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PHENOL ETHERS OF THREE NORTH AMERICAN *HEXASTYLIS* SPECIES

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Abstract—The essential oils of three species of *Hexastylis* were investigated Large amounts of safrole and elemicin together with several mono- and sesquiterpenes were identified in the oils It was found that American *Hexastylis* is very similar phytochemically to Japanese *Heterotropa*

The essential oils of leaves and roots of three *Hexastylis* species (*H arifolia, minus*, and *virginica*) were examined The fresh leaves and roots were extracted with ethyl acetate and the extracts analysed by GC and GC/MS [1–4] The results obtained were as follows *H arifolia* roots contained α-pinene (2 0%), camphene (1 1%), β-pinene (1 2%), 1,8-cineole (1 7%), safrole (58 2%), methyleugenol (19 9%), *trans*-methylisoeugenol (8 7%), elemicin (0 4%), *cis*-asarone (3 3%), leaves α-pinene (2 4%), camphene (1 3%), β-pinene (8 3%), Δ^3-carene (1 6%), linalol (trace), camphor (1 3%), safrole (69 9%), methyleugenol (5 4%), *cis*-methylisoeugenol (1 3%), *trans*-methylisoeugenol (2 2%), elemicin (1 3%) and asarone (1 3%), *H minus* roots α-pinene (1 6%), camphene (1 0%), β-pinene (1 0%), Δ^3-carene (trace), 1,8-cineole (1 3%), bornyl acetate (5 7%), safrole (trace), methyleugenol (trace), trimethoxytoluene (trace), α-ferulene (1 0%), α-elemene (17 1%), bergamotene (2 6%), bisabolene (trace), α-zingiberene (0 5%), *trans*-β-farnesene (trace), δ-cadinene (1 3%), guaiene (trace), elemicin (57 6%), *cis*-asarone (2 6%), *trans*-asarone (4 1%), leaves α-pinene (0 5%), camphene (trace), β-pinene (24 5%), Δ^3-carene (0 5%), 1,4-cineole (trace), 1, 8-cineole (1 7%), linalol (1 3%), menthofuran (trace), camphor (1 7%), α-terpineol (1 7%), bornyl acetate (4 3%), thymol (1 7%), δ-elemene (1 7%), trimethyltoluene (trace), β-elemene (3 0%), caryophyllene (10 3%), α-elemene (3 4%), bergamotene (0 5%), α-zingiberene (5 2%), α-humulene (trace), calarene (18 5%), δ-cadinene (trace), guaiene (trace), 1-allyl-2, 3, 4-trimethoxybenzene (trace), 1-allyl-3, 4,6-trimethoxybenzene (trace), elemicin (12 9%) and asarone (1 7%), and *H virginica* leaves α-pinene (4 2%), camphene (1 7%), β-pinene (39 5%), sabinene (trace), Δ^3-carene (4 4%), 1, 8-cineole (1 8%), bornyl acetate (2 4%), β-elemene (3 8%), caryophyllene (6 7%), α-zingiberene (12 9%), calarene (22 6%) and elemicin (trace)

Hexastylis arifolia contained over 50% of safrole in the essential oils of the leaves and roots On the other hand, the leaf oil of *H minus* contained a large amount of terpene (82 9% of the original oil) together with elemicin (12 9%) The main components of root oil of *H minus*, however, were elemicin (57 6%) and α-elemene (17 1%) The leaf oil of *H virginica* contained 12 terpenes which were closely similar to those of *H minus*

The chemical components of 30 species of Japanese *Heterotropa* (Aristolochiaceae), a genus which is closely related to *Hexastylis*, have been investigated by our group [5, 6] Phytochemically, the presence of safrole, elemicin and terpenes in the oils is significant in *Heterotropa* from the southern part of Japan American *Hexastylis* also contain safrole, elemicin and similar terpenes, showing that the two genera are related phytochemically

EXPERIMENTAL

Fresh whole plants (*ca* 200 g) were collected during the flowering season at Chapel Hill in North Carolina After separating leaves and roots, the ground material was extracted with EtOAc and the oil examined by GC and GC/MS Quantitative GC analysis was carried out on 0 28 mm × 30 m glass capillary column coated with OV-101 programmed from 100 to 250° GC/MS were on a 3 mm × 1 m glass column with 3% OV-101 on 100–200 mesh Chromosorb WAW and He at 15 ml/min The column temp was programmed from 50 to 200° (5°/min) All MS were obtained at 25 eV

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