SMALL AND HANDY -
The personal particle sampler

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Introduction

Pollen data from stationary 7-day volumetric spore traps (Hirst type) are worldwide used for pollen forecasts, for diagnostics and for therapy of pollen allergies as well as backgrounds for pollen exposure of study subjects during clinical studies. However, pollen exposure of individuals varies permanently due to human spatial mobility and due to distribution of pollen sources (Werchan et al. 2017). Therefore, even the nearest pollen station may not adequately reflect individual´s pollen exposure. To gain more realistic data about pollen exposure of individuals, a small personal particle sampler (PPS) was developed.
The main aim of the study is the validation of the PPS against the standard pollen monitoring method by a Burkard trap.

Objectives

The PPS (Fig. 1) works on the same volumetric principle as stationary traps – it sucks air through an orifice inside the device on an adhesive medium (stripe with silicon). The sampler is small and light - 13 cm × 2 cm × 2 cm and 94 g - equipped with a rechargeable battery, GPS, sensors and with possibility to adjust sampling intervals (Werchan et al. 2016, Sehlinger et al. 2017). A PPS (with flow rate of 2 or 4 l/min) was mounted on a Burkard trap running parallel during sunny days for 2 to maximal 10 hours per day during spring and summer of 2016. Exposed stripes of the PPS were stained and fully analyzed under a microscope with a 400x magnification. From the stained stripes of the Burkard trap 4 horizontal lines were analyzed (equivalent to 7,1 % of the surface area).

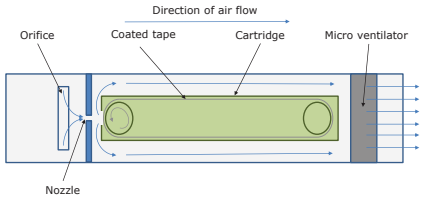

Fig 1) Functional structure of the PPS in detail. The rate of air flow depends on the voltage of the battery (3 V = 2 l/min; 5 V = 4 l/min) and the configuration used. PPS is equipped with sensors for temperature, relative humidity and barometric pressure and can record data continuously.

The PPS with exchangeable cartridge

The PPS with installed cartridge

Test setup PPS and Burkard trap for comparative measurements. The orifice of the Burkard trap and the PPS are orientated equally

First Results

The first evaluation data of the PPS show appropriate correlations with data from a stationary volumetric pollen trap. In simultaneous measurements in ambient air the following average ratios between PPS and Burkard trap were determined: birch pollen 1 to 1.7, grass pollen 1 to 2.4, pine pollen 1 to 2.1 and Alternaria spores 1 to 2.2 (Fig. 2 – Fig. 5). The validation requires additional measurements and needs to be completed for further pollen types in order to be reliable.

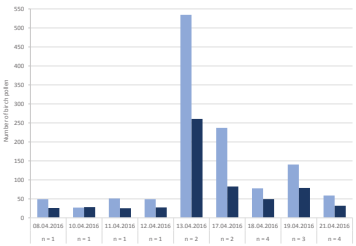

Fig 2) Comparison of average concentrations (n/m³) of ***Betula*** (birch) pollen between Burkard trap (in light blue) and PPS (in dark blue) during nine days in April 2016 at the Charité reference station; n = number of bi-hourly values for the day

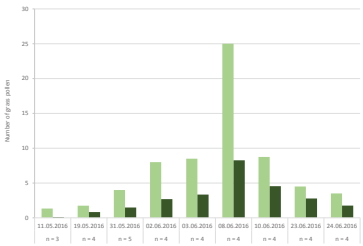

Fig 3) Comparison of average concentrations (n/m³) of ***Poaceae*** (grass) pollen between Burkard trap (light green) and PPS (dark green) during nine days in May and June 2016 at the Charité reference station; n = number of bi-hourly values for the day

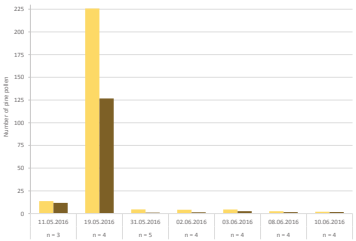

Fig 4) Comparison of average concentrations (n/m³) of ***Pinus*** (pine) pollen between Burkard trap (in yellow) and PPS (in brown) during seven days in April and May 2016 at the Charité reference station; n = number of bi-hourly values for the day

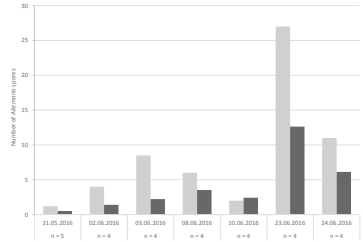

Fig 5) Comparison of average concentrations (n/m³) of ***Alternaria*** spores pollen between Burkard trap (in light grey) and PPS (in dark grey) during seven days in May and June 2016 at the Charité reference station; n = number of bi-hourly values for the day

Conclusion and Perspectives

The PPS may be a promising tool for assessing reliable data about pollen and fungi exposure of individuals in their day to day life without disturbing measurements by a big and noisy device.
The measured pollen concentrations together with the GPS sensor for position recording during the measurements and a PPS App to log allergy symptoms allows to correlate pollen exposure type and intensity with type and severity of the allergic symptoms and even with the location the exposure occurred. The analyzed data would possibly allow evaluating an individual's pollen threshold, therefore being able to accurately forecast an individual's symptoms and it would allow a better assessment of immunotherapy in field trials.

In relation to this presentation, I declare the following, real or perceived conflicts of interest: MW has no conflict of interest, TS is the CEO of Pectolite GmbH and Bluestone Technology GmbH and KCB is member of Pectolite GmbH.

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