Current Research in Environmental & Applied Mycology **7**(1): 48–55(2017) ISSN 2229-2225

www.creamjournal.org **Article**
**Doi 10.5943/cream/7/1/7**



# How many myxomycete cells are there in wood?

**Taylor KM[1], Feest A[2&3] and Stephenson SL[4]**

1.School of Biological Sciences, Woodland Road, Bristol, UK
2.Faculty of Engineering, University Walk, Bristol BS8 1TR, UK
3.Ecosulis, The Rickyard Newton St. Loe, Bath BA2 1LY, UK
4.Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701, USA

Taylor KM, Feest A, Stephenson SL 2017 – How many myxomycete cells are there in wood? Current Research in Environmental & Applied Mycology 7(1), 48–55, Doi 10.5943/cream/7/1/7

**Abstract**

Following proof that myxomycetes are to be found within wood we have counted the minimum numbers of cells in four surveys including wood that has not been in contact with the ground (three sites and two species of tree; one site samples from the ground and aerial). We found that 1). Numbers of cells increased with decay as measured by the C:N ration; 2). The largest population density was >64,000 $cm^{-1}$; 3). The preponderance of protists in wood that had not touched the ground were myxomycetes and the aerial dispersal of dry spores gives a colonization advantage to myxomycetes and 4). It is possible to find widely differing densities of myxomycetes in the same piece of wood.

**Key Words** – aerial dispersal – protozoa – slime moulds – wood decay

## Introduction

Taylor *et al*. (2015) reported that myxomycete cells can be found within the wood and thereby confirm the work of Ostrofsky and Shigo (1981). They made no mention of the population density of the wood dwelling cells only presence or absence in the wood of eight different species of tree. The ecology and the ecosystem functional relevance of myxomycetes would depend on the evidence of the density of myxomycete cells, since presence alone would not indicate any significant ecological role in the decomposition of woody tissues. Until the work of Taylor *et al*. (2015) the assumption of reported work was that myxomycetes were present as plasmodia, but the authors state that, despite numerous isolations of myxomycetes, plasmodia were never found before myxomonads (myxomycete amoebo-flagellates) had been recorded and plasmodia had never been seen to emerge from wood slivers.

Since Taylor *et al*. (2015) have reported that myxomycetes can be recovered from the internal tissues of wood it becomes possible to devise a methodology to count the number of cells in these tissues. Initially we used methods to replicate the method of Singh (1946) whereby direct counts were made of emerging myxomonads from slivers of wood from the centre of a piece of wood. This proved to be difficult to maintain over a period of time and the method militated against the possible extensive use in a survey of wood.

Feest and Madelin (1985) reported that the population of myxomycetes in soil could be determined by the use of a most probable number technique and we therefore used variant of their methodology in the current work.

Submitted 19 August 2016, Accepted 15 March 2017, Published online 22 March 2017
Corresponding author: A Feest – e-mail – A.Feest@bristol.ac.uk

The role of myxomycetes in wood decay would seem to relate to their predation of bacteria growing in wood either as a result of the mobilisation of nutrients by fungi or their own decomposition activities. If this is so, then the more decomposed a wood sample the greater the possible numbers of myxomonads. A useful indication of the state of wood decay is given by the carbon: nitrogen (C:N) ratio (Swift, Heal & Anderson, 1979, Anderson, & Ineson, 1984;) and this could be assessed by relating the numbers of myxomonad cells to the C:N ratio.
The first aim of this paper is therefore: a) to apply a methodology based on Feest & Madelin (1985) to samples of wood to enumerate the population of myxomonads in wood samples and b) to test for association with state of decay, source and species of tree and thus give some indication of the role of Myxomycetes in wood decay..

We adopted the methods described in Taylor *et al*. (2015) to determine the density of a piece of wood and this was supplemented by an assay of the nitrogen and carbon content to give a C:N ratio as an assessment of the state of decay of the wood. The retention of nitrogen in decaying tissues will imply that lower C:N ratios would be found in more decayed wood (Anderson, Rayner and Walton, 1984). There are limitations to this measure if nitrogen fixing bacteria are present and if nitrogen is translocated from soil by fungal hyphae this may confuse the issue although the opposite may also happen.

