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Status of lifespan in laelapid mites (Acari: Mesostigmata: Laelapidae)*

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In the Mesostigmata, Laelapidae is a family diverse in ecology and morphology (Babaeian *et al*., 2019; Moraes *et al*., 2022; Zhang *et al*., 2022). It is distributed all over the world (Keum *et al*., 2017; Joharchi & Halliday 2021), and has many habitats, including soil, the body surface of vertebrates or in their nests, arthropods and parasitic on mammals (Moreira & Moraes 2015; Nemati *et al*., 2018; Zhang, 2019; Attasopa *et al*., 2021). Laelapidae has 146 genera and more than 1500 species, including many predatory and parasitic species (Zhang *et al*., 2022). Some laelapid mites can prey on nematodes, thrips pupae, astigmatic mites, fungus gnat larvae, housefly eggs, mealybug and so on (Carrillo *et al*., 2015; Ajvad *et al*., 2018; Pérez-Rodríguez *et al*., 2018; Castro-López *et al*., 2021).

The taxonomic study of the family Laelapidae is extensive, but there are only 70 articles on the studies of lifespan, including only 29 species. Out of 29 laelapid species with published lifespan/developmental data, *Stratiolaelaps scimitus* (14 studies) and *Gaeolaelaps aculeifer* (11 studies) have the largest number of reports. From all data, the longest-lived mite could survive more than 500 days (e.g. *Androlaelaps fahrenholzi*) (Meng *et al.*, 1982), while the short-lived one was only in stock for 2 days (*e.g. Tropilaelaps clareae*) (Shen, 2018). Through data summary and analysis, the following factors were shown to affect the lifespan and development duration of the laelapid mites: (1) Temperature could greatly affect the biological parameters of mites (Roy *et al*., 2002). *Androlaelaps casalis* is a typical example; it took 15.6 days to develop from egg to adult at 19 °C, while at 31 °C, it just took 6.8 days. The lifespan of adult females also follows this pattern (Wang, 2011). The response to temperature in other mites of laelapid mites showed the same pattern, such as *Eulaelaps stabularis*, *Laelaspis astronomicus*, O*lolaelaps ussuriensis*, etc. (Meng *et al*., 1982; Zhou, 1992; Mustafa *et al*., 2016 a; Mustafa *et al*., 2016 b); (2) The change of relative humidity will also change mite's population dynamics (Pfingstl & Schatz 2021). Different species of mites have different responses to humidity: *Laelaps agilis* lived significantly longer at higher humidity (90% vs 75%), but *Cosmolaelaps chianensis* showed the opposite pattern (Edler and Solomon, 1979; Wang, 2010); (3) The lifespan and development duration of almost all the mites of the family Laelapidae can be affected by diets, which was one of the most studied influencing factors. Laelapidae can prey on a wide variety of prey; different prey species or stages could affect the lifespan (Walter & Oliver 1990; Zhang & Xie 2021).

Apart from the above three factors, there are many other factors, including reproductive mode and different rearing environments of the prey (Murphy & Sardar 1991; Wang, 2010), the access to, or the number of, sexual male partners (Hosamani *et al*., 2006) and fungal infection (Zhang, 2019) etc. This review provides some basic biological data for future research of laelapid mites.

Keywords: Laelapidae, Biology, Temperature, Diet, Predatory mites

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Species	References
Stratiolaelaps scimitus	14
Gaeolaelaps aculeifer	11
Tropilaelaps spp.	6
Androlaelaps casalis	6
Tropilaelaps clareae	4
Laelaps echidninus	2
Eulaelaps stabularis	2
Cosmolaelaps chianensis	2
Tricholaelaps myonyssognathus	1
Ololaelaps ussuriensis	1
Laelaspis astronomicus	2
Laelaspis vitzthumi	1
Laelaps myonyssognathus	1
Laelaps agilis	1
Hypoaspis solimani	1
Hypoaspis larvicolus	1
Haemolaelaps centrocarpus	1
Haemogamasus liponyssoides	1
Haemogamasus ambulans	1
Gaeolaelaps aculeiferoides	1
Geolaelaps oreithyiae	1
Cosmolaelaps vacua	1
Cosmolaelaps simplex	1
Cosmolaelaps qassimensis	1
Cosmolaelaps paulista	1
Cosmolaelaps keni	1
Cosmolaelaps jaboticabalensis	1
Androlaelaps. fahrenholzi	1
Androlaelaps zaheri	1
Androlaelaps aegypticus	1
	70

FIGURE 1. The number of references on the lifespan or developmental time of Laelapidae.

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