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Comparative analysis of different methods for evaluating evergreen oaks mycorrhized with black truffle

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0. Introducción.

Methods for the evaluation of mycorrhized plants

Forestry quality of the plants

Real Decreto 1220/2011, de 5 de septiembre,



Main methods used for plant certification in Spain and in Europe

Método de Reyna et al. CEAM-Valencia (España, 1997)

Método de Chevalier et al. INRA-ANVAR (Francia, 1972)

Método de Palazón et al. INIA - Aragón (España, 1999)

Método de Bencivenga et al. Universidad de Perugia (Italia) (1987 y 1995)

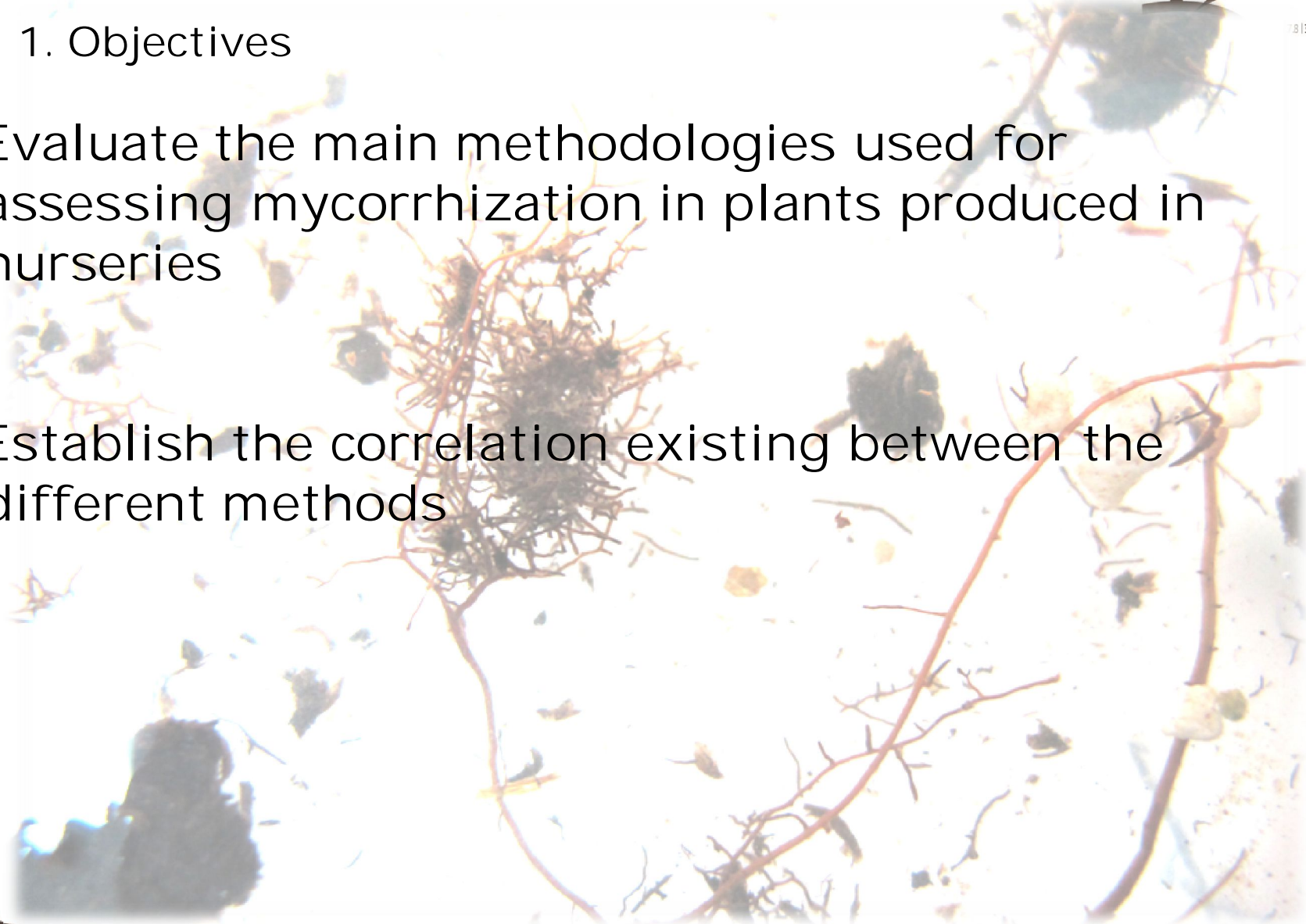
Método de Fischer y Colinas. Universidad de Lleida (España, 1996)



