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Preliminary inventory of macrofungi in the central zone of the biosphere reserve in the Sierra Gorda of Guanajuato

Inventario preliminar de macrohongos en la zona centro de la Reserva de la Biósfera en la Sierra Gorda de Guanajuato

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Abstract

Mexico produces around 25% of total guava (*Psidium guajava* L.) in the world. The importance of the guava crops has a focus traditional and industrial; however, this point does not free the guava about the intensive use of chemical products during its production. The promoting growth plant rhizobacteria (PGPR) representig a sustainable biotechnology option to minimize that problem. In this paper is described the physiological characterization since a qualitative focus of bacteria isolated from soil of guava orchards located in Salvatierra, Gto. The tests were performed shown the metabolic profile through the BIOLOG system; also, the antibiotics resistance tesa was developed, the evaluation of phosphates solubilization, nitrogen fixation, indol production and the germination in guava seeds. The results shown that the strains have routes of action potentialof PGPR and, these are candidates to will do quantitative studies about the same aspects.

Metabolic profile, Biolog, Rizhobacteria

Resumen

México produce alrededor del 25% del total de guayaba (*Psidium guajava* L.) a nivel mundial. La importancia radica desde el punto de vista artesanal hasta el industrial; sin embargo, esto no exenta a la guayaba de ser un fruto perjudicado por el uso intensivo de productos químicos durante su producción. Las bacterias promotoras de crecimiento (PGPR) representan una alternativa biotecnológica sustentable para atenuar dicho problema. En el presente trabajo se caracterizaron fisiológicamente desde un enfoque cualitativo y con pruebas in vitro bacterias aisladas a partir de suelos de huertos de guayaba ubicados en Salvatierra, Gto. Se realizaron pruebas relacionadas con el perfil metabólico por medio del sistema BIOLOG, así como pruebas de resistencia a antibióticos, solubilización de fosfatos y germinación en semillas de guayaba. Los resultados mostraron que los aislados presentaron potenciales vías de acción de las PGPR y que son candidatas para realizar estudios cuantitativos sobre los mismos aspectos evaluados.

Perfil metabólico, Biolog, Rizobacterias

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Introduction

Macrofungi or carpophores play an important role in human life as they participate in various ecological and economic cycles. They play several important roles as they are used in industry, agriculture, medicine, the food sector as well as in bio-remediation alternatives, etc. Unfortunately, only a small fraction of them have been described and subjected to scientific scrutiny, and there are also very few documented inventories of them in the country. It is estimated that Mexico has about 10% of the world's myco-biota, with approximately 200,000 species (Gúzman, 1998), of which 6,000 species (3.5%) are known: 4,000 macromycetes and 2,000 micromycetes (Mueller et al., 2007). Particularly in the state of Guanajuato, studies on the diversity of macromycete fungi are scarce, so to know an approximate number of fungal species it is necessary to carry out an arduous search and subsequent analysis in order to have an idea of the number of species. To effectively manage natural protected areas, it is necessary to carry out specific inventories that identify the taxa and their distribution, as well as contribute to the knowledge of the natural history of the species recorded (Janzen, 1997). Considering that the State of Guanajuato has a high biodiversity of macromycetes and that knowledge and reporting on fungi is minimal, there is a need for studies to estimate the diversity of fungi in the different forest systems. This study is focused on a preliminary inventory of macrofungi in the central zone of the Biosphere Reserve in the Sierra Gorda de Guanajuato.

Methodology to be developed

Study sites. Systematic sampling was carried out during the rainy season in the limits of the municipalities of Xichú and Victoria with Charco Azul as the starting point, in the centre of the Biosphere Reserve in the Sierra Gorda de Guanajuato.

Collection of biological material. For the collection and recording of wild macromycetes, we have carried out surveys during the months that correspond to the season of maximum rainfall, mainly during the summer, in the period July-September 2012 and 2013.

