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АНТИМИКРОБНЫЕ И ДРУГИЕ ЦЕЛЕБНЫЕ СВОЙСТВА САФЛОРЫ (*CARTHAMUS TINCTORIUS L.*)

А. А. Тургумбаева[1], К.Д. Рахимов[2], Г.О.Устенова[1]

[1] Казахский Национальный медицинский университет им. С.Д. Асфендиярова, Алматы, Казахстан
[2] Казахский медицинский университет непрерывного образования, Алматы, Казахстан
e-mail: aknurik_88@mail.ru

Ключевые слова: *Carthamus tinctorius*, Asteraceae, сафлора, цветы, фитохимия, эфирное масло.

Впервые изучен состав цветков сафлоры и экспериментально подтверждена целесообразность использования полученных продуктов в составе лекарственных средств. Способ получения средства, обладающего антимикробной, противовоспалительной и ранозаживляющей средства из цветки сафлоры *(Carthamus tinctorius L.)*. Качественный состав эфирного масла цветки сафлоры и количественное содержание идентифицированных компонентов в нём устанавливали методом газо-жидкостной хроматографии GC-FID (Gas Chromatography – Flame Ionization Detector) с использованием стандартных образцов. Методом ГЖХ установлено наличие 8 компонентов, из них также идентифицированы по стандартным образцам beta-bisabolene 6,63 % , E-Nuciferol 9,06%, Z-Nuciferol 14,14 %, Cis-Lanceol 42, 45%.

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ANTIMICROBIAL AND OTHER MEDICINAL PROPERTIES OF SAFFLOWER (*CARTHAMUS TINCTORIUS L.*)

A.A.Turgumbayeva [1], K.D. Rakhimov[2], G.O. Ustenova [1]

[1]S.D. Asfendiyarov Kazakh National Medical University, Almaty, Republic of Kazakhstan
[2]Kazakh Medical University Continuing Education, Almaty, Kazakhstan

Keywords: *Carthamus tinctorius*, Asteraceae, safflower, flowers, phytochemistry, volatile oil.

Abstract: *Carthamus tinctorius L. (Asteraceae)* is used medicinally in Europe, China and India amongst several places in the world. The aim was designed to study the biological activity and chemical composition of volatile oil of *Carthamus tinctorius L.* The composition of the volatile oil obtained from the dried flowers of *Carthamus tinctorius L.* collected in Kazakhstan was analyzed by gas chromatography (GC) and gas chromatography-mass spectrophotometry (GC- FID). 8 known and 2 unknown compounds were detected from the extract. The major compounds of the oil were 3-carene, beta-bisabolene, alpha-trans-bergamotol, Z-nuciferol, E-nuciferol, cis-Lanceol, n-tricosane and pentacosane. The volatile oil of this plant have been demonstrated to possess multiple pharmacological activities. In this review, we have explored the phytochemistry and pharmacological activities of *CarthamusTinctorius L.* as well as have received antimicrobial, anti-inflammatory, a medicinal ointment.

Introduction. Safflower, *Carthamus tinctorius L.*, is a member of the family Compositae or Asteraceae, cultivated mainly for its seed, which is used as edible oil and as birdseed. Traditionally, the crop was grown for its flowers, used for colouring and flavouring foods and making dyes, especially before cheaper aniline dyes became available, and in medicines.

The plant has a strong taproot which enables it to thrive in dry climates. Safflower is one of humanity's oldest crops, but generally it has been grown on small plots for the grower's personal use and

it remains a minor crop with world seed production around 800 000 t per year. Oil has been produced commercially and for export for about 50 years, first as an oil source for the paint industry, now for its edible oil for cooking, margarine and salad oil. Over 60 countries grow safflower, but over half is produced in India (mainly for the domestic vegetable oil market). Production in the USA, Mexico, Ethiopia, Argentina and Australia comprises most of the remainder. China has a significant area planted to safflower, but the florets are harvested for use in traditional medicines and the crop is not reported internationally. Also, the crop has also been cultivated in many other countries, such as Kazakhstan, Ethiopia, Argentina, China, Uzbekistan, Australia, Russian Federation, Pakistan, and Spain [1, 2]. Traditionally, the crop was grown for its flowers, used for coloring and flavoring foods and making dyes, especially before cheaper aniline dyes became available and in medicines. It is considered one of the alternative oil crops, particularly in the dry and semi dry lands due to its tolerance to drought, salinity and cold stress. Safflower oil quality is high due to its fatty acids composition. Standard safflower oil contains about 6-8 % palmitic acid, 2-3 % stearic acid, 16-20% oleic acid and 71-75 % linoleic acid. In addition, very low levels of myristic (0.24 %) and behenic (0.43 %) acids were recorded in its oil [3].

Safflower is widely distributed in eastern and western Asia. The flower of Safflower is used in folk medicine as an analgesic, antithrombotic and antihypertensive crude drug as well as a source of natural colorants [4-8]. Safflower has long been grown for the dye extracted from the flowers. Depending on the dyeing procedure and the addition of other colorants and mordant's, it imparts a yellow, red, brown or purple color to cloth. With the introduction of cheap synthetic dyes, its importance as a dye source has greatly declined. However, dyes are still produced on a small scale for traditional and religious purposes.