1. Objectives

Evaluate the main methodologies used for assessing mycorrhization in plants produced in nurseries

Establish the correlation existing between the different methods



2. Experimental Design.

1st. Part: Sampling of mycorrhized plants

- *Choosing the nurseries producers of mycorrhized plants*
- *Sampling of **120 plants** was carried out the 18th. of November 2011*



Nursery1:
12 plants/batch (5 batches) = 60 plants



Nursery 2:
12 plants/batch (5 batches) = 60 plants



2.Experimental Desing.

1st. Part: Sampling of mycorrhized plants

Processing of the plants

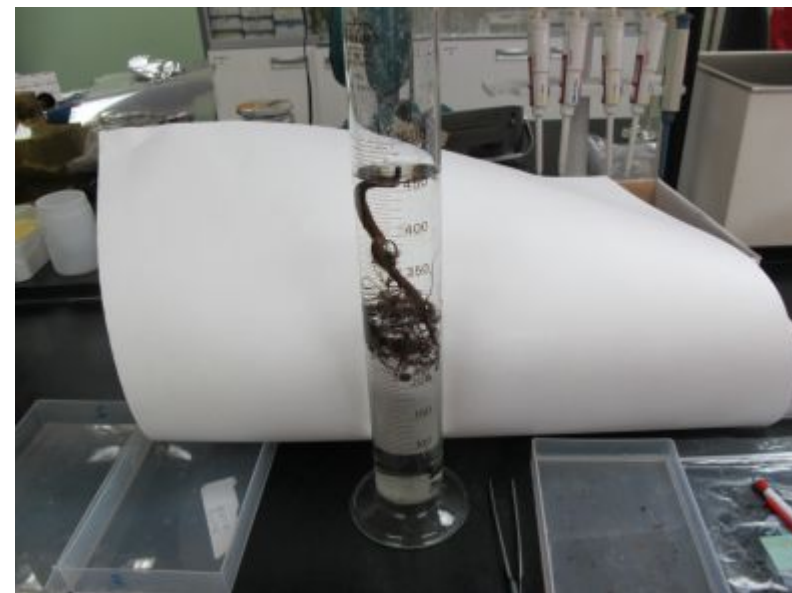
- ✓ 1st Washing
- ✓ Labeling of each plant
- ✓ Measurement Root system
Length , Diameter of the stem
- ✓ Bagging of each root system
- ✓ Storage at -20°C



2.Experimental Desing.

2nd. Part: Evaluation of each batch using all 5 methods (same experimenter)

- ✓ Thawing of batches
- ✓ Gentle washing using ultrasound bath
- ✓ Measurement of the root system volume of each plant

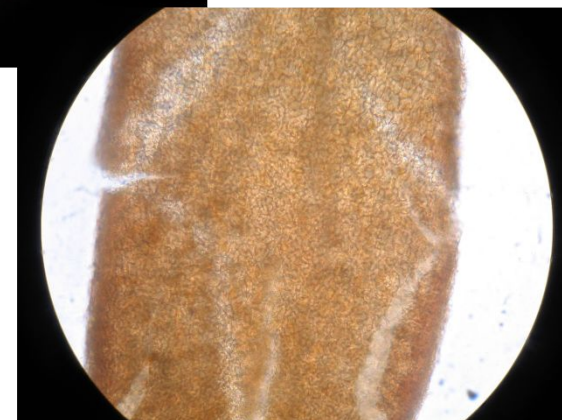


2. Diseño experimental.

2nd. Part: Evaluation of each batch using all 5 methods (same experimenter)

First observation of the plant

- ✓ Evaluation of the forestry quality
- ✓ -Microscopic observation of the presence/absence of mycorrhized roots with T.m. and/or other different fungi not used in the inoculation process.



