

A. Rambelli, S. Tempesta & B. Mulas

Fungi of Mediterranean ecosystems

Abstract

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The Authors examine the importance of fungi in the decomposition of vegetal organic matter and propose to study the phenomenon through the determination of the colony optimal or adaptive consistence. With researches carried out in mediterranean maquis areas different conditions selectioning fungal communities were investigated, among these matrices and areas considered as principal cause of a saprotrophic specialisation among fungi and plants.

Introduction

The ecology of litter fungi is a subject very studied by different researchers, mainly with the purpose to identify the composition of the different fungal communities; only little was done to study the importance of the different fungal species as colonizers of different vegetal residuals (Bills & Polishook 1994; Ciccarone & Rambelli 1998, 2000; Laessoe & Lodge 1994; Lodge 1997; Lodge & Cantrell 1994; Lodge & Laessoe 1995; Mulas & Rambelli 1995; Mulas & al. 1995; Pasqualetti & al. 1995; Pasqualetti & al. 1999; Polishook & al. 1996). Only recently the analysis of microfungi of different species of plant litters was extended to the evaluation of two parameters: number of colonies for unit of surface and type of colonies, this last parameter defined as optimal or adaptive (Pasqualetti & al. 1995). If we consider the colonization only as number of colonies we attribute the same importance to a colony with a regular development and to a colony with development suffered and if the species or the matrices are different we lose the possibilities to evaluate the importance of the different colonizations. Through the analysis of these parameters is possible to understand the definition of saprotrophic specialization. Obviously, the finding of a species on a matrix with optimal development does not exclude its presence on another with a better development: the subject is more and more open to new investigations.

From these considerations are arising interesting possibilities of researches on matrices of different ecosystems: evaluating the type of colonization we can understand the role of the single fungal species and indirectly their importance in mineralization processes (Pasqualetti & al. 1995; Rambelli 1991, 2000).

Thirteen sardinian mediterranean maquis areas were investigated with the purpose to single out the fungal communities colonizing the litter leaves of the different plants and to

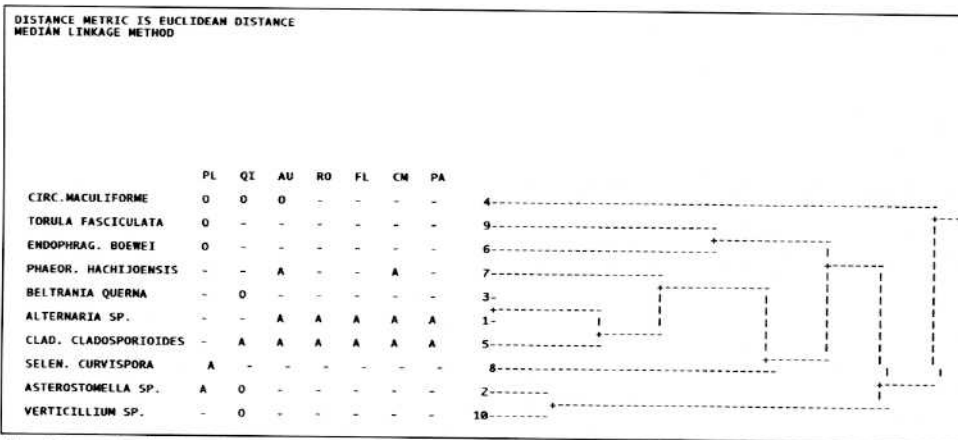


Fig. 1. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, QI = *Quercus ilex*, AU = *Arbutus unedo*, RO = *Rosmarinus officinalis*, FL = *Phillyrea latifolia*, CM = *Cistus monspeliensis*, PA = *Phillyrea angustifolia* at Ingurtosu.