Materials and methods

Plant Material: The plant materials used in study were obtained from Almaty, southern Kazakhstan, safflower (*Carthamus tinctorius L.*) collected in the summer. The plant was identified by taxonomist Konyrbekov M. of the station. A voucher specimen was preserved at the herbarium Krasnovodopadskaya Breeding Experimental Station, Ministry of Agriculture, Republic of Kazakhstan.

Phytochemistry

More than 200 compounds have been isolated from C. tinctorius and the commonly known ones are flavonoids, phenylethanoid glycosides, coumarins, fatty acids, steroids and polysaccharides [9]. Analysis of safflower seeds showed that crude protein ranged from 14.9 % to 17 %, total sugar from 3.2 % to 9.2 % and extractable lipids from 25 % to 40 % [10]. Oil content of the seeds is similar to that of olive and includes linoleic acid (63 %–72 %), oleic acid (16 %–25 %), and linolenic acid (1 %–6 %) [11-12].

Results and discussion

Compounds were quantified by performing area percentage calculations based on the total combined FID area. For example, the area for each reported peak was divided by total integrated area from the FID chromatogram from all reported peaks and multiplied by 100 to arrive at a percentage. The percentage of a peak is a percentage relative to all other constituents integrated in the FID chromatogram. The 8 components represented about 98.642% of the total detected constituents. The percentage content of the individual components, retention time, Kovat`s index (KI) are summarized in Table 1. The differences in chemical composition essential oil of the present study and previous research may be because of the geographic and climatic factors, chemo types, drying conditions and mode of distillation.

Table 1.0: Chemical composition of *Carthamus tinctorius L*

Compounds	Retention time	Kovat Index (KI)	Area %
3-Carene	8.325	1007.70	0.967
Beta-Bisabolene	28.546	1512.75	6.629
Unknown	29.113	1526.91	1.392
Alpha-trans-bergamotol	35.195	1686.46	3.457
Z-Nuciferol	36.585	1725.99	14.139
E-Nuciferol	37.713	1755.92	9.057
Cis-Lanceol	37.896	1761.72	42.449
Unknown	44.465	1957.40	11.967
n-Tricosane	54.610	2299.22	4.197
Pentacosane	59.914		4.388

Antimicrobial activity. Antimicrobial study was done for the volatile oil against five fungi and five bacteria. The oil was found to have a good activity against *Cryptococcus neoformans* ATCC 90113 with an IC_{50} value of 8 μg/ml. However, no antimicrobial activity was shown against *Carthamus tinctorius* L (Table 2). [6, 13], reported that the essential oil of *Carthamustinctorius*L exhibited a negative antifungal effect using broth microdilution and disc gel diffusion methods. The antifungal activity was assessed against five dermatophytes (*Trichophyton mentagrophytes, T.rubrum, Microsporumcanis, M.nanum and Epidermophytonfloccosum*), three filamentous fungi *(Aspergillousniger, A.fumigatus and Mucorsps*.) and five strains of yeast (*Saccharomyces cerevisiae,C.neoformans,Candida albicans,C.tropicalis and Torulopsisglabrata*). This report is similar with what we are reporting however we found the volatile oil *Carthamustinctorius*L IC_{50} value of 20.41 μg/ml against *C.neoformans*.

Antimalarial activity. Antimalarial activity was studied for the volatile oil of *CarthamustinctoriusL* against chloroquine sensitive *Plasmodium falciparum* (D6, Sierra Leone) and resistant (W2, Indo China). The oil showed moderate antimalarial activity (IC_{50} 47600 μg/ml against *P. falciparum* D6 and *P. falciparum* W2). *CarthamustinctoriusL* showed good activity with IC_{50} values >47600 μg/ml against *P. falciparum* D6 and *P. falciparum* W2 (Table 2) [14].

Antileishmanial activity. Antileishmanial evaluation was done on the oil *CarthamustinctoriusL* against *Leishmania donovani*. The oil showed moderate activity with IC_{50} and IC_{90} values of 80.0μg/ml. *CarthamustinctoriusL* showed activity with IC_{50} and IC_{90}>80 [15].

Table 2.0 – Biological activity of essential oil of *Carthamus tinctorius L.*

Biological activity	Test parasite	*CarthamustinctoriusL* essential oil (μg/ml)
Antileishmanial activity	*L. donovani* IC_{50} IC_{90}	 >80 >80
Antimalarial activity	*P.falciparum* D6 IC_{50} W2 IC_{50}	>47600
Antimicrobial	*C .neoformans*	<20.41

An ointment of essential oil the from safflower flowers grown Kazakhstan: for creating ointment of flowers safflower (*Carthamus tinctorius L.*) optimum composition of the excipients. So several models were created ointment bases - emulsion, a slurry, combined with application of various the excipients - sunflower oil, glycerol, paraffin oil, lanolin, etc., Emulsifiers - Tween-80, T-2 and others. The most efficient composition of the technological parameters was ointment base with the following composition (Table 3):

Table 3.0 The composation an ointment consisting 100 g.

