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Supplementary Information: Plant-Based, Aqueous, Water-Repellent Sprays for Coating Textiles†

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1 Supplementary Information

1.1 Chemical composition of plant wax extracts

Maple, horsetail, and ginkgo waxes have been described previously, and the findings of the present study generally agree with the literature.

Maple wax has been reported to have large amounts of alkanes and cyclic compounds.[1,2] However, one study found higher relative amounts of fatty acids and n-alcohols compared to those in the present study.[1]

For horsetail, Brune and Haas reported that sterile shoots have a total wax coverage of 3.1 μg/cm^2,[3] which is similar to the present results. The same study found the wax of sterile branches composed of, in decreasing order, aldehydes, primary alcohols, fatty acids, alkyl esters and alkanes. While the classes described align well, the present analysis found the primary alcohols to predominate, along with diols. Brune and Haas acknowledged the possibility that primary alcohols were underrepresented due to their wax extraction method.

Smoketree wax was first reported to contain large amounts of nonacosan-10-ol,[4] in agreement with our findings. Moreover, the major diol isomer was similarly reported as nonacosane-5,10-diol by Hunt and Baker.[5]

Gülz *et al.* reported ginkgo leaf total wax coverage to be 36.4 μg/cm^2, nearly identical to that found in the present study.[6] Furthermore, the presence of primary and secondary alcohols, aldehydes, alkyl acetates, and cyclic compounds was also reported by Gülz *et al.* However, the previous study reported fatty acids as the dominant compound class in ginkgo, which were not detected in this current investigation.

Coumarates have previously been described in lignin from ginkgo seed shells,[7] but their presence in leaf wax has not been reported to date. Other cyclic compounds have been reported, including benzyl acyl esters and γ-tocopherol,[6] as well as phenols, carboxyphenols, dimethoxycoumarins, and α- and γ-tocopherol.[8] In the case of Tu *et al.*, because their protocol did not record data far beyond the elution of nonacosan-10-ol, it is possible they did not detect the very-long-chain alkyl coumarates, which have a much higher retention time.[8]

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Table 1 Gas chromatography-mass spectrometry (GC-MS) analysis of cyclic compounds. Relative amounts of compound classes are shown as percentages of the total wax mixture for each plant species (averages ± s.e., n = 5). Plant species: smoketree (*Cotinus coggygria*), ginkgo (*Ginkgo biloba*), horsetail (*Equisetum arvense*, sterile shoots), cedar (*Cedrus atlantica*), maple (*Acer rubrum*), and katsura (*Cercidiphyllum japonicum*).

Compound class (% of total wax)	Maple	Horsetail	Ginkgo	Katsura	Cedar	Smoketree
Hydroxyphenethyl esters	3.2 ± 0.1	-	-	-	-	0.4 ± 0.0
Triterpenoids	24.3 ± 1.7	2.4 ± 0.2	-	1.3 ± 0.2	-	-
α-Tocopherol	-	0.6 ± 0.1	-	-	-	-
δ-Lactones	-	1.7 ± 0.4	-	-	-	-
Coumarates	-	-	14.4 ± 1.1	-	-	-

