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**CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF *MATRICARIA CHAMOMILLA L.*, *JASMINUM OFFICINALE L.* AND *URTICA DIOICA L.*: IMPORTANCE IN FOLK MEDICINE AND PHARMACEUTICALS**

**ХИМИЧЕСКИЙ СОСТАВ И АНТИОКСИДАНТНАЯ АКТИВНОСТЬ *MATRICARIA CHAMOMILLA L.*, *JASMINUM OFFICINALE L.* И *URTICA DIOICA L.*: ЗНАЧЕНИЕ В НАРОДНОЙ МЕДИЦИНЕ И ФАРМАЦЕВТИКЕ**

**MATRICARIA CHAMOMILLA L., JASMINUM OFFICINALE L. VA URTICA DIOICA L. NING KIMYOVIY TARKIBI VA ANTIOKSIDANT FAOLIYATI: XALQ TABIBI VA FARMASEVТИКАДАГИ АХИМІЯТЫ**

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**Abstract**

Medicinal plants are valuable sources of bioactive compounds with potential therapeutic applications. This study focuses on the chemical composition and antioxidant potential of three medicinal species: *Matricaria chamomilla L.*, *Jasminum officinale L.*, and *Urtica dioica L.*. The main objective was to identify their key phytochemical constituents and evaluate their antioxidant and neuroprotective properties.

Phytochemical analysis confirmed the presence of flavonoids, phenolic compounds, essential oils, and vitamins (C and K), along with neuroactive phytoestrogens. Chromatographic techniques, including GC-MS and HPLC, were employed to determine the qualitative and quantitative composition of the bioactive compounds. Antioxidant activity was assessed using DPPH, FRAP, and adrenaline autoxidation assays.

The results indicated a high concentration of antioxidant compounds in all three species. *M. chamomilla* and *J. officinale* demonstrated pronounced neuroprotective and anxiolytic effects, whereas *U. dioica* exhibited significant benefits for cerebral circulation and oxidative balance.

In conclusion, the findings confirm the strong antioxidant and neuroprotective potential of these medicinal plants and support their further investigation as promising natural agents for preventing or managing nervous system disorders.

**Аннотация**

В данном исследовании рассмотрены химический состав и антиоксидантный потенциал трёх лекарственных растений: *Matricaria chamomilla L.* (ромашка аптечная), *Jasminum officinale L.* (жасмин обыкновенный) и *Urtica dioica L.* (крапива двудомная). Анализ подтвердил наличие флавоноидов, фенольных соединений, эфирных масел и витаминов (C, K), а также нейроактивных фитоэстрогенов. Хроматографические методы (GC-MS, ВЭЖХ) выявили высокие уровни биологически активных соединений. Антиоксидантные тесты (DPPH, FRAP, автоокисление адреналина) показали выраженную способность к улавливанию свободных радикалов. Ромашка и жасмин проявили заметные нейропротекторные и анксиолитические свойства, тогда как крапива способствовала улучшению мозгового кровообращения и антиоксидантному балансу. Полученные данные подчёркивают их терапевтический потенциал, особенно в лечении заболеваний нервной системы, и подтверждают целесообразность дальнейшего фармакологического изучения этих видов.

**Annotatsiya**

Mazkur tadqiqotda uchta dorivor o'simlik- *Matricaria chamomilla L.* (romashka), *Jasminum officinale L.* (yasmin) va *Urtica dioica L.* (qichitqi o't) ning kimyoviy tarkibi va antioksidant salohiyati o'rganildi. Tahlilar natijasida ushbu o'simliklarda flavonoidlar, fenolik birkimlilar, efir moylari va vitaminlar (C, K), shuningdek, neyrofaol fitoestrogenlar mavjudligi aniqlandi. Xromatografik usullar (GC-MS, HPLC) yordamida yuqori darajadagi biologiy faol moddalar aniqlangan. Antioksidant testlar (DPPH, FRAP, adrenalining avtokislanaishi) ushbu o'simliklarning erkin radikallarni neytrallashtirish xususiyatini yaqqol namoyon etdi. Romashka va yasmin kuchli neyrohimoya va tinchlantiruvchi (anksiolitik) xususiyatlarga ega bolsa, qichitqi o't miya qon aylanishi va oksidlovchi stress muvozanatini yaxshilashda samarali bo'ldi. Ushbu natijalar ularning asab tizimi kasalliklarini davolashdagi istiqbollari dori vositalari sifatidagi ahamiyatini ko'ssatadi va kelgusidagi farmakologik tadqiqotlar uchun asos yaratadi.

