

БИОЛОГИЧЕСКАЯ АКТИВНОСТЬ
РАСТЕНИЙ

ANTIALLERGIC ACTIVITY
OF *MATRICARIA DISCOIDEA* HERB (ASTERACEAE)

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It has been established that *Matricaria discoidea* herb infusion containing flavonoids and polysaccharides, at doses of 100, 200 and 400 mg/kg, has a pronounced antiallergic effect on compound 48/80-induced model anaphylactoid reaction. The Weigle index in the study groups was 0.7–1.6. The median effectivedose (ED₅₀) was 111.7 mg/kg.

Keywords: *Matricaria discoidea* herb, compound 48/80, antiallergic activity

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Matricaria discoidea DC. (syn. *Chamomilla suaveolens* (Pursch) Rydb.) is a species widespread in the Republic of Belarus. It is known that the flowers and herb of *M. discoidea* contain essential oils, in which myrcene, β-farnesene and geranylisolate prevail and polysaccharides, coumarins, hydroxycinnamic and chlorogenic acids and flavonoids [1–4] are found.

Whereas the plant raw material is readily available, and its chemical composition has been studied in detail, there is no available data on pharmacological activity of *M. discoidea*.

The presence in *M. discoidea* of flavonoids as one of the dominant groups of biologically active substances suggests that, as in the case of other species [5, 6], it can exhibit anti-allergic activity.

The aim of this work was to study the anti-allergic activity of *M. discoidea* herb infusion on compound 48/80-induced model anaphylactoid reaction.

MATERIALS AND METHODS

The research was focused on the study of *Matricaria discoidea* herb infusion. Plant raw material was harvested at the stage of massive flowering in summer 2018 near the city of Bobruisk (the Republic of Belarus) in a field at least 500–700 m from a local road.

M. discoidea herb infusion was prepared using plant raw material with a particle size of 1 mm and purified water, at plant raw material to water ratio *P* 1.5 : 100. The herb was infused for 15 minutes. The resulting infusion of *M. discoidea* herb was studied for the content of flavonoids and polysaccharides.

The assay of flavonoids in terms of quercetin was carried out according to the following procedure:

1.0 mL of a 10 g/L aluminum chloride solution in alcohol (95%, v/v) *P* was added to 2.0 mL of *M. discoidea* herb infusion and diluted with ethanol (95%, v/v) *P* to a volume of 25.0 mL. After 20 min, the absorbance of the test solution was measured at 430 nm. As compensation liquid, 2.0 mL of the studied infusion adjusted with ethanol (95%, v/v) *P* to a volume of 25.0 mL was used.

Assay of polysaccharides was carried out as follows: 75 mL of ethanol (95%, v/v) *P* was added to 25.0 mL of *M. discoidea* herb infusion, mixed and heated in a water bath at 60°C for 5 min. The supernatant was filtered through a pre-weighed filter. The filter with the precipitate of polysaccharides was dried and weighed.

The resulting infusion of *M. discoidea* herb contained 10.41 ± 2.24 mg/mL flavonoids and 4.93 ± 0.57 mg/mL polysaccharides.

To conduct pharmacological studies, the resulting infusion was evaporated. The dry residue was dissolved in purified water *P* to obtain extract in sample concentrations of 100, 200 and 400 mg/kg. Purified water *P* was used as a placebo.

Bidens tripartita herb was used for a comparative assessment of the pharmacological activity. This medicinal plant is widely recognized for its anti-allergic properties, and as well as *M. discoidea* herb, contains flavonoids and polysaccharides as main groups of biologically active substances. *B. tripartita* herb infusion was prepared as described for *M. discoidea* herb. The resulting dosage form contained 8.16 ± 1.07 mg/mL of flavonoids and 3.40 ± 0.17 mg/mL of polysaccharides.

The herb infusion of *B. tripartita*, the recognized anti-allergic medicinal plant, was used as a reference medicine in the same doses.

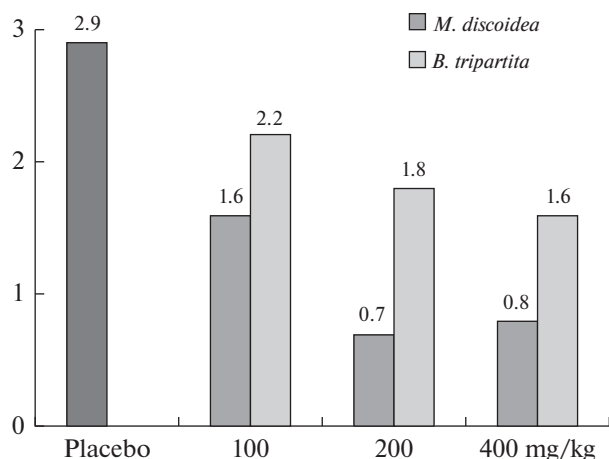


Fig. 1. Weigle index of *Matricaria discoidea* herb infusion, *Bidens tripartita* herb infusion and placebo. X-axis – group of animals; y-axis – Weigle index.

