

ALKALOIDS OF *Mandragora turcomanica*

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The aim of the present work was an investigation of the alkaloids of a species not studied previously — *Mandragora turcomanica* O. Mizgir, an endemic plant of the genus *Mandragora* (mandrake) growing on the southern slopes of the western Kopet Dagh in the Shevlan gorge located at the foot of mts. Syunt and Chokh-Agach [1].

Another four species of this small genus have been described; *M. caulescens* Clarke, from the Himalayas, distinguished by having a flower-bearing stem, *M. haussknechtii* Heldr. from Greece, *M. hispanica* Vierh. from Spain, and *M. shebblearei* C. Fischer from Tibet — a species close to *M. caulescens*. Folk names of *Mandragora* are *zel'e sonnue* [sleep herb] and *mertvaya golova* [dead head]. The poisonous properties of this plant have long been known: the Greek used it as a narcotic and an anesthetic.

Mediterranean species of mandrake have been known to Man since remote antiquity. *M. officinarum*, flowering in spring, and *M. autumnalis* Bertol. et Spreng, flowering in autumn, which are close to *M. turcomanica* have been investigated for alkaloid danger.

In 1889, Ahrens isolated from mandrake roots the alkaloid mandragorine, which proved to be a mixture of hyoscyamine and hyoscine [2]. According to Jackson and Berry [3] the roots contain alkaloids of the tropane series (hyoscyamine, hyoscine, (\pm)-3 α ,6 β -ditigloyloxytropane, and (\pm)-3 α -tigloyloxytropan-6 β -ol).

Mandragora turcomanica is a large annual stemless plant difficult to cultivate. We have studied the alkaloids of this plant cultivated in the Tashkent botanical garden of the Academy of Sciences of the Republic of Uzbekistan. We investigated all the organs of the plant: leaves, the whole epigeal part, roots, rhizomes, fruit at various vegetation periods, seeds. The air-dry raw material previously moistened with 5% ammonia solution was extracted with chloroform. The fruit and seeds were defatted with hexane. The total yields of bases obtained are given in Table 1.

The separation of the total materials obtained and the isolation of individual alkaloids from them were based on their solubilities in various organic solvents, the formation of salts, and chromatography on columns of alumina and silica gel.

Hyoscyamine was isolated from the total bases of the roots and rhizomes by treatment with benzene. The mother solutions were chromatographed on a column of silica gel. From individual fractions we obtained hyoscine in the form of the perchlorate and also apohyoscine. Most of the fractions consisted of mixtures of hyoscine and hyoscyamine with other, minor, alkaloids.

From the total alkaloids of the leaves, by their solubility in ether we obtained two fractions, which were chromatographed on a column of alumina. Elution was performed successively with hexane, ether, benzene, chloroform, and chloroform—methanol (1, 2, 5, and 10%). We isolated apohyoscine and hyoscine from the ethereal eluates, and hyoscine from the benzene and chloroform eluates. By treating the mixture of bases from the fruit and seeds with various solvents (ether, benzene) we isolated the liquid base hyoscine and the crystalline hyoscyamine, which were the main alkaloids in all the total mixtures isolated.

After the separation of the main alkaloids, TLC of the mother solutions showed the presence of another 5—6 bases. A qualitative examination of the general mass spectrum of the mother solutions from the roots and rhizomes showed the presence of molecular ions with m/z 542 (α - or β -belladonnine), m/z 275 (norhyoscyamine), m/z 271 (apoptropine), m/z 239 ((\pm)-3 α -tigloyloxytropan-6 β -ol), and m/z 223 (tigloidine) and also fragments of them. We observed in the mass spectrum the peaks

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TABLE 1. Total Amounts of Alkaloids Present in Various Organs of *Mandragora turcomanica* Cultivated in the Tashkent Botanical Garden

Plant organ	Vegetation period	Total alkaloids, %
Leaves	Beginning of growth	0.31
Roots and rhizomes	End of vegetation	0.22
Epigeal part	"	0.05
Fruit (unripe)	"	0.07
Seeds (ripe)	End of fruit-bearing	0.03

of ions with m/z 284 and 256, showing the presence of stearic and palmitic acids in the plant. In the mass spectra of individual fractions we detected unidentified alkaloids with M^+ 209, 219, and 333.

Thus, the alkaloids of the mandrake *Mandragora turcomanica* have been studied for the first time. Three known bases have been isolated and the presence in the plant of another five known alkaloids has been established (by TLC and mass spectrometry). It has been found that the main alkaloids in all the organs of the plant are the liquid base *l*-hyoscine and the crystalline *l*-hyoscyamine.

REFERENCES

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