Response to Pichersky et al.: Plant volatile isoprenoids and their opportunistic functions

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We thank Eran Pichersky, Thomas Sharkey and Jonathan Gershenson for their interest and their response [1] to our communication with Richard Firn and Clive Jones [2]. The scientific community (including ourselves) is, of course, thoroughly aware of the many important, fascinating and diverse roles of volatile isoprenoids for the plant species that emit these compounds. We made this clear in our Opinion article published in the September 2005 issue of *Trends in Plant Science* [3], where we refer to some of our own papers reporting different functions of plant volatiles. We agree with Firn and Jones [4], as do Pichersky, Sharkey and Gershenson [1], that ‘any particular secondary compound might not confer a selective advantage at present and in some cases might cost too little to have a measurable negative impact on fitness’. Our Opinion article [3], and our response to Firn and Jones [2] say no more than this. Neither our own articles, nor those of Firn and Jones [5,6] suggest that plants are explicitly or actively ‘forward-looking’. Neither do we suggest that there is no current role for most volatile isoprenoids because there are many important roles for this large group of compounds (e.g. Refs [7–9]). We do not say that most volatile isoprenoids are redundant because nobody knows (as Pichersky and co-authors point out). Conversely, we do not know that a function will be found for all secondary isoprenoid compounds.

We do suggest that volatile isoprenoids cannot be generally essential for plant health and survival (as are the higher molecular weight isoprenoids) because not all plant species produce and emit them. We assume that in evolutionary terms, synthesis of isoprenoids such as carotenoids and chlorophyll side chains were of prime importance for the survival of plants. We hypothesize that during the process of evolution, volatile isoprenoid production occurred as a fortuitous accident of essential isoprenoid production and that their many roles and functions might also be fortuitous and thereafter retained.

Following on from this, we further hypothesize that control and synthesis of the higher molecular weight isoprenoids might have some effect on the control and synthesis of the lower molecular weight volatile isoprenoids. Firn and Jones’s hypothesis is far more general and wide-ranging than our own but generally supports our ideas. Our hypothesis, in return, goes some way to supporting theirs. However, we did not intend our hypothesis to become involved in what we believe is a specialized and long-standing debate on secondary metabolism theory. Our ‘opportunist hypothesis’ refers to volatile isoprenoids, and to the exploration of mechanisms and controls that might not have been considered before by the volatile isoprenoid research community [3].

References


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