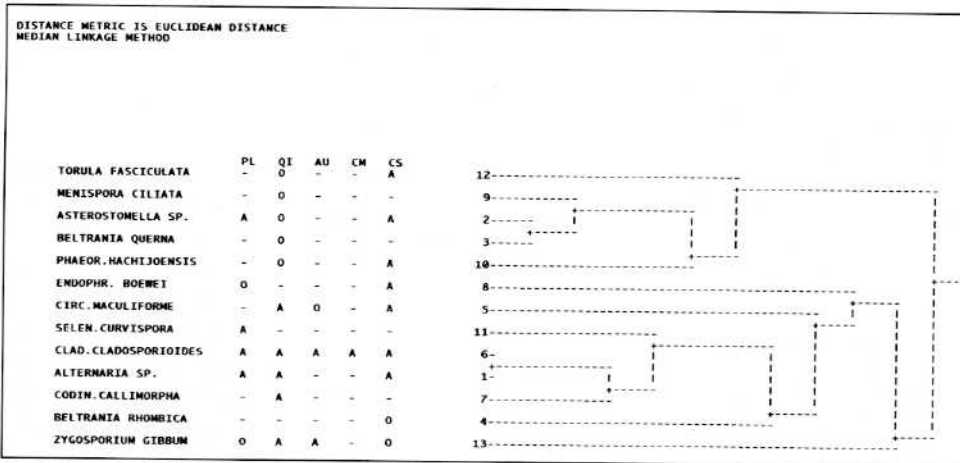


Fig. 2. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, QI = *Quercus ilex*, AU = *Arbutus unedo*, CM = *Cistus monspeliensis*, CS = *Cistus salvifolius* at Caprera.

determine their importance estimating the type of the colonies, optimal or adaptive. It is necessary to point out that these areas are characterized by little different environmental conditions, like exposition to the winds, to small different local temperatures, ecc., up to determine the presence or not of some plants species and the presence or not of some fungal species. Again, in some areas the vegetation is suffering for environmental impacts determined by swimming with related consequences.

The data, obtained by direct observation of the matrices, were elaborated by cluster analysis after determination of the type of colonization.

As we will see from the figures the majority of the fungal species colonize the dead leaves of *Pistacia lentiscus* as optimal and adaptive types. Nevertheless in several plant

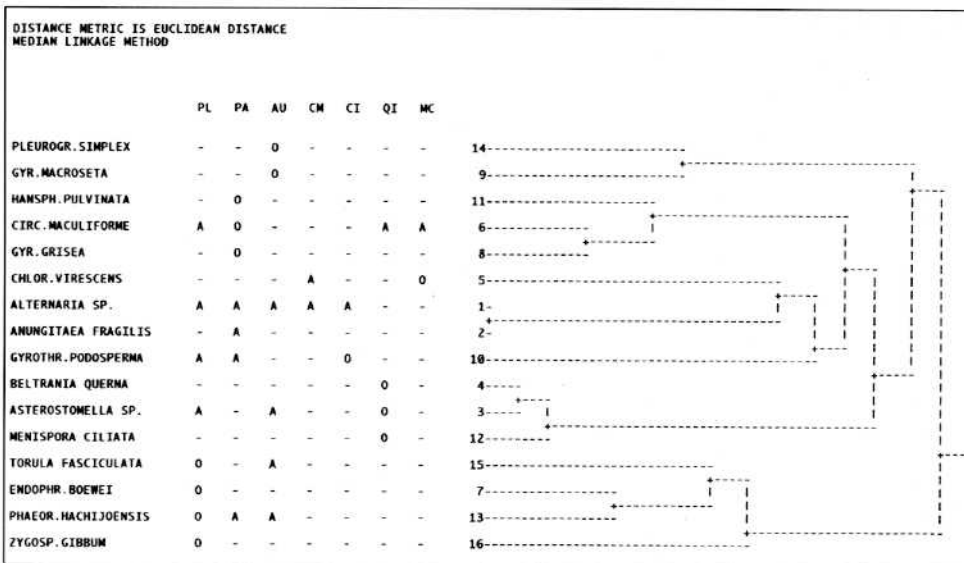


Fig. 3. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, PA = *Phyllirea angustifolia*, AU = *Arbutus unedo*, CM = *Cistus monspeliensis*, CI = *Cistus incanus*, QI = *Quercus ilex*, MC = *Mirtus communis* at Gonnese.

