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Common Ragweed (Ambrosia artemisiifolia): Changing Proteomic Patterns of Pollen under Elevated NO_2 Concentration and/or Future Rising Temperature Scenario

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Abstract : Ragweed (Ambrosia artemisiifolia) is an invasive weed that has become an increasing global problem. In addition to affecting land use and crop yields, ragweed has a strong impact on human health as it produces highly allergenic pollen. Global warming will result in an earlier and longer pollen season enhanced pollen production and an increase in pollen allergenicity with a negative effect on atopic patients. The aims of this study were to investigate the effects of increasing temperature, the future climate scenario in the Munich area, southern Germany, predicted on the basis of RCP8.5 until the end of 2050s, or/and NO_2, a major air pollutant, 1) on the vegetative and reproductive characteristics of ragweed plants, 2) on the total allergenicity of ragweed pollen, 3) on the total pollen proteomic patterns. Ragweed plants were cultivated for the whole plant vegetation period under controlled conditions either under ambient climate conditions or 4°C higher temperatures with or without additional NO_2. Higher temperature resulted in bigger plant sizes, longer male inflorescences, and longer pollen seasons. The total allergenic potential of the pollen was accessed by dot blot using serum from ragweed pollen sensitized patients. The comparative immunoblot analysis revealed that the in vivo fumigation of ragweed plants with elevated NO_2-concentrations significantly increased the allergenic potential of the pollen, and in combination with increased temperature, the allergenic potential was even higher. On the other hand, label-free protein quantification by liquid chromatography-tandem mass spectrometry (LC-MS/MS) was performed. The results showed that more proteins were significantly up- and down-regulated under higher temperatures with/without elevated NO_2 conditions. Most of the highly expressed proteins were participating intensively in the metabolic process, the cellular process, and the stress defense process. These findings suggest that rising temperature and elevated NO_2 are important environmental factors for higher abiotic stress activities, catalytic activities, and thus higher allergenic potential observed in pollen proteins.

Keywords : climate change, NO_2, pollen proteome, ragweed, temperature
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