

研究论文

内生真菌感染对黑麦草抗盐性的影响

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摘要 以感染内生真菌的多年生黑麦草 (*Lolium perenne* L.) (SR4000)为实验材料, 建植内生真菌感染 (EI) 和不感染 (EF) 的黑麦草种群, 并对其进行盐胁迫实验, 通过观察生长和生理生态指标的变化, 分析内生真菌对宿主植物抗盐性的影响。结果表明, 内生真菌感染对宿主黑麦草的营养生长没有增益效应, 相反在高盐浓度下, EI种群的分蘖能力和地上部分生物量均低于EF种群; 但内生真菌能够改变宿主种群生物量的分配格局, 将更大比例的生物量分配于根系。在高盐浓度下, 内生真菌感染可导致黑麦草叶内的脯氨酸含量显著增加、可溶性糖含量显著降低, 但对PS II光化学效率 F_v/F_m 值的变化没有影响。总体来看, 内生真菌感染并未改善宿主黑麦草的抗盐性。

关键词 黑麦草; 内生真菌; 盐胁迫

分类号 Q143, Q938, Q949.32

Effect of endophyte infection on salt resistance of ryegrass

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Abstract In their evolution, grasses have developed symbiotic associations with fungi including mycorrhizal fungi that grow in or on the roots, and endophytes that live their entire life cycle within the aerial portion of the host grass, typically forming nonpathogenic, systemic and usually intercellular associations. Currently, seven genera have been identified, including *Atkinsonella*, *Balansia*, *Balansiospora*, *Echinodopsis*, *Echinodopsis*, *Epichloë*, *Myriogenospora* and *Parepichloë*. Among them, the anamorphic (imperfect) stage of *Epichloë* spp., i.e. *Neotyphodium* spp., is most closely related to cultivated grasses. The most widely known *Neotyphodium* endophytes are *N. lolii* and *N. coenophialum*, which colonize perennial ryegrass (*Lolium perenne* L.) and tall fescue (*Festuca arundinacea* Schreb.) respectively. Endophytes may protect the hosts from biotic and abiotic stresses. In the past twenty years, much research has focused on the beneficial effect of endophyte infection on the biotic stress resistance of host grasses such as mammalian, insect and nematode herbivores. When abiotic stress was regarded, many studies showed that endophyte infection could improve drought resistance ability of host grasses. Similar to drought stress, salt stress also led plants to physiological drought. But up to now, no related research results were reported. Thus, in this paper *Lolium perenne* cv SR4000 infected by *Neotyphodium lolii* was chosen as experimental material. Vegetative growth and several physiological indexes (such as free proline content, soluble sugar content and photochemical efficiency of PSII) of endophyte-infected (EI) and endophyte-free (EF) populations under normal and salt stress conditions were compared in order to discuss the effect of endophyte infection on the salt resistant ability of the host ryegrass. The experiment was performed under greenhouse condition. EI and EF plants were transplanted into culture pots filled with 1L 1/2 Hoagland solution. One week later, salt (NaCl) was added to impose salt stress (control, low and high stress). Salt content for the above stresses was 0, 0.3% and 0.6%, respectively. Each treatment was replicated 5 times. From the beginning, tiller number and free proline content of each population were recorded every 5 days. Photochemical efficiency of PSII of experimental populations was surveyed at the middle and late period separately. At the end of the

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xperiment, shoots and roots were harvested and weighed separately. At the same time, soluble sugar content of both shoots and roots was measured. The whole experiment lasted 35 days. During the period, distilled water was supplied whenever the solution level in the pot dropped due to transpiration and evaporation. The results showed that endophyte infection did not improve shoot growth of ryegrass. Under high salt stress, tillering ability and shoot biomass of EI populations were all lower than those of EF populations. However, endophyte infection was beneficial to roots of ryegrass, which was demonstrated by the fact that root biomass of EI populations, under salt stresses, decreased more slowly than that of EF populations. When it came to the ratio of root to shoot, no significant change was observed between under control and under high salt stress for EI populations, while for EF populations, it decreased significantly in comparison with control, and the decrease rate was up to 41.7%. Taking these factors in consideration, under high salt stress, EI populations may maintain root growth at the cost of shoot growth, which may be beneficial to their survival. Salt stresses led to increase of free proline content of ryegrass leaves, and the degree of increase was heightened with extended stress time and advanced stress level. When compared with EF populations, proline content of EI populations was higher and especially significant under high stress. As for the content of soluble sugar, its value was similar under both control and low salt stress in EI and EF populations. Under high salt stress, however, the sugar content of EI populations was significantly lower than that of EF populations, which was considered to be unbeneficial to host grass' survival. Moreover, during the experimental period, photochemical efficiency of PS II was measured three times, but no significant difference was observed between EI and EF populations. In conclusion, endophyte infection did not alleviate negative effect of salt stress on the host ryegrass.

Key words Lolium perenne L; endophyte; salt stress

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