

## Bcl-2-like和Bax-like蛋白在白蚁生殖蚁和工蚁精子发生过程中的表达比较分析

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A comparative study on expression of Bcl-2 and Bax proteins in germ cells during spermatogenesis in reproductives and workers of termite *Reticulitermes aculabialis* (Isoptera: Rhinotermitidae)

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**摘要** 为探讨凋亡调节因子Bcl-2和Bax蛋白对白蚁生殖蚁和工蚁性腺发育的影响, 揭示白蚁生殖品级与非生殖品级性腺发育的调节机理, 以尖唇散白蚁*Reticulitermes aculabialis*为研究对象, 运用免疫细胞化学定位方法对生殖蚁和工蚁精子发生过程中的Bcl-2和Bax蛋白表达进行了研究。结果显示: 生殖蚁和工蚁精子发生过程中从精原细胞至精子时期均有Bcl-2-like和Bax-like的阳性表达。生殖蚁的次级精母细胞、精子细胞和精子中Bcl-2-like阳性表达率较高, 而在精原细胞和初级精母细胞中阳性率较低; 工蚁在次级精母细胞中最高, 在精原细胞和初级精母细胞中较低。除初级精母细胞期外, 工蚁生殖细胞其他发育阶段Bax-like阳性表达率均显著高于生殖蚁同一阶段生殖细胞。生殖蚁的生殖细胞在精原细胞、初级精母细胞和次级精母细胞时期Bax-like阳性表达率较高, 发育至精子时期阳性率最低; 工蚁在次级精母细胞、精子细胞和精子时期Bax-like表达率较高, 在初级精母细胞中表达率最低。在精子发生过程中, 生殖蚁生殖细胞Bax/Bcl-2表达量比值逐步下降; 而工蚁生殖细胞发育过程中Bax/Bcl-2表达量比值仅在次级精母细胞期下降, 其他发育时期均升高; 根据Bax/Bcl-2判断, 精原细胞和初级精母细胞是生殖蚁精子发生过程中主要的凋亡点, 而工蚁除了精原细胞和初级精母细胞外, 精子细胞和精子也是主要的凋亡目标。研究结果表明, 白蚁生殖细胞凋亡与其他动物一样受Bcl-2家族的调节, 在精子发生过程中Bcl-2-like和Bax-like表达具有动态变化规律, 正是这种变化调控生殖细胞在不同发育阶段的生或死; Bcl-2-like和Bax-like对生殖细胞凋亡调节不仅在精子发生中有非常重要的作用, 而且可能与工蚁品级的形成有关。

**关键词:** 尖唇散白蚁 Bcl-2蛋白家族 Bax蛋白 精子发生 细胞凋亡

**Abstract:** In order to investigate the involvement of Bcl-2 family protein in germ cell apoptosis during spermatogenesis and explore the differences of gonad development between reproductive caste and non reproductive caste in termites, the expression of Bcl-2 and Bax proteins in germ cells during spermatogenesis of reproductives and workers of termite *Reticulitermes aculabialis* was investigated using immunocytochemical localization method. The results showed that both the immunopositive Bcl-2-like and Bax-like protein existed in germ cells from spermatogonia to sperm stage during spermatogenesis in reproductives and workers. In the reproductives, the expression level of Bcl-2-like was higher in secondary spermatocyte, spermatid and sperm, while lower in spermatogonia and primary spermatocyte. In the workers, a strong expression of Bcl-2-like was shown in secondary spermatocytes, and a lower expression level in spermatogonia and primary spermatocytes. Except for the stage of primary spermatocytes, the expression ratio of Bax-like during spermatogenesis in workers was significantly higher than that in the reproductives. In reproductives, the expression level of Bax-like was higher in spermatogonia, primary spermatocytes and secondary spermatocytes, while the lowest in sperms. Workers had higher expression levels of Bax-like in the secondary spermatocytes, spermatids and sperms, and the lowest expression levels in primary spermatocyte. During spermatogenesis, the expression ratio of Bax/Bcl-2 gradually decreased in germ cells of reproductives. However, in workers the expression ratio only decreased in the secondary spermatocytes and increased in other germ cells. According to the expression ratio of Bax/Bcl-2, spermatogonia and primary spermatocytes were the main targets of apoptosis in reproductives, while in workers the main targets of apoptosis included spermatogonia, primary spermatocytes, spermatids and sperms. The results suggest that in the testis of termite, apoptosis of germ cells is regulated by the pro- and anti-apoptotic members of the Bcl-2 family proteins and the expression of Bcl-2-like and Bax-like show a dynamic change which determines the fate of survival or death of germ cells during spermatogenesis. Bcl-2-like and Bax-like not only play critical roles germ cell apoptosis in the testis, but also can be involved in caste differentiation of termites.

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