

## BIOLOGICALLY ACTIVE ALKALOIDS OF VERBASCUM SONGORICUM

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### Abstract

Three pyridine alkaloids were isolated and identified from the leaves of *Verbascum songoricum* Shrenk (Scrophulariaceae family): anabazine (1), plantagonine (2), indicaine (3) and 4 acid amides: acetamide (4), benzamide (5) cinnamic (6) and isoferulic (7). All alkaloids in this plant species were isolated for the first time. A new plant-based source of insecticidal alkaloid-anabazine was found.

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## I. INTRODUCTION

The alkaloids of plants belonging to the group of *Verbascum* have not been thoroughly studied so far. In the scientific literature, there is information about only two endemic species of this family of plants: *Verbascum nobile* Velen [1] and *V. Phoenicum* [2] alkaloids. The alkaloids of the plant *Verbascum songoricum* Schrenk were the first to be studied by us.

*Verbascum songoricum* Schrenk is a two-year medicinal plant belonging to Scrophulariaceae family, up to 2 meters tall, with thick hairy leaves. This plant is widespread in the foothills of the Republic of Uzbekistan and other Central Asian republics, up to the middle of the mountain region [3].

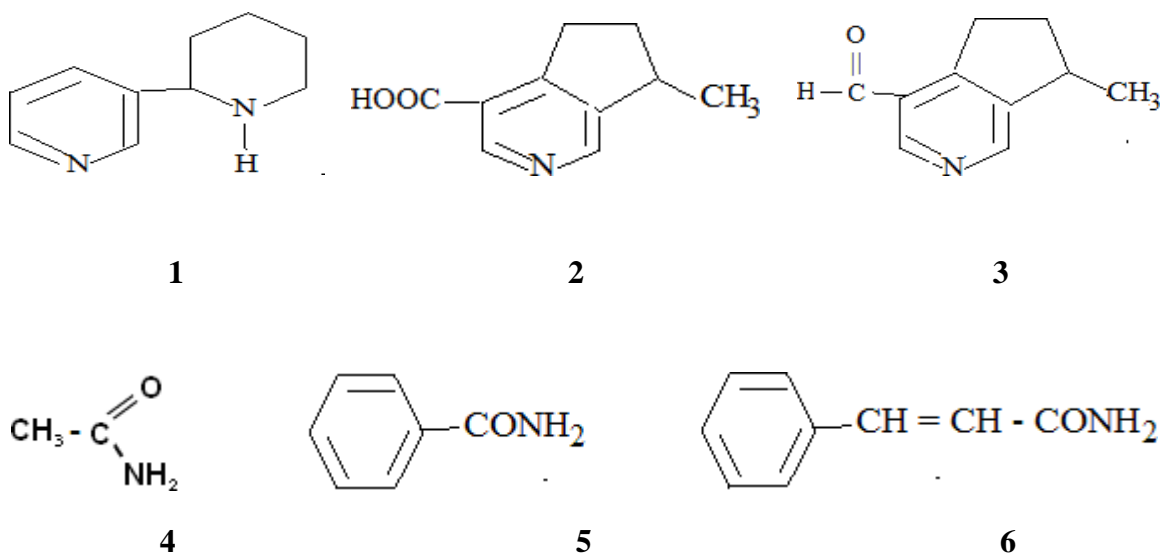
## II. RESEARCH RESULTS AND THEIR DISCUSSION

We soaked the leaf of *Verbascum songoricum* Shrenk (Fig. 1) with 10% ammonia solution collected from the slopes of Chimyan mountains of Tashkent region, and prepared a mixture of 0.25% alkaloids according to the usual chloroform extraction method [4].

