

## Report on the MiSAC Annual Competition 2021

### *Fungi and climate change*

Sponsored by the British Mycological Society (BMS)

The aim of the 33<sup>rd</sup> MiSAC Annual Competition, generously sponsored by the British Mycological Society (BMS), was to increase an understanding among teenagers of the interrelationships between the activities of fungi and climate change. The requirements maintained the well-established approach of basing the competition on a topic that is associated with school curricula but with specifications that require students to explore material beyond the curriculum.

In addition to receiving entries from regular participants, we were again pleased to note the continuing growth in interest from newcomers to the competition. As usual, there were two entry groups, KS3 and KS4 (S1/2 and S3/4 in Scotland). Sixty group entries were received from 48 establishments throughout the UK, ie, 12 submitted entries to both entry groups. In total, there were 234 separate entries consisting of 141 in the KS3 (S1/2) group and 93 at KS4 (S3/4). Many participants took the opportunity to work together in groups of up to 4, making a total of 332 students having had the experience of contributing to the competition. MiSAC would like to thank teachers for providing information on the entry form about how they heard of the competition; it is useful to us in that it helps us target efficient advertising of the competition for the next year. Judging, which took place at the University of Reading, was hosted by the NCBE, one of MiSAC's sponsors. The judging panel consisted of BMS representatives, Professor Naresh Magan from Cranfield University and Emeritus Professor Anthony Whalley, Liverpool John Moores University, and Dr Fiona Lane, Head of the NCBE, together with members of MiSAC.

The overall requirement was to produce information for a social-media web site for teenagers called *What you didn't know about climate change*. Areas to be considered were (1) the concept of climate change and its effects, (2) how the activities of fungi affect climate change and (3) how fungi themselves are influenced by climate change. Examples of relevant processes were provided for guidance but choice was not limited to those examples. Entrants were reminded that the judges would be looking for the scientific merit of an entry as well as it being informative, attractive and well-designed for the intended audience, ie, teenagers. The competition entry - two pages of a web site - had to be printed on one A3 sheet (or two A4 pages attached side-by-side) and could be prepared either by computer or by hand. Guidance on making an effective entry was provided: the first web page should briefly explain the scientific basis of climate change and describe one fungal activity which *reduced* greenhouse gases together with the special features which enabled the fungus to achieve this. On the second web page, entries were required to provide details of one fungal activity which *increases* greenhouse gases and its consequences and explain how climate change affects the activity and distribution of many fungi. Finally, entrants were required to briefly comment on whether fungal activity resulted in an overall increase or decrease in climate change.

As the judging procedure always examines how well students have paid attention to the requirements of the competition, it is important that entrants take careful note of the competition specifications and, this year, the judges found that entry requirements were generally well observed. Following instructions on the flyer is essential for an entry to be successful. Judges were impressed by the commendable efforts made to tackle what is quite a complex topic for students who are not taught in school curricula about fungi, their fundamental importance in decomposition and their roles in nutrient cycling. Despite this, creditable attempts were made to understand the roles of fungi in nature, the ways in which fungi influence climate change and are themselves influenced by it.

The concept of climate change is familiar to students and was well covered although some ignored the instruction that only a 'brief' explanation of the science was required. Entrants are advised to think ahead and make an overall plan of their two web pages; many used too much space to 'briefly' explain climate change, thus leaving inadequate space for information required on fungi on the second web page. Others became side-tracked by issues of pollution and many discussed 'nitrogen pollution' rather than specifying nitrous oxides. The judges felt this to be a very loose term; with our atmosphere having approximately 78% nitrogen it suggests that students were quoting on-line sources of information, commonly found in their internet web searches. Much information came from 'googling', with many using the same web references. Not many students quoted their sources; bibliographies were in short supply and there was limited evidence of entrants using sources published by MiSAC ([www.misac.org.uk](http://www.misac.org.uk)) and BMS ([www.britmycolsoc.org.uk](http://www.britmycolsoc.org.uk)) that were included on the flyer. These are written by mycologists and give reliable, accurate scientific information on the competition topic - which cannot be guaranteed on other web sites.

Nearly all students correctly stated that mycorrhizal fungi help to decrease the release of 'Green House Gases' (GHGs) but not very many were able to 'indicate the special features which enable the fungus to achieve this'. There are very large numbers of mycorrhizal fungi associated with the roots of about 90% of land plants, forming huge underground networks. Many of the fungi fruiting in woods in autumn are mycorrhizal. However, many entrants seemed to think there is only *one*

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fungus which is mycorrhizal. A majority of entrants gave good descriptions of the different mycorrhizal mechanisms of associating with plant roots.

Information for the second web page was tackled better by KS4 (S3/4) students. It was not well understood that an increase in the main activity of fungi (decomposition) resulting from increased temperatures would cause increased CO<sub>2</sub> emissions, therefore increasing global warming. Chytrids and herbivore gut archaea and the production of methane was, however, correctly quoted as 'one fungal activity which increases GHGs', though few entrants stated its consequences.

The better answers addressed 'how climate change affects the activity and distribution of many fungi' although this presented problems for others. MiSAC references, quoted in the competition flyer, address this issue. Of those entrants who responded to 'comment on whether fungal activity results in an overall increase or decrease in climate change', most seemed to think it decreased climate change - based on their accounts of the activity of mycorrhizas. However, most fungal activity involves decomposition and nutrient cycling which, increasing with a rise in temperatures and humidity, would cause the production of more GHGs. If a rise in temperature is accompanied by drought conditions, however, the fungi could not survive, resulting in a decrease in both fungal activity and production of GHGs.

Many students used the words 'fungus' and 'fungi' without understanding whether they relate to single or multiple organisms. The same applies to 'mycorrhiza' - singular; 'mycorrhizas' - plural. With some exceptions, there were few examples of named fungi being used in the correct context, although this was asked for in the guidance to the competition (eg, *Amanita muscaria* - a mycorrhizal fungus).

Credit was given for illustrating a good factual account with photographs, diagrams or data and also for presenting a design which is appropriate for a web site. Although students were advised to choose colours carefully, the combinations used by a number of entrants made the text very difficult to read, with a pale font placed over a lighter background. The judges were pleased that a large number of entrants had adhered to the requirements of the competition *and* had also managed to create a visually-attractive commentary on the role of fungi in climate change.

We should like to thank teachers for responding to the request to record full identification details on the back of each entry which eases the administration of several hundred entries, many involving more than one student. We would also like to thank teachers for their support of the competition this year, despite disruption to life and education caused by COVID-19. A total of £1270.00 was awarded to prize winners and their establishments, and several entries were awarded a commendation for the design of their web pages. Winning entries are displayed on the MiSAC web site, which includes a list of the prize-winning students and their schools. All entries which did not receive an award will have their work acknowledged by receiving a certificate of entry. MiSAC warmly thanks the BMS for generously sponsoring the competition, the students for making the competition a success and their teachers for their support. We look forward to entries for the next MiSAC competition, *Microbes made my lunch*, details of which are on the MiSAC web site, [www.misac.org.uk](http://www.misac.org.uk).