Whilst myxomycetes have been recovered from wood (Taylor et al. 2015) they have been shown by Feest to be only part of the whole microbiocoenosis found in soil and the situation might be the same in wood so material was tested for countable numbers of both amoebo-flagellates (as a general category minus the myxomonads) and ciliates. The capacity to form dry air dispersible spores should provide an advantage to myxomycetes compared to the other two taxa which could be tested at the same time as for myxomycetes by analysis of branches that have not been on the ground

Variables that might influence recovery of myxomycete cells from wood might include: size of sample, culture medium and sample shaking time and these culture conditions were tested to provide an optimum methodology as detailed below.

**Materials and Methods:**

Samples of branches were collected from three sites: Leigh woods, Wetmoor wood and Weston Big wood all situated near Bristol in the SW of the UK. Oak (*Quercus* sp.) samples from Leigh woods were picked from the ground. From Wetmoor both from the ground and still attached (aerial) branches were collected. Samples from Weston Big wood were of Lime (*Tilia europea*) picked from the ground.

A sample 3-5 cm long was cut from one end of the branch to determine the density of the wood. The branches had diameters of between 3-9 cm and 20-40 cm length and slivers of wood 5 x 4 x 2 mm size were aseptically removed from 30 sites across the surface of a split branch. Care was taken to avoid wood surrounding insect bore holes and other damaged areas and a total sample represented 0.5 to 1.5 g of wood. These slivers were placed in a conical flask containing 100 $cm^3$ of Evian water and shaken on a wrist action shaker for 30 minutes and samples put through a dilution series to determine the Most-Probable Number (MPN) of myxomycetes (Anon 1969). The wood chips were retrieved by filtering the suspension and drying at $60^0$C to constant weight and weighed. The dry weight of the wood sample was used to calculate the numbers of protozoa (myxomycetes, flagellates and ciliates) per g of dry wood. Combining the weight with the density of the wood allowed calculation of the numbers of organisms per $cm^3$ of wood as a constant measure as opposed to the variable dry weight of the wood dependant on state of decay.

The suspensions of organisms were serially diluted to give $x10^{-1}$, $x10^{-2}$ and $10^{-3}$dilutions of the original solution and $1cm^3$ was added to each of five quarter strength Corn Meal Agar plates overlain with a dilute suspension of *Aerobacter* sp.. The plates (15 per wood sample) were then incubated in unsealed plastic bags at $20^o$C for 2 weeks. The plates were observed from above in phase contrast

optics (x200) after one and two weeks for the presence of myxomonads, amoebo-flagellates and ciliates. The resulting "score" of positive plates was applied to Most Probable Number tables (Anon, 1969) and the number of organisms calculated per gram and per $cm^3$ of wood.

Nitrogen content of the wood was calculated by a micro-Kejldahl assay of powdered wood. Carbon was assayed by placing in a Perkin Elmer elemental analyser and completely burned and the amount of carbon in the gases was deduced by the change in volume of the combustion gases when the $CO_2$ was removed.

**Results:**

Tables 1-4 give the results of the assay of 30-31 branches for each site placed in order of density.

**Table 1** Physical characteristics of wood and numbers of protozoa recovered from samples of Oak wood collected from the floor of Wetmoor wood near Bristol UK. Ordered by density.

