Growth of Medicinal Mushrooms (MMs) on maize cobs with different pigmentation: NovEl biotechnological approaches to valorize Maize by-Products (NETMAP)

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Background:
Medicinal mushrooms (MMs) are gaining attention for their content of bioactive compounds whose effects are relevant for human health. The possibility to exploit cultural residues for the fungi cultivation represents a challenge to enhance the commercial use of MMs. Moreover, these different growth substrates may have positive impact on the fungi development with effects on their activities and final composition. Maize landraces are an important source of genetic variants for adaptation to specific environment and have high nutritional value. They are rich in secondary compounds and often show characteristic pigmentations of kernels and cobs. Nevertheless, their cultivation in small-scale farming does not allow an efficient recycling of their residues, like corncobs that could instead represent an interesting material for alternative uses.

Objectives - The research aims at developing a high value-added ingredient with interesting nutritional properties, obtained by growing MMs on corncobs of traditional Lombard maize varieties. Investigation will highlight whether and to what extent MMs bioactivities are maintained up to the production of the functional ingredient.

Methods - Local maize varieties with different cob pigmentation (Spinato di Gandino, Rostrato Rosso di Rovetta, Spinoso Nero Valle Camonica, Fiorine di Clusone) and the B73 inbred line were field grown. The harvested cobs to be used as growth substrate have been characterized for fiber and a few secondary metabolites contents both before and after the fungi growth and used as growth substrate. Solid State Fermentations (SSFs) were set-up employing the MMs *Pleurotus ostreatus*, *Ganoderma annularis*, *Flammulina velutipes* and *Lentinula edodes*: trials were first carried out in small jars using sterile chopped corncobs; the best performing strains were subsequently grown in boxes equipped with a semipermeable gas membrane. Fungal growth was measured periodically acquiring the SSF surface image, applying a pre-processing step. β-glucans were determined through the Mushroom and Yeast β-glucan assay kit (Megazyme).

Results: among corncobs, Spinoso Nero Valle Camonica showed the highest content of lignin, total monomeric antocyanins as well as the highest presence of free phenols with high antioxidant activity while Rostrato Rosso di Rovetta has the highest content of phenolic compounds, mainly present in a bound form. Among MMs, *Pleurotus* and *Ganoderma* had the best growing performances as indicated by the Image Analysis that proved a successful tool to monitor and characterize the mycelial growth on SSF. *Ganoderma* was found to grow immediately after the inoculum (no lag phase), while *Pleurotus* showed a lag phase,

possibly required to activate inducible lignocellulose-degrading enzymatic activities, as suggested also by its slow and reduced growth on corncobs of Spinoso Nero Valle Camonica landrace.

Conclusions: results will provide new insights on the role of fungal biomass in enhancing the nutritional and functional properties of food, considering the potential impact of processing conditions and/or the interactions with other maize components, on the functional and technological properties of the final product. The assessment on whether and to what extent the new product will be accepted by consumers will also represent an innovative NETMAP feature.