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RESEARCH OF PHARMACOLOGICAL PROPERTIES OF *LAMIUM ALBUM* L. HERB COMPLEXES

The antibacterial properties of lipophilic, phenolic complexes and dry extract and sedative activity of dry extract obtained from Lamium album (white dead-nettle) herb have been investigated. It is established that white dead-nettle dry extract shows weak, and complexes extracted with chloroform and ethyl acetate – a strong antibacterial activity against S. aureus. As for P. aeruginosa highest activity shows the phenolic complex, for C. albicans – lipophilic complex of L. album herb. Dry extract of white dead-nettle herb shows psycho-sedative properties at a dose of 100 mg/kg, and the tendency to anti-hypoxic and reduce anxiety action at a dose of 10 mg/kg. The dry extract exhibits greater degree of the discovered properties than the reference drug Alora®. Investigated complexes are promising targets for further study of pharmacological mechanisms of antibiotic, depressive and cerebroprotective activity.

Key words: white dead-nettle; antibacterial activity; sedative activity; anti-hypoxic activity

INTRODUCTION

Dead-nettle (*Lamium* L.) – genus of Lamiaceae family, represented in the world flora by over 25 species; there are 7 species in the flora of Ukraine. Species of *Lamium* are synthesizing different groups of biological active substances (BAS) and have sufficient resource base in Ukraine. The most common species of this genus is white dead-nettle – *L. album* L. Above-ground organs of *L. album* contain flavonoids, tannins, iridoids, saponins, alkaloids, essential oils and polysaccharides [10]. In folk medicine, white dead-nettle herb is used as a remedy with expectorant, anti-inflammatory, antispasmodic, diuretic, hemostatic and sedative effects. According to scientific sources extracts of this plant exhibit cytostatic, antiproliferative, antiradical activity [5, 8, 9]. A detailed study of white dead-nettle herb BAS, detection of pharmacological action of compounds complexes isolated from it, obtaining of new medicines of these complexes are actual tasks for the pharmacy.

Earlier in the *L. album* herb we have identified hydroxycoumarins: umbelliferone, scopoletin and aesculetin; flavonoids: isoquercitrin, quercitrin, rutin and astragalin; hydroxycinnamic acids – coffeic, chlorogenic and ferulic; by chromatography-mass spectrometry benzoic, salicylic, phenylacetic and vanillic acids were identified [1, 2]. We have obtained lipophilic, phenolic complexes and dry extract of the white dead-nettle herb and studied composition of their BAS (flavonoids, hydroxycinnamic acids, coumarins, fatty and amino acids, volatile compounds) [7].

The aim of this study was to investigate the antibacterial properties of the obtained complexes and dry extract and sedative activity of dry extract of *L. album* herb.

The objects of the study were lipophilic (extractant – chloroform), phenolic (extractant – ethyl acetate : ethanol 96 % 8 : 2) complexes and dry extract (extractant – 70 % ethanol) obtained from white dead-nettle herb, harvested in Kharkiv region in summer 2011 in the flowering stage.

MATERIALS AND METHODS

Determination of antibacterial activity was conducted under the guidance of the Senior Research Fellow Osolodchenko T. P. on the basis of the Kharkiv Research Institute of Microbiology and Immunology named after I. I. Mechnikov. To determine the antibacterial activity of researched substances used Mueller-Hinton agar, for the cultivation of microorganisms – nutrient agar and Saburo medium. According to WHO guidelines for the evaluation of antibacterial activity used test strains *Staphylococcus aureus* ATCC 25923, *Pseudomonas aeruginosa* ATCC 27853, *Candida albicans* ATCC 885/563. Microbial load amounted to 107 microbial cells per 1 ml of medium and established using optical turbidity standards "Mc Farland". Determination of antibacterial activity carried out on two layers thick in nutrient medium, poured in a Petri dish, by agar diffusion method ("wells"). The study was conducted using 1 % alcoholic solutions of the studied substances.

Sedative and antihypoxic activities of dry extract were determined at the department of pharmacology under the guidance of prof. Shtryhol S. Yu. To study the psychoactive properties of investigated extract was used a standard screening behavioral test of open field (OF), which allows to reveal nature of the impact on the CNS. Antihypoxic activity, which is the part of cerebroprotective action, studied on the model of normobaric hypoxic hypoxia with hypercapnia (NBHHH) [3, 4]. The study was