| Sample number | Density g cm-3 | C:N ratio | Myxos. cm-3 | Amoebo-flagellates cm-3 | Ciliates cm-3 | Myxos. g-1 | Amoebo-flagellates g-1 | Ciliates g-1 |
|---|---|---|---|---|---|---|---|---|
| 10 | 0.12 | 93.54 | 5384 | 0 | 0 | 44871 | 0 | 0 |
| 1 | 0.12 | 154.1 | 78 | 5490 | 31 | 653 | 45751 | 261 |
| 11 | 0.12 | 582 | 3707 | 1752 | 94 | 30898 | 14606 | 786 |
| 4 | 0.13 | 85.11 | 1545 | 135 | 38 | 11387 | 1040 | 297 |
| 6 | 0.15 | 140.4 | 39 | 1578 | 0 | 263 | 10526 | 0 |
| 9 | 0.16 | 95.96 | 127 | 433 | 127 | 796 | 2707 | 796 |
| 7 | 0.17 | 160.8 | 0 | 704 | 0 | 0 | 4142 | 0 |
| 20 | 0.18 | 222.2 | 861 | 2708 | 196 | 4787 | 15047 | 1094 |
| 26 | 0.18 | 532.8 | 178 | 1228 | 111 | 992 | 6823 | 620 |
| 19 | 0.2 | 241.2 | 0 | 1162 | 0 | 0 | 5813 | 0 |
| 25 | 0.21 | 388.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0.23 | 159.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0.23 | 427.4 | 3356 | 0 | 98 | 14592 | 0 | 429 |
| 23 | 0.25 | 526.1 | 1984 | 4365 | 0 | 7936 | 17460 | 0 |
| 14 | 0.26 | 335 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0.32 | 155.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0.32 | 333.5 | 1875 | 0 | 0 | 6861 | 0 | 0 |
| 15 | 0.32 | 333.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0.34 | 433.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0.34 | 526.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0.36 | 110.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0.37 | 117.1 | 359 | 0 | 0 |  | 972 | 0 |
| 18 | 0.37 | 294.3 | 167 | 0 | 0 | 453 | 0 | 0 |
| 3 | 0.42 | 186 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0.44 | 293.3 | 191 | 76 | 0 | 434 | 173 | 0 |
| 13 | 0.44 | 428.3 | 448 | 179 | 0 | 1018 | 407 | 0 |
| 27 | 0.47 | 294.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0.48 | 1169 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0.58 | 362.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0.6 | 2350. | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | 0.29 | 384.4 | 676.63 | 660.33 | 23.16 | 4342.79 | 4182.23 | 142.76 |

**Table 2** Physical characteristics of wood and numbers of protozoa recovered from samples of Oak wood collected from the floor of Leigh woods near Bristol UK. Ordered by density.

| Sample number | Density g cm-3 | C:N ratio | Myxos. cm-3 | Amoebo-flagellates cm-3 | Ciliates cm-3 | Myxos. g-1 | Amoebo-flagellates g-1 | Ciliates g-1 |
|---|---|---|---|---|---|---|---|---|
| 10 | 0.1 | 98.63 | 11029 | 61 | 208 | 110294 | 612 | 2083 |
| 31 | 0.1 | 61.65 | 4180 | 33 | 0 | 41806 | 334 | 0 |
| 3 | 0.11 | 33.66 | 2577 | 360 | 20 | 23430 | 3280 | 187 |
| 11 | 0.11 | 78.39 | 4393 | 639 | 0 | 39941 | 5809 | 0 |
| 18 | 0.11 | 72.73 | 4850 | 6790 | 155 | 44091 | 61728 | 1410 |
| 4 | 0.13 | 79.55 | 683 | 15627 | 0 | 5259 | 120210 | 0 |
| 15 | 0.13 | 82 | 18 | 18 | 0 | 140 | 140 | 0 |
| 22 | 0.13 | 89.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0.15 | 103.77 | 377 | 629 | 25 | 2518 | 4198 | 167 |
| 30 | 0.15 | 101.73 | 169 | 0 | 0 | 1128 | 0 | 0 |
| 12 | 0.16 | 110.67 | 2530 | 119 | 372 | 15813 | 744 | 2325 |
| 19 | 0.16 | 129.53 | 23263 | 25 | 452 | 145395 | 161 | 2827 |
| 28 | 0.17 | 109.93 | 13593 | 0 | 0 | 82079 | 0 | 0 |
| 5 | 0.19 | 124.81 | 20779 | 4545 | 0 | 109364 | 23923 | 0 |
| 1 | 0.21 | 111.54 | 0 | 187 | 0 | 0 | 893 | 0 |
| 24 | 0.21 | 133 | 340 | 0 | 0 | 1623 | 0 | 0 |
| 2 | 0.22 | 123.92 | 38076 | 0 | 0 | 173076 | 0 | 0 |
| 21 | 0.24 | 127.74 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0.26 | 210.22 | 25215 | 0 | 0 | 96982 | 0 | 0 |
| 6 | 0.27 | 86.3 | 6528 | 130 | 913 | 24177 | 483 | 3384 |
| 14 | 0.32 | 178.62 | 64142 | 0 | 0 | 200445 | 0 | 0 |
| 23 | 0.34 | 196.88 | 7314 | 37615 | 104 | 21511 | 110633 | 307 |
| 7 | 0.36 | 121.39 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0.37 | 109.52 | 64 | 0 | 0 | 173 | 0 | 0 |
| 13 | 0.37 | 219.95 | 76 | 0 | 0 | 206 | 0 | 0 |
| 25 | 0.4 | 164.54 | 114 | 0 | 0 | 285 | 0 | 0 |
| 17 | 0.41 | 166.64 | 19224 | 139 | 0 | 46888 | 341 | 0 |
| 26 | 0.42 | 186.04 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0.57 | 159.48 | 520 | 0 | 0 | 912 | 0 | 0 |
| 8 | 0.58 | 164.39 | 167 | 0 | 0 | 289 | 0 | 0 |
| 16 | 0.7 | 270.29 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | 0.26 | 129.24 | 8071.64 | 2158.61 | 72.54 | 38316.93 | 10757.71 | 409.35 |