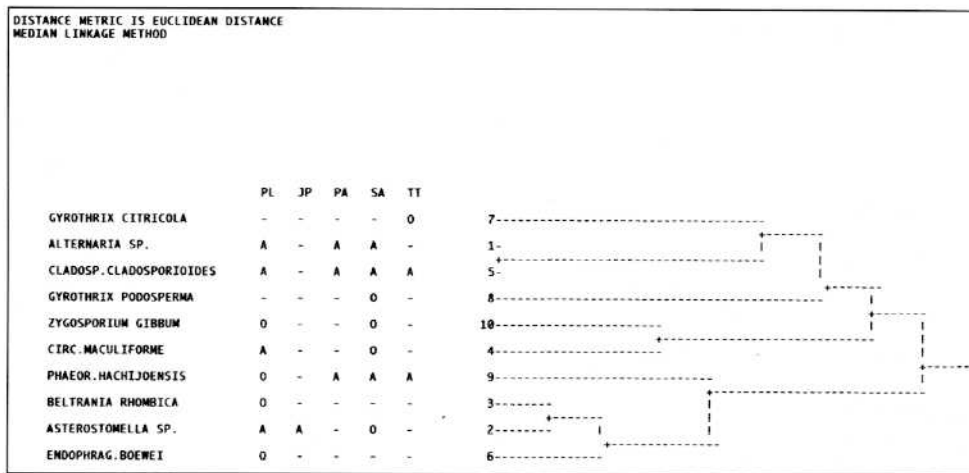


Fig. 4. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, QI = *Quercus ilex*, AU = *Arbutus unedo*, RO = *Rosmarinus officinalis*, FL = *Phillyrea latifolia*, CM = *Cistus monspeliensis*, PA = *Phillyrea angustifolia* at Ingurto.

species a small group of fungal species is present and they seem characteristic and bounded to the chemical and physical composition of the matrice: on the dead leaves of *P. lentiscus* is always present *Endophragmiella boewei* and very frequently *Phaeoramularia hachijoensis*, *Asterostomella* sp., *Gyrothrix grisea*, *Zygosporium gibbum*, *Torula fasciculata* and *Beltrania rhombica* (Figs 1-13).

Considering adaptive and optimal colonizations we find that some of these species can't

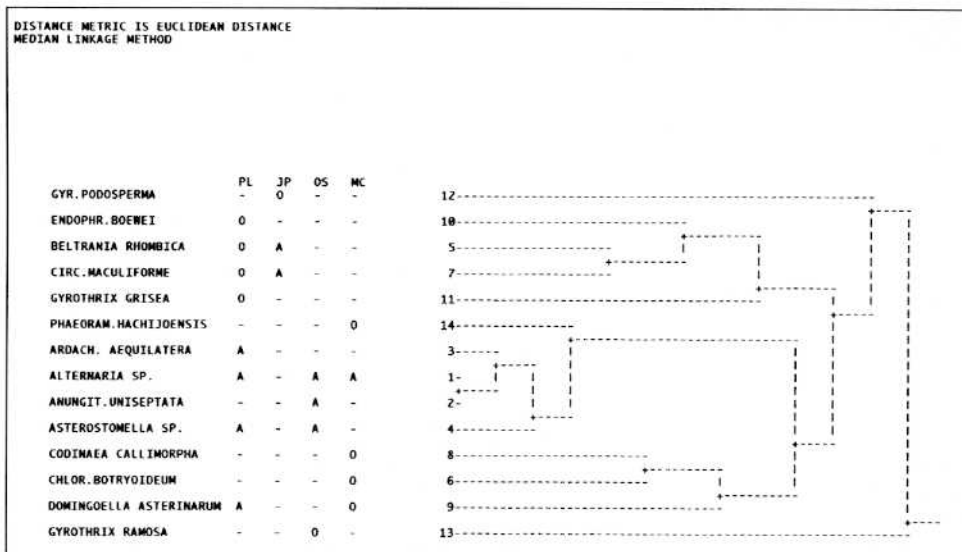


Fig. 5. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, JP = *Juniperus phoenicia*, OS = *Olea sylvestris*, MC = *Myrtus communis* at Santa Caterina.