Anti-allergic activity was studied using the model of anaphylactoid reaction induced by compound 48/80 in male outbred mice with weight of 30–35 g, 10 animals in a group [7].

The severity of the anaphylactoid reaction was expressed in Weigle indices (I) [8], which were calculated according to equation:

$$I = \frac{N \times 4 + N1 \times 3 + N2 \times 2 + N3}{N + N1 + N2 + N3 + N4}$$

where: I – the Weigle index, N – the number of dead animals, N1 – the number of animals which developed acute anaphylactoid reaction lasting at least 30 minutes, N2 – the number of animals which developed moderate anaphylactoid reaction lasting more than 15 minutes, but less than 30 minutes, N3 – the number of animals which developed weak anaphylactoid reaction lasting no more than 15 minutes, N4 – animals which did not show signs of anaphylactoid reaction.

The animals were obtained from the Rappolovo nursery of the Russian Academy of Medical Sciences and kept in the vivarium of the Vitebsk State Medical University in accordance with the established require-

ments. The work complied with the requirements for humane use of experimental animals.

Statistical processing of the results was carried out using the computer program “Statistica Advanced 10.0”.

RESULTS AND DISCUSSION

In the study groups receiving *M. discoidea* herb infusion, its antiallergic effect was dose-dependent. In group receiving 100 mg/kg of *M. discoidea* herb infusion, two animals were active, showing no signs of anaphylactoid reaction (decreased motor activity, rapid heartbeat, shortness of breath, convulsions). Other animals developed weak to moderate anaphylactoid reaction (Table 1). All animals of this group survived.

In the group receiving 200 mg/kg of *M. discoidea* herb infusion, the effect of compound 48/80 was more easily tolerated: in five animals out of 10, visible changes in the activity were not observed, signs of anaphylactoid reaction were absent. In the remaining animals, signs of weak anaphylactoid reaction prevailed.

Among animals, that received 400 mg/kg of *M. discoidea* herb infusion, signs of anaphylactoid reaction were not observed in 50% of animals, one animal died 15 minutes after administration of compound 48/80, and remaining animals developed a weak anaphylactoid reaction.

In all studied placebo groups, the anaphylactoid reaction was pronounced. The animals developed moderate and strong anaphylactoid reaction, three animals died after 15–30 minutes.

To compare antiallergic effect in groups receiving *M. discoidea* herb infusion and reference medicine, Weigle index was calculated (see the Fig. 1).

An analysis of the results shows that the Weigle index in the groups receiving *M. discoidea* herb infusion was lower than in placebo group and had a dose-dependent character described by second degree polynomial equation ($y = 0.00003x^2 - 0.0165x + 2.9191$; $r = 0.9993$). The median effective dose (ED₅₀) was 111.7 mg/kg.

The Weigle index in groups receiving the reference medicine – *Bidens tripartita* herb infusion, was also

Table 1. The severity of anaphylactoid reaction in animals of different groups

Group		No anaphylactoid reaction	Weak anaphylactoid reaction (5–15 min)	Moderate anaphylactoid reaction (15–30 min)	Severe anaphylactoid reaction (more than 30 min)	Died
<i>Matricaria discoidea</i> herb infusion	100 mg/kg	2	2	4	2	–
	200 mg/kg	5	4	–	1	–
	400 mg/kg	5	4	–	–	1
<i>Bidens tripartita</i> herb infusion	100 mg/kg	–	1	6	3	–
	200 mg/kg	1	4	2	2	1
	400 mg/kg	2	3	3	1	1
Placebo		–	–	4	3	3

lower than in placebo group and had a dose-dependent character described by the second degree polynomial equation ($y = 0.00001x^2 - 0.0079x + 2.8918$; $r = 0.9996$). The median effective dose (ED₅₀) of the reference medicine was 503.8 mg/kg.

Thus, *M. discoidea* herb infusion exceeded the reference medicine 4.5 times by the exhibited antiallergic activity.

CONCLUSION

The antiallergic activity of *Matricaria discoidea* herb infusion was studied using compound 48/80-in-

duced model anaphylactoid reaction. It was shown that *M. discoidea* herb infusion containing flavonoids and polysaccharides in the studied doses has a pronounced anti-anaphylactoid effect, the ED₅₀ is 111.7 mg/kg and exceeded that for infusion of *Bidens tripartita* herb by 4.5 times.

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Противоаллергическая активность травы *Matricaria discoidea* (Asteraceae)

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Аннотация—Установлено, что чай из травы *Matricaria discoidea*, содержащий флавоноиды и полисахариды, в дозах 100, 200 и 400 мг/кг обладает выраженным противоаллергическим эффектом на модели анафилактической реакции, индуцированной соединением 48/80. Индекс Weigle в исследуемых группах составил 0.7–1.6. Полуэффе́ктивная доза ED₅₀ равна 111.7 мг/кг.

Ключевые слова: трава *Matricaria discoidea*, соединение 48/80, противоаллергическая активность

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