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Plant-Fungi Chemogeography: Fungal Symbionts are More Chemically Dissimilar than Host Plants

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Introduction

Liverworts evolved before plants with roots, yet liverworts have fungal symbionts that act like roots by transporting nutrients to the plant in exchange for sugars. Plant-fungal symbioses can be found in ~90% of all plant species. Plants and fungi use volatile organic compounds (VOCs) to communicate and facilitate ecological interactions. The liverwort *Conocephalum salebrosum* exhibits variation in VOCs amongst different ecoregions of Alabama, and it was hypothesized that the fungal symbionts could contribute to this variation. Multiple liverwort-fungi populations were sampled to contrast the VOCs of liverworts and fungal symbionts.

Methods

Figure 1 Locations and ecological regions the liverworts we cted

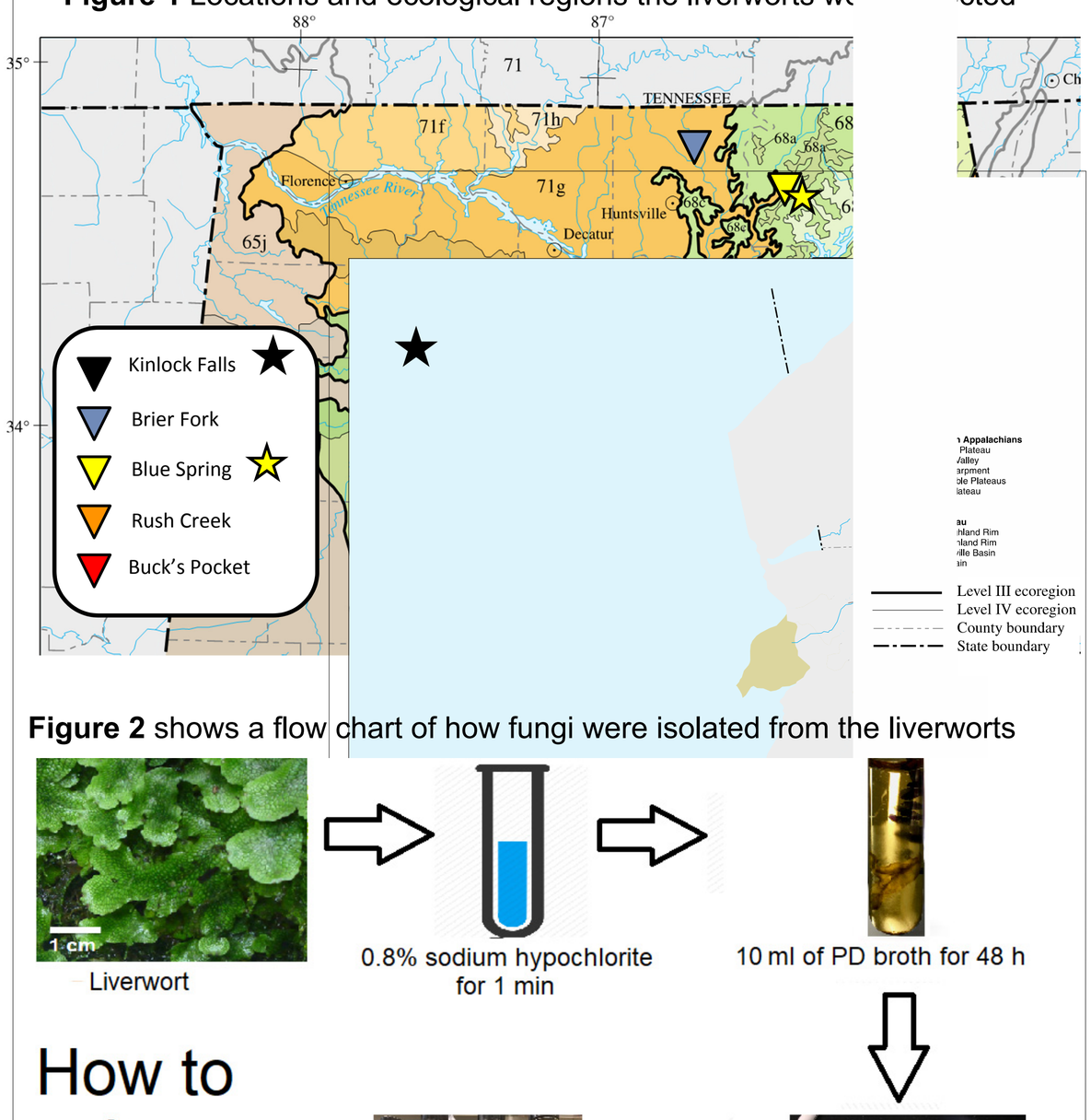


Figure 2 shows a flow chart of how fungi were isolated from the liverworts

- Liverworts & fungus VOCs were extracted by hydrodistillation
- Gas Chromatography-Mass Spectrometry (GC-MS) was used to determine the composition of VOCs

Results

Figure 3 shows liverwort relatedness based on concentrations of 39 VOCs.

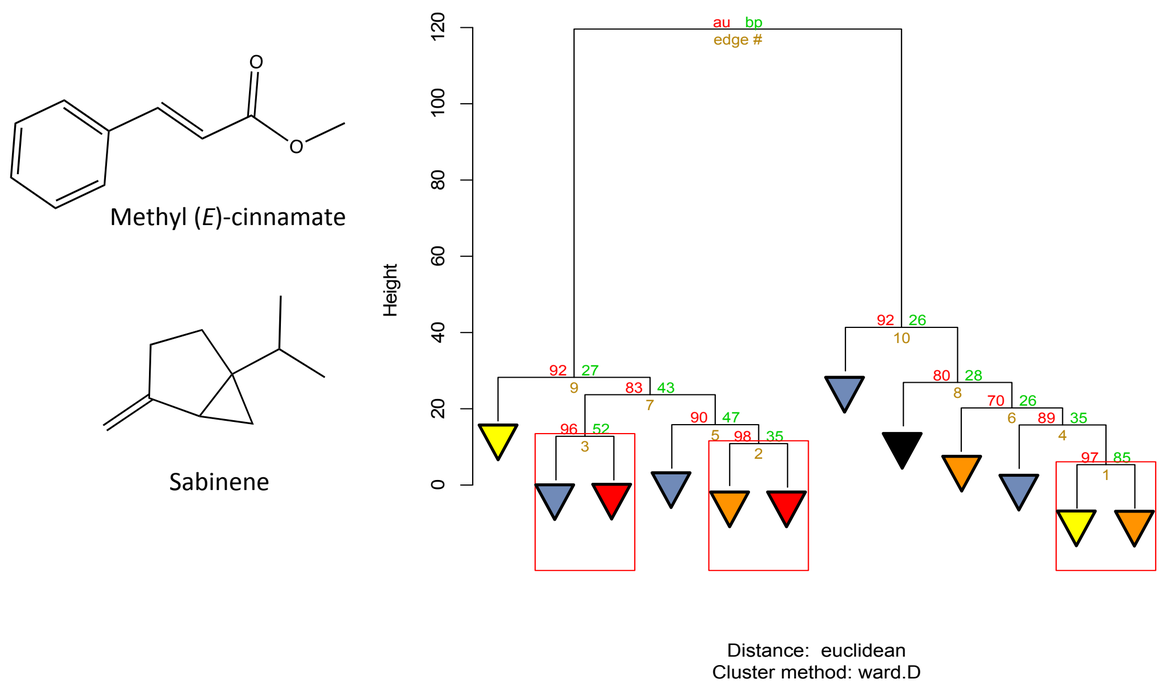
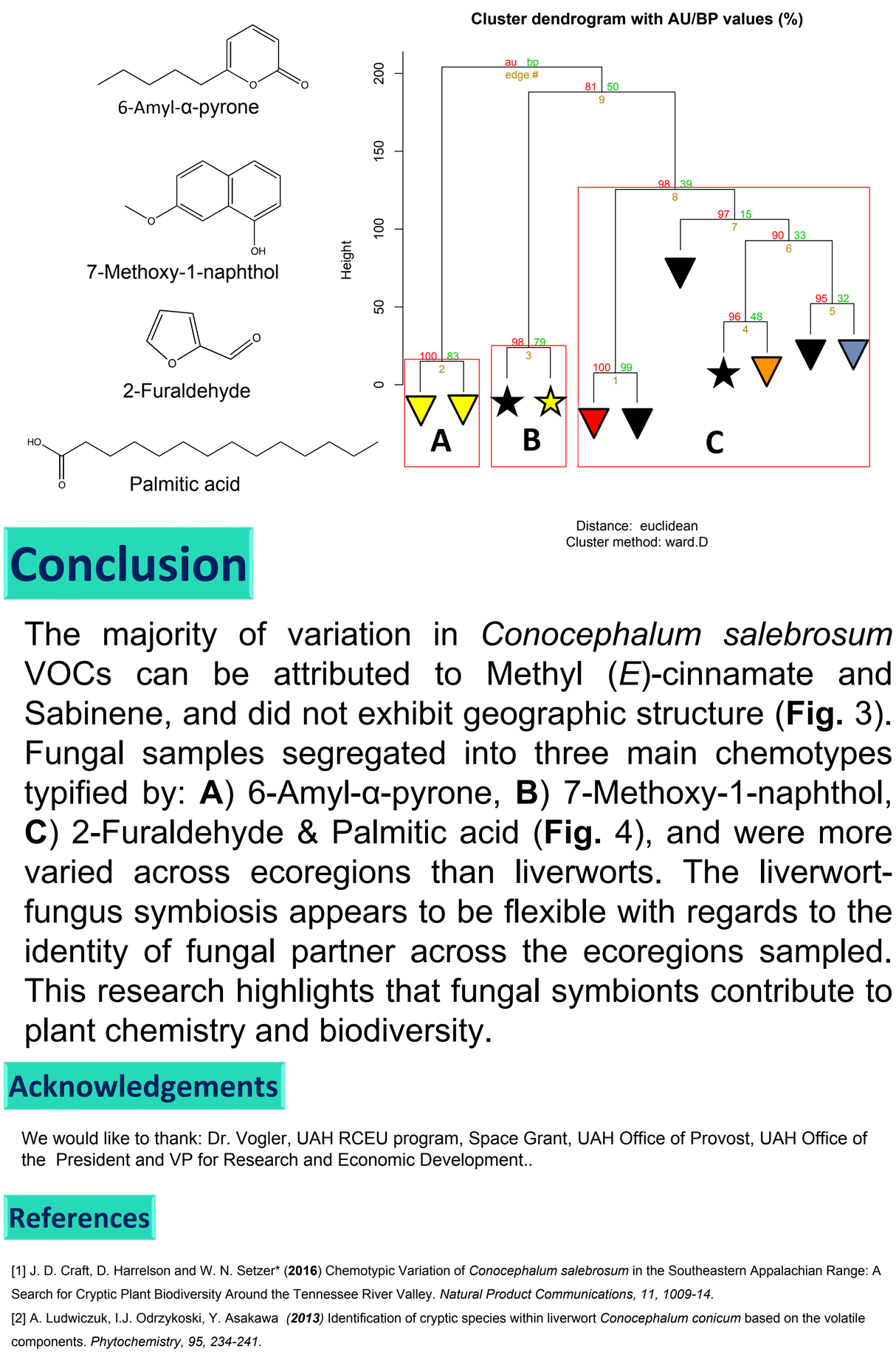


Figure 4 shows relatedness of fungus based on 28 VOCs. Triangles indicate fungi isolated from *C. salebrosum* and stars indicate fungi isolated from a co-occurring liverwort, *Dumortiera hirsuta.*



Conclusion

The majority of variation in *Conocephalum salebrosum* VOCs can be attributed to Methyl (*E*)-cinnamate and Sabinene, and did not exhibit geographic structure (**Fig.** 3). Fungal samples segregated into three main chemotypes typified by: **A**) 6-Amyl-α-pyrone, **B**) 7-Methoxy-1-naphthol, **C**) 2-Furaldehyde & Palmitic acid (**Fig.** 4), and were more varied across ecoregions than liverworts. The liverwort-fungus symbiosis appears to be flexible with regards to the identity of fungal partner across the ecoregions sampled. This research highlights that fungal symbionts contribute to plant chemistry and biodiversity.

Acknowledgements

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References

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[2] A. Ludwiczuk, I.J. Odrzykoski, Y. Asakawa ***(2013)*** Identification of cryptic species within liverwort *Conocephalum conicum* based on the volatile components. *Phytochemistry, 95, 234-241.*