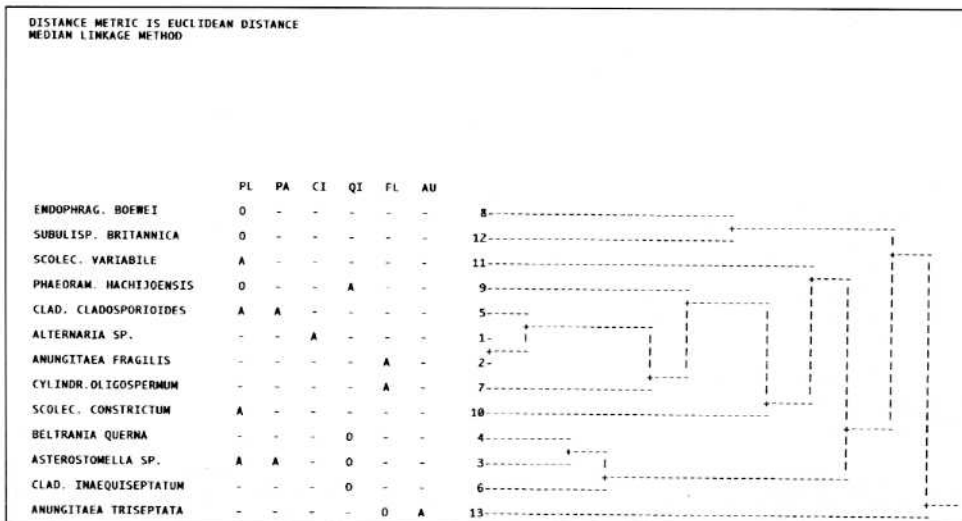


Fig. 6. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, PA = *Phillyrea latifolia*, CI = *Cistus incabius*, QI = *Quercus ilex*, FL = *Phillyrea latifolia*, AU = *Arbutus unedo* at Naracauli.

be characterizing the matrix since may be present also on leaves of other matrices, like *Asterostomella* sp., this fungus at Ingurtosu colonize also the leaves of *Quercus ilex* (Fig. 1) and at Capo S.Marco the leaves of *Juniperus phoenicia* (Fig. 9) and other cases could be mentioned. On the other hand we find *Beltrania querna* always on the leaves of *Q. ilex* at La Madonnina, Naracauli, Ingurtosu, Gonnese, and Caprera where *Q. ilex* is present (Figs

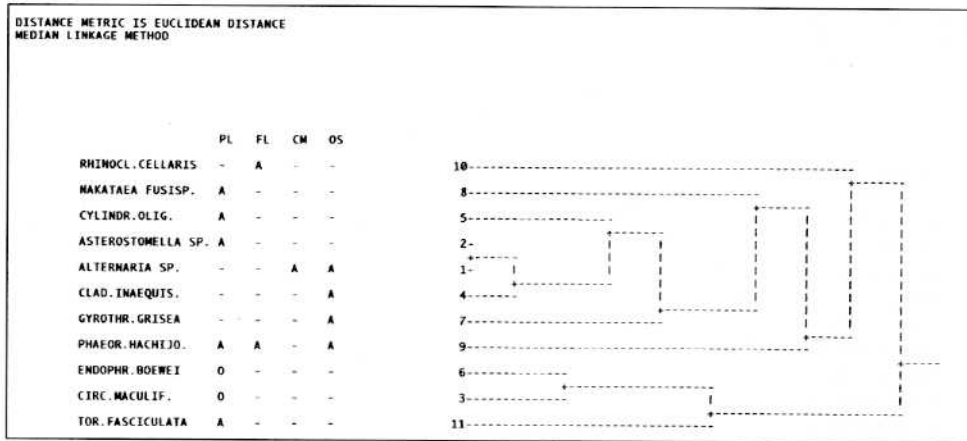


Fig. 7. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, FL = *Phillyrea latifolia*, CM = *Cistus monspeliensis*, OS = *Olea sylvestris* at Buggerru.