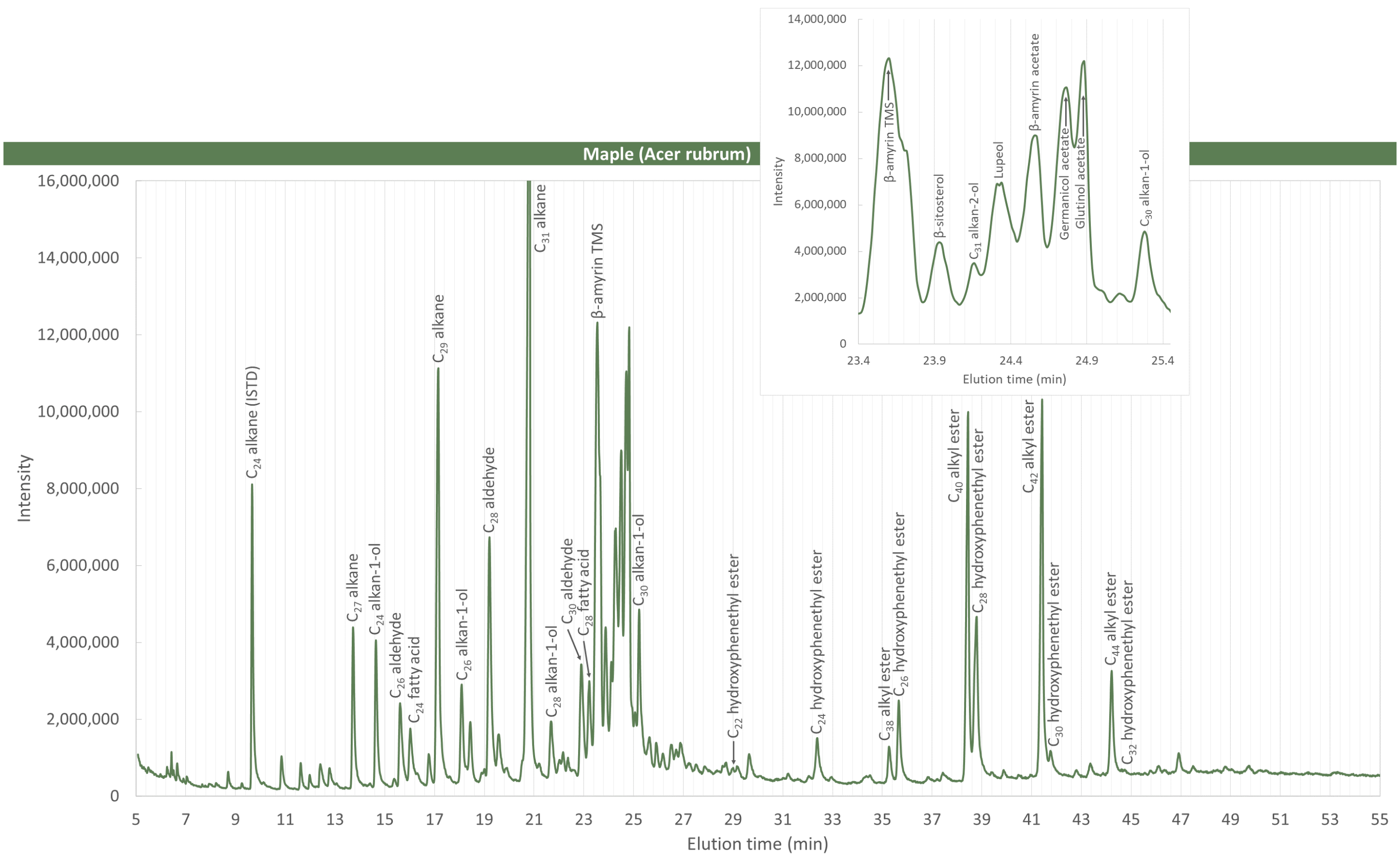

Fig. 1 Gas chromatography-mass spectrometry total ion current trace of TMS-derivatized maple (*Acer rubrum*) wax. Identified peaks have been labeled with compound class, chain length, and, where relevant, functional group position. For the hydroxyphenethyl ester series, the acyl chain lengths are noted. ISTD = internal standard

