the present laboratory study was to investigate the development, mortality and longevity of females and males of this predator with two different age groups of 1-2 and 4-5 days old *A. gossypii* nymphs on cucumber leaves as a prey under controlled laboratory conditions.

Materials and Methods

All rearings and laboratory experiments were carried out under the same controlled climatic conditions of 25±1C°, 60±10% RH and 16:8 L:D.

The stock culture of *A. gossypii* was maintained on cotton plants in a climatically controlled chamber. In order to obtain the uniformly aged *A. gossypii* nymphs which were used in the experiments, plastic cylindrical Petri dishes (5.5cm ∅ by 2cm) with a mesh-covered hole in the lid were used. Freshly excised cucumber leaf discs (4.5cm ∅) were placed upside down on top of a layer of 0.7% Agar gel in the Petri dishes. Up to ten young adult virginoparae *A. gossypii* females were placed gently in each Petri dish by means of a moistened fine camelhair brush. The females were left for nymphs laying for 24 hours. The newly laid nymphs were then further reared till reaching the desired age.

The stock culture of *D. tamaninii* was initiated from few individuals obtained courtesy from Prof. Dr. O. Alomar, IRTA, Unitat d`Entomologia Aplicada, Barcelona, Spain. The colony was reared on tobacco plants (as an oviposition substrate) within cages (60x60x40cm) sealed with gauze from all sides for aeration. *A. gossypii* and *T. vaporariorum* were used to feed the colony.

In order to determine the embryonic developmental time of *D. tamaninii*, 20 mature adult females were randomly selected from the stock culture and then confined singly for egg laying by a clip-on-cage on the lower side of cucumber leaves (infested with *A. gossypii*) for 24 hours. The cucumber plants containing the freshly laid *D. tamaninii* eggs were then incubated and checked daily for freshly hatching *D. tamaninii* nymphs.

For establishing the developmental time of *D. tamaninii*, newly hatched nymphs were placed individually into Petri dishes containing excess numbers of either 1-2 or 4-5 days old *A. gossypii* on cucumber leaf discs. The development from one nymphal instar to the next was monitored every 12 hours by checking for the exuviae. Mortality of the nympal instars was also recorded. Twenty replicates were used with each prey age.

In order to investigate the longevity of *D. tamaninii*, individual adult females and males, soonafter emergence from the last nympal instar, were kept singly in Petri dishes with excess numbers of either 1-2 or 4-5 days old *A. gossypii* for the adults to feed on. Food was added daily and the mortality of the adults during life time was recorded.

Results

The developmental times of the different developmental stages of *D. tamaninii* with both prey ages of *A. gossypii* are represented in figure 1. In addition to the egg stage which lasted in average 12.5 days, the predatory bug completed it's development through 5 nymphal instars of which the last one lasted longest with

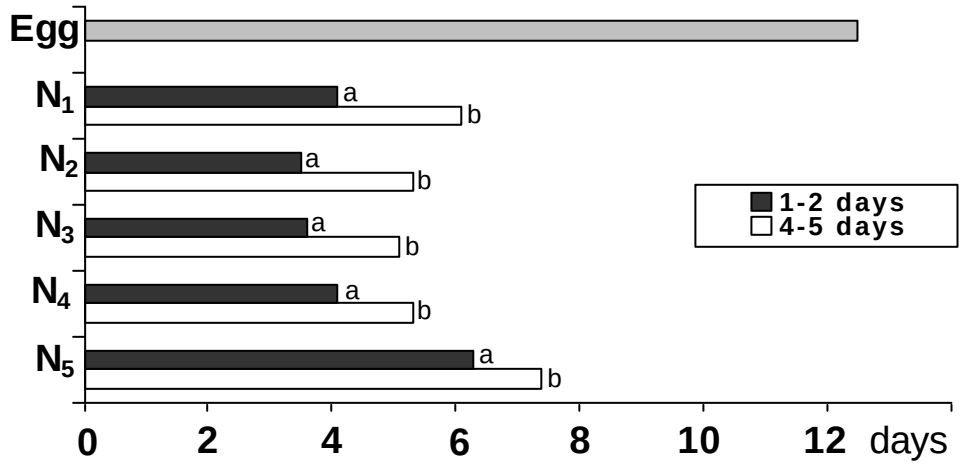

Fig. 1: Mean embryonic and nymphal developmental time of *Dicyphus tamaninii* by feeding on 1-2 and 4-5 days old *Aphis gossypii* on cucumber leaves at 25±1°C. Different letters within each nymphal instar indicate significant differences at 0.05 confidence level (U-test)[a]

a mean of 6.3, 7.4 days when fed on 1-2 and 4-5 days old *A. gossypii*, respectively. In general, *D. tamaninii* nymphs feeding on 1-2 days old *A. gossypii* required significantly shorter time (21.2 days) to complete their development to adult than those fed on 4-5 days old prey which required 29.2 days. This delay in development was more clearly exhibited in the first two nymphal instars.

