

Investigation of the electrostatic charge of basidiospores of the *Phellinus igniarius* group

Research Article

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Abstract: The polarity and magnitude of primary electric charges carried by basidiospores in the airborne state were investigated in living fungal fruiting bodies under natural forest conditions using a portable experimental device designed by the author. The operating principle was the falling of spores in the homogeneous horizontal electric field. The vertical and horizontal components of the trajectories of the spores were determined according to their deposition sites on electrodes (vertical metal plates). Altogether 33 samples of spores were examined for polarity, 10 of these samples (with 10^4 – 10^6 spores per sample) also were used to calculate the mean spore charge-to-mass quotient and the mean spore charge. The detection limits of spore charge-to-mass quotient varied in the range from $(4.9 \pm 2.3) \times 10^{-5}$ to $(1.36 \pm 0.33) \times 10^{-4} \text{ C kg}^{-1}$. Basidiospores (subglobose, smooth, diameter of 4–6 μm) of the closely related (sibling) species *Phellinus alni*, *P. nigricans*, *P. populicola* and *P. tremulae* (Hymenochaetales, Basidiomycota) carried positive electrical charges that have mean values from 48 to 305 elementary charges. The intraspecies variation of the spore charge could depend on the natural variation in spore size.

Keywords: Ballistospore • Charge/mass ratio • Charge-to-mass quotient • Electric charge • Hymenochaetales • Primary charge

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1. Introduction

A hundred years was needed to discover all paramount elements of the ballistosporic discharge mechanism of basidiospores [1,2]. Already at the very beginning of investigations of this mechanism, the presence of electrostatic charges on basidiospores upon launching from sterigmata was found [3]. The next study on primary electrostatic charges on ballistosporic basidiospores [4] showed that the majority of spores carried positive electrostatic charges in some species, whereas the majority carried negative electrostatic charges in other species. Then the mean spore charge-to-mass quotient and the mean spore electrostatic charge were measured experimentally in *Serpula lacrymans* (Wulfen) J. Schröt. [5]. The fourth and last experimental study on spore electrostatic charges [6] gave the extreme and mean values of the spore charge-to-mass quotient and spore electrostatic charge for ten species. The concept that electrostatic charges may play a role in the process of spore release [4] was rejected when the forces maintaining the spore release were calculated

[5,6]. Now, after the discovery of the paramount elements of the discharge mechanism, it is clear that spore release is maintained by surface tension forces. Present knowledge on the discharge is incomplete. For example, it is not clear how the osmolytes are delivered to the spore surface in a sufficient concentration to act as nuclei for the condensation of water [7]. New ideas for completing the knowledge of the ballistospore discharge mechanism in Basidiomycetes may be identified when the basic aspects of electrostatic charges are better understood. Detailed information about electrostatic charges would help to estimate the role of basidiospores in atmospheric processes. Contribution of fungi to primary biogenic aerosols in the atmosphere is studied intensively at the present time [8,9].

Despite the fact that the studies of Buller, Gregory, Swinbank *et al.*, and Webster *et al.* [3–6] include data on electrostatic charges in 15 species, information on both the magnitude and the polarity of charges exists only in three species. In most species, either the magnitude (in 7 species) or the polarity (5 species) was recorded. The bulk of the data were found using small spore samples

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