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Abstract

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Development, reproduction and thermotolerance evaluation of high temperature adapted stain of *Neoseiulus barkeri* under no selective pressure*

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Neoseiulus barkeri is a generalist biological control agent of multiple insect pests (Hao *et al.*, 2021). Its development, reproduction and predation ability were negatively affected by short-term heat treatment (Li *et al.*, 2021), further affecting its biocontrol efficiency. We established a high-temperature adapted strain (HTAS) of *N. barkeri* through long-term heat hardening and acclimation. However, whether the temperature tolerance of HTAS of *N. barkeri* will change when the selective pressure is removed remains unknown.

In this study, the HTAS of *N. barkeri* was reared at 25 °C to investigate the development, reproduction and thermotolerance across generations. The results showed that the developmental duration of immature stages of the F_0, F_1 and F_4 of *N. barkeri* increased gradually from significantly shorter (F_0 and F_1) than that of the conventional strain (CS) to no significant difference (F_4). Meanwhile, with the increase of generations, the reproductive capacity of *N. barkeri* HTAS under no selection pressure decreased at first (F_0 to F_1) and then increased (F_1 to F_4), but kept significantly higher than that of CS with higher daily fecundity, longer oviposition period and higher daily maximum fecundity. Survival rates of female adult mites from both HTAS and CS decreased with the increase of heat shock duration (heat shock treatment at 42 °C). However, the survival rate of HTAS in different generations (F_1, F_4, F_7 and F_{10}) was significantly higher than that of CS when exposed to heat stress for 6h, 8h and 12h, but there was no significant difference among generations. In addition, the LT_{50} and LT_{95} values of each generation were significantly higher than CS. Furthermore, all generations of *N. barkeri* HTAS (F_0–F_{10}) showed type II functional response on protonymph *Tetranychus urticae* after short-term heat stress (42 °C, 2h). The predation ability of *N. barkeri* HTAS decreased with the increase of generations, but was significantly higher than that of CS with a lower attack rate *a*, a shorter handling time T_h and a higher average predation a/T_h. Our study revealed that under the removal of selection pressure, the developmental duration of progeny of HTAS of *N. barkeri* was gradually approaching that of the CS, but its reproductive capacity was significantly higher than that of CS; the tolerance to thermal environment declined slightly with the increase of generations, but was still significantly higher than that of CS. These results highlight the key differences between these two strains of *N. barkeri* under no selection pressure, and indicate that HTAS of *N. barkeri* can be an effective biological control agent not only in thermal environment, but also in relatively suitable environment.

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Keywords: Developmental duration, fecundity, thermotolerance, functional response

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