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Types of Ectomycorrhizae on Pohorje

By

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K e y w o r d s : Natural regeneration, mycorrhiza, altimontane spruce cultures, grass root competition.

S u m m a r y

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Types of ectomycorrhizae were studied in six different plots in anthropogenic altimontane spruce cultures on Pohorje (distric cambisol, 1200 m/a.s.l., potential beech sites). The plots were treated differently to prevent growth of grasses: the test plots were either covered by a cover or by cutting remains. The grass-covered plots were chosen in the immediate vicinity and the control plots in the relatively well preserved remains of a natural beech forest. In the samples of equal volume all roots were counted and types of ectomycorrhizae briefly characterised. In 20 soil samples, a total of 26582 spruce roots were counted. Less than 1% were non-mycorrhizal and in average 39% were old, non-turgescent types of ectomycorrhizae. The average number of ectomycorrhizal types and percentage of mycorrhizal roots showed to depend on the treatment, whereby grass-covered plots showed lowest and the control plots highest shares of mycorrhization. It was concluded that a mosaic distribution and removal of cutting remains heaps, in terms of location and time, might be proposed as an adequate silvicultural measure for supporting biodiversity of mycorrhizal fungi in these ecosystems.

I n t r o d u c t i o n

The anthropogenic altimontane spruce cultures on Pohorje represent an intensively changed forest ecosystem, resulting from burning, agricultural land extension and non-natural regeneration of the forests (ROBIČ 1985).

In such altered conditions nutrient circulation is fast and a quick exchange from the fungal decomposers and mycorrhizal fungi in the mycorrhizosphere into a bacterial decomposing community takes place. With respect to the importance of

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the interactions in the mycorrhizosphere (SIMARD 1996, KRAIGHER 1996) our objective was to compare the success of forest regeneration (as reported by ROBIC & al. 1998) to the abundance of types of ectomycorrhizae on plots more or less overgrown by grasses.

Material and Methods

The research object is located in the Pohorje mountain range in the forest district Lukanja. Forest stands are part of the anthropogenic altimontane spruce cultures (*Cardamini savensi-Fagetum* var. geogr. *Abies alba* Košir 1979, or alternatively *Luzulo sylvaticae-Piceetum* M.Wraber 1963 var. geogr. *Hieracium transsilvanicum* Zupančič 1995 mscr.). Such spruce stands grow on distric brown soils and at potential beech sites. A deep mull-humus layer is significant. The average C/N ratio lowers with depth (all data from ROBIČ 1985). These forest stands are floristicaly distinctively changed from natural and their normal functioning is interrupted.

In June 1997 types of ectomycorrhizae have been analysed on two locations by sampling equal volumes of soil (270 ml, 0 to 18 cm deep) in the plots covered for various lengths of time by a cover or by cutting remains (test plots); in the immediate vicinity of such surfaces (plots in grass) and in the relatively well preserved remains of a beech forest in the vicinity of the test plots (control plots). In the soil samples all roots were counted and types of ectomycorrhizae briefly characterised to the morphotype level (modified after AGERER 1987-98, as described in KRAIGHER & al. 1996). Data (number of roots, mycorrhizal roots and old, unidentifiable types (SNT)) were expressed per 1 dm^3 of the soil.

Results and Discussion

In 20 soil samples, a total of 26582 spruce roots were counted. Less than 1% were nonmycorrhizal and an average of 39% were unidentifiable (mostly old, non-turgescent) types of ectomycorrhizae. Results are shown in Fig. 1 and Table 1.

The following types were identified or briefly characterised: *Russula sp.* (9%), *Piceirhiza chordata* (0.1%), *Piceirhiza bicolorata* (5%), *Piceirhiza glutinosa* (1.3%), *Cenococcum geophillum* (0.4%), *Tricholoma sp.* (2%), *Cortinarius sp.* (0.1%), *Xerocomus badius* (1%), three as yet non-described types: UV01 (1.5%), UV02 (11%) and UV03 (17%) and a few other types (at 9% of the total number of mycorrhizal roots) (see Fig. 1).

The average number of the identified types in the grass plots was two to three times lower than the average in non-covered forest ground. The number of types of ectomycorrhizae showed a reduced mycorrhizal component in the soils with grass cover in comparison to the other plots (Table 1).

In natural forest stands most of the absorbing roots in organic and organic-mineral layers of the soil are ectomycorrhizal (TAYLOR 1995, KRAIGHER 1996, 1997). In different stages of the forest and under influences of different stress factors the plant community structure can change. If grasses prevail, they can prevent any regeneration (ZACKRISSON & al. 1997), possibly resulting from competition for natural resources both above- and below-ground as well as from prevention of active mycelial networks in the soils.

