

## Longevity of the ladybird predator *Serangium parcesetosum* Sicard (Col., Coccinellidae) on natural and artificial nutritional sources

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**Zusammenfassung:** Lebensdauer des räuberischen Marienkäfers *Serangium parcesetosum* SICARD (Col., Coccinellidae) mit natürlicher und künstlicher Nahrung.

Der in der Literatur nur wenig bekannte Marienkäfer *Serangium parcesetosum* SICARD (Col., Coccinellidae) scheint, ein spezialisierter Prädator der Weißen Fliegen zu sein. Untersuchungen über die Lebensdauer eines Prädators sind eine der wichtigsten Parameter für seine erfolgreiche Verwendung in der biologischen Bekämpfung. Solche Informationen über *S. parcesetosum* sind bisher in der Literatur allerdings nur unzulänglich bekannt bzw. fehlen vollständig. Folglich war das Ziel dieser Arbeit, bei zwei unterschiedlichen Temperaturen im Labor zu untersuchen, wie lang *S. parcesetosum* mit *Bemisia tabaci* (GENN.) bzw. *Trialeurodes vaporariorum* WESTWOOD (Hom., Aleyrodidae) als Beute sowie mit bestimmten künstlichen Nahrungen überleben kann. Die Ergebnisse zeigten, dass beide Geschlechter von *S. parcesetosum* auf Baumwolle mit *B. tabaci* als Beute, mit Ausnahme der Männchen bei 30°C, signifikant länger mit allen anderen Nahrungen lebten. Bei beiden Temperaturen war die Lebensdauer der Weibchen, mit allen untersuchten Nahrungen, signifikant länger als die der Männchen. Sie schwankte bei beiden Geschlechtern von durchschnittlich 94,3 (♂♂) bis 175,4 (♀♀) Tagen bei 18°C bzw. 50,3 (♂♂) bis 92,4 (♀♀) Tage bei 30°C mit den getesteten Nahrungen. Die adulten Weibchen und Männchen von *S. parcesetosum* konnten für eine beträchtliche Zeit mit künstlichen Nahrungen überleben. Bei beiden Temperaturen war die durchschnittliche Überlebensdauer beider Geschlechter bei einem Angebot von 10%iger Honig-Emulsion als Nahrung signifikant länger als nur mit Baumwollblättern bzw. ohne ein Angebot an Nahrung.

**Key words:** *Serangium parcesetosum*, *Bemisia tabaci*, *Trialeurodes vaporariorum*, natural, artificial, nutritional sources, longevity

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The little known ladybird, *Serangium parcesetosum* SICARD (Col., Coccinellidae) seems to be an important predator of whiteflies. It has found attacking *Bemisia tabaci* (GENN.) (Hom., Aleyrodidae) (KAPADIA & PURI 1992), *Aleurolobus barodensis* MASK (PATEL et al. 1996), *Aleurothrixus floccosus* MASKELL (ABBOUD & AHMAD 1998), *Bemisia argentifolii* BELLOWS and PERRING (LEGASPI et al. 2001) as well as *Dialeurodes citri* (ASHMEAD) (YIGIT et al. 2003). However, in Germany the laboratory studies demonstrated that *S. parcesetosum* is a promising predator of *B. tabaci* (AL-ZYLOUD & SENGONCA 2004; SENGONCA et al. 2004; AL-ZYLOUD et al. 2005a, b; SENGONCA et al. 2005).

One of the important features for a successful predator is to live for a long period on the prey species and also not feed on the plant in the prey absence. Long longevity accomplished by voraciously feeding of *S. parcesetosum* adults resulted in a successful control of *B. argentifolii* (ELLIS et al. 2001). To use this predator successfully in controlling the whiteflies, especially *B. tabaci* and *Trialeurodes vaporariorum* WESTWOOD (Hom., Aleyrodidae), it was important to investigate its natural and artificial nutritional sources. However, such knowledge of *S. parcesetosum* is still insufficient or completely lacking in the literature.