Table 1

ANTIBACTERIAL PROPERTIES OF *L. ALBUM* HERB COMPLEXES

Complex	The diameters of the zones of stunted growth, mm (M + m), p ≤ 0,05		
	S. aureus	*P. aeruginosa*	*C. albicans*
Dry extract of *L. album* herb	12,2 ± 0,3	20,0 ± 0,3	13,2 ± 0,2
Lipophilic complex of *L. album* herb	30,3 ± 0,4	24,3 ± 0,2	18,1 ± 0,4
Phenolic complex of *L. album* herb	30,0 ± 0,2	28,0 ± 0,1	16,4 ± 0,1

conducted on random bred female white mice weighing 14-21 g, which were kept in vivarium conditions. As the reference drug used syrup "Alora" containing passionflower (*Passiflora incarnata* L.) liquid extract. According to the literature, passionflower extract shows most pronounced psychotropic properties at the doses of 300-400 mg/kg [6], therefore in our experiment reference drug was inserted intragastric (i/g) at a dose of 375 mg/kg in the form of liquid extract. Researched dry extract was inserted i/g at doses of 10 mg/kg and 100 mg/kg. As the syrup "Alora" contains a small amount of ethanol in the aqueous solution, preparation technology of researched dry extract used as excipient ethanol, as well as Tween-80 and purified water. The resulting solution was inserted to animals at the rate of 0.1 ml to 10.0 g of live weight. Tests performed after the lapse of 15-25 minutes after a single insertion of substances.

RESULTS AND DISCUSSION

Results of antimicrobial activity research are shown in Table 1.

As a result of studies founded that white dead-nettle dry extract shows weak, and chloroform and ethyl acetate complexes – a strong antibacterial activity against *S. aureus*. As for *P. aeruginosa* highest activity shows the phenolic complex, for *C. albicans* – lipophilic complex of *L. album* herb. Dry extract proved the least active on all strains of microorganisms used for research.

The OF test results are shown in Table 2.

According to the obtained data, the study extract at a dose of 100 mg/kg, and the reference drug at a dose of 375 mg/kg after a single insertion exhibit a pronounced psychosedative effect which manifests through reduction of motor and orientation-research activity by 26.6 % and 35.7 % respectively. Depressive effect on the CNS is more pronounced for the dead-nettle herb extract than "Alora" syrup, and equally were observed depression of horizontal (32 % compared with the control) and vertical (50 % compared with the control, $p < 0.05$) components.

A distinctive feature of the complex action of dead-nettle 100 mg/kg is pronounced reduction of vegetative support of emotional reaction (2 times decrease in the number of defecation, urination and grooming acts). This property of dry extract may be the component of stress-protect action and used for correcting of neurogenic vegetative disorders.

Single-dose dead-nettle dry extract at a dose of 10 mg/kg does not exert sedation, however, it reduces quantity of vertical activity (stands) by 46 % compared with the control. Lack of motivation to study an unknown location in animals and reduced the frequency of grooming characteristic for action of dead-nettle herb extract at 10 mg/kg may be due to its tranquilizing activity.

Thus, a single insertion of white dead-nettle dry extract at a dose of 100 mg/kg, according to the OF test, demonstrated a more pronounced psychosedative effect on

Table 2

RESULTS OF "OPEN FIELD" TEST AFTER THE INSERTION OF DRY EXTRACT OF WHITE DEAD-NETTLE AND REFERENCE DRUG

Indicators (for 3 min)	Control (0.9 % NaCl i/g, n = 6)	"Alora" syrup (375 mg/kg i/g, n = 6)	Extract (10 mg/kg i/g, n = 6)	Extract (100 mg/kg i/g, n = 6)
Locomotor activity: Number of squares	75.67 ± 10.94	54.33 ± 10.29 (-28.2 %)	76.50 ± 9.31 (+ 1.09 %)	51.50 ± 6.70 (-31.94 %)
Orientation-research activity: Stands	23.17 ± 3.60	12.50 ± 1.14* (-46.05 %)	12.50 ± 2.78* (-46.05 %)	5.00 ± 1.63* (-78.42 %)
Holes	39.33 ± 2.78	31.17 ± 7.20 (-20.75 %)	44.67 ± 3.60 (+ 13.58 %)	29.50 ± 3.60 (-25.00%)
Sum	62.5 ± 2.29	43.67 ± 7.52*	47.17 ± 6.05	31.17 ± 4.9*
Emotion reactions: Boluses	1.33 ± 0.16	2.00 ± 0.98	1.33 ± 0.65	0.33 ± 0.16*
Urinations	0.5 ± 0.16	0.00 ± 0.00	0.50 ± 0.16	0.67 ± 0.16
Grooming	2.0 ± 0.65	2.33 ± 1.31	0.83 ± 0.49	1.50 ± 0.82
Sum	3.83 ± 0.49	5.0 ± 1.31	2.67 ± 0.82	2.50 ± 0.98
Sum of all types of activity	140.33 ± 13.56	103.0 ± 18.6 (-26.60 %)	136.33 ± 14.54 (-2.85 %)	90.17 ± 11.27* (-35.74 %)

Note: * – significant changes in the control group ($p < 0.05$).

