# Nootropic Activity of Extracts from Wild and Cultivated *Alfredia Cernua*

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Antihypoxic and nootropic activities of extracts from aerial parts of wild and cultivated *Alfredia cernua* (L.) *Cass.* were studied on the models of pressure chamber hypoxia, open field test, and passive avoidance conditioning. The extracts of *Alfredia cernua* promoted retention of the orientation reflex and passive avoidance conditioned response and normalized orientation and exploratory activities disordered as a result of hypoxic injury. The efficiency of the extracts was superior to that of piracetam by the effect on retention of passive avoidance response throughout the greater part of the experiment. Nootropic activity of cultivated *Alfredia cernua* was not inferior to that of the wild plant.

**Key Words:** *Alfredia cernua; open field; passive avoidance conditioned reflex*

Pharmacologists engaged in research of all kinds are now more and more often resort to substances of plant origin, and this practice proved to be rather effective.

Among the plants attracting the attention of pharmacologists are plants with mnemotropic activity. One of them is little studied, but promising for medicine *Alfredia cernua* (L.) *Cass* used in popular medicine of Siberia for nervous diseases treatment [5]. Antioxidant activity of extracts from the aerial part of *Alfredia cernua* (ACE) was demonstrated *in vitro* [7]. We demonstrated the nootropic effect of ACE in 95% ethanol [6].

Despite sufficient resources of alfredia [4,5], industrial use of this plant can lead to exhaustion of its resources. That is why the plant has been cultivated in the Siberian Botanical Gardens of Tomsk State University since 1982 [1].

We compared the nootropic effects of wild and cultivated alfredia extracts.

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## MATERIALS AND METHODS

The study was carried out in 50 outbred female mice (20-25 g). The extracts were administered intragastrically through a tube in a dose of 100 mg/kg 1 h before the experiment for 5 days. Piracetam (nootropil, USB) served as the reference drug. The nootropic effects of the extracts were studied using conditioned passive avoidance (PA) task after a hypoxic trauma, induced by hypoxia in a pressure chamber [3]. After 15 min, the orientation and exploratory behavior of animals was studied in the open field test and then PA conditioning was performed [2]. The retention of the reflex was evaluated by the latency of entry (LE) into the dark section of the chamber on days 7, 14, 21, and 28 after training. The data were statistically processed using Student's *t* test.

## RESULTS

Course treatment with wild and cultured ACE caused no changes in behavioral activity of normal animals in the open field in comparison with intact controls (Table 1).

Hypoxic exposure modulated open-field behavior by impairing cognitive functions in experimental

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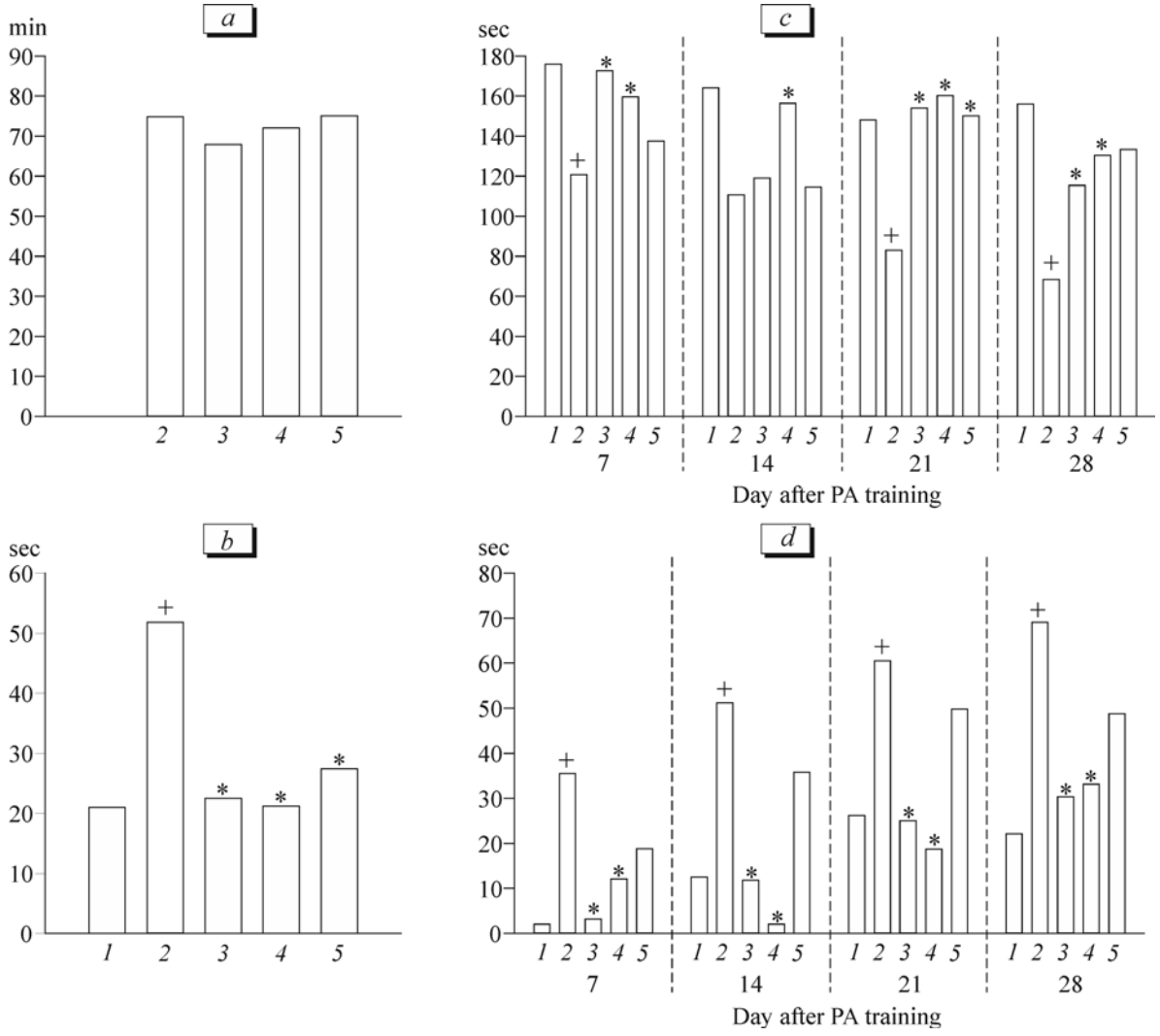