Therefore, the present work was directed to study the longevity of *S. parcesetosum* on natural nutritional sources such as *B. tabaci* and *T. vaporariorum* as well as on certain artificial nutritional sources at two different temperatures in the laboratory.

**Materials and Methods**

All the insects used in the study were obtained from original colonies available at the Institute of Phytopathology, University of Bonn. The rearing of *S. parcesetosum* was maintained on cotton plants infested with *B. tabaci* or cucumber plants infested with *T. vaporariorum* in meshed cylindrical Plexiglas cages (19 cm in diameter and 40 cm in height). *B. tabaci* was kept on cotton plants, while *T. vaporariorum* was reared on cucumber plants in meshed cages (80x50x60 cm). All the colonies were held in climatically controlled chambers at 25±1°C temperature, 60±10% RH and 16:8 h (L:D) photoperiod. The laboratory experiments were carried out at 18±1°C and 30±1°C temperatures and the above mentioned climatic conditions.

For recording the longevity of *S. parcesetosum* on natural nutritional sources, newly emerged adult females and males were kept individually in round Plexiglas cages 11-cm diameter and 3-cm height, filled partially with 0.5 cm thick layer of wetted cotton pad. The cages were contained cotton or cucumber leaves infested with more than 300 eggs, nymphs and puparia of *B. tabaci* or *T. vaporariorum* as prey. The females and males were transferred within a period of three days to new round Plexiglas cages. The longevity of both sexes was recorded after the individuals died. There were at least twelve replicates of each sex at each temperature and prey species.

To set up the experiments on artificial nutritional sources, max. 24 h adult females and males were divided into three groups of twelve individuals of each sex. The individuals within each group were placed in round Plexiglas cages as mentioned above and offered 10% honey emulsion, cotton leaves or left without food. The cages were checked daily and new cotton leaves or honey emulsion were added whenever needed. The experiments were continued till the last individual died and the longevity of both sexes was determined. The data were analysed using two-way ANOVA (CLEWER & SCARISBRICK 2001).