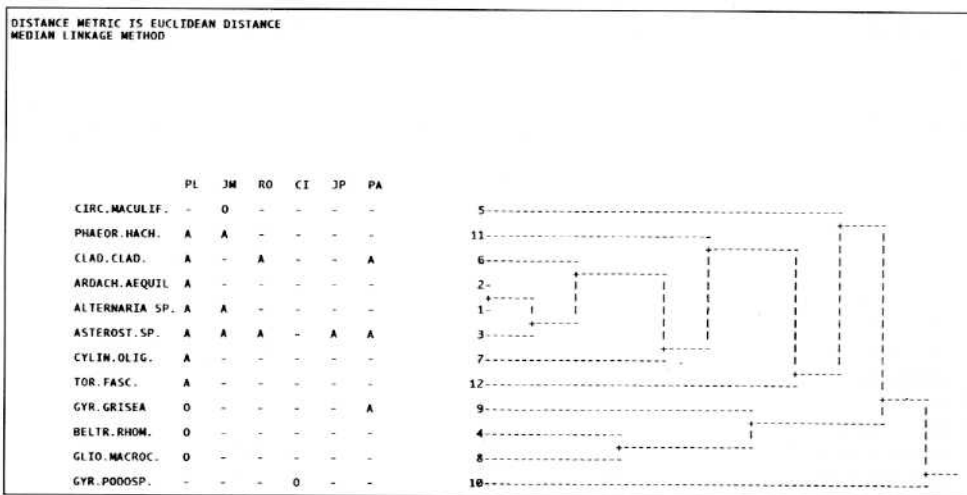


Fig. 8. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, JM = *Juniperus macrocarpa*, RO = *Rosmarinus officinalis*, CI = *Cistus incanus*, JP = *Juniperus phoenicia*, PA = *Phillyrea angustifolia* at Capo Mannu.

2, 3, 6, 13). At Santa Caterina *Myrrus communis* is colonized by *Chloridium botryoideum*, *Codinaea callimorpha*, *Phaeoramularia hachijoensis* and *Domingoella asterinarum*: all these species belong to a group of *Dematiaceae* characterized by low pigmentation (Fig. 5). At La Maddonnina, Caprera and Gonnese the dead leaves of *Q. ilex* are colonized by *B. querna* but also present are *Asterostomella* sp., *Torula fasciculata*, *Menispora ciliata*; at Caprera, area very contaminated during summer time, the colonization is composed also by *Asterostomella* sp., *T. fasciculata*, *Memmoniella ciliata* and *Rhachijoensis*.

Circinotrichum maculiforme is present on leaves of *Arbutus unedo* at Caprera and Ingurtosu (Figs 1, 2). At Torre del Sevo the colonization of *P. lentiscus* is well evident like that of *Chamaerops humilis*, of *Cistus monspeliensis* and *Rosmarinus officinalis* (Fig. 12).