**Fig. 1.** Effects of ACE on survival of mice under conditions of hypercapnic hypoxia (*a*), LE into dark section of the box during PA training (*b*) and reproduction (*c*) and duration of stay in dark section of the box (*d*). $X \pm m$, $n$=10. *1*) intact control; *2*) hypoxic control; *3*) wild ACE; *4*) cultivated ACE; *5*) piracetam. $p \leq 0.05$ compared to: *hypoxic and $^{+}$intact control.

animals. Horizontal and vertical activities in the hypoxic control group decreased by 3.9 and 19 times, respectively, the hole reflex decreased by 4.6 times in comparison with intact animals (Table 1). Treatment with wild and cultivated ACE similarly stimulated orientation and exploratory behavior of animals in comparison with the hypoxic control group. The increase was mainly due to increase of the horizontal and vertical activities and hole reflex. The efficiency of ACE in restoration of the parameters of orientation and exploratory activity after hypoxic trauma was similar to that of piracetam. Hence, ACE normalized orientation and exploratory activities after hypoxic exposure without modifying behavior of normal animals.

The time of entry into the dark section during PA conditioning increased 2.4 times in the hypoxic control group, which attested to disorders in the orientation reflex (Fig. 1). The use of extracts from wild and cultured alfredia similarly increased this parameter, which returned to the level of intact control. Animals treated with piracetam exhibited a pronounced trend to retention of the orientation response.

In the hypoxic control group, LE was 1.8-fold shorter than in intact control group throughout the experiment (Fig. 1). The number of entries into the dark compartment was maximum in animals exposed to hypoxia during all periods of testing. The time spent in the dark compartment was 7-fold longer in the hypoxic control group than in intact animals. These data indicate disorders in PA training and retrieval under the effect of hypoxic injury.

Extracts from wild and cultivated alfredia similarly restored the reflex. The extracts maintained LE

**TABLE 1.** Effect of Alfredia Extracts on Orientation and Exploratory Behavior of Mice in the Open Field ($X \pm m$, $n$=10)

| Group | Total motor activity | Horizontal activity | Vertical activity | Hole reflex | Grooming | Defecation |
|---|---|---|---|---|---|---|
| **Normal animals** | | | | | | |
| Intact control | 107.78±6.51 | 60.4±3.7 | 11.1±2.0 | 34.7±4.2 | 1.2±0.6 | 0.33±0.2 |
| Wild ACE | 109.33±8.00 | 64.6±5.6 | 7.7±1.3 | 36.2±3.3 | 0.9±0.5 | 0±0$^{+}$ |
| Cultivated ACE | 106.33±7.31 | 63.0±3.8 | 10.2±1.7 | 31.2±3.9 | 1.7±0.9 | 0.2±0.1 |
| Piracetam | 92.9±7.0 | 51.3±4.8 | 6.6±1.2 | 33.7±3.3 | 1.0±0.5 | 0.3±0.1 |
| **15 min after hypoxic trauma** | | | | | | |
| Intact control | 76.6±8.48 | 47.0±5.5 | 6.4±0.7 | 20.5±3.1 | 2.1±0.6 | 0.6±0.3 |
| Hypoxic control | 18.56±6.42$^{+}$ | 12.0±4.4$^{+}$ | 0.3±0.2$^{+}$ | 4.4±1.7$^{+}$ | 1.8±0.4 | 0±0 |
| Wild ACE | 53.33±13.93* | 31.9±7.9* | 3.3±1.3* | 14.2±2.7* | 3.9±0.5* | 0±0 |
| Cultivated ACE | 48.10±7.22* | 29.4±5.2* | 3.8±1.1* | 11.3±2.4* | 3.4±0.6* | 0.2±0.1 |
| Piracetam | 50.4±9.0 | 23.9±5.3 | 5.0±0.9* | 18.1±3.8* | 3.1 | 0.4±0.2 |

**Note.** $p \leq 0.05$ compared to *hypoxic and $^{+}$intact control.

at the level of intact control during all periods of testing. The effects of the extracts were more pronounced than the effect of piracetam at the initial stages of the experiment. Piracetam was effective only on day 21 of the experiment. The total time spent in the dark compartment on day 21 (test 4) was 2.4-3.2 times shorter than in the hypoxic control group. The number of entries into the dark compartment decreased more than 2-fold after ACE treatment.

Hence, extracts from wild and cultivated alfredia are characterized by nootropic effects restoring the orientation and exploratory activities in the open field after hypoxic injury and promoted retention of PA response. By nootropic activity cultivated alfredia is not inferior to the wild plant.

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