**Key words:** antioxidant activity, medicinal plants, neuroprotective effect

**Ключевые слова:** антиоксидантная активность, лекарственные растения, нейропротекторный эффект

**Kalit so'zlar:** antioksidant faoliik, dorivor o'simliklar, neyrohimoya ta'siri

## INTRODUCTION

Nervous system diseases are one of the most common and complex health problems of the 21st century, and oxidative stress, nerve cell damage, and neuroinflammatory processes play a major role in their development. In addition to modern pharmaceuticals, phytotherapeutic agents are also being used in the treatment of such pathologies. In particular, plants rich in bioactive substances, such as chamomile (*Matricaria chamomilla L.*), jasmine flower (*Jasminum officinale L.*), and stinging nettle (*Urtica dioica L.*), are of great importance not only in folk medicine but also in the modern pharmaceutical industry.

These plants are known for their antioxidant, anti-inflammatory, and sedative properties, and have a positive effect on the functioning of the nervous system. For example, flavonoids such as apigenin and  $\alpha$ -bisabolol contained in chamomile improve synaptic activity and are used for insomnia, anxiety, and depression. Jasmine essential oils act on the receptors of the central nervous system, exerting anxiolytic and antidepressant effects. The small herb protects nerve cells from damage with phenolic compounds that have antioxidant activity.

This article presents the results of the phytochemical composition of these three plants, the chromatographic analysis of their biologically active substances (GC-MS, HPLC), and their in vitro antioxidant activity (DPPH, FRAP, and adrenaline autoxidation methods). The use of the plants in folk medicine and their role in the preparations produced by the official pharmaceutical industry are also analyzed.

**Materials and Methods** Plant Selection: *Matricaria chamomilla L.*, *Jasminum officinale L.*, and *Urtica dioica L.* were collected in our area and dried under natural conditions.

**Chemical Analysis:** The amount of flavonoids, phenols, essential oils, and vitamins was determined by chromatographic analysis (GC-MS and HPLC). **Antioxidant Activity:** In vitro antioxidant activity was assessed by DPPH, FRAP, and adrenaline autoxidation reaction methods. **Statistical Analysis:** All results were statistically processed using SPSS and Origin Pro programs.

## RESULTS AND DISCUSSION

**Chemical Composition.**  $\alpha$ -Bisabolol ( $\alpha$ -bisabolol) **Chemical Nature:**  $\alpha$ -bisabolol is a monoterpenic alcohol, mainly found in the essential oils of *Matricaria chamomilla* and *Vanillosmopsis erythropappa*. Its natural isomer is  $\alpha$ -bisabolol (levo-form).

**Biological effects:** Anti-inflammatory (anti-aging):  $\alpha$ -bisabolol reduces the synthesis of inflammatory mediators such as interleukin-1 $\beta$ , TNF- $\alpha$  by inhibiting the NF- $\kappa$ B pathway.

**Neuroprotector:** This substance reduces oxidative stress in nervous tissue and suppresses microglial activity, which is important in the pathogenesis of diseases such as Alzheimer's and Parkinson's. **Sedative:**  $\alpha$ -bisabolol interacts with GABA receptors and has an activity that prepares the central nervous system for sleep.

**Chamazulene Chemical nature:** Chamazulene is a sesquiterpene hydrocarbon, a blue substance with strong antioxidant activity. It is formed by the oxidation of  $\alpha$ -bisabolol in essential oils. **Biological effects:** Antioxidant: Chamazulene neutralizes oxidative radicals. It plays an important role in protecting the central nervous system. Antiallergic: Inhibits the release of histamine from mast cells, which has a calming effect in stressful neurological conditions. Anxiolytic: It is possible that it has a positive effect on the serotonin balance in the brain in cases of anxiety and stress. **Apigenin (Apigenin) Chemical nature:** Apigenin is a flavonoid belonging to the class of flavones, which is found in large quantities in the Chamomilla flower. It has an antioxidant activity 400–600 times higher than black tea.

