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Air-Pollutant-Philic Plants for Air Remediation

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Author(s)

Misa Takahashi, Hiromichi Morikawa

ABSTRACT

In this communication, we review our work over two decades on air-pollutant-philic plants that can grow with air pollutants as the sole nutrient source. We believe that such plants are instrumental in mitigating air pollution. Our target air pollutant has been atmospheric nitrogen dioxide (NO₂), and our work on this subject has consisted of three parts: Variation in plants' abilities to mitigate air pollutants among naturally occurring plants, genetic improvement of plants' abilities to mitigate air pollutants, and the plant vitalization effect of NO₂. So far, an estimation of the half-life of nitrogen derived from NO₂ uptake in plants belonging to the 217 taxa studied to date has shown no plants to be naturally occurring air-pollutant-philic. However, we found that an enormous difference exists in plants' ability to uptake and assimilate atmospheric NO₂. Future studies on the causes of this process may provide an important clue to aid the genetic production of plants that are effectively air-pollutant-philic. Both genetic engineering of the genes involved in the primary nitrate metabolism and genetic modification by ion-beam irradiation failed to make plants air-pollutant-philic, but mutants obtained in these studies will prove useful in revealing those genes critical in doing so. During our study on air-pollutant-philic plants, we unexpectedly discovered that prolonged exposure of plants to a sufficient level of NO₂ activates the uptake and metabolism of nutrients that fuel plant growth and development. We named this phenomenon "the plant vitalization effect of NO₂" (PVEON). Investigations into the mechanisms and genes involved in PVEON will provide an important clue to making plants air-pollutant-philic in the future.

KEYWORDS

 Air-Pollutant-Philic Plants; Air Remediation; Genetic Modification; Nitrogen Dioxide NO₂; Plant Vitalization Effect of NO₂

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