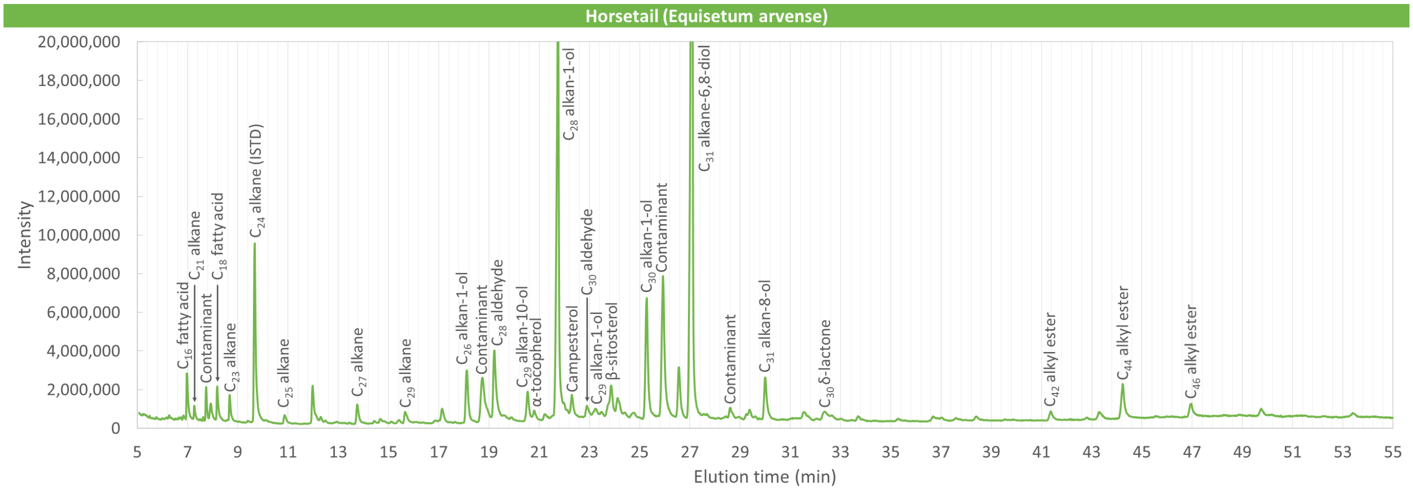

Fig. 2 Gas chromatography-mass spectrometry total ion current trace of TMS-derivatized horsetail (*Equisetum arvense*, sterile shoots) wax. Identified peaks have been labeled with compound class, chain length, and, where relevant, functional group position. Common contaminants, such as column degradation byproducts or environmental pollutants, have been labeled. ISTD = internal standard

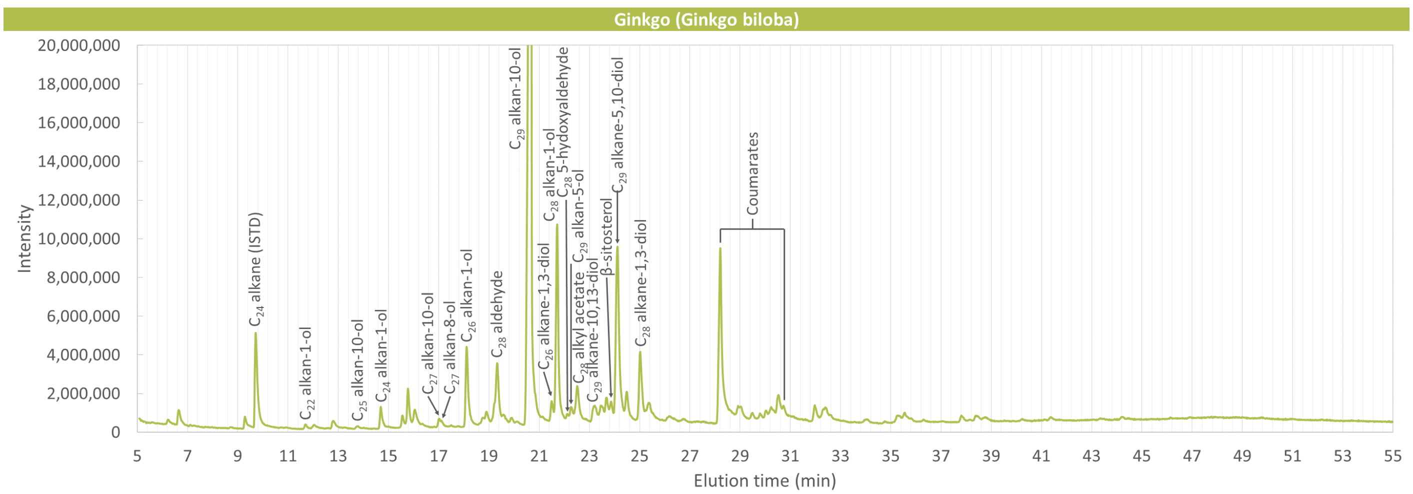

Fig. 3 Gas chromatography-mass spectrometry total ion current trace of TMS-derivatized ginkgo (*Ginkgo biloba*) wax. Identified peaks have been labeled with compound class, chain length, and, where relevant, functional group position. ISTD = internal standard