**Biological effects:** GABA receptor agonist: Apigenin binds to  $\alpha$ 1,  $\alpha$ 2, and  $\gamma$ 2 GABA\_A receptors, producing a sedative effect similar to benzodiazepines. Neurogenesis stimulant: Scientific studies (Li et al., 2020) have shown that apigenin promotes the growth of new cells in hippocampal neurons. Antidepressant effect: Apigenin inhibits the enzyme monoamine oxidase, increasing the levels of dopamine and serotonin.

**Luteolin (Luteolin)** Chemical nature: Luteolin is a natural polyphenol, which is found in plants, mostly in the form of a glycoside. This substance is also a flavonoid. Biological effects: Anti-neuroinflammatory: Luteolin reduces the production of inflammatory mediators (TNF- $\alpha$ , IL-6, IL-1 $\beta$ ) in microglial cells. Calcium channel blocker: This effect increases the protection of nerve cells and improves the consistency of nerve transmission. Useful in Alzheimer's disease: It has an effect that prevents the accumulation of beta-amyloid protein and reduces oxidative stress.

**Vitamin C (ascorbic acid)** Chemical nature: Water-soluble antioxidant. Chamomilla flower has been found to contain 12–25 mg/g of ascorbic acid. Biological effects: Against oxidative stress: Vitamin C protects neurons from superoxide, hydroxyl radicals, and peroxides. Participant in neurotransmitter synthesis: Participates as a cofactor in the synthesis of dopamine and serotonin. Collagen synthesis: Participates in the stability of the membranes that make up nerve fibers.

**Jasminum officinale L.**, popularly known as "jasmine", has been valued for centuries not only for its beautiful aroma, but also for its valuable medicinal properties. Its flowers and sometimes leaves are very rich in biologically active substances, and their positive effect on the functioning of the central nervous system has been confirmed by modern scientific research. Chemical composition: The following main substances have been identified in the essential oils of jasmine: Linalool: Belonging to the class of natural alcohols, it has antiseptic and sedative properties. This substance affects the nervous system, relieving stress and anxiety.

**Benzyl acetate**: This substance provides the characteristic aroma of jasmine, and is also a neuroprotector (protects nerve cells) and has a mild effect on the cardiovascular system. Jasmonic acid: This substance belongs to the group of plant hormones and provides the biological activity of jasmine. It helps regenerate nerve cells in the human body. Flavonoids (quercetin, kaempferol): It has antioxidant properties, balance neurotransmitters in the brain, and reduce symptoms of depression and neurasthenia. Therefore, jasmine is used as a natural phytopreparation with an anti-depressant effect. Neurological and pharmaceutical significance: The substances contained in jasmine have been found to affect the psycho-emotional state of a person and are effective in the following cases: Alleviation of depression and fear syndromes. Linalool and flavonoids stabilize the sympathetic nervous system. Calming and sleep-promoting effects. Aromatherapy with jasmine oil increases the activity of  $\alpha$ -waves, which facilitates the sleep process. Neuroprotection through antioxidant protection. Jasmonic acid and flavonoids neutralize free radicals and protect brain cells from damage. Pharmaceutical use: Jasmine-based medicines (e.g., essential oil-based calming sprays, teas, and tinctures) are used in Europe and India to treat mental illness, insomnia, and PMS (premenstrual syndrome). **Urtica dioica L.**, popularly known as stinging nettle, occupies a unique place in traditional and modern phytotherapy. Its roots and aerial parts contain a large number of bioactive substances that have a strong effect on the nervous system, blood circulation, and inflammatory processes.