Of the samples taken; 68 of 121 produced myxomycetes, 44 amoebo-flagellates and 20 ciliates. Tables 1-4 are ordered in order of density and show that the denser samples produced the greatest recovery of flagellates and ciliates but Myxomycetes were recovered from all densities. Of particular interest is the recovery from branches still attached to the tree where 14/30 had myxomycetes, 9/30 had flagellates and just 2/30 ciliates. Even more telling is that, excluding one sample yielding >32,000 $cm^{-3}$ amoebo-flagellates and probably affected by invertebrates, gives the following average populations: 593.5 myxomycetes; 74.1 amoebo-flagellates and 5.3 ciliates $cm^{-3}$. Clearly dry spore dispersal is effective in giving the myxomycetes an advantage in colonising wood . The largest population density of myxomycetes was 64,142 $cm^{-3}$ representing over 200,000 per gram of wood. Since the wood samples tested were very small this will mean that the lowest value detectable is larger than for larger size samples and in this case for samples between 0.5 and 1.5 g the minimum detectable values would be between 400 – 133 cells per g (based on the presence of one positive recovery plate out of the fifteen used).

**Table 3** Physical characteristics of wood and numbers of protozoa recovered from samples of Oak wood collected from the canopy of Wetmoor woods near Bristol UK. Ordered by density. Sample 10 probably taken from an invertebrate affected section of wood.

| Sample number | Density g cm-3 | C:N ratio | Myxos. cm-3 | Amoebo-flagellates cm-3 | Ciliates cm-3 | Myxos. g-1 | Amoebo-flagellates g-1 | Ciliates g-1 |
|---|---|---|---|---|---|---|---|---|
| 8 | 0.13 | 97.39 | 784 | 0 | 0 | 6032 | 0 | 0 |
| 20 | 0.13 | 137.06 | 153 | 249 | 0 | 1179 | 1917 | 0 |
| 23 | 0.13 | 144 | 692 | 538 | 0 | 5325 | 4142 | 0 |
| 21 | 0.14 | 106.26 | 51 | 128 | 0 | 368 | 920 | 0 |
| 10 | 0.17 | 97.48 | 344 | 32419 | 0 | 2026 | 190703 | 0 |
| 3 | 0.17 | 192.08 | 205 | 0 | 0 | 1208 | 0 | 0 |
| 12 | 0.18 | 80.54 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0.19 | 126.68 | 139 | 55 | 55 | 735 | 294 | 294 |
| 4 | 0.22 | 212.45 | 9527 | 0 | 0 | 43.307 | 0 | 0 |
| 16 | 0.24 | 191.92 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0.25 | 183.04 | 0 | 135 | 0 | 0 | 541 | 0 |
| 24 | 0.26 | 189.04 | 394 | 0 | 0 | 1516 | 0 | 0 |
| 1 | 0.27 | 145.03 | 0 | 0 | 0 | 0 | 0 | |
| 15 | 0.3 | 104.61 | 0 | 97 | 0 | 0 | 326 | 0 |
| 9 | 0.3 | 195.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0.31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0.31 | 139.38 | 225 | 0 | 0 | 726 | 0 | 0 |
| 6 | 0.31 | 143.38 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0.31 | 302.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0.34 | 169.18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0.36 | 117.71 | 297 | 0 | 0 | 827 | 0 | 0 |
| 18 | 0.36 | 141.32 | 0 | 578 | 105 | 0 | 1605 | 291 |
| 2 | 0.36 | 174.04 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0.37 | 225.57 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0.38 | 185.32 | 443 | 0 | 0 | 1167 | 0 | 0 |
| 27 | 0.38 | 203.78 | 2166 | 379 | 0 | 5702 | 997 | 0 |
| 14 | 0.39 | 189.76 | 2386 | 0 | 0 | 6119 | 0 | 0 |
| 19 | 0.4 | 187.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0.54 | 177 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0.72 | 421.27 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | 0.297 | 166.04 | 593.53 | 1152.6 | 5.333 | 1099.11 | 6714.83 | 20.17 |