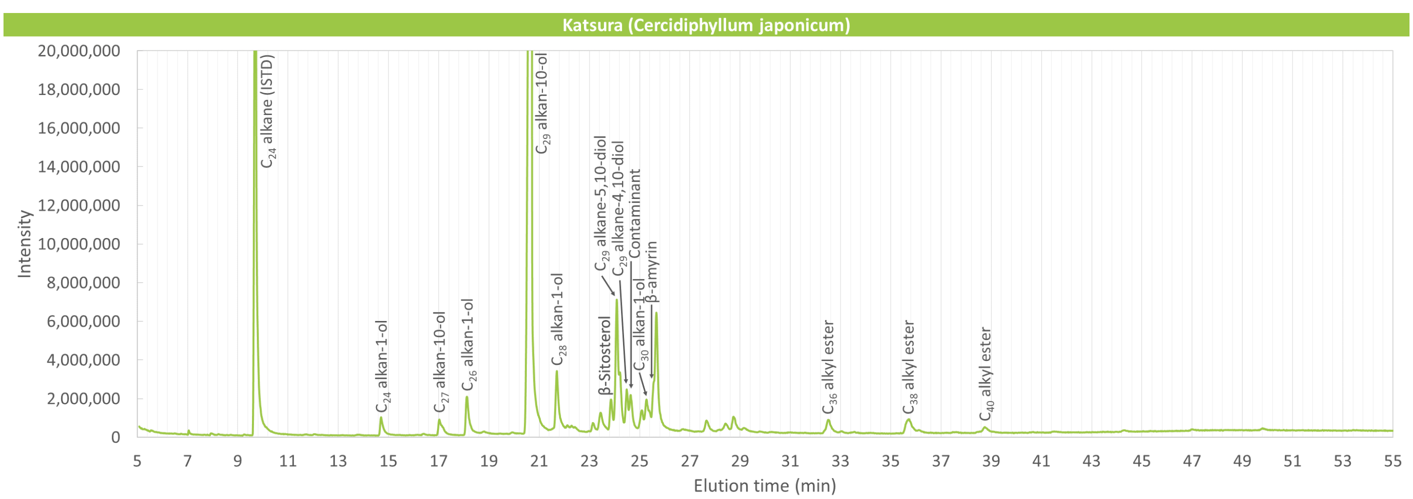

Fig. 4 Gas chromatography-mass spectrometry total ion current trace of TMS-derivatized katsura (*Cercidiphyllum japonicum*) wax. Identified peaks have been labeled with compound class, chain length, and, where relevant, functional group position. Common contaminants, such as column degradation byproducts or environmental pollutants, have been labeled. ISTD = internal standard

