

Molecular evaluation of some *Amanita ponderosa* and the fungal strains living in association with these mushrooms in the southwestern Iberian Peninsula

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Received: 25 June 2013 / Accepted: 29 October 2013
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Abstract *Amanita ponderosa* are wild edible mushrooms that grow only in some microclimates, particularly those in the southwestern part of the Iberian Peninsula. Due to the vast diversity of mushrooms in nature, as well as nutrient variability, which is highly dependent on soil type and environmental conditions, it is essential to be able to characterize fungal microbiota that lives in association with mushrooms and to differentiate *A. ponderosa* strains of different regions for certification purposes. In this study, we characterized the genetic profile of *A. ponderosa* mushrooms and the fungal strains that live in association with them in their natural habitat and compared the fingerprinting profiles obtained by M13-PCR amplification of the genomic DNA. We found that the predominant fungal isolates living in association with *A. ponderosa* were *Aspergillus* spp., *Penicillium* spp. and *Mucor* spp. M13-PCR molecular analysis showed that different fungal isolates had different genetic profiles. This approach allowed us to differentiate the different fungi strains isolated from fruiting bodies of *A. ponderosa* both rapidly and in a reproducible manner and to group them according to genus. Our fingerprinting analyses also distinguished different *A. ponderosa* mushrooms collected from different regions. Consequently, we conclude that

this method is a very discriminatory approach for differentiating both *A. ponderosa* from different sites and the fungal microbiota that lives in association with these mushrooms.

Keywords *Amanita ponderosa* · M13-PCR · Molecular profile · Wild edible mushrooms · Fungal microbiota

Introduction

The commercial harvesting of edible mushroom is an economically important business in many rural areas of some countries. Edible mushrooms are widely consumed due to their organoleptic properties, such as their texture, attractive taste and flavor (Agrahar-Murugkar and Subbulakshmi 2005; De Pinho et al. 2008; Zawirska-wojtasiak et al. 2009; Guillamón et al. 2010), their chemical composition, with a high content of protein, dietary fibre and vitamins E, B, C and D and low levels of sugar and fat, and their high mineral content, namely calcium, phosphorus, iron, potassium, selenium and cadmium (Vetter 2005; Ouzouni et al. 2007; Guillamón et al. 2010; Beluhan and Ranogajec 2011; Reis et al. 2012). In addition to their nutritional value, some edible mushrooms are known for its medicinal properties (Barros et al. 2007; Barros et al. 2008; Vaz et al. 2011; Liu et al. 2012; Pereira et al. 2012). Therefore, the consumption of edible wild-growing mushrooms has been very popular. However, as some species are highly toxic and their consumption dangerous to human health, it is very important to be able characterize wild mushrooms for certification purposes.

The genus *Amanita* Pers. is one of the best known and most characteristic genera within Agaricales Clem. and comprises edible and poisonous mushrooms that are distributed throughout the worldwide. They occupy primarily a mycorrhizal habit and play a significant role in forest ecosystems (González et al. 2002; Moreno et al. 2008). This genus has

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