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DYNAMICS OF THE ACCUMULATION OF THE ALKALOIDS OF *Arundo donax*

V. U. Khuzhaev, S. F. Aripova, and R. Sh. Shakirov

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Arundo donax – giant reed — is a perennial plant up to 5-6 m tall, the length of each leaf being about 1 m [1]. In Central Asia it is used as building material and fuel [2]. The amount of cellulose in the stems of *A. donax* reaches 44%, in view of which it is used as a raw material for the production of cellulose [3]. The plant is widely distributed in the Caucusus, in Europe, and in Central Asia (on the territories of Tadhzikistan and Turkmenia) [2-4]. *A. donax* is a very easily cultivated plant [5, 6], and in Uzbekistan there are specimens grown in the Botanical Garden of the Academy of Sciences of the Republic of Uzbekistan (AN RUz).

We have studied the introduced (Botanical Garden AN RUz) form of this plant, which has not been investigated previously. The study covered the dynamics of the accumulation of alkaloids in four vegetation periods (early period, height of the plant 15-20 cm; development period, 1-1.5 m; period of vigorous growth, 4-5 m; and end of vegetation, 5-6 m) and each organ of the plant separately. The results are presented in Table 1. The maximum alkaloid content was found in the early period of development. With the growth of the plant, the amount of alkaloids in the epigeal part gradually fell. The same pattern was observed in the roots, but in the period of withering of the epigeal part (end of vegetation) alkaloids again accumulated in the roots. The amount of donaxine in a sample of *A. donax* from the Botanical Garden was lower than in one gathered in the Shaartuz region of Tadzhikistan [4], although the total alkaloid content of the introduced form was higher than that of the wild form. There was practically no donaxine in the roots of the *A. donax* (Botanical Garden). However, in its qualitative composition the introduced form was far more diverse and richer than the wild form.

The study of the levels of total alkaloids in the various plant organs showed that the alkaloids were mainly localized in the leaves, roots and rhizomes, while donaxine was the main component among the total.

Thin-layer chromatography showed the presence of about ten alkaloids in the plant.

The total mixture of alkaloids obtained was separated according to solubilities in various organic solvents and chromatographically on columns of alumina and silica gel. Five alkaloids were isolated: donaxine, the new alkaloid arundine [7], and bases with mp 109-110°C (1), mp 178-180°C (2), and mp 110-111°C (3).

From its spectral characteristics, base (1), with a molecular mass of 219, proved to be the known alkaloid N-phenyl-β-naphthylamine [8]. This is the first time that it has been isolated from a plant of the Gramineae family. Base (2) was an optically active substance with $[\alpha]_D$ +16° ($CHCl_3$). UV spectrum: $\lambda_{max}^{C_2H_5OH}$ 240, 290 nm (lgε 3.82; 3.42). The IR spectrum of (2) contained absorption bands at (cm^{-1}) 3460 (OH), 3360 (NH), 1685 (N—C=O), 1630, 1500, 760 cm^{-1} (substituted benzene ring). The mass spectrum of (2) showed peaks of ions with *m/z* 206 ($M^{+\cdot}$, 60%), 188, 149, 146, 130, 120 (100%), 93, 92, 58, 44.

In the PMR spectrum of (2) were seen two two-proton multiplets with their centers at 2.45 and 3.12 ppm (2 × CH_2), a three-proton singlet at 2.85 ppm (NH—CH_3), an unresolved signal at 5.10 ppm (2 × NH), and signals in the 6.65-7.25 (4H) ppm interval (aromatic protons).

The spectral characteristics of base (2) agreed well with those of donaxaridine, isolated previously from *A. donax* collected at another growth site (Shaartuz, Tadzhistikisatn) [8]. However, in contrast to the latter, base (2) was optically active, from which it followed that (2) was the dextrorotatory isomer of donaxaridine, isolated from a plant for the first time.

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, fax (3712) 891475. Translated from Khimiya Prirodnykh Soedinenii, No. 5, pp. 687-688, September-October, 1994. Original article submitted March 14, 1994.

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TABLE 1. Dynamics of the Accumulation of the Alkaloids of *Arundo donax*

Plant organ	Vegetation period and date of collection	Total alkaloids, %
Epigeal part	Beginning of vegetation, April 19, 1993	0.9
Roots	"	0.7
Epigeal part	Development period, May 25, 1993	0.8
Roots	"	0.55
Epigeal part	Period of vigorous growth, August 10,1993	0.36
Epigeal part	End of vegetation period, November 25, 1992	0.033
Leaves	"	0.13
Stems	"	0.022
Bark of the stems	"	0.030
Roots, rhizomes	"	0.44

Thus, the dynamics of the accumulation of alkaloids in an introduced form of *A. donax* has been studied, and five alkaloids have been isolated.

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