



A WORKING GROUP FOR FAIR PROTECTION OF BUTTON MUSHROOM VARIETIES

Dr. Jean Michel Savoie
INRA, UR1264, Mycology and Food Safety,
BP81, F-33883 Villenave d'Ornon, France
savoie@bordeaux.inra.fr

Growers and spawn makers continuously search for varieties and strains of mushrooms with improved qualities. The sought after qualities may be found in wild strains of the species, but they are unlikely to be found in a combination that is commercially desirable [1]. It is possible to combine the desirable traits through selective breeding, but breeding usually requires considerable investment in time and resources. Consequently, breeders may be reluctant to commit to the development of a new variety if they know it will be difficult to cover their investment due to lack of protection of the new variety or strain. On the other hand, patenting living organisms that are used for human food that could contribute to improved food security is a subject of discussion from an ethical point of view. During the 7th International Conference on Mushroom Biology and Mushroom Products (ICMBMP7) hosted by the INRA research group in Arcachon (France) in 2011, a round table discussion was held on "Regulation for the protection of new mushroom varieties". A representative of the International Union for the Protection of New Varieties of Plants (UPOV) was invited to the discussion. UPOV is an intergovernmental organization established by a convention in Paris in 1961 that was most recently revised in 1991.

UPOV's mission is "to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society". It is not well known, but edible mushroom varieties may be protected in most countries via the UPOV convention.

UPOV grants to breeders an intellectual property right differing from patents. There are no restrictions on who may be considered a breeder under the UPOV system: a breeder might be an individual, a farmer, a researcher, a public institute, a private company, etc...

MEMBERS OF THE INTERNATIONAL UNION FOR THE
PROTECTION OF NEW VARIETIES OF PLANTS
International Convention for the Protection of New Varieties of
Plants

Albania - Argentina - Australia - Austria - Azerbaijan - Belarus - Belgium - Bolivia (Plurinational State of) - Brazil - Bulgaria - Canada - Chile - China - Colombia - Costa Rica - Croatia - Czech Republic - Denmark - Dominican Republic - Ecuador - Estonia - European Union - Finland - France - Georgia - Germany - Hungary - Iceland - Ireland - Israel - Italy - Japan - Jordan - Kenya - Kyrgyzstan - Latvia - Lithuania - Mexico - Morocco - Netherlands - New Zealand - Nicaragua - Norway - Oman - Panama - Paraguay - Peru - Poland - Portugal - Republic of Korea - Republic of Moldova - Romania - Russian Federation - Serbia - Singapore - Slovakia - Slovenia - South Africa - Spain - Sweden - Switzerland - The former Yugoslav Republic of Macedonia - Trinidad and Tobago - Tunisia - Turkey - Ukraine - United Kingdom - United States of America - Uruguay - Uzbekistan - Viet Nam.

<http://www.upov.int/portal/index.html.en>

For consideration for protection as a new variety, variety A must satisfy three criteria for the DUS (**D**istinctiveness, **U**niformity, and **S**tability) system as follows:

- Breeder exemption: anyone can use variety A for breeding of a new variety (by crossing with another variety). Authorization is not required.
- Experimentation and Research are free with variety A.
- No restriction for private use and for non-commercial purpose; for example, use by amateur gardeners and subsistence farmers.

This system might be a compromise between the protection encouraging breeders to develop new varieties by expecting a return on investment, and the global qualitative and quantitative improvement of food production as common public goods that should benefit the welfare of mankind.

The protection of varieties of the button mushroom, *Agaricus bisporus*, concerns breeders. The first hybrid *A. bisporus* strains (Horst-U1, -U3) were developed in The Netherlands in the 1980's. In recent studies using microsatellite markers or SNPs, it was shown that almost all hybrids commercialized over the last 20 years have no or very few differences with U1 or U3 [2, 3]. However, they are not all direct copies. In hybrids that seemed to be genetically identical to Horst-U1 at the heterokaryotic level, the analyses of each constituting nuclei have demonstrated allelic rearrangements [2]. Are these allelic rearrangements the result of significant work of a secondary breeder that could enter in the breeder exception of the UPOV breeder's rights?