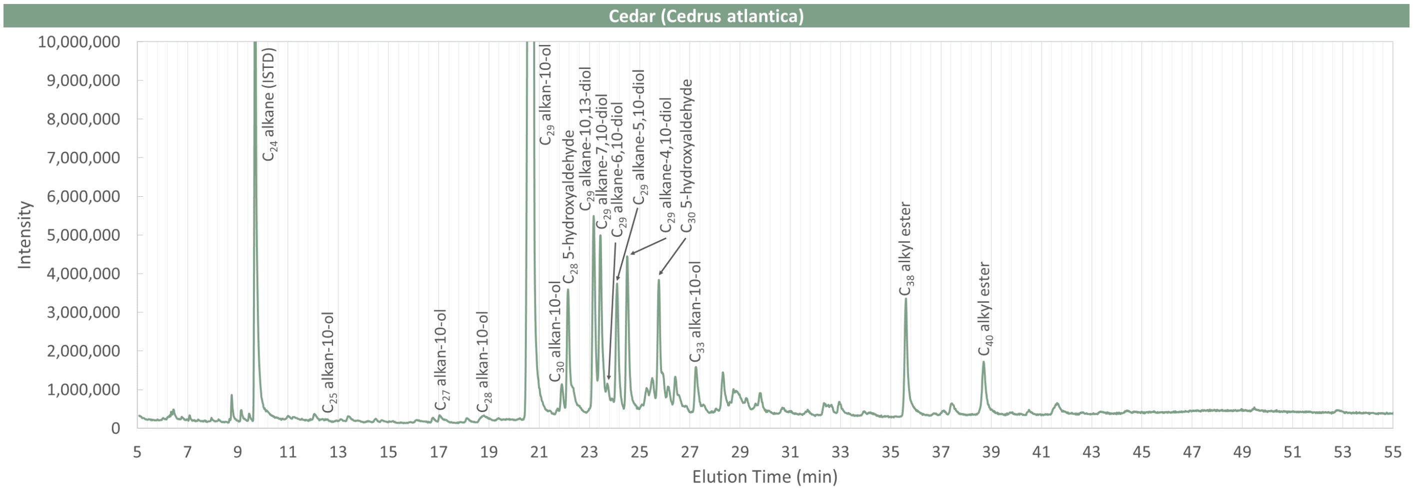

Fig. 5 Gas chromatography-mass spectrometry total ion current trace of TMS-derivatized cedar (*Cedrus atlantica*) wax. Identified peaks have been labeled with compound class, chain length, and, where relevant, functional group position. ISTD = internal standard

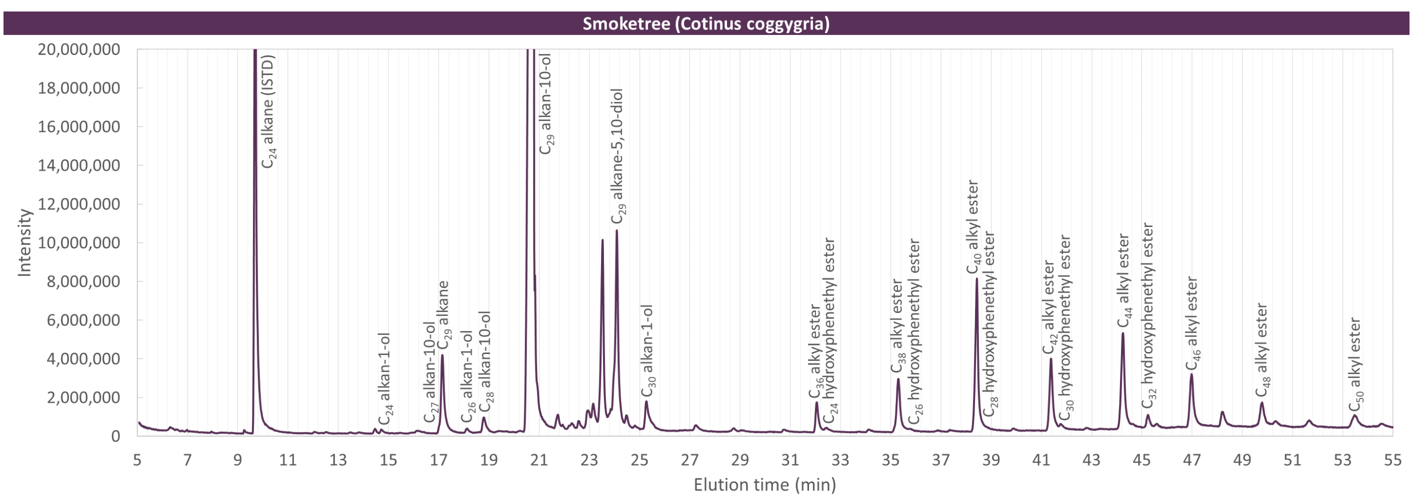

Fig. 6 Gas chromatography-mass spectrometry total ion current trace of TMS-derivatized smoketree (*Cotinus coggygria*) wax. Identified peaks have been labeled with compound class, chain length, and, where relevant, functional group position. For the hydroxyphenethyl ester series, the acyl chain lengths are noted. ISTD = internal standard

