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SURVIVAL OF AQUATIC HYPHOMYCETES UNDER DRY CONDITIONS

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Abstract

Aquatic hyphomycetes which constitute a dominant mycoflora on decaying submerged plant debris have also been found to occur in terrestrial systems. Mycelial and conidial survival of aquatic hyphomycetes under xeric conditions is presented.

Introduction

Reports of aquatic hyphomycetes from terrestrial systems (Bandoni, 1972; 1974; Koske & Duncan, 1974; Park, 1974; Webster, 1977; Daniels & Menge, 1980; Khan, 1981) indicate that these fungi may possess ecological competence for activity and survival in terrestrial habitats. This is supported by Thakur (1977) who found survival of these fungi for 2-5 months in air dried leaves at room temperature, and by Sanders & Webster (1978) who by transfering inoculated oak leaf disks to leaf litter in a wood, showed capability of some of these fungi to survive under terrestrial water regimes. In the present work mycelial and conidial survival of some aquatic hyphomycetes were tested under xeric conditions.

Materials and Methods

Unwetted colonies of *Lemnoniera aquatica* and *Tricladium splendens* sporulated on distilled water agar and on 0.1% malt agar media and unwetted *Articulospora tetracladia* sporulated only on distilled water agar medium were used. Four mm. diam disks with conidia were taken from the central sporulating parts of colonies while conidia-free disks were cut from the growing margins of colonies. The disks in 9 cm Petri dish halves were placed in a desiccator containing approximately 500 g of oven dried silica gel. Rate of drying was estimated by weighing exposed fungal-free distilled water agar disks and no further loss of weight occured after 6 h. After one week the disks were immersed in sterile distilled water to test viability.

To test the survival under more xeric conditions, thin mycelial pellets (3-4mm diam. of fungi were grown in shaken 2% malt broth at 15°C. Pellets were thoroughly washed with three changes of sterile distilled water and placed in sets of 20-30 in 9 cm sterile

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plastic Petri dish halves. These were stacked in a desiccator with silica gel drying agent. For each species a separate desiccator was used, and 30 dried pellets for each species (except for *L. aquatica*) were retrieved weekly for up to 12 weeks. The viability of pellets was tested by seeding 15 pellets on 2% malt agar plates and by immersing 15 pellets in sterile distilled water.

To study the survival of conidia of aquatic hyphomycetes, the conidia were exposed to desiccation mounted on 16 mm. diam washed cellophane disks. Sporulating wetted pellets of test fungi were brushed against the top surfaces of sterile disks supported on water agar thus depositing a reasonable number of conidia in a uniform thin layer of water on the surface of the disks. The disks were put to 9 cm sterile plastic Petri dish halves which were stacked in desiccator. The disk-mounted conidial samples were retrieved at hourly intervals and plated on 2% malt agar (the disk surface bearing conidia faced the agar surface). After 50 h incubation at 15°C, at least 100 conidia were observed randomly for percentage viability. Control disks not subjected to drying were observed after 16 h to estimate viable proportion of the conidial population. Half life (50% survival) of conidia was determined (Table 2) by plotting viability data against time for each species and by calculating for each plot a linear regression curve from the data, in accord with the principles set out by Yarwood & Sylvester (1959).

Results and Discussion

L. aquatica and *T. splendens* in either conidia-free or conidia-containing disks of distilled water agar and 0.1% malt agar did not show any survival. Similarly *A. tetracladia* conidia-containing disks from distilled water agar cultures and conidia free disks (from 0.1% malt agar cultures) did not show survival. All other combinations survived.

