



Effects of flour mites feeding on powders of two insects and yeast on the life parameters of *Stratiolaelaps scimitus**

YI YAN, NA ZHANG, SHUO ZHANG, MENGLEI CHEN & LIXIA XIE¹*Department of Entomology, College of Plant Protection, Shandong Agricultural University; Shandong Provincial Key Laboratory for Biology of Vegetable Diseases and Insect Pests, Taian, 271018, China*Yan Y: [✉ miteyy@163.com](mailto:miteyy@163.com); [ORCID](https://orcid.org/0000-0002-4041-3366) <https://orcid.org/0000-0002-4041-3366>Zhang N: [✉ 764076392@qq.com](mailto:764076392@qq.com); [ORCID](https://orcid.org/0000-0001-7871-6138) <https://orcid.org/0000-0001-7871-6138>Zhang S: [✉ 1959085487@qq.com](mailto:1959085487@qq.com); [ORCID](https://orcid.org/0000-0003-4640-1275) <https://orcid.org/0000-0003-4640-1275>Chen ML: [✉ 1139633356@qq.com](mailto:1139633356@qq.com); [ORCID](https://orcid.org/0000-0001-6777-6266) <https://orcid.org/0000-0001-6777-6266>¹Corresponding author: Xie LX: [✉ xielxia2006@163.com](mailto:xielxia2006@163.com); [ORCID](https://orcid.org/0000-0003-1029-3575) <https://orcid.org/0000-0003-1029-3575>

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Stratiolaelaps scimitus is a polyphagous and soil-dwelling predatory mite that has been commercialized and widely used to control small pest insects and mites (Knapp *et al.* 2018; Xie *et al.* 2018). This mite can prey on acaroid mites (Park *et al.* 2021), thrips pupae (Zhang 2019), fungus gnat (Enkegaard *et al.* 1997), *Drosophila* eggs or larvae (Wang 2010) and bee mites (Rondeau *et al.* 2019) etc. As a kind of natural enemy with great potential, its artificial mass-production is very important, and large-scale population breeding of this mite is the premise of its commercial production and application. The nutritional level of substitute prey or diets is closely related to the growth, development and reproduction of predatory mites (Zhang *et al.* 2020; 2021). Therefore, the reproductive capacity and biological characteristics of predatory mites can be improved by improving the nutritional level of substitute prey or diets.

We use the powder of *Locusta migratoria manilensis*, yeast and *Tenebrio molitor* to feed *Tyrophagus putrescentia* for 15 generations (respectively referred to as *TpL*, *TpY* and *TpT*), and then use these acaroid mites to feed *S. scimitus*. We constructed ‘age-stage, two-sex’ life tables (Chi 1988) of these *S. scimitus* to evaluate their biological characteristics. When *S. scimitus* fed on *TpL*, *TpY* and *TpT*, the duration of the pre-adult stage was not significantly different, but female fecundity (*F*), the intrinsic rate of increase (*r*) and the finite rates of increase (λ) were significantly different (Table 1); all three parameters were the largest when feeding on *TpL*, intermediate on *TpY* and the smallest on *TpT*. The size (dorsal shield length and width) at maturity of offspring females showed the same pattern: the largest (655.08 μm and 368.01 μm) on *TpL*, intermediate (646.43 μm \times 367.23 μm) on *TpY* and the smallest (637.01 μm \times 357.32 μm) on *TpT*. These results indicated that *TpL* was more favorable than *TpY* and *TpT* to the growth, development and reproduction of *S. scimitus*

TABLE 1. Mean (\pm SE) *Stratiolaelaps scimitus*’s life table parameters of flour mites feeding on powders of two insects and yeast.

Life parameters	<i>TpL</i>	<i>TpY</i>	<i>TpT</i>
<i>F</i> (eggs)	71.94 \pm 3.32 a	67.09 \pm 3.17 ab	61.49 \pm 2.02 b
<i>r</i> (day ⁻¹)	0.1666 \pm 0.0030 a	0.1543 \pm 0.0057 ab	0.1465 \pm 0.0048 b
λ (day ⁻¹)	1.1813 \pm 0.0036 a	1.1668 \pm 0.0066 ab	1.1577 \pm 0.0055 b

Standard errors were estimated by using the bootstrap technique with 100,000 resampling.

Means within a column followed by different letters are significantly different (paired bootstrap test: $P < 0.05$).

The large-scale breeding of natural enemies is the key to biological control. The polyphagous predatory mites can be reared on a large scale at a low cost by using substitute prey or even artificial diets (Khanamani *et al.* 2017; Azevedo *et al.* 2019; Su *et al.* 2019). This study is expected to provide a new idea and reference for the artificial large-scale breeding of polyphagous predatory mites.

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Keywords: Predatory mites; insect-sourced diets; nutrition; two-sex life table

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