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Fungi in archaeological areas*

Abstract

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This review include the data concerning the presence of representations of fungi since prehistoric times. Particular attention is paid to their use in magical rituals, in nutrition and as a remedy for certain diseases. The work also examines some examples of megaliths whose shape recalls that of a mushroom, and the role of mushrooms in anthracological studies. Finally, data on the presence of mushrooms, some of them rare, of reforested areas and residual dune systems within the Archaeological Park of Selinunte are reported.

Key words: archaeology, anthracology, human diet, Selinunte, Sicily.

Introduction

Since prehistoric times, man has always been attracted to fungi (Karg & al. 2012), which he considered both magic elements of nature (Akers & al. 2011), a source of food (Cheung 2008) and, a remedy for various diseases (Wilford 1998).

Fungi has been also involved in ancient religious beliefs, sickness and health, religion and war. The Roman emperor Claudius was murdered, by his wife Agrippina, by poisonous mushrooms of the genus *Amanita* Pers. The fungi were also considered by some cultures as the rottenness of life while for others they were a delicious food (Bertelsen 2013). The ancient Egyptians as plants of immortality considered mushrooms, “a gift from the God Osiris” (Abdel-Azeem & al. 2016).

Many populations used mushrooms in rituals since they believed in their properties able to produce super human strength and to mitigate human fatigue (Geng & al. 2017) while Chinese culture has treasured mushrooms as a health food, an “elixir of life” (Valverde & al. 2015).

Even in the case of mushrooms, archaeological sites are an important reservoir of information (Santiago & al. 2016).

In this review paper is reported a summary of the information on the use of fungi in prehistory, anthracological research and, in ancient human diet. The presence of some interesting fungal cenosis in archaeological areas of Sicily (southern Italy) is also highlighted.

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Prehistoric use of mushrooms

Approximately 9000 years BC, the Saharan aboriginal tribes of North Africa used mushrooms (possibly *Psilocybe mairei* Singer) in magic rituals (Samorini 1992). This is testified in stone paintings by mushroom head' depiction created by Sandawe indigenous ethnic group of Tanzania and the rock art of Bradshaw in Western Australia (Pettigrew 2011).

In northeastern Siberia, Dikov (1971) discovered fungoid petroglyphs referred to the hallucinogenic *Amanita muscaria* (L.) Lam. on rocks in the Pegtymel River region.

The Spanish mural in the municipality of Villar del Humo (Spain) depict a mushroom with pileus and stipe very similar to those of *P. hispanica* Guzmán (Guzmán 2012).

The ancient Greek drink “Kykeon”, usually refers to a psychoactive compounded brew, also containing *Psilocybe* species, used at the climax of the Eleusinian Mysteries to break a sacred fast (Naples 2013). In the town of Eleusis (West Attica, Greece) there is a stele on which Persephone appears to be passing to Demeter an hallucinogenic mushroom (Wasson & al. 1978).

The native American cultures (Olmec, Zapotec, Maya and, Aztec) had symbols, statues and paintings which indicate that they consumed “teonanácatl” (*P. mexicana* R. Heim), especially during religious rituals, as a way to communicate with deities (Carod-Artal 2015). Also the tribes of Nahua, Mazatec, Mixtec were involved in mushroom use for similar reasons (Camporesi 1998).

Mushroom megaliths

Megalithic natural rock formations with the shape of mushrooms can be observed in the former regions of Macedonia, Anatolia and, Thrace. In some cases, these structures have been modified by human intervention to increase their fungal likeness (Spasova 2015). Mushrooms rock formation are also reported from Cappadocia (Turkey) (Sarıkaya & al. 2015). The “stem” is constructed by limestone and volcanic ash, while the cap is of lahar or ignimbrite. The rocks are usually ornamented with carvings, paintings and, folkloric motifs which indicate the psychoactive activity of mushrooms (Guzmán 2008).

In the archaeological site of Aryannoor (Kerala, India), the megalithic monuments known as kuda-kallu resemble mushrooms or have a parasol-shape (Samorini 1995). In modern times, these forms were taken up by the German architect Jürgen Mayer, who designed the Metropol Parasol in Seville (Spain).

Fungi in anthracological research

The remains of wood charcoals from archaeological excavations and natural deposits are very useful tools for anthracological studies in several regions (Ludemann & Nelle 2015). The fungal hyphae can be preserved within the wood charcoal after the burning process (Schweingruber 1982).

A huge number of fungi, mainly belonging to the class *Basidiomycetes*, are responsible for wood degradation (Stamets 2005). The *Basidiomycetes*, some *Ascomycetes* and Imperfect fungi, can attack both Angiosperms and Gymnosperms, and can even decompose the heartwood of living conifers (Moskal-del Hoyo 2010). Brown-rot, white-rot, and soft-rot fungi are responsible of wood decay and cause different types of morphological changes in branches (Xu & Goodell 2001), logs and, stumps (Karadelev & al. 2017a, 2017b; Venturella 2017).

The analysis of the type of decay of wood is generally possible on the basis of morphological parameters but some difficulties may occur in the case of mixed decayed patterns. This is primarily due to the interactions that occur, especially in the case of *Basidiomycetes*, between the different fungal species that colonize the wood (Boddy 2000).

