Biology, Food, Medicinal, and Biotechnological Applications of the Tropical Mushroom *Pleurotus tuberregium* (Rumph.:Fr.) Singer

Omoanghe S. Isikhuemhen,[1] Paul Stamets,[2] & Rytas Vilgalys[3]

[1]Mushroom Biology and Fungal Biotechnology Laboratory, School of Agriculture and Environmental Sciences, North Carolina A&T State University, Greensboro, NC 27411, USA;
[2]Fungi Perfecti LLC Research Laboratories, 50 SE Nelson Rd., Shelton, WA 98584, USA;
[3]Department of Biology, Duke University, Durham, NC 27708, USA

Pleurotus tuberregium (Syn. *Lentinus tuberregium*), a tropical Basidiomycete, is the only species of *Pleurotus* known to produce fruit bodies from a true sclerotium. *P. tuberregium,* often collected in the field growing on decaying logs, can also be cultivated on many different lignocellulosic substrates. Fruit bodies can be found growing out of the sclerotia in the wild and can be induced to do the same if subjected to soaking followed by exposure to warm temperature and humid conditions. This fungus is reported to be distributed in most of equatorial Africa, Madagascar, India, Sri Lanka, South East Asia, Papua New Guinea, New Caledonia, and Northern Australia.

Until recent times, the taxonomic position of *P. tuberregium* has been problematic. The leathery fruit bodies and dimitic hyphal system with intercalary skeletal hyphae possessed by this fungus led authorities such as E. J. H. Corner and D. N. Pegler to place *P. tuberregium* in the genus *Panus* and *Lentinus,* respectively. However, more recent studies have shown *P. tuberregium* to have nematotoxic abilities, which supports the classification of this fungus in the genus *Pleurotus* by R. Singer in 1986. Molecular systematics using ribosomal DNA sequences have shown *P. tuberregium* to be nested with the genus *Pleurotus*.

Phylogeny studies of *P. tuberregium* based on ITS sequences have shown that the African isolates studied showed very little variation, indicating a homogenous gene pool of *P. tuberregium* in Western Africa. In contrast, there was more gene flow in the Australasia–Pacific region, which could suggest that the origin of diversification for *P. tuberregium* is the Australasia–Pacific region.

In nature, during the early months of the rainy season, sporophores germinating from fruit bodies discharge spores. These spores, having adequate humidity and warmth in the environment, germinate and seek compatible mates to combine with and begin the dominant dikaryotic mycelia stage in their life cycle. The life cycle of *P. tuberregium* is different from most other Basidiomycetes in having the sclerotial stage between the mycelia stage and fruit body formation. However, we have also observed in nature and in the laboratory that the genetic background and substrate conditions can cause some isolates of *P. tuberregium* to go from the mycelia stage directly to sporophore formation. Field observations and laboratory studies have revealed that *P. tuberregium* is a white rot fungus that secretes laccase- and manganese-dependent peroxidase as its main enzymes used in lignin degradation. Cultivation studies have also shown that *P. tuberregium* can grow on virtually any lignocellulosic substrate to produce sclerotia and sporophores.

The advantage derived from this quality is the possibility of mass producing the highly-sought-after

FIGURE 1. Sclerotium of *Pleurotus tuberregium* (Rumph.: Fr.) Singer.

sclerotia in West Africa, where until recent times, collection from the wild was the only source.

Also, the understanding of the breeding pattern, which is tetrapolar, as well as breeding and selection studies have led to the development of improved strains for use in commercial cultivation of this fungus. Similarly, its high temperature requirements in addition to its ability to degrade many lignocellulosic substrates has made it a potential candidate for biotechnological approaches to waste recycling and bioremediation of recalcitrant pollutants.

There are many reports that document traditional uses of *P. tuberregium* for food and medicine in Africa. Nutritional analysis has shown both sclerotium and sporophores of *P. tuberregium* to be an excellent source of protein, carbohydrates, and essential minerals. Scientific studies into the medicinal properties of *P. tuberregium* are active areas of research today. Extracts from sclerotia of *P. tuberregium* have been shown to have antibacterial and antitumor activities. Protein-bound polysaccharides isolated from *P. tuberregium* have been shown to have high antitumor activities against Sarcoma 180. Liquid cultivation of mycelia of *P. tuberregium* has been reported. Mass production of mycelia in bioreactors in developed countries and sclerotia in developing countries, where adequate environmental conditions prevail, will be the source of materials from *P. tuberregium* needed in medicinal products preparation and biotechnological applications.