Table 3

THE LIFETIME OF THE MICE IN SEALED CHAMBER AFTER THE INSERTION OF DRY EXTRACT OF WHITE DEAD-NETTLE AND REFERENCE DRUG

Group, preparation, dose	The lifetime of the mice, s	Change % compared with the control
Control (0.9% NaCl i/g, n = 6)	3184.67 ± 393.13	–
"Alora" (375 mg/kg i/g, n = 6)	3346.33 ± 1076.96	+ 5.08
Dry extract (10 mg/kg i/g, n = 6)	3726.33 ± 1279.11	+ 17.01
Dry extract (100 mg/kg i/g, n = 6)	2111.33 ± 234.64*	-33.70

Note: * – significant changes in the control group ($p < 0.05$).

the CNS than using known hypnotic – "Alora" syrup. Dry extract at a dose of 10 mg/kg after a single insertion provides a tranquilizing effect (reducing anxiety), not showing sedation.

In conditions of NBHHH test (Table 3) mouse lived in a hermetically sealed chamber on average during 3185 c. Insertion of dead-nettle dry extract manifested itself as follows: reducing the lifetime of the mice in the high dose (100 mg/kg) to 33.7% ($p < 0.05$ for control) but statistically unreliable ($p>0.05$) increasing it to 17 % in the low dose (10 mg/kg). Thus, we can conclude tendency to the presence of antihypoxic properties of dead-nettle dry extract in dose 10 mg/kg.

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In these conditions, the reference drug had almost no effect on the recorded index, showing a tendency to increase it of 5.1 %.

CONCLUSIONS

Lipophilic and phenolic complexes obtained from white dead-nettle herb show a strong antibacterial activity against *S. aureus*, *P. aeruginosa* and antifungal activity against *C. albicans*.

Dry extract of white dead-nettle herb shows psychosedative properties at a dose of 100 mg/kg, and the tendency to antihypoxic action and reduce anxiety in a dose of 10 mg/kg. The dry extract exhibits greater degree of the discovered properties than the reference drug Alora® – effective and well-known in Ukraine plant hypnotic.

Investigated complexes are promising targets for further study of pharmacological mechanisms of antibiotic, depressive and cerebroprotective activity.

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ДОСЛІДЖЕННЯ ФАРМАКОЛОГІЧНИХ ВЛАСТИВОСТЕЙ КОМПЛЕКСІВ ТРАВИ *LAMIUM ALBUM* L.

Досліджені антибактеріальні властивості ліпофільного, фенольного комплексів і сухого екстракту та седативна активність сухого екстракту трави *L. album.* Встановлено, що сухий екстракт глухої кропиви білої проявляє слабку, а хлороформний та етилацетатний комплекси – виражену антибактеріальну активність по відношенню до *S. aureus*. Щодо *P. aeruginosa* найвищу активність демонструє фенольний комплекс, щодо *C. albicans* – ліпофільний комплекс трави *L. album*. Сухий екстракт глухої кропиви білої проявляє психоседативні властивості в дозі 100 мг/кг, а також тенденцію до антигіпоксичної дії та зниження тривоги в дозі 10 мг/кг. Виявлені властивості сухий екстракт проявляє в більшій мірі, ніж препарат порівняння Алора®. Досліджувані комплекси є перспективними об'єктами для подальшого фармакологічного вивчення на предмет механізмів антибактеріальної, депримуючої і церебропротекторної активності.

Ключові слова: Глуха кропива біла; антибактеріальна активність; седативна активність; антигіпоксична активність

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ИССЛЕДОВАНИЕ ФАРМАКОЛОГИЧЕСКИХ СВОЙСТВ КОМПЛЕКСОВ ТРАВЫ *LAMIUM ALBUM* L.

Исследованы антибактериальные свойства липофильного, фенольного комплексов и сухого экстракта и седативная активность сухого экстракта травы *L. album*. Установлено, что сухой экстракт яснотки белой проявляет слабую, а хлороформный и этилацетатный комплексы – выраженную антибактериальную активность по отношению к *S. aureus*. Относительно *P. aeruginosa* высокую активность демонстрирует фенольный комплекс, относительно *C. albicans* – липофильный комплекс травы *L. album*. Сухой экстракт яснотки белой проявляет психоседативные свойства в дозе 100 мг/кг, а также тенденцию к антигипоксическому действию и снижению тревоги в дозе 10 мг/кг. Выявленные свойства сухой экстракт проявляет в большей степени, чем препарат сравнения Алора®. Исследуемые комплексы являются перспективными объектами для дальнейшего фармакологического изучения на предмет механизмов антибактериальной, депримирующей и церебропротекторной активности.

Ключевые слова: Яснотка белая; антибактериальная активность; седативная активность; антигипоксическая активность

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