A wide diversity of soil bacterial, archaeal and, fungal communities were isolated from archaeological layers in Monte Iato settlement in Sicily (Siles & al. 2018).

Fungi in ancient human diet

Dried mushrooms formed part of the human diet of archaeological populations (O'Regan & al. 2016) while Hamilton & al. (2009) reported a rare example of mushrooms-based diet in pigs during the Neolithic.

The use of mushrooms by Greek, Egyptian, Roman, Chinese, and, Mexican civilizations in diets and health has been documented throughout human history (Gargano & al. 2017). Egyptian pharaohs considered mushrooms to be food reserved only for royalty; common people were not allowed to touch them (Abdel-Azeem & al. 2016). There is clear evidence that mushrooms were used as food by hunter-gatherers in the Palaeolithic. Micro remains recognized as bolete mushrooms (*Boletus* sp.) were found in a human dental calculus in the El Mirón cave in Spain (Power & al. 2015).

The well-preserved Iceman Ötzi or Similaun Mummy from the Chalcolithic Europe (3500 - 1700 BC) carried, among the numerous items of his equipment, a “Black Matter” prepared from *Fomes fomentarius* (L.) Fr. and two objects on the leather thongs as fragments of *Fomitopsis betulina* (Bull.) B.K. Cui, M.L. Han & Y.C. Dai (Peintner & al. 1998). Ötzi certainly benefited from the antibacterial, anti-parasitic, antiviral, anti-inflammatory, anticancer, neuroprotective, and immunomodulating properties of *F. betulina* (Pleszczyńska & al. 2017). In particular, Ötzi used the medicinal mushrooms against whipworm (*Trichuris trichiura* L., 1771) infections and to purge his bowels (Dickson & al. 2000). The use of *F. betulina* as a laxative by prehistoric peoples living in Northern Europe is also reported by Wilford (1998).

Fungi in the Archaeological Park of Selinunte

The Archaeological Park of Selinunte (S.-W. Sicily) is included in the SIC (Sites of Community Interest) named “Dunal system Capo Granitola, Porto Palo e Foce del Belice” (code ITA010011) (La Rosa & al. 2007). The area is characterized by a dunal system, wetlands, reforestations with *Pinus halepensis* Mill. and *Eucalyptus camaldulensis* Dehnh, evergreen sclerophyllous vegetation with a prevalence of *Pistacia lentiscus* L. and maquis dominated by *Anagyris foetida* L. with scattered woods of *Quercus calliprinos* Webb.

In the conifers wood there is a prevalence of very common mycorrhizal species such as *Amanita ovoidea* (Bull.) Link, *Neoboletus erythropus* (Pers.) C. Hahn, *Suillellus queletii* (Schulzer) Vizzini, Simonini & Gelardi, *Suillus granulatus* (L.) Roussel and, *S. collinitus* (Fr.) Kuntze, saprotrophs [*Agaricus silvicolae-similis* Bohus & Locsmándi, *A. xanthodermus* var. *xanthodermus* Genev., *Clitopaxillus alexandri* (Gillet) G. Moreno, Vizzini, Consiglio & P. Alvarado, *Gymnopus dryophilus* (Bull.) Murrill], and parasitic [*Chroogomphus rutilus* (Schaeff.) O. K. Mill.].

The reafforestation of *E. camaldulensis* wood hosts a very interesting and infrequent species, *Lyophyllum buxum* (Maire) Singer, which is located near the coast on sandy substrates.

As far as mycorrhizal species are concerned, as already noted by Venturella & Gargano (2008), the ecological characteristics of the Mediterranean area prevent eucalyptus plants from maintaining the same number of mycorrhizal species as those found in the coastal areas of Australia.

In the sandy coastal areas, where the Mediterranean scrub vegetation is present with a prevalence of *P. lentiscus*, we can observe *Battarrea phalloides* (Dicks.) Pers., a species typical of dry, sandy localities, sunny edges, and in clearings of different types of deciduous, mixed, and coniferous woodlands (Lantieri & al. 2009) which is included in Armenia, Austria, Czech Republic, France, Germany, Hungary, FYR Macedonia, Poland, Serbia, Spain, and, UK Red Lists.

The presence of *B. phalloides* along the sandy coasts of southern Sicily confirms the mycological affinities between these areas and similar environments of the coasts of North Africa and Tunisia in particular (Ouali & al. 2018).

A few number of basidiomata of *Xerula mediterranea* (Pacioni & Lalli) Quadr. & Lunghini were collected in the rear dunes characterized by vegetation belonging to *Crucianelletalia maritimae* Sissing 1974.

Discussion and Conclusions

In conclusion, it can be said that mushrooms accompany man in his evolution. They contribute at various levels to the historical reconstruction of events that occurred in archaeological sites. Their presence on various substrates confirms the high diversity of these organisms, which represent the largest group present in nature after insects.

In the case of the Archaeological Park of Selinunte, since the mushrooms are mainly located near the residual dune systems, it is necessary to strengthen the actions of protection and conservation of these habitats in order to preserve their integrity and trying to put a stop to the progressive anthropization and erosion. The actions to be taken for the protection of the wooded areas inside the archaeological sites are also necessary because, although they are mainly represented by exotic species, they host a rich contingent of fungal species, some of which are infrequent.

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