Investigation on Arbuscular Mycorrhizal Fungi (AMF) associated with *Crocus sativus* in Khorasan Razavi and Southern Khorasan provinces (north east of Iran)

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Abstract

Iran is the largest producer of saffron (*Crocus sativus*) in the world. More than 80% of higher plant species have a mutual relationship with mycorrhizal fungi, which enhances the plant growth and its productivity. With identification of native arbuscular mycorrhizal fungi and their application, it could be possible to expand saffron cultivated area and increase the performance of arable lands. In the present study, native AMF species associated with saffron roots in Khorasan Razavi and Southern Khorasan provinces (north east of Iran), and nine species of arbuscular mycorrhizal fungi, viz., *Claroideoglomus claroideum*, *C. etunicatum*, *Corymboglomus tortuosum*, *Funnelliformis celenoides*, *F. geosporum*, *F. mosseae*, *Paraglomus albidum*, *Rhizophagus manihotis* and *R. mosseae* were identified which are all newly recorded for saffron mycoflora of Iran. *Rhizophagus manihotis* and *F. mosseae* were the most frequent species in all soil samples. Although, the maximum plants and fungal growth and root colonization usually take place in spring, but in case of saffron, results showed that, this happened in autumn which indicates, the fungus has adapted itself to host plant life cycle. On the other hand, correlation coefficient between spore population and root colonization was very low for Torbat specimens, which could be related to other factors e.g. environmental and geographical conditions.

Keywords: Glomeromycota, root colonization, saffron, spore population

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مواد و روش ها

در ماه‌های اوت تا سپتامبر سال 2009، نمونه‌هایی از پودرهای زعفران از استان‌های خوزستان و گلستان (ایران) به‌دست آوردیم. این نمونه‌ها از یک ناحیه به طرف دیگر آن ماه می‌رود. این نمونه‌ها به‌سوی کنشگر دانشجویان که هم‌کاری می‌کنند. در این مطالعه، به عنوان یکی از آزمون‌های بهترین نتایج پذیر این نمونه‌ها به‌دست آمده است. این نمونه‌ها برای دانشگرانی که پژوهش می‌کنند، افزایش و کاهش ریشه‌ها از در صورت نداشتن نشان می‌دهند. این نمونه‌ها در فصول پاییز و تابستان از نظر کاهش و افزایش ریشه‌ها در دو فصل‌های گرم و سرد می‌باشند. این نمونه‌ها در کل سال تابستان به‌دست آمده است. این نمونه‌ها در کل سال تابستان به‌دست آمده است.
Paraglomus albidum (C. Walker & L.H. Rhodes) Oehl, G.A. Silva & Sieverd., in Oehl, Silva, Goto & Sieverding

Rhizophagus aggregatus (N.C. Schenck & G.S. Sm.)

C. Walker

R. manihotis (R.H. Howeler, Sieverd. & N.C. Schenck) C. Walker & A. Schüßler (Fig. 1).

All of these species are recorded for the first time from saffron rhizosphere from Iran of which, Rhizophagus manihotis and Funneliformis mosseae were the most frequent species in all areas (Fig. 2).
Periodically sampled for enumerating number of spores in different sites indicated that, there is a variation in spore population in different intervals of the year. The result presented in Table 1, indicates that, the number of spores (1g of dry soil) and RLC% in Khalil-Abad, Torbat and Ferdows were 8–22, 25–34%; 6–19, 21–30% and 13–37, 35–41%, respectively. Correlation coefficient between spore populations and root colonization in the Khalil-Abad ($r^2 = 0.38$, $p < 0.05$), Ferdows ($r^2 = 0.74$, $p < 0.05$) and Torbat ($r^2 = 0.09$, $p < 0.05$) was calculated. The significant relationship between spore populations and root colonization in the sites Khalil-Abad and Ferdows was not found for Torbat site. Kianmehr (1981) also did not find any significant relationship between spore number of and root colonization in saffron. It seems, spore abundance is not a key factor for root colonization because, inoculums of arbuscular mycorrhizal fungi consist of different types of infective propagules, viz., spores, vesicles, hyphal fragments and hyphae from mycorrhizal root pieces (Brundrett 1991). Meanwhile, environmental conditions impact on the physiology of the plant host, soil chemical properties and physiological state of the fungal propagules. These complex interactions all influence infectivity and resultant mycorrhizal development. Therefore, in some cases, AMF spores require much more time for germination and some species of AMF are not able to germinate (McGee 1989) and in the natural ecosystem, most of the spores do not remain alive. Moreover, seasonal, environmental and geographical conditions act a crucial role in root colonization and AMF spore abundance, the circumstances which cannot be indexed in results. We also observed that, the number of spores in autumn was higher than spring and summer (Fig. 3).
Spring is the growing season for most of the plants and maximum rate of root colonization occurs in this season, where in case of saffron, the maximum rate of root colonization observed in autumn. This indicates that, saffron AMF adapted its life cycle with the host plant. Effect of seasonal changes in the spore population in the rhizosphere of mycorrhizal plant has been reported by many researchers (Giovannetti 1985, Sylvia 1986). They showed that, spore abundance reaches to high level usually in mid- or late time of growth period. This could be related to reducing rate of carbohydrate content of plants in autumn, and making a stimulus to produce more spores for survival of AMF generation (Gupta et al. 2000). Klironomos et al. (1993) also reported that, the AMF spore frequency in the rhizosphere of maple tree (Acer saccharum) was higher in autumn than other seasons. It is, therefore, concluded that, according to the host plant, formation and function of AMF could be different both in the same habitat and the same season.

References