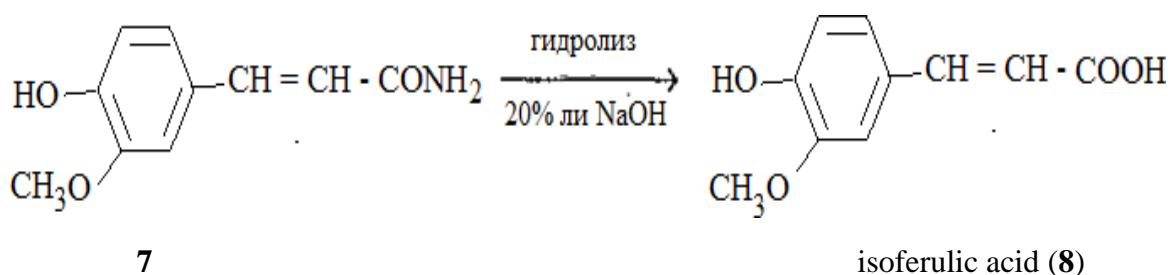


**Figure 1. Verbascum songoricum Schrenk plant in bloom**

We isolated amides of acids three alkaloids: anabazin (1), plantagonine (2), indicaine (3) and 4 amides: acetamide (4), benamide (5), cinnamon (6) isoferul (7) acids as a result of the solubility of this mixture of alkaloids and being in a silica gel column. Anabasine was first isolated from a plant belonging to the cowtail family Scrophulariaceae.



As a result of hydrolysis of isoferulic acid amide (7) with 20% sodium hydroxide solution, we formed isoferulic acid.



Thus, we isolated 3 alkaloids and 4 carboxylic acid amides belonging to the pyridine group from the leaves of *Verbascum songoricum* Schrenk. Synthesis of isoferulic acid was carried out. The main component of the plant leaf is anabazine alkaloid, which makes up 60-65% of the alkaloid mixture. The presence of anabazin in plants belonging to the cowtail family was the first to be determined by us. Therefore, it was determined that the jungor cowtail, which has a large natural reserve, can be a new natural source for obtaining a highly effective insecticide alkaloid-anabazine sulfate.

### III. RESEARCH METHOD AND MATERIALS

Isolation of alkaloids from the leaves of *Verbascum songoricum* Schrenk. We extracted 5 kg of *V. Songoricum* Schrenk plants, collected during flowering from Chimyon mountains, Bostonlik district, Tashkent region, dried in a sunless place, soaked in 10% ammonia solution, with chloroform according to the usual method.

As a result of extraction, we isolated 5.2 g of ether and 7.3 g of chloroform alkaloids mixture (total 12.5 g or 0.25% of dry plant mass).

5.2 g of the ethereal part alkaloids mixture was treated with petroleum ether. Evaporating the solvent, we obtained 1.86 g of a residue consisting mainly of a single alkaloid with an  $R_f$  of 0.42.

Anabasin (1). As a result of purification of 1.86 g of the residue in a silica gel column, we isolated 1.63 g of liquid alkaloid.  $[\alpha]_D - 76^\circ$  (c 0.3; chloroform),  $R_f$  is equal to 0.42 in the benzene-ethanol (4:1) solvent system [8].

UV - spectrum,  $\lambda_{max}$ , HM: 263 (lgε 3,18).

IR - spectrum,  $\nu_{max}$ ,  $cm^{-1}$ : 720, 1060, 1600, 2920, 2980, 3200-3400.

Mass spectrum, m/z: 162(M<sup>+</sup>), 161, 133, 119, 105, 84(100%), 56, 42.

**Anabazine picrate.** We formed anabazin picrate crystals as a result of adding an alcoholic solution of picric acid dropwise to an alcoholic solution of anabazin. Liquid of picrate recrystallized in water is 203 – 205°C.

**Isoferulic acid amide (7).** 0.65 g of isoferulic acid amide [5, 6] crystals were isolated as a result of treatment with acetone of 3.34 g of the mixture of ether alkaloids, which remained insoluble in petroleum ether. Liquid of the substance recrystallized in acetone is 193 – 195°C,  $[\alpha]_D \pm 0^\circ$  (c 0,3; ethanol),  $R_f$  0,49 in benzene-ethanol (4:1) solvent system.