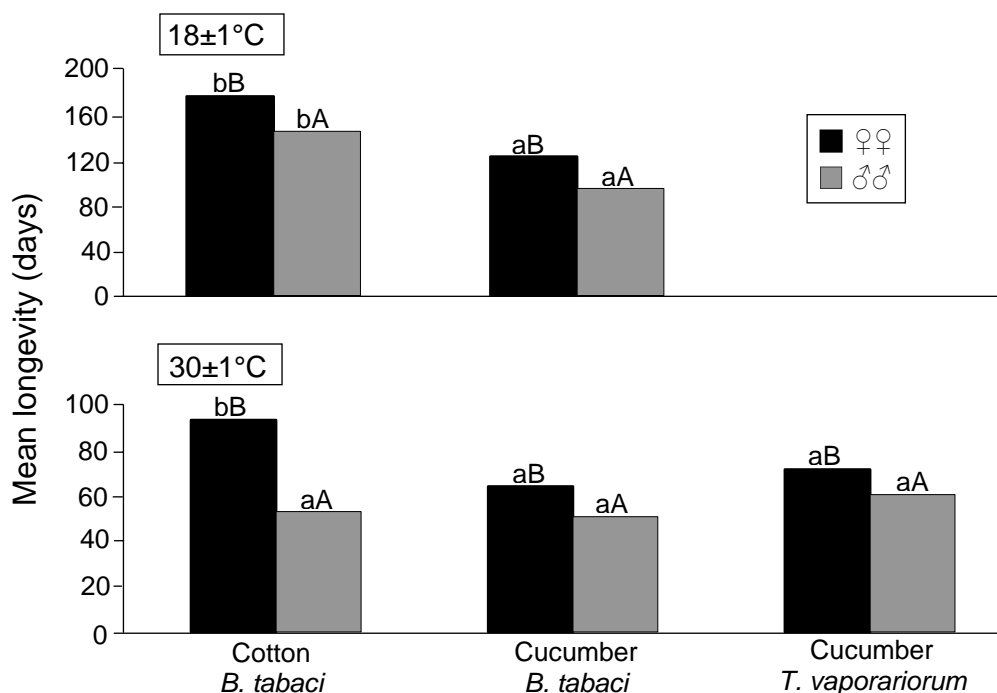


Fig. 1: Mean longevity of *Serangium parcesetosum* females and males by feeding on different natural nutritional sources at two different temperatures. [Bars with different small letters indicate significant differences among the different nutritional sources within the same sex and temperature. Bars with different capital letters indicate significant differences between the different sexes within the same nutritional source and temperature at p≤5% (two-way ANOVA)].

## Results

The longevity of *S. parcesetosum* varied significantly according to the natural nutritional source and sex of the predator (Fig. 1). Both predatory sexes had significantly lived longer on cotton with *B. tabaci* than on the other nutritional sources at both temperatures, except males at 30°C. At both temperatures, females had significantly lived longer than males. Mean longevity at 18°C valued 175.4 (♀♀) and 144.5 (♂♂) days as well as 122.2 (♀♀) and 94.3 (♂♂) days on cotton and cucumber, respectively. In contrast, at 30°C it was a mean of 92.4 (♀♀) and 52.5 (♂♂), 63.4 (♀♀) and 50.3 (♂♂) as well as 70.8 (♀♀) and 59.9 (♂♂) days on cotton/*B. tabaci*, cucumber/*B. tabaci* and cucumber/*T. vaporariorum*, respectively.

Mean longevity period of *S. parcesetosum* females and males was significantly longer on 10% honey emulsion than on cotton leaves or when left without food at both temperatures. Within the same temperature and nutritional source, some significant differences were found in the mean longevity period between females and males. Means of 26.7 (♀♀) and 24.9 (♂♂), 10.7 (♀♀) and 10.2 (♂♂) as well as 9.1 (♀♀) and 5.8 (♂♂) days at 18°C, while at 30°C means of 14.2 (♀♀) and 8.3 (♂♂), 4.7 (♀♀) and 5.0 (♂♂) as well as 2.7 (♀♀) and 2.4 (♂♂) days were recorded on 10% honey emulsion, cotton leaves and without food, respectively.