Herborisation and identification of carpophores. The herborisation of the collected carpophores was carried out by taking the measurements and macroscopic characteristics corresponding to the taxonomic group (colour, characteristics of the petiole and stipe, etc.) according to Cifuentes et al. Once the main macroscopic characteristics were recorded, the fungi were dried on the same day of collection at 50-55 °C for 24 h (Vázquez-Marrufo, 2003). In addition, each specimen was photographically recorded, and record cards were filled in with morphological characteristics, chemical reactions and the use of keys and guides for identification (Arora et al., 1986; Taylor, 2002). The collected samples have been stored in cardboard containers with desiccant material for their preservation, deposited in the mycological collection of the Instituto Tecnológico Superior de Irapuato for further molecular studies.

Results

Study site. The municipality is entirely within the Sierra Gorda de Guanajuato Biosphere Reserve and has a surface area of 912.20 square kilometres (3.0% of the state's surface area).

It is bordered to the north by the state of San Luis Potosí, to the east by Atarjea, to the south by the state of Querétaro and Santa Catarina, and to the west by Victoria. Bordering the Municipality of Victoria is the community of Casitas, where the area known as Charco Azul is located, which is 15 km away along the road to San Luis de la Paz.

Registration of specimens. A total of 212 specimens were recorded, of which 165 were identified to species level (77.8%) and 47 individuals were identified only to genus level (22.17%). A total of 48 species were identified and 17 were unassigned. The species corresponded to 24 genera, 15 families and 6 orders.

Table 1 shows the number of specimens per genus recorded. As can be seen, the most represented genera are *Amanita* and *Lycoperdon* with 34 and 24 specimens respectively, *Marasmius*, *Suillus*, *Boletus*, *Russula* and *Lactarius* with abundance values between 12 and 18 specimens.

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List of species. Although there is no list of macrofungi for the study area, it is important to point out that due to the climatic, vegetation and soil conditions, the number of species must be much higher than those reported here, so that in the following years the list will surely incorporate new records for the area.

Some species were more common, such as *L. perlatum*, *L. pyriforme*, *A. pantherina*, *A. rubescens* and *F. velutipes*, accounting for 20% of the total, while other species such as *T. atrosquamosum*, *C. splendens*, *G. dryphilus*, *X. badius*, *X. chrysenteron*, *D. confragosa* and *S. esculentus* were exceedingly rare, together accounting for only 3%.

Representative specimens. Some of the most representative species are presented in Figures 1 - 5 below, together with their edibility, toxicity, and lifestyle.

Genders	No. of specimens
Lepiota	4
Lycoperdon	24
Amanita	34
Cortinarius	5
Cuptophyllus	2
Hygrophorus	2
Hygrocybe	6
Hebeloma	3
Calocybe	2
Marasmius	12
Gymnopus	1
Mycena	9
Strobilurus	1
Flammulina	10
Lepista	5
Tricholoma	4
Suillus	12
Boletus	15
Scleroderma	7
Xerocomus	2
Ramaria	14
Daedaleopsis	1
Russula	18
Lactarius	17
Aleuria	4
Total	212