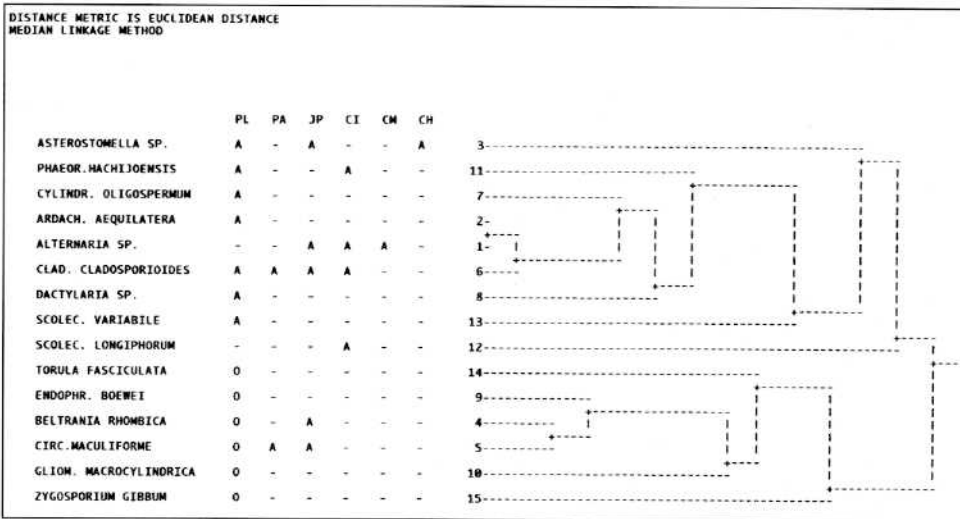


Fig. 9. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, PA = *Phillyrea angustifolia*, JP = *Juniperus phoenicia*, CI = *Cistus incanus*, CM = *Cistus monspeliensis*, CH = *Chamaerops humilis* at Capo San Marco.

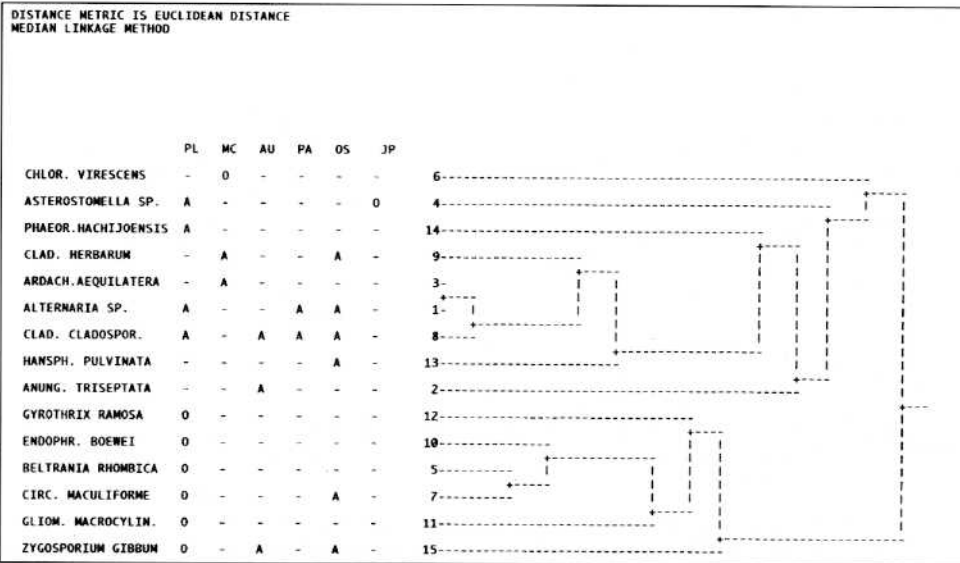


Fig. 10. Fungal colonization and type of the colonies on PL = *Pistacia lentiscus*, MC = *Myrtus communis*, AU = *Arbutus unedo*, PA = *Phillyrea angustifolia*, OS = *Olea sylvestris*, JP = *Juniperus phoenicia* at Santo Stefano.

At San Antioco some groups of fungi are specialized on the different matrices. The cluster divide the fungal community in two groups, one composed by specie prevalently with adaptive colonization (with exception of *Anungiraea triseptata*), a second composed by species with optimal colonization in all matrices (Fig. 11). This group is also divided into two subgroups: one composed by species exclusively present as optimal colonizers on *P.*