Due to the life cycle of *A. bisporus*, most of the spores produced by a fruiting body are heterokaryotic containing compatible nuclei and are able to produce fruiting bodies without first mating. These spores are produced after a short phase of karyogamy followed by meiosis separating the two nuclei (Fig. 1). During these events, allelic rearrangements may occur and lead to small changes in the phenotype of the fruiting bodies arising from the spore, without changes in the genetic background. New phenotypes can be selected after a round of screening, but they are directly derived from the genotype giving the spores used. When the genotype at the origin of the new derived phenotype is a hybrid, is this selection work enough to not infringe the rights of the first breeder who obtained the hybrid? This kind of question was taken into account in the 1991 revision of the UPOV convention by including the Essential Derived Varieties (EDV) in the Breeder's Rights.

Consequently, the secondary breeder producing an EDV has to negotiate with the primary breeder before selling it as a new variety, but defining when there is an essential derivation between two varieties is not so easy. To prevent further conflicts and long procedures, a consensus has to be generated within the mushroom industry on the definition of an EDV and how to demonstrate its statute. This has been done by a number of seed federations with definitions of what should be considered as an EDV adapted to the biology of their species. For initiating the thought with *A. bisporus*, a working group has recently been formed in Europe with representatives of research

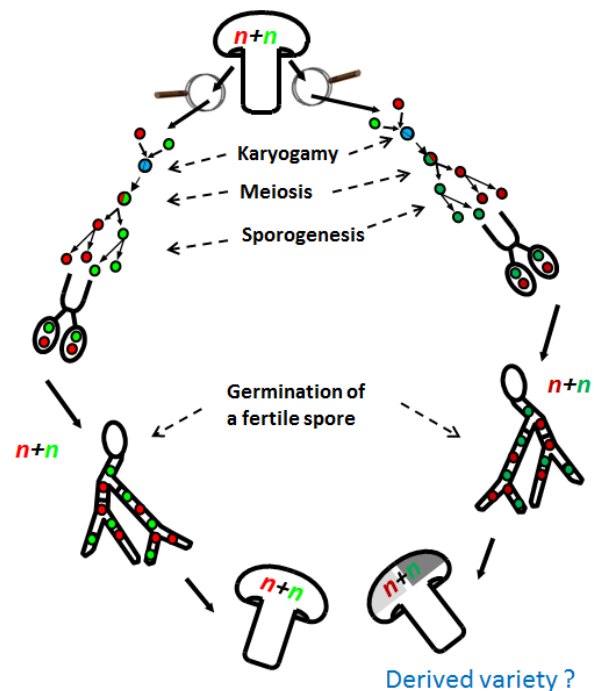


Fig. 1. Dominant Life cycle of *Agaricus bisporus* in which derived varieties can be obtained from fertile spores, without sex.



groups of Wageningen UR (The Netherlands) and INRA Bordeaux (France), and of the spawn industry: Amycel, Limgroup, Sylvan.

The intention of the working group is to publish a position paper in a scientific journal that describes how EDVs can be generated due to the typical life cycle of *A. bisporus* and to propose delimitations of EDV definition. It would be used as a reference for protection of new varieties to be delivered in the future after its publication, but it will have no consequence on present-day varieties. With this initiative the ambition of the working group is to generate worldwide support on the EDV issue for the button mushroom. Relevant parties are encouraged to share their views and contribute to the activities of the working group. Comments from readers of the Bulletin of the World Society for Mushroom Biology and Mushroom Products are most welcome.

The contact person of the working group is:

Dr. Anton S.M. Sonnenberg

Wageningen UR

P.O. Box 16

6700 AA Wageningen

The Netherlands

Phone: +31 317 481336

Email: anton.sonnenberg@wur.nl

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