UV - spectrum,  $\lambda_{max}$ , HM: 218, 322 (lgε 4,30; 4,18)

IR - spectrum,  $\nu_{max}$ ,  $cm^{-1}$ : 815, 870, 1000, 1280, 1405, 1520, 1600, 1670 2850, 3160, 3340.

Mass spectrum, m/z: 193(M<sup>+</sup>, 100%), 192, 161, 149, 148, 135, 91, 77.

**Hydrolysis of isoferulic acid amide.** We equipped a flask containing 0.5 g of isoferulic acid amide and 10 ml of 20% sodium hydroxide solution with a reflux condenser. We boiled the reaction mixture in a sand bath for 4 hours. Then the alkaline mixture was cooled, acidified with hydrochloric acid (1:1) solution, and we extracted the reaction product with ether. Evaporating with ether, we formed crystals of isoferulic acid [8] with  $R_f$  0.15. Liquid acid recrystallized in alcohol is 224-226°C.

**Cinnamic acid amide (6).** Additional 0.54 g of anabazin and 0.1 g of cinnamic acid amide were isolated as a result of chromatography of the dark solution from which isoferulic acid amide crystals isolated on a silica gel column. Cinnamic acid amide crystallized in ethanol liquid t. 147 -149°C,  $R_f$  0.65 solvent system: benzene-ethanol (4:1).

By directly comparing this substance with the amide of cinnamic acid isolated from the plant *Verbascum nobile* [2], we found that they are the same substance.

**Separation of the mixture of alkaloids with chloroform.** We isolated 0.7 g of acetamide (4) as a result of treating 7.3 g of a mixture of alkaloids with chloroform with boiling benzene. We chromatographed 6.50 g of residue insoluble in benzene on the column which silica gel was positioned. The column was washed with pure benzene, then with a mixture of benzene-ethanol (99:2) and (95:5) solvents. We isolated 7.8 g crystals of benzamide (5) with a liquid temperature of 128-130°C from pure benzene eluate.

We separated 0.55 g plantagonin (2) and 0.75 g benzamide (5) from benzene-ethanol (98:2) eluate; 0.55 g plantagonin (2) and 0.75 g benzamide (5) from zero (98:2) eluate; 1.05 g of isoferulic acid amide (7) and 0.25 g of indicain (3) from benzene-ethanol (98:5 eluate).

**Plantagonin (2).** Extracted from the benzene-ethanol (99:2) eluate and crystallized plantagonin in acetone, liquid 218 – 220°C,  $[\alpha]_D + 38^\circ$  (c 0,2; ethanol), benzene-ethanol (4:1) is in solvent system  $R_f$  0,58.

**Indicain (3).** By passing the benzene-ethanol (98:5) eluate through an aluminum oxide column, we isolated an oily base with an  $R_f$  0,45.

**Indicaine picrate.** As a result of adding alcoholic solutions of indicain and picric acid, we formed crystals of indicaine picrate at liquid 150 -152°C.

In the identification of plantagonine and indicaine alkaloids, we used real samples of these alkaloids isolated from the plant *Pedicularis olgae* Rgl [7-8].

#### IV. CONCLUSION

1. The alkaloids of *Verbascum songoricum* Schrenk, belonging to the *Scrophulariaceae* family, were studied for the first time, and 3 pyridine alkaloids - anabazin, plantagonine, indicaine, and 4 carboxylic acid amides: acetamide, benzamide, cinnamon, and isoferulic acid amides were isolated in pure crystalline form.

2. It was found that the main alkaloid of the above-ground part of this plant is anabazin, which makes up 60-65% of the extracted alkaloids mixture, and this plant with a large natural reserve can be a new natural raw material source of highly effective insecticide-anabazin.

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