Mortality in the different nymphal instars of *D. tamaninii* is represented in figure 2. When fed on 1-2 days old *A. gossypii*, 16 of the initial 20 *D. tamaninii* nymphs reached the adult stage (20% mortality), while with 4-5 days old prey the mortality valued 25%. With both prey ages, maximum mortality occurred during the first two nymphal intars.

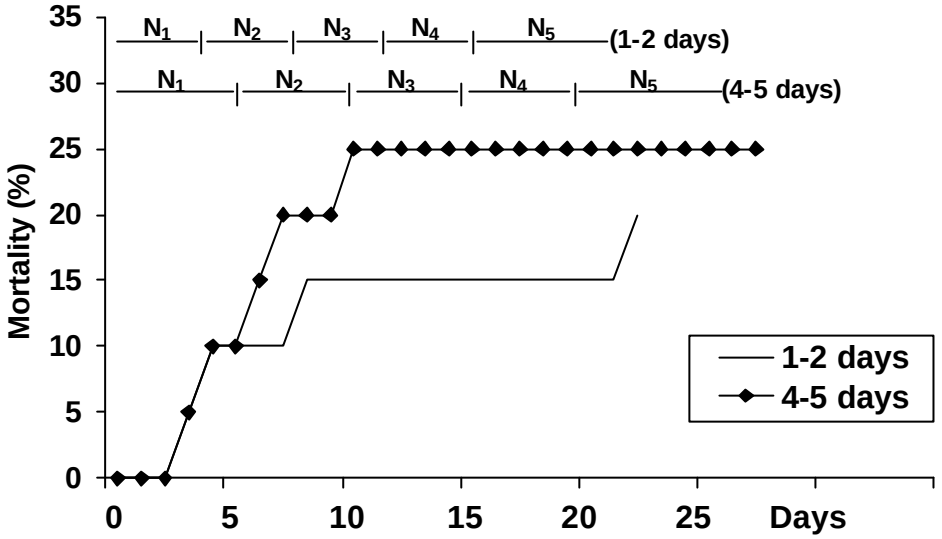

Fig. 2: Percentage mortality of *Dicyphus tamaninii* during development at 25±1°C by feeding on 1-2 and 4-5 days old *Aphis gossypii* on cucumber leaves.

Longevity of *D. tamaninii* adults showed in general considerable variation (table 1). For instance, the longevity of *D. tamaninii* females ranged from 12 to 65 days, while that of the males from 6 to 43 days. *D. tamaninii* adults lived longer when fed on 4-5 days old *A. gossypii* and females lived generally longer than males with both prey ages used.

Prey age (Days)	Sex	Longevity of *D. tamaninii* (Days)	
		Mean	Min.-Max.
1-2	&&	29.0 aA	12 - 50
	%%	26.3 aA	6 - 43
4-5	&&	44.1 bA	28 - 65
	%%	31.4 cA	18 - 41

Table 1: Longevity of *Dicyphus tamaninii* females and males by feeding on 1-2 and 4-5 days old *Aphis gossypii* on cucumber leaves at 25±1°C. Different small letters indicate significant differences between males and females within the same prey age. Different capital letters indicate significant differences with different prey ages within the same sex (U-test)[a].

Discussion

Results showed that *D. tamaninii* could successfully prey and fully develop on both ages of *A. gossypii* used. However, the development lasted for a significantly longer time when the predator was fed on 4-5 days rather than 1-2 days old prey. Furthermore, when fed on the same prey age, there were no significant differences in the developmental times between females and males. ALVARADO et al. (1997) studied the efficiency of the same predatory bug on two aphid species and found that, by feeding on *A. gossypii*, it completed its development from egg hatch to adult in 21.5 days, which agrees with what we found when 1-2 days old *A. gossypii* were used as a prey. ALBAJES et al. (1996) reported total developmental times of 18.9 and 20.2 days when *D. tamaninii* was allowed to prey on the western flower Thrips and sweet potato whiteflies, respectively.

There was delay in development as well as higher mortality of *D. tamaninii* when fed on 4-5 days old *A. gossypii*, particularly in the early developmental stages. This may be attributed to that the early nymphal instars have a relative difficulty in attacking larger prey successfully. No previous literature dealing with the development of *D. tamaninii* by feeding on different prey ages could be found. Nevertheless, FAUVEL et al. (1987), studying the development of the similar predatory mirid bug *Macrolophus caliginosus* WAGNER with different aphid species as a prey, attributed the longer developmental time and higher mortality to the size, mobility and the cuticle-resistance of some aphid preys they used.

Longevity of *D. tamaninii* varied widely according to the sex and prey age used. In general, females lived longer than males when both were fed on the same prey age, while the longevity of both sexes was longer when fed on 4-5 rather than 1-2 days old *A. gossypii*. No accurate previous information about longevity are available in the literature. However, FAUVEL et al. (1987) reported that the longevity of *M. caliginosus* varied widely and ranged from 39.8 to 209.7 days, which seems to have a similar trend to that of our results.

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