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RECENT STUDIES ON THE ALKALOIDS OF ANATOLIAN *THALICTRUM* SPECIES

ANADOLU *THALICTRUM* TÜRLERİNİN ALKALOİTLERİ ÜZERİNDE SON ÇALIŞMALAR

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Studies which have been conducted in the last 25 years on the alkaloids of 9 Thalictrum taxa out of 11 growing in Turkey are reviewed. 58 alkaloids including 12 new alkaloids have been isolated and characterized by chromatospectral techniques. Most recently, berberine, fuzitine and fangchinoline were isolated from Thalictrum orientale.

Türkiye'de yetişen 11 Thalictrum taksonunun 9'u üzerinde son 25 yıldır yürütülen çalışmalarda, 12'si yeni olmak üzere 58 alkaloit elde edilerek yapı tayinleri kromatospektral yöntemlerle gerçekleştirilmiştir. En son olarak, Thalictrum orientale'den berberin, fuzitin ve fangchinolin elde edilmiştir.

Key words: *Thalictrum; Alkaloid*

Anahtar kelimeler: *Thalictrum, Alkaloit*

Introduction

Thalictrum (Meadow rue) species are found generally on rocky slopes, crevices, damp ledges and/or meadows. It is represented in Turkey by nine species and altogether eleven taxa (1). The first taxonomic monograph of Thalictrum species was published by Lecoyer (2). Trelease, Greene and Boivin continued on these studies (3,4). The investigations of various Thalictrum alkaloids have appeared in the literature before 1930's in Russia and less than ten alkaloids have been isolated from the genus in 1948. The first review on the Thalictrum alkaloids was published in 1965 and the alkaloids of about sixty species were described in the 70s (5-14). To date, investigators have identified 290 Thalictrum alkaloids in about 80 Thalictrum species (15). While the major works were undertaken in Bulgaria, Japan, the USSR and the United States, the first studies on the alkaloids of Thalictrum were carried out with *T.lucidum* by Baytop *et al* in Turkey (16). Başer *et al* have studied the alkaloids of *T. aquilegifolium, T. foetidum, T. isopyroides, T. minus* var. *majus, T. minus* var. *microphyllum, T. minus* var. *minus* and *T. sultanabadense* since 1980 (17-32). Lastly, the alkaloids of *Thalictrum orientale* have been investigated (33,34).

Ethnomedical uses of *Thalictrum* species growing in Turkey are as follows; The roots of *T. flavum* are used as diuretic, purgative in jaundice and epilepsy (35,36). T. *minus* L. var. *minus* (Karakatran otu, Ağrı-Eleşkirt, Turkey) is applied as a poultice to wounds for its antiinflammatory activity (37).

The only paper on the pharmacological study of Anatolian Thalictrum species was published by Turkish researchers in 1988. In this study, the pharmacological effects of takatonine iodide were tested on isolated jejunum and uterus of rabbits. Takatonine iodide reduced the amplitude of jejunum contractions both spontaneously and induced by acetylcholine chloride. Takatonine iodide contracted uterus preparations even in diestrus, but relaxed those in oestrus. The LD_{50} of this compound was determined as 166.6 $mg.kg^{-1}$ in mice (38).

Hypotensive effect of an alkaloid fraction from *T. minus* var. *microphyllum* was reported. Antipyretic, hypotensive, antiinflammatory and antimicrobial effects were seen on most of the Thalictrum alka-

loids in various pharmacological tests (7,25).

From the ethanolic extract of the powdered roots and rhizomes of *T. orientale* Boiss., berberine, fuzitine and fangchinoline were isolated and characterized. The occurrence of fangchinoline and fuzitine in the genus Thalictrum was shown for the first time (33,34). Distribution of the alkaloids of Anatolian Thalictrum species are given in the table.

Morphological and anatomical features of *Thalictrum orientale* were also published (39).

