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SHORT COMMUNICATION

Composition of essential oils from four Apiaceae and Asteraceae species growing in Uzbekistan

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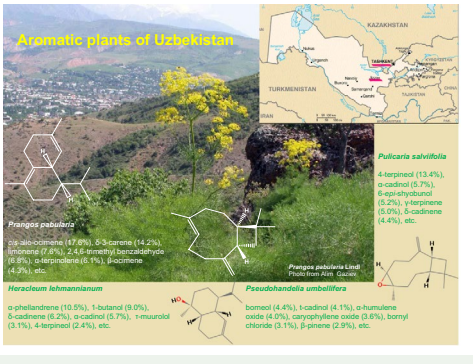
ABSTRACT

The chemical composition of essential oils isolated from the aerial parts of *Heracleum lehmannianum, Prangos pabularia, Pseudohandelia umbellifera* and *Pulicaria salviifolia*, all of them growing in Uzbekistan, were determined by GC-MS analysis. The main components of the oil from *H. lehmannianum* were α-phellandrene (10.5%), 1-butanol (9.0%), δ-cadinene (6.2%), α-cadinol (5.7%), τ-muurolol (3.1%), 4-terpineol (2.4%) and α-muurolene (2.6%), while *cis*-allo-ocimene (17.6%), δ-3-carene (14.2%), limonene (7.6%), 2,4,6-trimethylbenzaldehyde (6.8%), α-terpinolene (6.1%), β-ocimene (4.3%), α-ocimene (4.2%), α-phellandrene (4.2%) were the major oil components in *P. pabularia*, and borneol (4.4%), t-cadinol (4.1%), α-humulene oxide (4.0%), caryophyllene oxide (3.6%), bornyl chloride (3.1%), β-pinene (2.9%) in *P. umbellifera*. The essential oil of *P. salviifolia* had a much more complex composition which was dominated by 4-terpineol (13.4%), α-cadinol (5.7%), 6-*epi*-shyobunol (5.2%), γ-terpinene (5.0%), δ-cadinene (4.4%), α-terpinene (3.5%).



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1. Introduction

The flora of Uzbekistan comprises 4344 species, of which 231 and 624 belong to the Apiaceae and Asteraceae families, respectively (Sennikov et al. 2016). The genus *Heracleum* L. is one of the largest within the family Apiaceae. Of *Heracleum*, two species, namely *Heracleum lehmannianum* Bunge and *Heracleum dissectum* Ledeb, are found in Uzbekistan. *H. lehmannianum* Bunge (local name Leman gulpari) is a perennial plant and grows to heights of 2–3 m close to rivers in the lower, middle and upper belt of the Western Tien Shan and Pamir Alai mountains (Tojibaev et al. 2015). The plant has been traditionally used for the treatment of stomach ache and as analgesic (Tayjanov et al. 2016). Studies by Tolibaev and Glushenkova (1996) have shown that *H. lehmannianum* Bunge contains various classes of lipids and acyl-containing lipids. The genus has a great potential as a source of novel coumarin compounds (Komissarenko and Temirbekov 1975; Walasek et al. 2015).

Among the flora of Uzbekistan, eight species of the *Prangos* Lindl. genus are found. *Prangos pabularia* Lindl (local name Hashakbop tulkiquyruq) is used as hay and winter fodder for cattle in Iran, Central Asia, North India and Caucasian (Razavi 2012). It is a perennial plant and grows from foothills to the upper mountain zone. The roots and fruits of this plant have medicinal properties for which they have been used in traditional medicine. In Indian folk medicine, roots and fruits of *P. pabularia* have been applied as diuretic, carminative, laxative, stimulans, emmenagogue and liver tonic. An infusion of the roots is useful in indigestion, flatulence and regulation of menstrual cycles (Farooq et al. 2014). Phytochemical screening of *P. pabularia* revealed the presence of various chemical constituents, comprising coumarins, furocoumarins, alkaloids, phenolic acids and lactonic constituents, terpenoids and glycosides (Mukhamedova et al. 1967; Tada et al. 2002; Farooq et al. 2014).

The genus *Pseudohandelia* Tzvel. belongs to the family of Asteraceae. Only one species, *Pseudohandelia umbellifera* (Boiss.) Tzvel. (local name Soyabongulli sohta handeliya), is found in Uzbekistan (Vvedenskiy 1959). This plant species is also distributed over Western Siberia, Iran, Afghanistan and other Central Asian countries. *P. umbellifera* has been used in traditional medicine for treatment of tachycardia, epilepsy, hepatitis, various kidney and liver diseases, cardiovascular diseases, as well as diuretic and anthelmintic drug. Chemical studies of this species detected sesquiterpene lactones (Urmanova et al. 1978).