2. Diseño experimental.

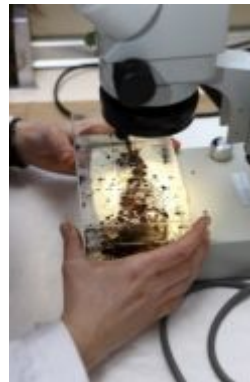
2nd. Part: Evaluation of each batch using all 5 methods (same experimenter)

Evaluation of the plant: starting with the less destructive method and ending with the most destructive

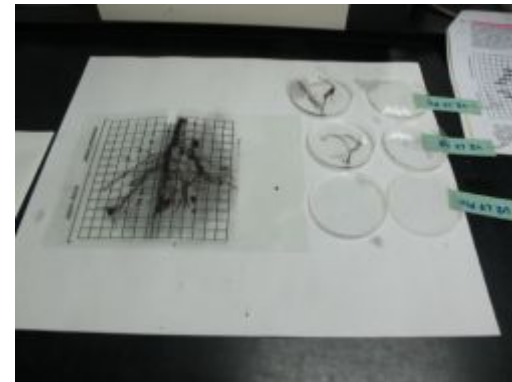
1°Reyna et al. CEAM-Valencia



2°Chevalier et al. INRA-ANVAR



3°Bencivenga et al. *Universidad de Perugia*



4°Palazón et al. INIA - Aragón



5°Fischer y Colinas. *Universidad de Lleida*



3.Resultados y discusión.

Do we have the same evaluation results across all methods?

Assessment per batches

Lote	%	Reyna et al	Chevalier et al.	Bencivenga et al.	Palazon et al.	Fisher and Colinas
1	42.3	si	si	si	si	si
2	31.2	no	si	si	si	si
3	31.2	no	si	no	no	si
4	33.5	si	si	no	si	si
5	30.0	si	si	no	no	si
6	25.2	si	si	no	no	no
7	18.9	no	no	no	no	no
8	33.9	si	si	si	si	si
9	25.3	no	si	no	no	si
10	32.4	si	si	no	no	si

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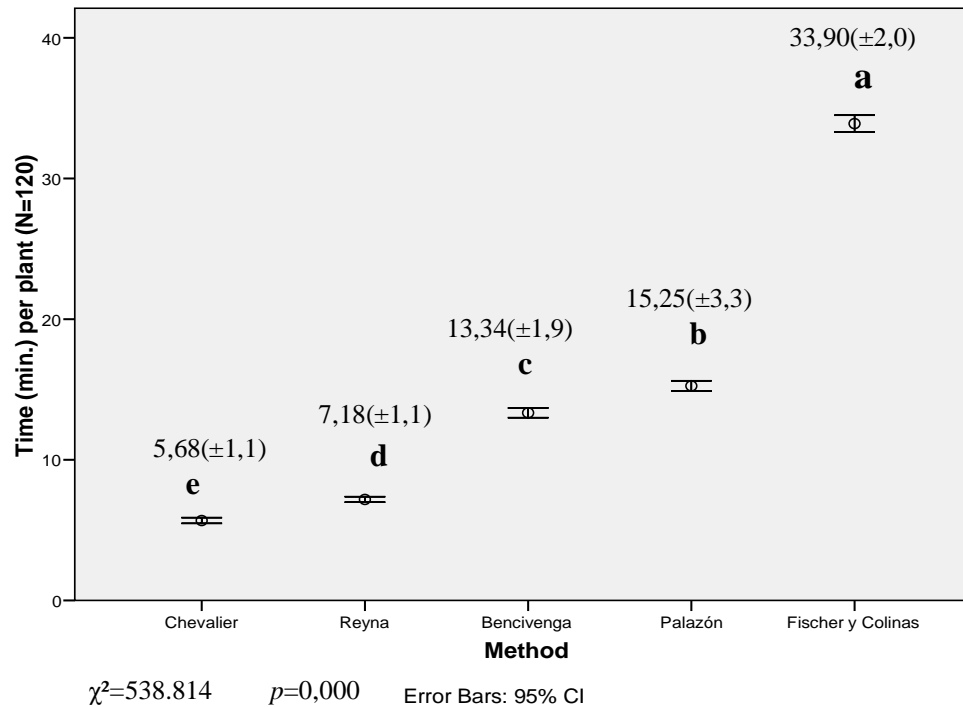
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χ^2 : 10.833 p: 0.029

3. Results and discussion.

Correlation between sampling time per plant and each method



3.Resultados y discusión.