Excluding the aerial sample the mean density of the myxomycete population of the three ground sample sites followed the progress of decay as determined by the mean C:N ratio thus:

| Site and source | Mean C:N | Mean Myxos $cm^{-3}$ |
|---|---|---|
| Leigh Woods Oak | 129.2 | 8072 |
| Weston Big Wood Lime | 215.6 | 1240 |
| Wetmoor Woods Oak | 384.5 | 677 |

The more decayed a branch the higher the number of myxomycete cells. This was true for amoeba-flagellates and ciliates although their population densities were lower and the frequency of recovery was also lower. Carbon: nitrogen ratio and density as measures of decomposition were tested for association by a linear regression of for example the data in Table 1 and produced a very highly significant ratio ($p<0.001$)

Where samples had been taken from the same branch, albeit different ends, it was possible to compare results for both the density and myxomycete populations. Table 5 shows that densities did not differ greatly between ends but that myxomycete populations could (sometimes significantly) and therefore one would assume that the populations of myxomycetes were patchily distributed throughout a single branch.

**Table 4** Physical characteristics of wood and numbers of protozoa recovered from samples of Lime wood collected from the canopy of Weston Big woods near Bristol UK. Ordered by density. Samples 11 &4 probably from an insect affected piece of wood.

| Sample number | Density g cm-3 | C:N ratio | Myxos. cm-3 | Amoebo-flagellates cm-3 | Ciliates cm-3 | Myxos. g-1 | Amoebo-flagellates g-1 | Ciliates g-1 |
|---|---|---|---|---|---|---|---|---|
| 13 | 0.14 | 101.23 | 984 | 0 | 0 | 7032 | 0 | 0 |
| 27 | 0.14 | 60.6 | 38 | 0 | 0 | 273 | 0 | 0 |
| 7 | 0.15 | 125.82 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0.15 | 96.47 | 663 | 0 | 0 | 4424 | 0 | 0 |
| 30 | 0.17 | 79.67 | 9444 | 5085 | 145 | 55555 | 29914 | 854 |
| 12 | 0.2 | 159.93 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0.21 | 247.52 | 743 | 0 | 0 | 3539 | 0 | 0 |
| 6 | 0.22 | 110.93 | 251 | 2517 | 251 | 1144 | 11441 | 1144 |
| 23 | 0.22 | 214.32 | 0 | 430 | 0 | 0 | 1955 | 0 |
| 24 | 0.22 | 111.83 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0.23 | 124.83 | 4079 | 0 | 0 | 17738 | 0 | 0 |
| 28 | 0.23 | 244.47 | 0 | 87 | 0 | 0 | 380 | 0 |
| 2 | 0.27 | 209.5 | 1476 | 84 | 0 | 5468 | 312 | 0 |
| 5 | 0.31 | 509 | 13225 | 105 | 0 | 42662 | 341 | 0 |
| 16 | 0.33 | 220.67 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0.34 | 184.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0.35 | 165.57 | 2075 | 10379 | 0 | 5931 | 29655 | 0 |
| 4 | 0.36 | 139.24 | 1691 | 12080 | 96 | 4697 | 33557 | 268 |
| 22 | 0.36 | 119.25 | 230 | 92 | 0 | 886 | 354 | 0 |
| 19 | 0.38 | 169.74 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0.41 | 247 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0.44 | 144.66 | 2140 | 0 | 0 | 4864 | 0 | 0 |
| 15 | 0.48 | 244.05 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0.5 | 384.25 | 163 | 0 | 0 | 327 | 0 | 0 |
| 18 | 0.52 | 379.58 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0.52 | 327.79 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0.59 | 270.18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0.64 | 327.79 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0.69 | 238.79 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0.75 | 510 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | 0.351 | 215.62 | 1240.06 | 1028.63 | 16.4 | 5151.33 | 3596.96 | 75.53 |

