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CONSTITUENTS AND BIOLOGICAL ACTIVITIES OF SOME IRANIAN *FERULA* SPECIES.

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ABSTRACT

Ferula is a genus of about 170 species of flowering plants in the carrot family (umbelliferae) native to the Mediterranean region east to central Asia, mostly growing in arid climates. They are herbaceous perennial plants growing to 1-4m tall, with stout, hollow, somewhat succulent stems. The leaves are trip innate or even more finely divided, with a stout based sheath clasping the stem. The flowers are usually yellow, rarely white, produced in large umbels. The present review descripts the chemical and biological activities of some Iranian *Ferula* species: *Ferula flabelliloba* Rech. f. & Aell; *Ferula galbaniflua* Boiss; *Ferula gommosa* Boiss; *Ferula hirtella* Boiss; *Ferula latisecta* Rech; *Ferula macrocolea* Boiss; *Ferula microcolea* Boiss; *Ferula ovina* Boiss; *Ferula stenocarpa* Boiss and Hausskn and *Ferula szowitsiana* DC.

KEYWORD: Iranian *Ferula* species, Umbelliferae, Constituents, Biological activities.

INTRODUCTION

The genus *Ferula* comprises perennial herbs distributed from the Mediterranean region to central Asia. Thirty species of the genus are found in Iran, among which 15 are endemic.[1, 2]

The rhizomes of the plants yield oil that is used in the Indian perfumery industry.[3] There have been several studies of the genus *Ferula*, reporting the isolation and spectroscopic characterize of new compounds present in solvent extracts. The reported compounds were mainly coumarins and sesquiterpenes esters; most of these exhibited the daucane skeleton.[4-6]

Ferula flabelliloba Rech. f. & Aell.

The aerial parts of *F. flabelliloba* were collected during the flowering period in the Mashhad to Neyshabur (Province of Khorassan) Iran.

Water-distilled essential oil from aerial parts of *Ferula flabelliloba* Rech. f. & Aell. was analyzed by GC/MS. Twenty compounds constituting 80% of the total components detected were identified. Among them α-pinene (10%), γ-cadinene (13.2%), α-cadinol (12%) and cadina-4, 1(10)-dien-8β-ol was found to be the major components in the oil.[7]

Ferula galbaniflua Boiss

The essential oils obtained by hydrodistillation of the stem and root of *Ferula galbaniflua* were investigated by GC and GC/MS. Forty-one components were identified in the stem oil and 34 components in the root oils representing 87.4% and 86.1% of their total oils, respectively, β-pinene was the major components in both oils: stem (46.4%) and root ("58.8%). The other main constituents in the stem oil were cis-chrysanthenyl acetate (6.1%) and (E)-nerolidol (5.2%)[8]

Ferula gommosa Boiss

The *Ferula gommosa* Boiss. is a wild plant indigenous to Iran. It grows in the northern and western parts of the country[9]

The fruit essential oil of *Ferula gommosa* Boiss., umbelliferae, which has been used as an antiepileptic remedy in Iranian traditional medicine, was evaluated for anticonvulsant activity against experimented seizures. The essential oil had no effects against seizures induced by maximal electroshock. However, it protected mice against pentylenetetrazole – induced tonic seizures. The protected dose produced neurotoxicity.

Moreover, this dose was too close to the LD_{50} of the essential oil. Gas chromatography and gas

chromatography-mass spectroscopy analyzed of the essential oil revealed the present of β-pinene (50%), α-pinene (18.3%), 3-carene (6.7%), α-thujene (3.3%) and sabinene (3.1%) as the main components.

The anticonvulsant and toxic effects of the essential oil may be related to the compounds pinene and α-thujene respectively that present in the essential oil.[10]

***Ferula hirtella* Boiss.**
The aerial parts of *Ferula hirtella* Boiss. was collected on Chalous Road 120 km north of Tehran, during the flowering stage.

The oil obtained by hydro-distillation of the aerial parts of *Ferula hirtella* Boiss. was analyzed by GC and GC/MS.

