

研究综述与进展

线虫耐寒性研究进展

戴素明<sup>1, 3</sup>, 成新跃<sup>2</sup>, 肖启明<sup>3</sup>, 谢丙炎<sup>1, \*</sup>

1. 中国农业科学院蔬菜花卉研究所, 北京 100081

2. 北京师范大学生命科学学院, 北京 100875

3. 湖南农业大学生物安全科技学院, 长沙 410128

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**摘要** 于分布在温带和寒带的线虫, 它们只有战胜冬季寒冷的挑战, 才能有利于种群的存在与发展。因此, 耐寒性是线虫生物学研究中不可忽视的内容。综述了关于线虫在低温胁迫下的耐寒性测定方法、耐寒对策及耐寒机制等方面的研究进展。线虫的耐寒性和昆虫一样, 可通过过冷却点和低温存活率两种指标进行评价, 但在具体的实验方法上, 线虫耐寒性研究有其不同之处。线虫的耐寒对策和耐寒机制具有多样化。耐寒对策主要有耐冻和避冻, 二者能共同渗透于线虫的耐寒过程中。耐寒机制包括特殊发育阶段的形成、低温驯化作用、低分子量抗冻物质的聚集、以及高分子量抗冻蛋白和热休克蛋白的产生, 等等。此外, 还强调应从多个角度研究线虫的耐寒性, 如寒冷敏感型线虫的研究、寄生线虫的耐寒对策研究以及交叉胁迫的研究。

**关键词** [线虫](#); [耐寒性](#); [方法](#); [耐寒对策](#); [耐寒机制](#)

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Research progress in Nematode cold tolerance

DAI Su-Ming<sup>1, 3</sup>, CHENG Xi ng-Yue<sup>2</sup>, XIAO Qi -Mi ng<sup>3</sup>, XIE Bi ng-Yan<sup>1, \*</sup>

1. Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences, Beijing 100081, China;

2. College of Life Sciences, Beijing Normal University, Beijing 100875, China;

3. College of Bio-safety Science and Technology, Hunan Agricultural University, Changsha 410128, China

**Abstract** In order to have normal development and better existence, nematodes should overcome the challenges of winter cold in the temperate and frigid areas. Therefore, the research on nematode cold tolerance assumes greater significance. The present status of knowledge alongwith the methods to study nematode cold tolerance, its strategies and mechanisms are reviewed in this paper. Research methods for nematodes cold tolerance are similar to that of insects, including measurement of supercooling points and assessment of survival; but the detailed experimental technique for nematodes has its own characteristics. The F50 has been shown as a valid measure of the degree of supercooling. Cold tolerance strategies have been mainly divided into freezing tolerance and freeze avoidance. Freeze tolerance is widespread among nematodes but not all nematode species are freezing tolerant. As the sheath or eggshell can prevent inoculative freezing, some nematodes can survive by freeze avoidance. In nematodes, these two strategies are not mutually exclusive as in found in case of arthropods. Nematodes are also able to optimize their strategy in response to changes in the environment. Nematodes have adopted various cold tolerance mechanisms. In many parasitic nematodes, which spend part of their life cycle in a protected and favourable environment (i.e. the host), only particular developmental stage has adopted these mechanisms. Cold acclimation before cold stress significantly increases the cold hardiness of nematodes. In addition, other mechanisms of cold stress include the synthesis of cryoprotectants, antifreezing proteins and heat shock proteins. Further, it has been suggested that the nematode cold tolerance must also be investigated from other aspects, such as chill susceptibility, cold tolerance of parasitic stages and the effect of cross-stresses.

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**Key words** [nematodes](#); [cold tolerance](#); [methods](#); [cold tolerance strategies](#); [cold tolerance mechanisms](#)

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通讯作者 谢丙炎 [xieby@mail.caas.net.cn](mailto:xieby@mail.caas.net.cn)