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Drying-induced changes in terpenoid composition in *Rhododendron anthopogon* leaves

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ABSTRACT

To access the drying impact on essential oil of *Rhododendron anthopogon* D. Don, leaves of the species were collected from alpine meadows of Tungnath (Uttarakhand Himalaya, India). Both the fresh and shade dried leaves were used for oil extraction through hydrodistillation method. The results showed that α-Humulene was the most abundant compound, accounting for 25.6 % and 21.23 % in fresh and dried leaves, respectively, followed by α-pinene (24.9 % and 19.6 %, respectively. Other compounds also showed notable amounts, such as 2-β-pinene (7.71 % and 4.85 % in fresh and dried leaves, respectively) and *trans*-caryophyllene (5.12 % and 6.40 %, respectively). Analysis also revealed that nonadecane, *p*-menth-1-en-8-ol, β-citronellol, and *trans*-carane were present only in the essential oil extracted from dried leaves. The results indicated that, the biosynthesis of terpenoids in *R. anthopogon* responded differently to leaf drying. The production of sesquiterpenoids and triterpenoids, as well as phenylpropanoids was unaffected by the drying process, continuing at similar levels in both fresh and dried leaves. However, the biosynthesis of terpenoid backbone was only detectable in the essential oil from dried leaves. The selective activation of metabolic pathways observed in response to desiccation stress highlights the potential for significant alterations in the essential oil's chemical composition and biological properties. Further research is required to elucidate the precise molecular mechanisms and environmental factors mediating this phenomenon.

1. Introduction

Rhododendron anthopogon D. Don is an aromatic plant species whose fragrance is widespread throughout the alpine regions of the Indian Himalayas. The plant is a member of the Ericaceae family that grows at an elevation of about 3000–4000 m asl in Himalayan countries such as India, Pakistan, Nepal, Bhutan, and Tibet. In Indian Himalayan region, it is found in high altitudes of Uttarakhand, Himachal Pradesh, Jammu and Kashmir, Sikkim, and Arunachal Pradesh. It is one of the smallest *Rhododendron* species (2–3 ft), with dark, green, oval leaves that are intensely aromatic. White or yellowish flowers with a pinkish tinge grow in compact clusters. Coughs and colds are traditionally treated with a tea made from leaves and flowers in native areas. The GCMS analysis of the essential oil of *R. anthopogon* leaves, and flowers from Nepal Himalayas was first done by Yonzon et al., (2005), and they found its essence was rich in δ-cadinene. Innocenti et al. (2010) uncovered its chemical composition and major components, including α-pinene, β-pinene, limonene, and sesquiterpene δ-cadinene of the plant. In another study, Dosoky et al. (2016) also identified 70 volatile components from Nepalese *R. anthopogon*. The study revealed that, α-pinene, δ-cadinene, and β-pinene was the major compounds of the plant. However, in Indian Western Himalayan region, Guleria et al. (2011) extracted essential oil from *R. anthopogon* shade dried leaves collected from Himachal Pradesh, India, and observed that, β-caryophyllene (1.21 %), α-humulene (4.06 %), *p*-methadone-2,9- diol (2.13 %), limonene (11.26 %), E-nerolidol (0.21 %), and γ -terpinene (1.03 %) are some of the major components of the plant. The presence of compounds like δ-cadinene, α-pinene, β-pinene, limonene, β-caryophyllene, α-humulene, and others suggests potential uses in various fields, including pharmaceuticals, cosmetics, and perfumery (Innocenti et al., 2010; Guleria et al., 2011; Baral et al., 2014; Dosoky et al., 2019).

Drying leaves can significantly impact the content and quality of

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