

Review Article

The Sainfoins (*Onobrychis* Mill., Fabaceae) – Forage For Grazing Animals, Honey And Medicinal Plants.

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Abstract: The sainfoins (*Onobrychis* Mill., Fabaceae) are Eurasian perennial plants. Genus *Onobrychis* includes species, which are well known as forage for grazing animals and honey plants. Traditionally sainfoins are used against diarrhea although they are not amongst most popular medicinal plants. The plant extracts possess anti-bacterial activity and anti-tumor effect as well as an affinity to the estrogen receptor. Sainfoins contain phenolic compounds, most often flavonoids and tannins, they have low toxicity, but are prospective in the pest control.

Keywords: *Onobrychis* Mill., ethnobotany, pharmacology.

INTRODUCTION

The sainfoins (*Onobrychis* Mill., Fabaceae) are Eurasian perennial plants. More than 150 species are presently known. The Flora Europaea lists 80 species of *Onobrychis* (ILDIS World Database of Legumes 2010, Euro+Med 2006-2019). The main centre of diversity extends from Central Asia to Iran, with 56 species – 27 of which are endemic – in the latter country alone ILDIS World Database of Legumes 2010. Many of the taxa are doubtfully distinct species and obviously still in a process of current evolution and adaptive radiation (Aktoklu 2001, Ranjbar *et al.*, 2009, 2010, Kozuharova *et al.*, 2017a & b). Genus *Onobrychis* includes species, which are well known as forage for grazing animals and honey plants (Mossadegh 1990, Sorkun & Dogan 1995, Manning 2001, Carbonero *et al.*, 2011, Čeksterytė *et al.*, 2013, Kozuharova 2018a & b). Particular emphasis is on *Onobrychis viciifolia* (Łuczaj 2012). This species is naturalized throughout many countries in Europe and North America grasslands.

Ethnobotany and Ethnopharmacology

The ethnobotanical study shows that *O. montana* in the Alps is a valuable forage for grazing animals (Pieroni & Giusti 2009).

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medicinal plants (Bowers *et al.*, 1995, Bonet *et al.*, 1999, Agelet & Valles, 2003).

Modern Pharmacological Tests

Few modern pharmacological tests are performed. *Onobrychis ebenoides* possesses strong anti-tumor effect as well as an affinity to the estrogen receptor due to the ebenfuran content (Halabalaki *et al.*, 2000, Gutterson & Ralston 2002, Halabalaki *et al.*, 2006, 2008a & b, Katsanou *et al.*, 2006, Papoutsis *et al.*, 2007, Tchokouaha *et al.*, 2010). For *O. cornuta* is reported anti-bacterial activity (Joudi & Bibalini 2010). It was shown that *O. nitida* has anti-bacterial activity effect against *B. subtilis* and *S. aureus* and the extracts could be used in pharmacological or dietary applications due to their valuable properties (Bektaş *et al.*, 2018).

Bioactive Compounds

Most often for the members of genus *Onobrychis* are reported phenolic compounds, most often flavonoids and tannins. *Onobrychis biebersteinii*, *Onobrychis arenaria* and *Onobrychis tanaitica* contain flavonoids (Kazakov *et al.*, 1981, Lukyanchikov & Kasakov 1982a, Lukyanchikov & Kasakov 1982b, Bektaş *et al.*, 2018). *Onobrychis bobrovii* and *Onobrychis pulchella* contain polyphenols (Kazakov *et al.*, 1981, Lukyanchikov 1982). Members of genus *Onobrychis* are reported to contain phenolic acids

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(Lukyanchikov *et al.*, 1985). *Onobrychis viciifolia* contains polyphenols, condensed tannins, arbutin, kaempferol, quercetin, rutin, afzelin, the branched quercetin-3-(2 G -rhamnosylrutinoside), the amino acid l-tryptophan, the inositol (+)-pinitol, seven derivatives of the cinnamic acid etc. (Lees *et al.*, 1995, Singh *et al.*, 1997, Marais *et al.*, 2000, Lu *et al.*, 2000, Regos *et al.*, 2009). Proanthocyanidins in sainfoin *Onobrychis viciifolia* are of interest to ameliorate the sustainability of livestock production. It was shown that large variability existed in PA concentrations (23.0–47.5 mg g⁻¹ leaf dry matter (DM)), share of prodelphinidins (79–96%), and mean degree of polymerization (11–14) among, but also within, accessions (Marais *et al.*, 2015). Also arylbenzofurans have been isolated as insect feeding deterrents from the roots of the forage legume, sainfoin. They have been identified as 2-(2'-hydroxy-4'-methoxyphenyl)-5-hydroxy-6-methoxybenzofuran (sainfuran) and 2-(2',4'-dimethoxyphenyl)-5-hydroxy-methoxybenzofuran (methylsainfuran) (Russell 1984).

Three new compounds (2-phenyl-benzofurans) are isolated from *Onobrychis ebenoides*: ebenfuran I, ebenfuran II, and ebenfuran III. Their structures were elucidated on the basis of chemical and spectral data as 2-(2,4-dihydroxyphenyl)-5-hydroxy-6-methoxybenzofuran (1), 2-(2,4-dihydroxyphenyl)-3-formyl-4-hydroxy-6-methoxybenzofuran (2), and 2-(2,4-dihydroxyphenyl)-3-formyl-4-hydroxy-6-methoxy-5-(3-methyl-buten-2-yl)-benzofuran (3) (Halabalaki *et al.*, 2000). Phytochemical investigation of a methanol extract of *Onobrychis ebenoides* yields five new 3-formyl-2-arylbenzofurans, namely, ebenfurans IV–VIII (1–5), together with the known compounds ebenfurans I, II (6), and III (7). Only 1 and 7 exhibited growth inhibitory activity against MCF-7 and Ishikawa cells, suggesting that the prenyl moiety at position C-5 is the key determinant of the cytotoxic activity of this group of compounds (Halabalaki *et al.*, 2008).

Toxicity

In vitro is shown that *Onobrychis viciifolia* has low toxicity (Ince & Filazi 2009).

Pest Control

Prospective field for practical application of the bioactive compounds obtained from *Onobrychis viciifolia* is the pest control. It is active against mosquitoes *Aedes aegypti* and *Anopheles gambiae* (Bowers *et al.*, 1995). The arylbenzofurans possess insect feeding deterrent (Russell 1984). The condensed tannins of several legume taxa, including *Onobrychis viciifolia* have protective activity against the larvae of the economically important nematodes *Trichostrongylus colubriformis* and *Haemonchus contortus* by reducing the egg hatching and migration, development and viability of the larvae (Molan *et al.*, 2000, Barrau *et al.*, 2005, Brunet *et al.*, 2008). However the extracts of *O. viciifolia* do not have a significant

inhibitory effect on the *Eimeria* oocyst (ovine coccidia) in lambs (Saratsis *et al.*, 2012).

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