Correlation between methods with respect to the % of mycorrhization

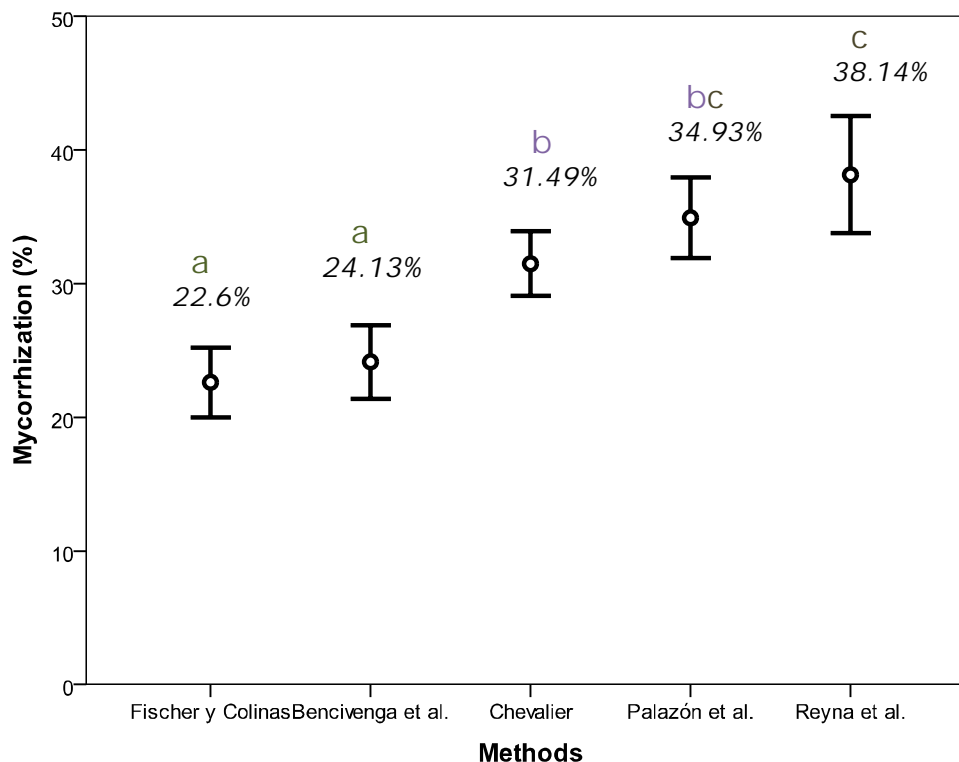
			Reyna	Chevalier	Bencivenga	Palazón	Fischer y Colinas
Rho de Spearman	Reyna	Coefficiente de correlación	1.000	.119	.184	.101	.159
		Sig. (bilateral)	.	.219	.057	.313	.106
		N	109	109	107	101	105
	Chevalier	Coefficiente de correlación			0.397(**)	0.523(**)	0.519(**)
		Sig. (bilateral)		.	.000	.000	.000
		N			117	110	115
	Bencivenga	Coefficiente de correlación				0.494(**)	0.574(**)
		Sig. (bilateral)				.000	.000
		N				109	114
	Palazón	Coefficiente de correlación					0.609(**)
		Sig. (bilateral)					.000
		N					110
	Fischer y Colinas	Coefficiente de correlación					1.000
		Sig. (bilateral)					
		N					115

** La correlación es significativa al nivel 0,01 (bilateral).

3.Resultados y discusión.

Correlation between methods with respect to the % of mycorrhization?

Graphic representation of the percentage confidence interval ($\alpha = 0.05$) mycorrhization obtained through various methods.



Alls methods tend to overestimate the percentage (Gógán 2011)

4. Conclusions.

- The methods based on Fischer and Colinas, and Bencivenga et al. gave lower % of mycorrhization for all batches
- The method based on Reyna et al. gave the highest mycorrhization level and didn't correlate with any of the other methods. All remaining 4 methods did have some correlation in their assessment of the mycorrhization level
- All 5 methods gave the same results for the extreme cases of high level and absence of mycorrhization.
- These results highlight the necessity for unified evaluation criteria of mycorrhized plants

Thank you for your attention

Acknowledgments



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