

LETTER TO THE EDITOR

Passive Infiltration of Insecticides into Plant Materials/Essential Oils during Shipment

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Dear Editor:

Many countries have strict quarantine regulations concerning the importation of plant materials. The United States, for example, has changed the regulations such that some materials (such a fresh *Juniperus* leaves) are almost impossible to import. However, there is a long standing tradition of allowing herbarium vouchers into the country (even if the materials are not yet completely dried). Because some plant essential oils may be lost or decompose upon fully drying, transportation of plant material presents problem for chemotaxonomists. In discussing this issue with our local herbarium curator, Dr. Walter Holmes, he mentioned that he always pours formaldehyde over his plant press, then places the plant press in a plastic bag. He said he never has had any problems at plant quarantine if they open his bag. I was reluctant to carry formaldehyde overseas and was concerned about the effects that formaldehyde might have on the plant oils. However, "moth balls" (1,4-dichlorobenzene) appeared to be a solution because these come in little balls or flakes and can be added between the sheets of fresh plant leaves and removed as soon as one clears quarantine. So, on a recent trip to Haiti, I took some "moth balls" (1,4-dichlorobenzene) and sprinkled these on the leaves in the plant press and then placed the plant press in a plastic bag. When I returned to the lab, I put the leaves in the freezer until distilled.

After distillation, I analyzed the oils and found 1,4-dichlorobenzene to be the major component of the oil (up to 48% of total oil). The plants and moth balls had been in the plant press (inside a plastic bag) in the airplane baggage compartment and in transit for less than 24 h. So it seemed possible that these effects might be due to the decompression at high altitude and then the infiltration of the 1,4-dichlorobenzene at normal atmospheric pressure.

In order to investigate this phenomena under standardized conditions, I collected a large sample (2 kg) of leaves from an individual *Juniperus monosperma* (Engelm.) Sarg. tree growing near our lab. One half of the leaves were frozen (-20°C) and the other leaves were placed in a plant press with 1,4-dichlorobenzene crystals sprinkled on the paper and thence sealed in a plastic bag. After 48 h, both sets of leaves were steam distilled (1) for 2 h. The frozen leaves yielded 0.79% (oven dry wt. basis) essential oil and the plant press + 1,4-dichlorobenzene treated leaves yielded 1.69% (oven dry wt. basis).

GC/MS analysis and quantitation revealed that the frozen leaves contained no 1,4-dichlorobenzene, whereas the treated leaves contained a major peak of dichlorobenzene (46.7%). This was confirmed by running the commercial moth balls (1,4-dichlorobenzene) on GC/MS (Figure 1).

Several lessons can be learned from my experience. One needs to test the effects of using an insecticide in the lab before applying it to plant collecting. Secondly, the amount and speed at which the 1,4-dichlorobenzene was incorporated into the leaf essential oils is very noteworthy. I have noticed that it is the practice for some plant collectors to place the leaves of several species in a plastic bag and then separate out the species after returning to the lab (often several days later). Is it possible that species such as mints and sage, whose glands tend to rupture easily, may emit terpenes that are then incorporated into other species in the same bag? This certainly seems to be a possibility and should be examined.

In any case, this letter is caution to collectors that we must be very careful about adding preservatives or insecticides to our plants during transit.

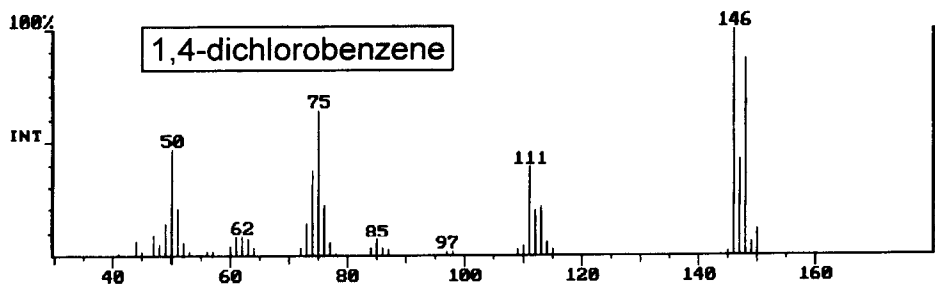


Figure 1. ITMS of 1,4-dichlorobenzene

Reference

1. R. P. Adams, *Cedarwood oil - Analysis and properties*. In: *Modern Methods of Plant Analysis: Oils and Waxes*. Edits., H. F. Linskens and J. F. Jackson, pp 159-173, Springer-Verlag, Berlin (1991).

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