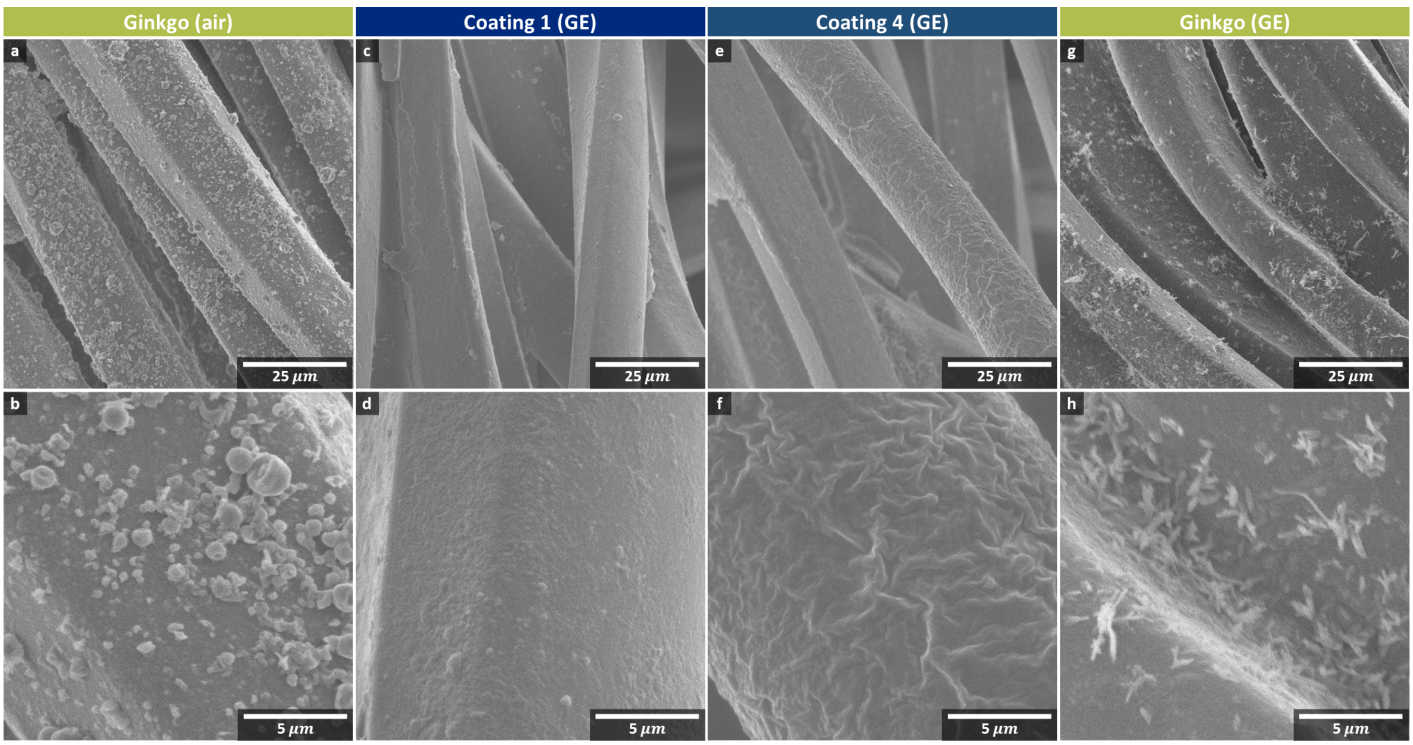

Fig. 7 Comparison of the morphology of ginkgo plant wax suspensions (green) and commercial water repellent coatings (blue) sprayed onto polyester fabric and dried either through air drying (a-b) or a GE: home drying machine (c-h).

Author Contributions

We strongly encourage authors to include author contributions and recommend using CRediT for standardised contribution descriptions. Please refer to our general author guidelines for more information about authorship.

Conflicts of interest

There are no conflicts to declare.

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