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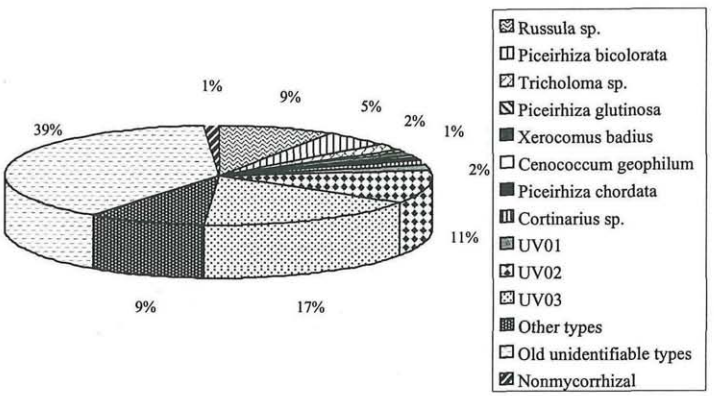

Fig. 1. Types of ectomycorrhizae on Pohorje (% of all mycorrhizal roots).

Table 1. Data on mycorrhization from differently treated plots on Pohorje.

Treatments on plots / Mycorrhizal data	Grass - cover	Cutt. heap	Cover	New bed	Old bed	Control	Average[a] / Total[t]
Number of roots	2417	3327	3901	3399	8114	1379	26582[t]
Number of roots per dm^3	1758	4033	4728	4120	9835	6575	4833[a]
Share of roots (%)	10	13	16	13	31	22	17[a]
Nonmycorrhizal roots (%)	0	0	3	3	0	0	1[a]
Old mycorrhizal roots (%)	40	50	35	38	34	47	39[a]
Av. no. of roots / soil core (270 ml) & var. coeff. (%)	483 (82)	1109 (48)	1300 (54)	1133 (43)	2705 (59)	1808 (57)	1423[a] (72)
Av. no. of ectomyc. types	3	8	7	7	7	9	20[t]

Ectomycorrhiza is a normal phenomenon in all forests studied so far in Slovenia (KRAIGHER 1997), the absence of ectomycorrhizae on tree roots is an exception. The very low percentage of different types of ectomycorrhizae and the reduction in number of mycorrhizal roots on the grass plots studied can have an influence on the reduced regeneration of spruce (which has been reported for the same plots by ROBIČ & al. 1998). The presence of only a few types of ectomycorrhizae can have a negative effect on the efficiency of the interconnections between different components in these ecosystems.

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References

AGERER R. 1987-1998. Colour Atlas of Ectomycorrhizae, 1st-11th delivery. - Einhorn Verlag, Schwäbisch Gmünd.

KRAIGHER H. 1996. Tipi ektomikorize - pomen, taksonomija in aplikacije. - Zbornik gozdarstva in lesarstva 49: 33-66.

— 1997. Mikobioindikacija onesnaženosti dveh gozdnih rastišč. - Zbornik gozdarstva in lesarstva 52: 279-322.

— , BATIC F. & AGERER R. 1996. Types of ectomycorrhizae and mycobioindication of forest site pollution. - Phyton (Horn, Austria) 36 (3): 115-120.

ROBIČ D. 1985. Problemi naravnega obnavljanja antropogenih altimontanskih smrekovij na Pohorju. - Zbornik gozdarstva in lesarstva 26: 149-159.

— , VILHAR U. & KRAIGHER H. 1998. Silvicultural aspects of grass competition in the rizosphere of an anthropogenic altimontance spruce culture. - In: DIACI J. (Ed.), Mountain forest, conference proceedings, the 19th forestry days, March 26-27, 1998, Logarska dolina, pp. 255-268. - BF Ljubljana.

SIMARD S. 1996. Interspecific carbon transfer in ectomycorrhizal tree species mixtures. - PhD Thesis. Oregon State University, USA. pp. 210.

TAYLOR A. 1995. Ectomycorrhizal response to environmental perturbation. - In: Proceedings of the BIOFOSP. Slovenian Forestry Institute & BF, Ljubljana, pp. 173-180.

ZACKRISSON O., NILSSON M.C., DAHLBERG A. & JADERLUND A. 1997. Interference mechanisms in conifer-Ericaceae-feathermoss communities. - Oikos. 78 (2): 209-220.

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