Table 1 Genders and their abundances in number of recorded specimens

Genders	No. of specimens
Lepiota brunneoincarta	4
Lycoperdon perlatum	10
Lycoperdon pyriforme	7
Lycoperdon spp1	2
Lycoperdon spp2	3
Lycoperdon spp3	2
Amanita ovoidea	5
Amanita pantherina	7
Amanita rubescens	9
Amanita citrina	4
Amanita caesaria	4
Amanita virosa	2
Amanita muscaria	3
Cortinarius splendens	1
Cortinarius alboviolaceus	4
Cuptophyllus pratensis	2
Hygrophorus pudorinus	3
Hygrocybe coccinea	3
Hebeloma radicosum	3
Calocybe carnea	2
Marasmius oreades	3
Marasmius spp1	2
Marasmius spp2	3
Marasmius spp3	4
Gymnopus drypjilus	1
Mycena inclinata	2
Mycena spp1	4
Mycena spp2	3
Strobilurus esculentus	1
Flammulina velutipes	10
Lepista sordida	3
Lepista inversa	2
Tricholoma aestuans	3
Tricholoma arrosquamosum	1
Suillus luteus	2
Suillus americanus	1
Suillus bovinus	2
Suillus granulatus	4
Suillus spp1	3
Boletus radicalis	2
Boletus edulis	5
Boletus spp1	2
Boletus spp2	1
Boletus spp3	3
Boletus spp4	2
Scleroderma citrinum	4
Scleroderma spp1	3
Xerocomus badius	1
Xerocomus chrysenteron	1
Ramaria flaccida	3
Ramaria spp	6
Ramaria stricta	5
Daedaleopsis confragosa	1
Russula lepida	4
Russula vesca	4
Russula sanguinea	4
Russula fageticola	2
Russula spp1	2
Russula spp2	2
Lactarius indigo	6
Lactarius tabidus	1
Lactarius torminosus	4
Lactarius vellereus	1
Lactarius delicius	5
Aleuria aurantia	4

Table 2 List of species and number of specimens recorded for each species

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Figure 1 *Lactarius indigo*. Edible, ectomycorrhizal

Figure 2 *Ramaria flava*. Poorly Edible, ectomycorrhizal

Figure 3 *Lactarius deliciosus*. Excellent edible, ectomycorrhizal

Figure 4 *Amanita muscaria*. Hallucinogenic toxic, ectomycorrhizal

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Figure 5 *Amanita caesarea*. Excellent edible, ectomycorrhizal

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Conclusions

Macrofungi are organisms that are little studied due to their ephemeral nature. They are only generated when soil moisture and temperature conditions are adequate, especially soil moisture, so they are highly dependent on rainfall and its distribution throughout the year. In one year, they can be very abundant and the following two or three years relatively scarce, with not only the diversity but also the species represented varying.

This study presents a list of 48 species and 17 specimens that have not been morphologically identified so far, so that further studies are needed to refine their identification. With the preparation of detailed descriptions of the species so far recorded in the area, it is possible to compile a guide to mushrooms, so that it can serve as a reference and support for studies in the field of mycology. The classification into edible, toxic and deadly mushrooms, as well as their lifestyle, whether they are ectomycorrhizal symbionts, saprophytes, or parasites, will also help to make better use of these fascinating fruiting bodies.

References

Arora, D. 1986. Mushrooms demystified: A comprehensive guide to the fleshly fungi. 2nd Edition. Ten Speed Press. Berkeley, CA. USA. 959 pp.

Cifuentes, J., Villegas, M. y Pérez-Ramírez, L. 1994. Manual de Herbario. Herbario FCME. Facultad de Ciencias, UNAM. México. Gúzman, G. Inventorying the fungi of México. Biod. and Conser. 1998a. 7:369-384

Janzen, D. H. 1997. Wildland biodiversity management in the tropics. In: Reaka-Kudla, M. L., D. E. Wilson and E. O. Wilson (Eds.). Biodiversity II. Understanding and protecting our biological resources. Joseph Henry Press. Washington, DC. USA. pp. 411-431.

Mueller, G. M., Schmit, J. P., Leacock, P. R., Buyck, B., Cifuentes, J., Desjardin, D. E., & Wu, Q. (2007). Global diversity and distribution of macrofungi. Biodiversity and conservation, 16(1), 37-48.

Taylor AFS. 2002. Fungal diversity in ectomycorrhizal communities: sampling effort and species detection. Plant and Soil. 244:19- 28.

Vázquez, MG. 2003. Modificaciones estructurales y funcionales asociadas al uso forestal en el Bosque de Santa Rosa, Gto. Tesis de Doctor en Ciencias (Biotecnología de plantas). Centro de Investigación y de Estudios Avanzados - IPN, unidad Irapuato.

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