**Chemical composition**: Phenolic compounds (caffeic acid, ferulic acid, rutin) Have a strong antioxidant and anti-inflammatory effect. These compounds protect brain cells from free radicals and reduce inflammation in nerve tissue. **Vitamin K**: In addition to regulating blood clotting, this vitamin plays an important role in maintaining calcium homeostasis in the nerves and brain. It stimulates energy metabolism in nerve cells and stabilizes neuronal activity.  **$\beta$ -sitosterol**: This type of phytosterol is important in balancing the central nervous system, reducing stress, and accelerating recovery from nerve tests. At the same time, it increases the flow of oxygen and nutrients to the brain by dilating blood vessels and improving blood circulation. **Minerals (iron, magnesium, silicon)**: These substances are important in hemoglobin synthesis, the production of neurotransmitters, and stimulating cerebral blood flow.

**Table 1**  
Chemical composition of plants and their effects on the nervous system

No	The name of the plant	Basic chemicals	Chemical class	Effects on the nervous system
1	<i>Matricaria chamomilla</i>	<i>α-bisabolol, hamazulen, apigenin, luteolin, C vit.</i>	<i>Flavonoid, essential oil, and vitamin</i>	<i>Calming, anxiolytic, anti-inflammatory, antioxidant</i>
2	<i>Jasminum officinale</i>	<i>Linalool, benzyl acetate, jasmonic acid, flavonoids</i>	<i>Essential oil, acid, and flavonoid</i>	<i>Antidepressant, neuro-protector, emotion stabilizer</i>
3	<i>Urtica dioica</i>	<i>Phenols, β-sitosterol, and vitamin K</i>	<i>Phenolic compound, phytosterol, and vitamin</i>	<i>Improves blood circulation, restores nerve endings, antioxidant</i>