Results and discussion

Cumulative results of the isolated alkaloids from nine Anatolian *Thalictrum* taxa are given in the table. Berberine was present in all the taxa but *Thalictrum aquilegifolium* yielded only three aporphine alkaloids. Except for *Thalictrum orientale*, all the other taxa contained magnoflorine. *Thalictrum minus* is known to be a rich source of alkaloids and *Thalictrum minus* complex is represented in Turkey by three varieties. Studies on all three taxa resulted in the isolation and identification of several new and known alkaloids. *Thalictrum foetidum* is a rich source of dimeric bisbenzylisoquinoline alkaloids including thalidasine, thaligosinine and thalrugosaminine and aporphine-benzylisoquinoline dimeric alkaloids including thalictrogamine, thalipine and thalmelatidine. In addition to argemonine (pavine alkaloid) the above ground parts of this plant yielded different alkaloids. Aporphine alkaloids were isolated from *T. isopyroides*. On the other hand, *T. lucidum* contained four protoberberine alkaloids. *T. minus* var. *majus* was a source of six dimeric bisbenzylisoquinoline alkaloids (O-methylthalicberine, O-methylthalmethine, obaberine, oxyacanthine, thaligosine, thalicberine). Twentynine alkaloids were isolated from the roots, rhizomes and leaves of *T. minus* var. *microphyllum* including the novel alkaloids bursanine, istanbulamine, iznikine, N-2'-noradiantifoline and uskudaramine. The predominance of monomers to dimers in the leaves of this plant was noted. *T. minus* var. *microphyllum* and var. *minus* were shown to contain thaliglucinone (phenantrene alkaloid). In addition, the follow-

Table . Thalictrum species growing in Turkey and their alkaloids.

Thalictrum species	Plant parts	Alkaloids	Ref.
T.aquilegifolium L.	Leaf, root	Isoboldine, isocorydine, magnoflorine	26
T. foetidum L.	Underground, above ground	Argemonine, berberine, magnoflorine, thalidasine, thaligosinine, thalipine, thalictrogamine, thalmelatine, thalrugosaminine	29,31
T. isopyroides C.A.Meyer	Underground	N-demethylthalphenine, glaucine, magnoflorine, N-methyllaurotetanine	32
T. lucidum L.	Root	Berberine, jatrorrhizine, magnoflorine, palmatine	16
T. minus. var. *majus* (Crantz) Crepin	Root, above ground	Adiantifoline, berberine, O-methylthalicberine, magnoflorine, obaberine, O-methylthalmethine, oxyacanthine, thaligosine, thalicberine, thalmelatidine	30
T. minus var. *microphyllum* Boiss.	Underground	Adiantifoline, aromoline, berberine, bursanine*, homoaromoline, iznikine*, istanbulamine*, obaberine, magnoflorine, obamegine, jatrorrhizine, palmatine, O-methylthalicberine, N-2'-noradiantifoline*, takatonine, thalactamine, thaliadanine, thalicberine, thaliphylline*, thaliglucinone, thaligosine, thaligrisine*, thalmethine, thalrugosine, thalirugine, thalmelatidine, thalrugosinone, thalimicrinone*, üsküdaramine*, 8-trichloromethyldihydro-berberine**	17-22,25
T. minus. var. *minus*	Leaf, underground	Adiantifoline, berberine, magnoflorine, northalibroline*, (-)-N-methylcanadine, O-methylthalicberine, O-methylthalmethine, thaliphylline*, thaliglucinone, thalicberine, thalivarmine*, thalmelatidine, thalmethine, thalmineline*, thalsivasine*	23,27,28
T. orientale Bosis.	Underground	Berberine, fangchinoline, fuzitine	33,34
T. sultanabadense Stapf	Root, above ground	Berberine, hernandezine, magnoflorine, thalbadensine, thalifoline, thalictine	24

*New Alkaloids, **Artefact

ing new bisbenzylisoquinolines, such as, northalibroline, thaliphylline, thalivarmine and thalsivasine were isolated from the leaves of *T. minus* var. *minus*.

Fangchinoline and fuzitine were isolated from *T. orientale* collected from Niğde-Ulukışla in Turkey (33,34). *T. sultanabadense* of Eastern Turkey yielded six alkaloids including the isoquinoline alkaloid thalifoline (monomeric alkaloid) (24).

The continuation of research into the chemistry of *Thalictrum* species is hoped to clarify taxonomical problems as well as to prove the richness of chemical diversity in the genus *Thalictrum*.

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