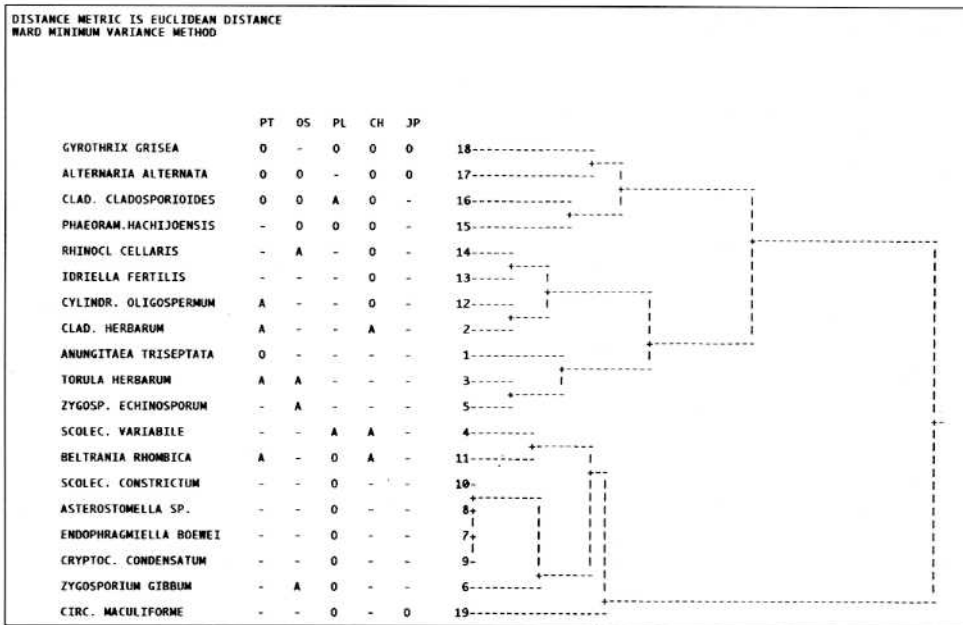


Fig. 11. Fungal colonization and type of the colonies on PT = *Phillyrea latifolia*, OS = *Olea sylvestris*, PL = *Pistacia lentiscus*, CH = *Chamaerops humilis*, JP = *Juniperus phoenicia* at San Antioco.

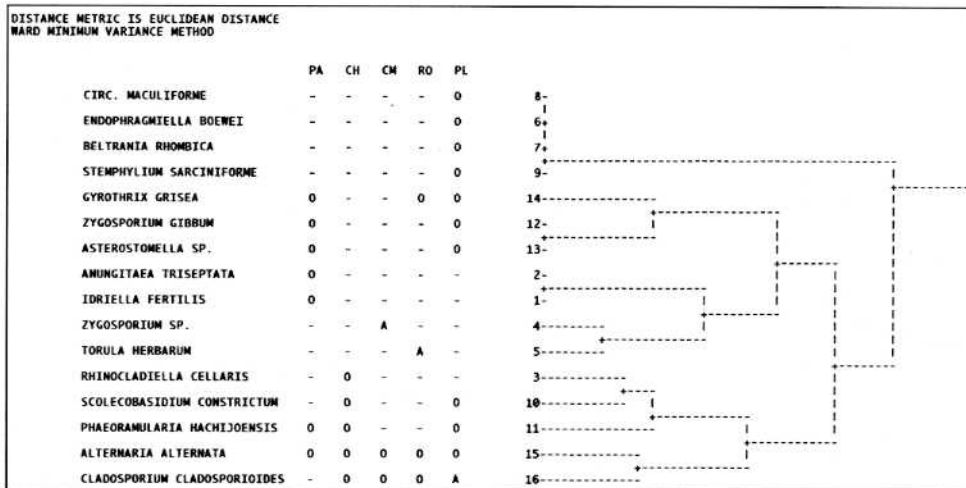


Fig. 12. Fungal colonization and type of the colonies on PA = *Phillyrea angustifolia*, CH = *Chamaerops humilis*, CM = *Cistus monspeliensis*, RO = *Rosmarinus officinalis*, PL = *Pistacia lentiscus* at Torre del Sevo.

lentiscus (*Z. gibbum*, *E. boewei*, *Asterostomella* sp. *Cryptocoryneum condensatum*, *Scolecobasidium constrictum* and *B. rhombica*), a second composed by species with optimal colonization on *C. humilis* (*Idriella fertilis*, *Cylindrotrichum oligospermum* and *Rhinocladiella cellaris*).