The genus *Pulicaria* Gaertn. belongs to the Asteraceae family, which encompasses 63 species. Four of them grow in Uzbekistan, which includes *Pulicaria gnaphalodes* (Vent.) Boiss, *Pulicaria prostrate* (Gilib.) Aschers., *Pulicaria salviifolia* Bunge and *Pulicaria uliginosa* Stev. (Vvedenskiy 1959). Some species of this genus have been used in traditional medicine to treat inflammation, dysentery, diabetes, cardiac and intestinal disorders, skin diseases, and abscesses (Casiglia et al. 2016). *P. salvifolia* Bunge (local name Lulband) is a strong sweet-scented plant smelling like honey. This plant grows in dry zones, dry stony, slopes with rocky debris and pebbly, gypsum-soiled foothills. A decoction of *P. salviifolia* has been administered traditionally for decreasing the blood sugar content, as a treatment of diabetes. The compounds salvin, salvicin and salvifolin isolated from this species showed significant hypoglycaemic activity in rats (Eisenman et al. 2013). Previously, *P. salviifolia* was found to contain terpenoids, diterpenoids, as well as flavonoids, triterpenoids and sterols (Eshbakova and Saidkhodzhaev 2001).

There has been no study on the volatile compounds and essential oils of *H. lehmannianum, P. pabularia, P. umbellifera* and *P. salviifolia* growing in Uzbekistan. With the present work, we would like to expand the knowledge on these four *Apiaceae* and *Asteraceae* species

2. Results and discussion

The data obtained from the research are presented in Table S1. Ninety-two compounds were identified in the oil of *H. lehmannianum,* comprising 79.8% of the total peak area. In our work, the main components of the oil were α-phellandrene (10.5%), 1-butanol (9.0%), δ-cadinene (6.2%), α-cadinol (5.7%), τ-muurolol (3.1%), α-muurolene (2.6%) and 4-terpineol (2.4%). Tkachenko and Zenkevich (1987) investigated essential oil obtained from the aerial parts of *H. lehmannianum* introduced to Leningrad region of Russia and identified 15 compounds, anethol (47.0%), limonene (17.0%), γ-terpinene (8.0%) and terpinolene (7.8%) being the major components in these Russian *H. lehmannianum* variety.

The essential oil compositions of *P. pabularia* from Russian, Indian, Turkish and Iranian origins have been previously reported (Kuznetsova et al. 1973; Koul and Thakur 1978; Özek et al. 2007; Razavi 2012). The studies demonstrated that the oils of *P. pabularia* growing in different locations had diverse compositions. The essential oils of the fruits and leaves of the plant were dominated by α-humulene, bicyclogermacrene, germacrene D, spathulenol and camphene. In the oil of Uzbek *P. pabularia* from the present study, 86 constituents were identified which is representing 93.4% of the material. *cis*-Allo-ocimene (17.6%), δ-3-carene (14.2%), limonene (7.6%), 2,4,6-trimethylbenzaldehyde (6.8%), α-terpinolene (6.1%), β-ocimene (4.3%), α-ocimene (4.2%) and α-phellandrene (4.2%) were the major oil components.

The essential oil compositions of *P. umbellifera* from Iran have earlier been reported by Ghani et al. (2010). They characterised 48 compounds, 7-hydroxycoumarin (15.7%), (*E,E*)-farnesol (9.5%), (*Z*)-nuciferol acetate (7.7%), *cis*-lanceol acetate (5.9%), phytol (5.1%) and γ-terpinene-7-al (4.3%) being the major component. Our results indicated a much more complex composition in the oil from the Uzbek *P. umbellifera* specimen: 99 compounds constituting 89.0% of the bulk, and borneol (4.4%), t-cadinol (4.1%), α-humulene oxide (4.0%), caryophyllene oxide (3.6%), bornyl chloride (3.1%) and β-pinene (2.9%) as the main components.

In the literature, there is only one report on the essential oils of *P. salviifolia*. Atazhanova et al. (2017) described 35 components in the oil of *P. salviifolia* from Kazakhstan, of which the major ones were 4-terpineol (11.2%), δ-cadinene (9.2%), α-cadinol (11.3%) and caryophyllene (8.2%). In the *P. salviifolia* oil from Uzbek origin, we detected 98 compounds (representing 89.6% of the peak area) which is indicating a more intricate composition. Uzbek *P. salviifolia* oil was dominated by 4-terpineol (13.4%), α-cadinol (5.7%), 6-*epi*-shyobunol (5.2%), γ-terpinene (5.0%), δ-cadinene (4.4%) and α-terpinene (3.5%).

Our results indicated that all investigated plants – *H. lehmannianum, P. pabularia, P. umbellifera* and *P. salviifolia* – contain α-cadinol, δ-cadinene, caryophyllene oxide, β-selinene, 4-terpineol, *p*-cymene and limonene. The oil of the Uzbek plants had a profile than those of the same species growing in other locations. Specimens of the same plant species apparently have largely different chemical profiles of their essential oils, based on the different nutrient profiles which in turn are depending on soil, temperature level, climate and environment.

Supplementary material

Experimental details relating to this paper are available online, alongside Table S1.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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