Tables 1 & 2 give the result of mycelial survival of *Alatospora* sp., *A. tetracladia, L. aquatica, Lunulospora curvula* Ingold, *Tetracladium marchalianum* De Wildeman and conidial survival of *Alatospora* sp., *Articulospora tetracladia, Mycocentrospora filiformis* (Greathead) Iqbal and *Tetracladium marchalianum.*

Survival of aquatic hyphomycetes in a "domicilium alienum" of extreme dry conditions over a period studied gives an indication of their biological success in aquatic, semiaquatic and terrestrial habitats. Although the humidity of air over silica gel is variable (Beecher, 1979) with the water content of silica gel, the moisture content of the silica gel remained below 5% and the relative humidity of the atmosphere did not exceed 8% which is a very dry condition as compared to soil conditions.

Failure of survival of sporulating and non sporulating distilled water agar cultures and 0.1% malt agar cultures of *L. aquatica* and *T. splendens*, and also non sporulating cultures of *A. tetracladia* grown on the same media, can be explained as a result of growth of

Table 1. Survival of mycelium of aquatic Hyphomycetes.

Species	Age of Pellets (Days)	Mean Dry Weight(g)	Weeks 1	2	3	4	5	6	7	8	9	10	11	12
Alatospora sp.	21	0.95 ± 0.09	30	30	30	30	30	30	30	30	30	30	30	30
Articulospora tetracladia	8	1.18 ± 0.79	30	30	30	30	30	30	30	30	30	30	30	30
Lemonniera aquatica	–	–		*4/11		9/14		9/14		11/17		2/15		0/18
Lunulospora curvula	10	1.88 ± 0.32	30	28	26	24	24	10	11	22	9	0	1	0
Tetrachaetum elegans	8	0.25 ± 0.15	18	15	7	6	0	0	0	0	0	0	0	0
Tetracladium marchalianum	8	0.15 ± 0.02	30	30	30	30	30	30	30	30	30	30	30	30

*4/11 indicates 4 viable pellets out of total of 11 pellets tested at this time interval.

Table 2. Survival of conidia of aquatic Hyphomycetes under dry conditions.

Species	50% survival period (minutes)	Correlation coefficient (r)
Alatospora sp.	900.00	0.5204
Articulospora tetracladia	0.05	0.7838
Lunulospora curvula	16.70	0.9870
Mycocentrospora filiformis	96.00	0.9368
Tetrachaetum elegans	9.08	1.00
Tetracladium marchalianum	492.00	0.7344

cultures on weak media leading to poorly-nourished mycelium and conidia of low durability.

The failure of survival under dry conditions of sporulating cultures and of conidia obtained from pellets grown in 2% malt liquid cultures support the statement of Ingold (1979). The half-life survival of dry *A. tetracladia* conidia was 0.05 min., while it showed 100% survival of dry mycelium over 12 weeks. No evidence was found that conidia of any of the aquatic hyphomycete species examined are better at surviving drying periods than was the mycelium. Mycelium of *Alatospora* sp, *A. tetracladia,* and *T. marchalianum* showed a consistent survival under dry conditions without any loss over 12 weeks. In *L. aquatica* and *L. curvula,* the viability was observed after 10 and 11 weeks, respectively. *Tetrachaetum elegans* which survived for 4 weeks its reported from a terrestrial situation at a river bank (Webster, 1977). There does not appear to be any correlation between longevity of survival, size of conidium, quantity and age of mycelium. Sanders & Webster (1978) observed survival of *A. tetracladia* and *L. aquatica* over 13 weeks time in partly decaying leaves when exposed to air which is almost similar to survival periods of 13 and 10 weeks as found by Thakur (1977) in half-skeletonized leaves, who reported a negative correlation between the degree of decay of substrata and longevity of survival. This evidence is similar to the failure of *A. tetracladia, L. aquatica* and *T. splendens* to survive when grown on weak agar medium. Similarly it indicates that in nature, the survival of a species is most likely to be determined both by its growth conditions in relation to stress. The growing knowledge of their occurrence in terrestrial situations and their activity under conditions attached to these situations (Sanders & Webster, 1978) implies, that these fungi are competent in their aquatic biotopes that extreme disturbances in these biotopes (i.e. drying out) can not exclude them from their "*domicilium proprium aquaticum*" or their nature as aquatic fungi.

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