## Discussion

We have shown that it is possible to estimate the myxomonad population in wood samples and that the population is within the wood and not superficial as indicated by Taylor *et al*. (2015) thus satisfying our first research aim. This has also been seen to relate to state of decay with more myxomonads (and other protozoa) in the lower C:N ration samples of wood thus the population increases with decay and there is a presumed role for myxomycetes in the decay process satisfying our second research aim. At no time was a plasmodium recovered from the wood samples before myxomonads had developed and thus one can assume that the population is largely composed of myxomonads (as in soil see: Stephenson & Feest 2012).

**Table 5** Pairs of samples from the same branch where in three cases there is a highly significant difference of myxomonad population estimate between ends.

| Sample Number | Density g-3 | Difference between densities | Myxos cm-3 | Difference between pairs | Significance |
|---|---|---|---|---|---|
| 2 | 0.36 | 0.06 | 0 | 0 | 0 |
| 3 | 0.42 | | | | |
| 16 | 0.32 | 0.02 | 0 | 0 | 0 |
| 17 | 0.34 | | | | |
| 23 | 0.25 | 0.02 | 1984 | 1372 | NS |
| 24 | 0.23 | | 3356 | | |
| 25 | 0.25 | 0.02 | 0 | 178 | 0 |
| 26 | 0.23 | | 178 | | |
| 27 | 0.21 | 0.03 | 0 | 191 | 0 |
| 28 | 0.18 | | 191 | | |
| 34 | 0.13 | 0.06 | 683 | 20096 | p=<0.01 |
| 35 | 0.19 | | 20779 | | |
| 43 | 0.37 | 0.05 | 76 | 64066 | p=<0.01 |
| 44 | 0.32 | | 64142 | | |
| 64 | 0.17 | 0.05 | 205 | 9322 | p=<0.01 |
| 65 | 0.22 | | 9527 | | |

It is possible that some of these population estimates are greatly underestimating the actual population if myxomonad cysts in wood respond in the same way as they do in soil when frozen. Freezing induces excystment of dormant cysts in soil that do not become active even when in a wet environment (Feest & Stephenson, 2013). This underestimation can be up to 90% thus the highest population we recovered of c.64,000 $cm^{-3}$ might be even greater. At these densities it is clear that myxomonads are of relevance to the decay of wood and the remobilisation of nutrients from wood.

The advantage that myxomycetes have in the possession of dry air-dispersible spores is clearly shown in the still attached samples of wood where colonisation by myxomycetes was greater than for other protozoa thus the possession of complex sporangia, with on occasions active spore release mechanisms, can be explained as having considerable "fitness" advantages.

## References


Anderson JM, Ineson P. 1984 – Interactions between microorganisms and soil invertebrates in nutrient flux pathways of forest ecosystems; in Invertebrate-microbial interactions ed. Anderson JM, Rayner ADM, Walton DWH. Cambridge University Press p.59–88.

Anon. 1969 – The bacteriological examination of water supplies. Ministry of Health. Reports on Public Health and Medical Subjects No. 71, HMSO, London

Feest A, Madelin MFM.1985 – A method for the enumeration of myxomycetes in soils and its application to a wide range of soils. FEMS Micobiology Ecology 1, 103–9.

Feest A, Stephenson SL. 2013 – The response of myxogastrids to soil amendments. Mycosphere 4, 363–444.

Ostrofsky A, Shigo AL. 1981 – A myxomycete isolated from discoloured wood of a living Red Maple. Mycologia 73, 997–1000.

Singh BN. 1946 – A method of estimating the numbers of soil protozoa, especially amoebae, based on their differential feeding on bacteria. Annals of Applied Biology. 33,112–9.

Stephenson SL, Feest A. 2012 – The ecology of soil mycetozoans. Acta Protistologica. 51, 201–8.

Swift MJ, Heal OW, Anderson JM. 1979 – Decomposition in terrestrial ecosystems (Studies in ecology; vol.5). Blackwell Scientific Publications, Oxford.

Taylor KM, Feest A, Stephenson SL. 2015 – The occurrence of myxomycetes in wood? Fungal Ecology 17, 179–182.