PRESENT AND FUTURE: SEARCHING FOR NATURAL OCCURRING STRAINS FOR MUSHROOM PRODUCTION

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New strains and new species

One of the problems in mushroom production is that commercial strains sometimes decline in their production performance after several consecutive subcultures or a long period of storage in culture medium, leading to a reduction in yield. Biological efficiencies (BE) may sometimes be increased by optimization of cultural conditions, such as combining different substrates or adding nutritional supplements. However, these practices are not always successful in recovering the production of a commercial strain’s performance. An alternative solution for coping with declining productivity of a long-used strain could be collecting and evaluating new natural occurring strains, that are more productive with more desirable quality aspects. Additionally, there are many edible mushrooms, worldwide, that are mostly known and consumed by “micophagous” people in each region. It is also interesting to use this “popular knowledge” and search for these “new” naturally occurring species that could be intensively produced in mushroom farms increasing the availability of new mushroom products. This is the primary reason why, during the last several years, we made many field trips to study and collect some of the indigenous mycobiota of Argentina (Wright & Albertó, 2002, Wright & Albertó 2006).

The cultivation of *Agaricus pseudoargentinus* Albertó & Wright

Several years ago, we collected and named a new species of *Agaricus* (A. *pseudoargentinus*, Albertó & Wright 1994). In order to obtain fruitbodies of wild edible mushrooms of the genus *Agaricus*, six naturally occurring species from the environs of Buenos Aires (Argentina), *A. bisporus*, *A. campestris*, *A. fiardii*, *A. nivescens*, *A. pampeanus*, and *A. pseudoargentinus* were cultured under growing conditions similar to those required by *A. bisporus*. All strains grew well on sterile wheat grains, allowing optimum spawn production (Albertó 1997). Colonization of compost took between 11 and 18 days after spawning. Only *A. bisporus* and *A. pseudoargentinus* produced fruit bodies. *A. pseudoargentinus* produced pin-heads after 42 days of casing and developed fruitbodies at 18°C but with low yield (Fig. 1), reaching 230g/10 kg of compost (Albertó 1995).
The cultivation of *Lentinus tigrinus* (Bull.) Fr

*Lentinus tigrinus* was originally described as *Pleurotus lindquistii* by Singer (1960) as growing on trunks of *Salix humboldtiana* in the marginal rain forest of Río de la Plata (Buenos Aires). It was transferred to the genus *Lentinus* by Lechner & Albertó (2000). *Lentinus tigrinus* is a species with a fleshy pileus, strong odor and agreeable taste. In order to determine the optimal conditions for the production of this species, three substrates based on *Salix* sp. sawdust, wheat straw and supplements were tested in 500 g dry weight bags at two different fruiting temperatures. Naturally occurring strains of this species were incubated at 30ºC. Primordium initiation could be observed 11 to 16 days after induction conditions began. This species produced highest yields with biological efficiency (BE) of 62% with supplemented sawdust at 25ºC. When substrate in bags was reduced to 100 g dry weight, spawning run time was reduced from 28 to 30 days to 10 to 14 days and BE increased to more than 100% (Lechner & Albertó 2007).

The cultivation of *Polyporus tenuiculus* (P. Beauv.) Fr.

*Polyporus tenuiculus* is a naturally occurring species from Central and South America (Borgues & Wright 2002) that is consumed by different ethnic groups in the region. To determine the optimal conditions for fruiting body production, two strains were assayed on wheat straw and sawdust with and without supplements. Incubation (60 d) at 25ºC was needed to produce a solid block. The highest yield was obtained with supplemented willow sawdust. In a second experiment, different supplements were used to improve BE and to
determine quality traits and biodegradation capacity. Highest yields were obtained on sawdust with 25% supplement reaching 83% BE. *P. tenuiculus* showed a capacity to degrade sawdust, causing a decrease of 67-75% cellulose, 80-86% hemicellulose and 61-66% lignin content at the end of the cultivation cycle (Omarini et al. 2009). This species can also be produced on logs (Fig. 2) using wood of *Populus* sp. and *Eucalyptus* sp. (Albertó & Omarini 2012). This is a promising species both for commercial production and for its potential use in the degradation of other biowastes. A sensory analysis also was made and compared with *P. ostreatus* (Omarini et al. 2010a). Also, volatile composition and nutritional quality of this species grown on different agro industrial waste was determined (Omarini et al. 2010b).

Fig. 2. Production of *Polyporus tenuiculus* on logs.
The cultivation of *Pleurotus albidus* (Berk.) Pegler

*Pleurotus ostreatus* has been commercially cultivated in Argentina for about 30 years. The majority of farmers use wheat straw as a substrate that is pasteurized by steam or hot water (Jaramillo & Albertó 2013).

In Argentina there are, so far, six species of *Pleurotus*, namely *P. albidus*, *P. cystidiosus*, *P. ostreatus*, *P. pulmonarius*, *P. rickii* and *P. djamor*, the latter with three varieties: var. *djamor*, var. *cyathiformis* and var. *roseus* (Lechner et al. 2004, Lechner et al. 2005). Yield values and morphological variations of fruitbodies obtained from the cultivation of fourteen *Pleurotus* strains isolated from naturally occurring specimens from Argentina were evaluated on supplemented Salix sawdust, wheat straw (W) and supplemented wheat straw (SW). The species studied were *Pleurotus albidus*, *P. cystidiosus*, *P. djamor*, *P. ostreatus* and *P. pulmonarius*. In general, wild strains had a reasonable performance on W or SW. The highest yield was obtained with *P. albidus* on wheat straw with a BE of 171% compared to 82% BE obtained for the commercial strain of *P. ostreatus* in the same substrate. It was also possible to find a strain of *P. ostreatus* with better BE than the commercial strain evaluated. Because of the high yields and the good quality of mushrooms obtained, we proposed *P. albidus* as a new species for intensive industrial cultivation (Lechner & Albertó 2011). This species, characterized by the white, circular to infundibuliform pileus with a margin entire to lacerate-crenate (Albertó et al. 2002) requires culture conditions similar to those of *P. ostreatus*. It will allow farmers to cultivate it without new requirements or larger investments allowing for expansion of the variety of products available to consumers.

Improvement of yields of *Agrocybe cylindracea* (Brig.) Singer

*Agrocybe cylindracea* is an excellent edible mushroom appreciated for its culinary properties and pleasant odor. This mushroom is known worldwide as *A. aegerita*, although we use the name *A. cylindracea* because this is the correct name (Uhart & Albertó 2007). We made an evaluation of genotypes and substrates to select the most productive strains. Commercial and naturally occurring *A. cylindracea* strains (12) from different continents were cultivated on wheat straw in order to compare their BE. Those strains that achieved highest yields were tested with different supplements. The Asiatic naturally occurring strain cultivated with soybean flour as a supplement achieved an average BE of 179% (Fig. 3), to our knowledge the highest reported for this species (Uhart et al. 2008).

Naturally occurring species could be a very important and large source of “new” germplasm to be cultivated worldwide. Providing high quality, functional food with fungal proteins would be distinct advantage for consumers.

Many naturally occurring strains could offer adaptive advantages to be locally produced, such as disease resistance or capacity to be cultivated in extreme conditions of temperature and humidity. Therefore, we propose the study of naturally occurring species as a useful practice to improve yields, to introduce new species to markets and to serve as a back-up for commercial germplasm of fungal species.
Fig. 3. Production of *Agrocybe cylindracea* on supplemented wheat straw.

**REFERENCES**