The active substance	
essential oil obtained from the flowers of safflower	9.0
The auxiliary substances	
sunflower oil	40.0
T-2	5.0
Purified Water	46.8
Oleum Menthaepiperitae	0.2
Total weight	100, 0

By its consistency suitable for application of ointment and a prolonged exposure to lesion focus. Other compositions were not suitable for their consistency of, as were liquefaction or thick, which was inconvenient terms of application, and distinguished by the fact that the system was subjected to separation and was losing their structural and mechanical properties.

At the stage of carried out preparation and auxiliary of drugs and materials. At the initial stage emulsion base was prepared of the following composition: 40 parts of sunflower oil, 5 parts of emulsifier T-2 ad 100.0 parts of purified water. Emulsion base was prepared in the following way: an emulsifier T-2 was melted in a water bath, and added to overheated oil in the last turn slowly added in a thin stream hot

water (90 °C). Then, medicinal substances were injected into the finished emulsion base. The addition of essential oil obtained from safflower flowers to the base was carried out at preliminary maximum dispersing them before molecular state, which was carried out with constant stirring to forming a stable system. In the next step was carried out homogenization ointment to obtain homogeneous mass. Ointment from almost white to slightly yellowish color with a weak a characteristic smell of Oleum Menthaepiperitae. The proposed method allows to obtain means of wound healing, regenerating and anti-inflammatory activity.

The indexes of quality according with the requirements of the State Pharmacopoeia of the Republic of Kazakhstan.

Conclusions

From the result of the study, it could be concluded that the safflower collected from the Southern region of Kazakhstan is one of the best genotype available. *Carthamus tinctorius* is regarded as a valuable plant in Kazakh system of medicine, Chinese medicine and modern drug development areas for its versatile medicinal uses. The aim was designed to study the biological activity and chemical composition of volatile oil of *Carthamus tinctorius L.* The composition of the volatile oil obtained from the dried flowers of *Carthamus tinctorius L.* growing in Kazakhstan was analyzed by gas chromatography (GC) and gas chromatography-mass spectrophotometry (GC- FID). 8 known and 2 unknown compounds were detected from the extract. The major compounds of the oil were 3-carene, beta-bisabolene, alpha-trans-bergamotol, Z-nuciferol, E-nuciferol, cis-Lanceol, n-tricosane and pentacosane. The traditional use of *Carthamus tinctorius L.* against various skin infections wounds has been corroborated since the extracts displayed in vitro antimicrobial properties against different test organisms. The fact that the ethyl acetate extracts of this medicinal plant were very active against the test organisms. To our knowledge from literature, this is the first time, report on the antileishmanial activity, antimalarial activity and antimicrobial properties of extracts. Obtained an experimental industrial series of ointment based medicinal vegetative raw materials (*Carthamus tinctorius L.*).

Development of an optimal composition and rational technology medicinal products based on essential oil obtained from the flowers of safflower, sunflower oil, emulsifiers T-2 and others. The antimicrobial, anti-inflammatory, regenerative, curative effect. From the result obtained in the study traditional use of *Carthamus tinctorius L* against various skin infections wounds has been corroborated since the extracts displayed in vitro antimicrobial properties against different test organisms. Further studies of other phyto-active compounds will possibly lead to exploration of new methods for therapeutic and industrial application.

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МАҚСАРЫ ӨСІМДІГІНІҢ (*CARTHAMUS TINCTORIUS L.*) МИКРОБҚА ҚАРСЫ ЖӘНЕ БАСҚА ШИПАЛЫ ҚАСИЕТТЕРІН ЗЕРТТЕУ

А. А. Тургумбаева[1], К.Д. Рахимов[2], Г.О.Устенова[1].

[1] С.Ж.Асфендияров атындағы Қазақ Ұлттық Медицина Университеті
Алматы, Қазақстан.
[2] Қазақ медициналық үздіксіз білім беру университет, Алматы, Қазақстан.

Тірек сөздер: *Carthamus tinctorius*, Asteraceae, мақсары, гүл, фитохимия, эфир майы.

Алғаш рет мақсары өсімдігінің гүлі тәжірбие жүзінде зерттелді және дәрілік қалып жасау негіздемесі ұсынылды. Шикізат гүлінен *Carthamus Tinctorius* микробқа, қабынуға қарсы және жара жазушы әсері бар дәрілік қалып жасады. Сол себепті біздің зерттеуіміздегі Қазақстандық мақсары өсімдігінің гүлінен сары түсті, майлы экстракт алынды. Өсімдік шикізаты гүлінен алынған майлы экстрактының эфир майлары құрамы GC-FID (Gas Chromatography – Flame Ionization Detector, газ хроматограммасы жалынды фотометорлық детектор) анықталды, нәтижесінде келесідей заттар көп бөлінді beta-bisabolene 6,63 % , E-Nuciferol 9,06%, Z-Nuciferol 14,14 %, Cis-Lanceol 42, 45%.

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