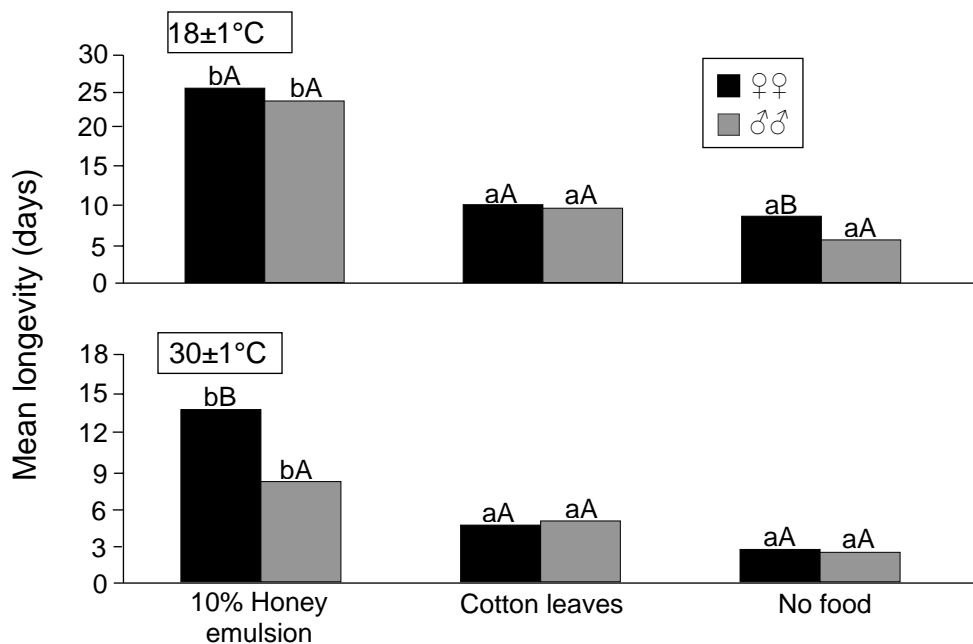


Fig. 2: Mean longevity of *Serangium parcesetosum* females and males by feeding on different artificial nutritional sources at two different temperatures. [Bars with different small letters indicate significant differences among the different nutritional sources within the same sex and temperature. Bars with different capital letters indicate significant differences between the different sexes within the same nutritional source and temperature at  $p \leq 5\%$  (two-factor ANOVA)].

## Discussion

The results of the current study indicated that *S. parcesetosum* females had significantly lived longer than males on all natural nutritional sources at both temperatures. Similar results were stated by KAPADIA and PURI (1992), who reported longer longevity of females than males with *B. tabaci* on eggplant at 23.7°C. A mean longevity of 29.8 days was obtained for the predator at 27°C with *A. barodensis* (PATEL et al. 1996), which is shorter than that in the current study with both whiteflies species tested. LEGASPI et al. (1996) found that the longevity of *S. parcesetosum* with *B. argentifolii* on cantaloupe increased with decreasing temperature, which agrees with the current results. In the present study, it seems that the longevity of *S. parcesetosum* was longer at 18°C on both plant species especially on cotton. It might be explained by that the predator was reared on *B. tabaci* using cotton as a host plant. Therefore, it could be that the predator has

adapted itself on cotton plants and lived more on them. A similar trend of results was obtained by LEGASPI et al. (1996), where the longevity of *S. parcesetosum* on hibiscus was longer comparing to that on cucumber, cantaloupe and tomato, when the predator was reared on hibiscus infested with *B. argentifolii*. Also, the interaction of plant-whitefly-predator as well as the plant characteristics can affect the longevity of the predator (AL-ZYOUND et al. 2005a). Additionally, variations among the results could be due to different nutrients in the offered whitefly species, which is in agreement with SENGONCA et al. (2005). ELLIS et al. (2001) stated that the prolonged survival and continuous feeding of *S. parcesetosum* adults are effectively suppressed *B. argentifolii* population. Long survival of adults (SENGONCA et al. 2004) accomplished by high daily prey consumption (SENGONCA et al. 2005) is a great feature of *S. parcesetosum* to be a successful predator.

The ability of a natural enemy to survive on alternative nutritional sources may have an advantage in stabilizing its population dynamics (LALONDE et al. 1999). However, the present results revealed that *S. parcesetosum* females and males were able to survive for a considerable period of time on artificial nutritional sources. At both temperatures tested, the mean longevity period of females and males was significantly longer on 10% honey emulsion than on cotton leaves or when left without food. There were no studies on the artificial nutritional sources of *S. parcesetosum* in the literature. However, similarly RICHARDS and EVANS (1998) reported that alternative nutrition such as sucrose solution might serve only to maintain the coccinellid predators, but do not permit immature growth or adult reproduction.

In conclusion, *S. parcesetosum* exhibited the ability to survive for long period on the offered whiteflies as well as for a considerable time on honey emulsion. Consequently, this ladybird is a very promising predator to be used in a biological control program to provide a great level of *B. tabaci* and *T. vaporariorum* suppression.