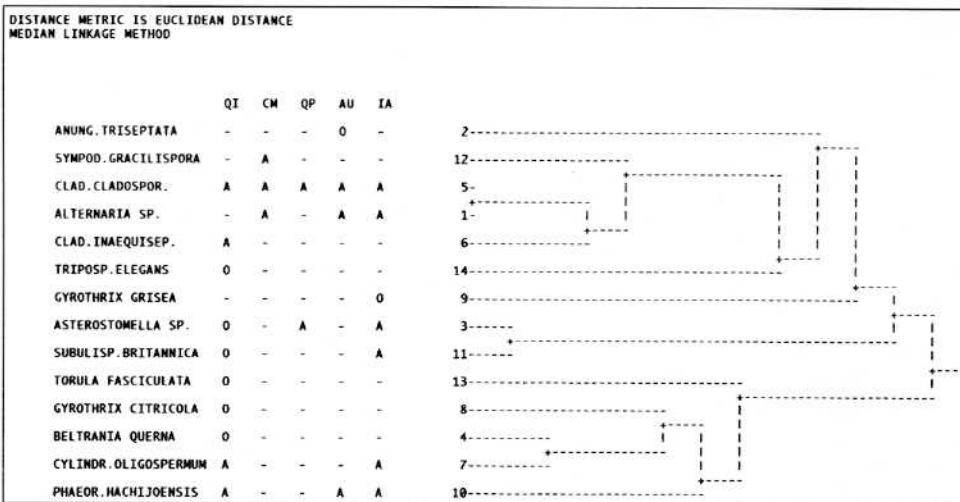


Fig. 13. Fungal colonization and type of the colonies on QI = *Quercus ilex*, CM = *Cistus monspeliensis*, QP = *Quercus pubescens*, AU = *Arbutus unedo*, IA = *Ilex aquifolium* at La Madonnina.

Another group is composed by species present on more matrices.

Examining the associations through species we have found *C. maculiforme* present in 11 areas and in 7 is associated with *E. boewei* on *Pistacia lentiscus*; but in the area of Ingurtosu is optimal on *P. lentiscus*, on *Quercus ilex* and *Arbutus unedo*. Considering that the species is able to produce a very high number of spores and to colonize vegetal fragments almost partially transformed from the activity of other colonizers the distribution of *C. maculiforme* is certainly interesting.

Rarely *T. fasciculata* is simultaneously present on two or more matrices; at Caprera and La Madonnina is present as optimal with *B. querna* on *Q. ilex*. On *P. lentiscus* seems associated to *E. boewei* in the areas of Ingurtosu, Gonnese, Capo S.Marco and Buggerru as optimal and at Capo Mannu as adaptive.

Asterostomella sp. as optimal seems associated to *B. querna* on *Q. ilex* in the areas of Ingurtosu, Caprera, Gonnese, Naracauli, La Madonnina; in the first 4 areas is also adaptive on *P. lentiscus* were *E. boewei* is always optimal.

As we have seen with previous researches (Pasqualetti & al. 1999) *B. rhombica* is a species able of high morphological variability in different environments and on different matrices. Nevertheless, on *P. lentiscus* seems associated to *E. boewei* as optimal in 7 areas; only at Caprera is optimal on *Cistus salvifolius* (Fig. 2), and adaptive on *J. phoenicia*, *Phillyrea latifolia* and *C. humilis* in different areas.

A not negligible problem is that concerning the different beginning of colonization on the different matrices. Since all the matrices were simultaneously sampled is reasonable to think that on some matrices the fungal colonization starts before and could be delayed on others and this is related to chemical composition of the matrix and to environmental conditions. This could explain the absence or the rare presence of optimal colonization on some matrices. *Phillyrea angustifolia* has optimal colonizations only at Gonnese and Torre del Sevo (Figs 3, 12): in these areas the optimal colonization is abundant on several matrices, presumably for favorable environmental conditions like a higher humidity.

