

Basidioma Development and Mating System Analysis of Somatic Hybrids by Protoplast Fusion in Edible and Medicinal Mushrooms

Young-Bok Yoo, Gyu-Hyun Kim, Kang-Hyo Lee, Beom-Gi Kim, Pyung-Gyun Shin, Won-Sik Kong, and Kab-Yeul Jang

Applied Microbiology Division, National Institute of Agricultural Science and Technology, RDA, Suwon 441-707, South Korea

The major species of *Pleurotus* are tetrapolar heterothallisms. Single basidiospore isolates are homokaryotic and self-sterile. Somatic hybrids of intercompatible and interincompatible strains were obtained by protoplast fusion. The fusion products of compatible strains, *Pleurotus ostreatus* (Jacq.: Fr.) Kumm. and *P. ostreatus* f. *florida*, formed heterokaryons, while fusants of incompatible strains such as *P. ostreatus cornucopiae* (Paul.) Roll. + *P. f. florida*, *P. ostreatus* + *Ganoderma applanatum* (Pers.) Pat., *P. ostreatus* f. *florida* + *Ganoderma lucidum* (Curt.: Fr.) P. Karst., and *P. ostreatus* + *Flammulina velutipes* (Curt.: Fr.) P. Karst. formed synkaryons that retained genes from both parents.

Induction of basidiomata was attempted on sawdust substrates containing poplar tree added to rice bran in a 1000-ml glass bottle. To obtain primordia, the mycelia in a bottle with cotton plug were exposed to high intensity white light for 20–60 days at 5–15°C. Out of 377 synkaryons, 35 somatic hybrids induced poor fruiting bodies similarly to homokaryotic strains. Phenotypes of fruiting bodies in synkaryons were similar to either one of the fusion partners. Only some genetic characters including fruiting body morphology and pileus color were more or less different from parental strains. All of the basidiocarps of synkaryons formed clamp connections.

To determine the mating system analysis of somatic hybrids and wild *P. ostreatus*, single-spore isolates from each basidioma were paired in

all possible combinations. A tetrapolar mating system was found among monospore isolates in somatic hybrids and wild-type *P. ostreatus*. Four mating types were found in a single basidioma and pairings of somatic hybrids' between them yielded 25% fertility as with the normal wild type of *P. ostreatus* strain. Homokaryons from each somatic hybrid combination were paired with tester homokaryons of the initial wild type of *P. ostreatus* and *P. ostreatus* f. *florida*. The changed mating types were identified in the somatic hybrids' progeny. The pattern of mating type switching in somatic hybrids depends on the compatibility of the fusion partner. There are several factors related to the mechanism of clamp connection formation and fruiting body development of synkaryons. A major one may be associated with self-fertility and mating type switching as in homokaryotic fruiting of wild-type *P. ostreatus*. Gene expression during emergence of clamp connections in synkaryons may be linked to mating type switching. This is related to the function of heterokaryotization of synkaryons without transfer of mating type genes or nuclei, and eventually leads to the differentiation and development of mature fruiting bodies. These results indicate that basidioma development and mating system pattern of somatic hybrids between incompatible species were similar to those of self-fertile homokaryons of wild-type *P. ostreatus*. This review discusses these aspects.