#### References

- ABBOUD, R. & AHMAD, M. (1998): Effect of temperature and prey-species on development of the immature stages of the coccinellid, *Serangium parcesetosum* SICARD (Col., Coccinellidae). – Arab J. Pl. Prot. 16: 90-93.
- AL-ZYOUND, F. & SENGONCA, C. (2004): Prey consumption preferences of *Serangium parcesetosum* SICARD (Col., Coccinellidae) for different prey stages, species and parasitized prey. – J. Pest Science 77: 197-204.
- AL-ZYOUND, F., TORT, N. & SENGONCA, C. (2005 a): Influence of host plant species of *Bemisia tabaci* (GENN.) (Hom., Aleyrodidae) on some of the biological and ecological characteristics of the entomophagous *Serangium parcesetosum* SICARD (Col., Coccinellidae). – J. Pest Science 78: 25-30.
- AL-ZYOUND, F., TORT, N. & SENGONCA, C. (2005 b): Influence of leaf portion and plant species on the egg-laying behavior of the predatory ladybird *Serangium parcesetosum* SICARD (Col., Coccinellidae) under the presence of another natural enemy. – J. Pest Science (in print).
- CLEWER, A.G. & SCARISBRICK, D.H. (2001): Practical statistics and experimental design for plant and crop Science. – John Wiley and Sons, Chichester. pp. 1-332.
- ELLIS, D., MCAVOY, R., ABU AYYASH, L., FLANAGAN, M. & CIOMPERLIK, M. (2001): Evaluation of *Serangium parcesetosum* (Col., Coccinellidae) for biological control of silverleaf whitefly, *Bemisia argentifolii* (Hom., Aleyrodidae), on poinsettia. – Florida Entomologist 84: 215-221.
- KAPADIA, M.N. & PURI, S.N. (1992): Biology of *Serangium parcesetosum* as a predator of cotton whitefly. – J. Maharashtra Agric. Univ. 17: 162-163.
- LALONDE, R., MCGREGOR, R., ROITBERG, B.D. & GILLESPIE, D.R. (1999): Plant feeding by arthropod predators contributes to the stability of predator-prey population dynamics. – Oikos 87: 603-608.
- LEGASPI, J.C., CIOMPERLIK, M.A. & LEGASPI, B.C. (2001): Field cage evaluation of *Serangium parcesetosum* (Col., Coccinellidae) as a predator of citrus blackfly eggs (Hom., Aleyrodidae). – Southw. Entomol. Sci. Notes 26: 171-172.
- LEGASPI, J.C., LEGASPI, B.C., MEAGHER, R.L. & CIOMPERLIK, M.A. (1996): Evaluation of *Serangium parcesetosum* (Col., Coccinellidae) as a biological control agent of the silverleaf whitefly (Hom., Aleyrodidae). – Environ. Entomol. 25: 1421-1427.
- PATEL, C.B., RAI, A.B., PASTAGIA, J.J., PATEL, H.M. & PATEL, M.B. (1996): Biology and predator potential of *Serangium parcesetosum* SICARD (Col., Coccinellidae), of sugarcane whitefly (*Aleurolobus barodensis* MASK.). – GAU Res. J. 21: 56-60.

- RICHARDS, D.R. & EVANS, E.W. (1998): Reproductive responses of aphidophagous lady beetles (Col., Coccinellidae) to nonaphid diets: an example from alfalfa. – *Ann. Ent. Soc. Am.* 91: 632-640.
- SENGONCA, C., AL-ZYOUD, F. & BLAESER, P. (2004): Life table of the entomophagous ladybird *Serangium parcesetosum* SICARD (Col., Coccinellidae) by feeding on *Bemisia tabaci* (GENN.) (Hom., Aleyrodidae) as prey at two different temperatures and plant species. – *J. Plant Diseases Protection* 111: 598-609.
- SENGONCA, C., AL-ZYOUD, F. & BLAESER, P. (2005): Prey consumption of the entomophagous ladybird *Serangium parcesetosum* SICARD (Col., Coccinellidae) during larval and adult stages with *Bemisia tabaci* (GENN.) (Hom., Aleyrodidae) as prey at two different temperatures. – *J. Pest Science* (in print).
- YIGIT, A., CANHILAL, R. & EKMEKCI, U. (2003): Seasonal population fluctuations of *Serangium parcesetosum* (Col., Coccinellidae), a predator of citrus whitefly, *Dialeurodes citri* (Hom., Aleyrodidae) in Turkey's Eastern Mediterranean Citrus Groves. – *Environ. Entomol.* 32: 1105-1114.