The oil was characterized by higher amounts of α-pinene (15.4%) and thymol (14.9%) among 35 components comprising 84.8% of the total oil detected.[11]

***Ferula latisecta* Rech**
The hydro-distilled oil from the aerial parts of *Ferula latisecta* Rech. was analyzed by GC and GC/MS. (Z)-ocimenone (32.4%), (E)-ocimenone (20.3%) and cis-pinocarvone (11.4%) were the main components among the 22 constituents characterized in the oil, representing 87.7% of the total components detected.[12]

***Ferula macrocolea* Boiss**
The plant material (*F. macrocolea*) was collected from Fasam 30km north of Tehran, Iran, of flowering stage. Dried aerial parts (250g) were ground and subjected to hydro-distillation for 3h using a Clevenger-type apparatus to yield 1.1% w/w oil.

A hydro-distilled essential oil of the aerial parts of *Ferula macrocolea* Boiss. an endemic species of Iran, was analyzed by GC/MS. The dominant components were β-pinene (15.9%), α-pinene (10.4%) and β-caryophyllene (8.6%). The identification of the copounds was made by comparing[13], their mass spectra and retention indices with those given in the Literature and authentic samples[14]

***Ferula microcolea* Boiss.**
The aerial parts of *F. microcolea* (Boiss.) Boiss. were collected during the flowering stage of Gardaneh Kandavan, om Chalous Road, 120km north of Iran.

The oil obtained by hydrodistillation of the aerial parts of *F. microcolea* (Boiss.) Boiss., which is endemic to Iran, was analyzed by GC and GC/MS. Thirty compounds representing 88.9% of the oil of *F. mictocolea* were identified, among them α-pinene (19.2%), nonane (13.2%) and β-pinene (13.0%) were the major ones.[11]

***Ferula ovina* Boiss**
The aerial parts of *F. ovina* Boiss. were collected during the flowering stage.

The composition of the essential oils of *Ferula ovina* consisted mainly of monoterpenes. α-pinene (50.0%) and limonene (11.5%) were the main components.[15] GC analysis was performed on a Shimadzu 15A gas chromatography equipped with a split/splitless injector (250ºc) and a flame ionization detector (250ºc). Nitrogen was used as carrier gas (1ml/min).

The capillary column used was DB-5 (50m × 0.2mm, film thickness 0.32µm). The column temperature was kept constant at 220ºc for 5min.

Relative percentage amounts were calculated from peal area using Shimadzu C-R4A chromatopac without the use of correction factors.

GC/MS analysis was performed using a Hewlett-packard 5973 with a HP-5MS column (30m × 0.25mm, film thickness 0.25µm). The column temperature was kept at 60ºc for 3min and programmed to 220ºc at rate of 5ºc/min and kept constant at 220ºc for 5min. The flow rate of He as carrier gas with (1ml/min) was with split ratio of 1.50. A quadrupole mass spectrum was scanned over 45-465 amu with an ionizing voltage of 70ev and ionizing current of 150A.

Identification of the constituents of oil was made by comparison of their mass spectra and retention indices (RI) with those given in the Literature and those authentic samples.[16]

***Ferula stenocarpa* Boiss and Hausskn**
The chemical composition of the essential oil obtained from the aerial parts of Ferula stenocarpa Boiss. a native plant of Iran, was examined by using GC and GC/MS. Twenty-six compounds constituting 98.8% of the total components detected were identified. α-pinene (48.8%) and β-pinene (30.1%) were found to be the major components in the oil.

Plant material was collected from Baba-Kalan area in Gachsaran, Province of Kohkiloyeh (Iran).

The oil was obtained from the aerial parts of *Ferula stenocarpa* by hydro-distillation for 3h using a Clevenger-type apparatus, yield 0.33% oil with a strong odor.[17]

***Ferula szowitsiana* DC**
Water distilled essential oil from the aerial parts of *Ferula szowitsiana* DC. (syn. *F. Khorasanica* Rech. F. et Aell) was analyzed by GC and GC/MS.

Twenty-three components representing 100% of the oil of *Ferula szowitsiana* were identified of which α-pinene

(12.5%) and β-pinene (10.1%) and germacrene-D (12.5%) were found to be the major constituents.[18]

CONCLUSION

As mentioned in this review constituents and biological activities of Iranian *Ferula* species including *Ferula flabelliloba* Rech. f. & Aell; *Ferula galbaniflua* Boiss; *Ferula gommosa* Boiss; *Ferula hirtella* Boiss; *Ferula latisecta* Rech; *Ferula macrocolea* Boiss; *Ferula microcolea* Boiss; *Ferula ovina* Boiss; *Ferula stenocarpa* Boiss and Hausskn and *Ferula szowitsiana* DC.

Ferula species produce mainly α-pinene, β-pinene and in some species limonene.

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