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VAM Propagule Activity as Affected by Burning*

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Abstract

Four experiments were performed to study the effect of burning or heating on VAM spore germination and the infectivity of VAM propagules other than spores. The results showed that soil collected from burned plots have the lowest number of VAM propagules, and that the native spores from burned plots have the lowest germination rate. Burning or oven-heating may cause changes on some soil constituents able to inhibit the VAM spore germination and propagule infectivity. Discussion is made as regards the implications of these findings on the burned ecosystem.

Introduction

Although changes in physical, chemical, and microbiological conditions of soil after burning are well documented, only a few papers concerning the vesicular-arbuscular mycorrhizal (VAM) fungi have been published. Recent reports on the effect of burning on VAM fungi showed a decrease in the propagule number (Klopatek et al., 1987; 1988), and relation with the vegetation dynamic (Dhillion et al., 1988). To study the effects of burning, VAM spore germination and propagule infectivity were examined under different experimental conditions.

Materials and Methods

Soil (pH = 5.4) from a site of Galicia (Spain NW), was sampled 1 (Sm 1) and 4 (Sm 4) months after burning in September 1988, and four experiments were carried out. (1) The native VAM spores (*Acaulospora laevis* Gerdemann et Trappe) from burned and unburned adjacent plots were collected to evaluate their germination rates in water-agar medium (1%) adjusted to soil pH. Soil samples from burned and unburned

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plots were serially diluted to compare the number of infective propagules applying the MPN method (Porter, 1979), using *Trifolium pratense* L. as test plant. (2) In order to test if the results of germination in the experiment 1 were caused by direct or indirect effect of fire, spores of *Glomus macrocarpum* Tul. et Tul. were germinated in media containing burned or unburned water soil extracts, and in water-agar as a control medium. (3) To check if the effect of burning was a consequence of soil heating, spores of *G. macrocarpum* were germinated in media containing oven-heated (200°C/3 h) or unheated water soil extract. (4) Soil from unburned plots was previously sieved by 125 μm to eliminate spores, and then serialy diluted according to the MPN method as above. Each three days during 6 weeks of plant growth, the pots were treated with oven-heated or unheated aqueous soil extract adjusted to pH 5.4. The MPN method was used to evaluate the effects of these extracts on the infectivity of VAM propagules other than spores.

Results

The native VAM spores collected from burned plots showed the lowest germination rate. The lowest propagule density was also observed in soil from burned plots both

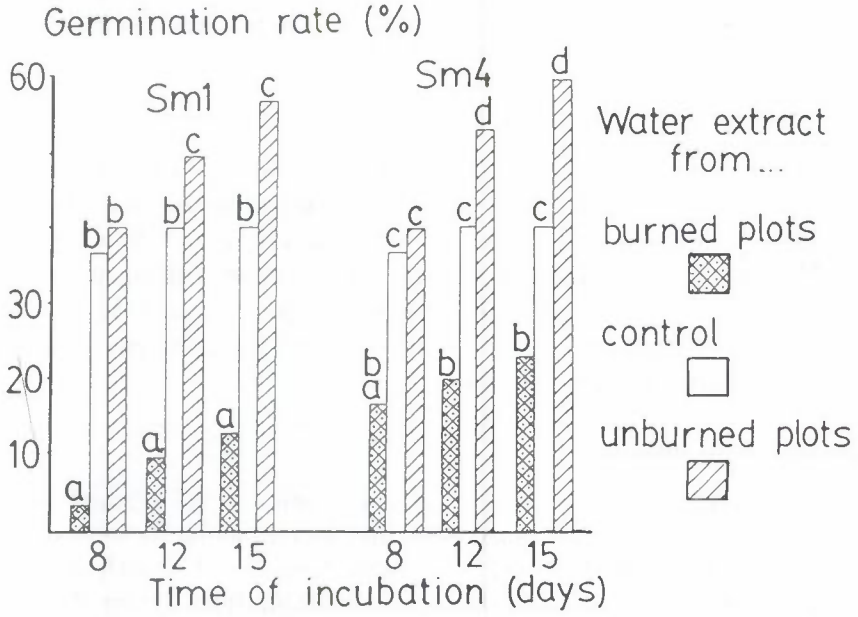

Figure 1. Germination rate of spores of *G. macrocarpum* incubated in media with aqueous extracts from burned or unburned plots in different sampling dates (Sm 1 and Sm 4) (experiment 2). Different letters into the same sampling date indicate significant difference for $p \leqslant 0.01$.

in Sm 1 and Sm 4. The spores of *G. macrocarpum* showed the highest germination rates when incubated in the unburned soil extract medium (Fig. 1), and in the unheated one. The estimates of VAM propagules other than spores showed the highest value in pots treated with unheated soil extract, and the lowest one in those treated with heated soil extract (271 and 87 propagules per 100 ml of soil respectively).

Discussion

These experiments show that burning and heating have had an important effect both on VAM spore germination and on the infectivity of other VAM propagules in soil. Inhibitory-like substances present in soil for a long time (more than 4 months in the experiment), being caused by heat-induced changes in some soil constituents, may affect the viability of VAM spores as suggested by Daniels and Graham (1976).

The present results are in agreement with those of Klopatek et al. (1987; 1988), but not entirely with the consideration of Dhillion et al. (1988) who suggest that burning effects on the VAM fungal population may be mediated by the effects of fire on plant community. The implications of these findings are of great importance since a good stablishment of plants would depend on the existence of an active VAM propagule population in soil (Allen and Allen, 1985).

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