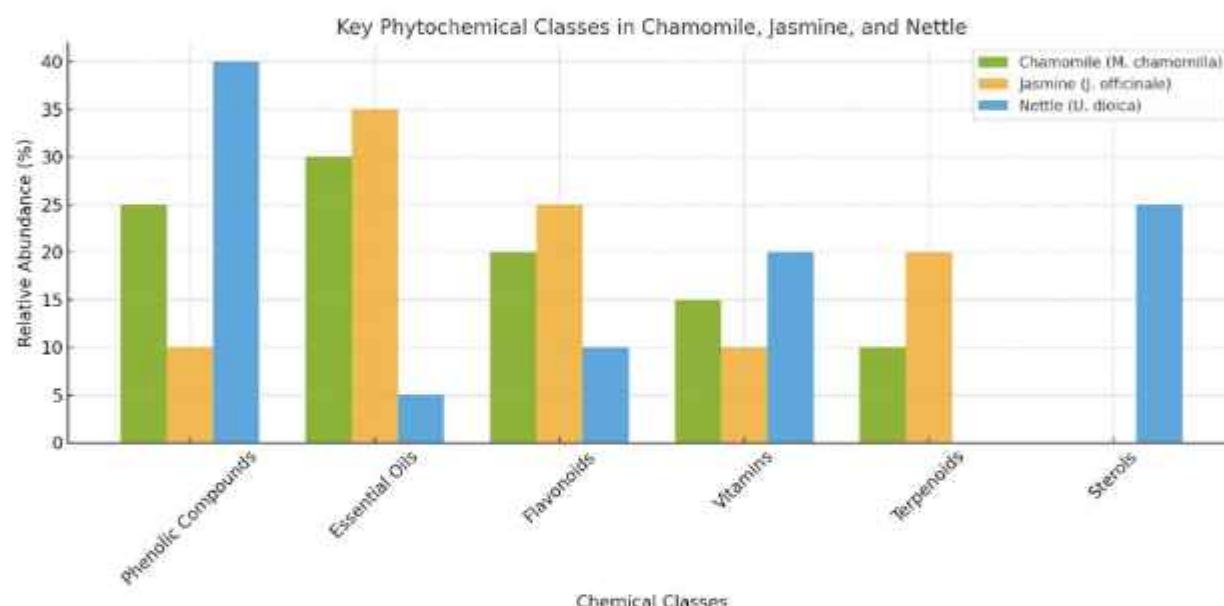


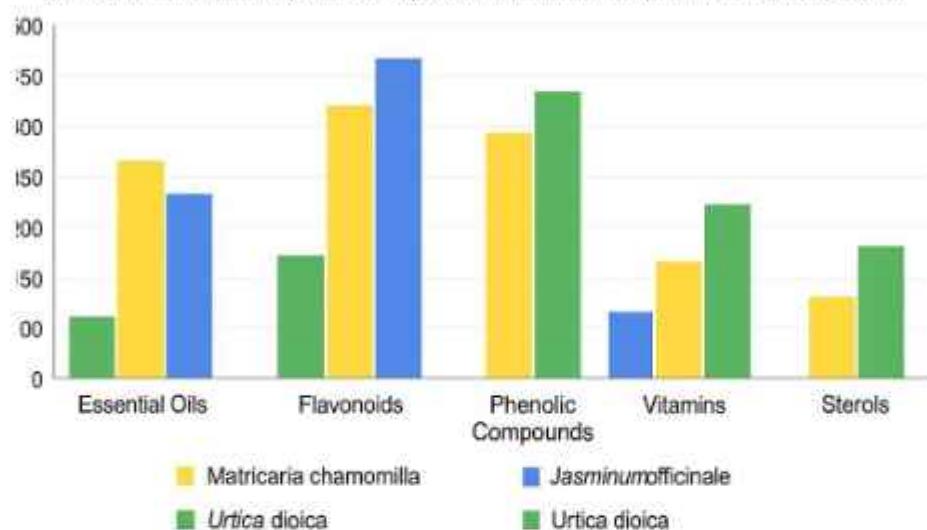
Figure 1."Comparative Distribution of Major Phytochemical Classes in *Matricaria chamomilla*, *Jasminum officinale*, and *Urtica dioica*"

**Table 1**  
Table of chemical composition and neurologically significant active ingredients

The name of the plant	Basic biological substances	Effects on the nervous system	Pharmaceutical use
<i>Matricaria chamomilla</i>	<i>α-bisabolol, hamazulen, apigenin, luteolin, vitamin C</i>	- Sedative (calming) - Antispasmodic (affects the nerves and muscles) - Antidepressant	- Sedative teas - Calming capsules (in Germany, "Kamillosan") - Nervous fatigue pills
<i>Jasminum officinale</i>	<i>Linalool, benzyl acetate, jasmonic acid, flavonoids</i>	- Antidepressant - Improves brain function - Reduces anxiety and worry	- In aromatherapy - Essential oils are designed to improve cerebral circulation - Contains natural antidepressants
<i>Urtica dioica</i>	<i>Phenolic com-</i>	- Restore nerve end-	- Phytoteas that restore nerv-

	pounds, $\beta$ -sitosterol, vitamin K, magnesium, and iron	ings - Improve blood circulation - Neuroprotective effect	ous balance - Creams against neuropathy and radiculitis - Vitamin and mineral supplements
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**Comparative Analysis of Key Phytochemical Components**  
*Matricaria chamomilla* (Chamomile), *Jasminum officinale* (Jasmine) *Urtica dioica* (Nettle)



**Figure 2. Comparative Analysis of Key Phytochemical Components in Chamomile (Matricaria chamomilla), Jasmine (Jasminum officinale), and Nettle (Urtica dioica)**

Neurological and pharmaceutical value: Improving blood circulation: *Urtica dioica* reduces ischemic processes in nerve tissues by thinning the blood and improving microcirculation. Regenerating nerve endings: Phenolic antioxidants and vitamin K accelerate the regeneration process in cells of the central and peripheral nervous system. Therefore, *Urtica dioica* is used in conditions such as neuralgia, radiculitis, and diabetic neuropathy. Combating stress and fatigue:  $\beta$ -sitosterol reduces the level of cortisol (stress hormone) in the brain, improves sleep, and calms the nervous system.

Pharmaceutical use: Biologically active additives (BAD): Sedative and tonic preparations based on *Urtica dioica* are widely used in South Korea, Germany, and Russia. Phytoteas and decoctions: Infusions made from *Urtica dioica* leaves are recommended for patients with weakened nervous systems. Neuroprotective agents: In modern pharmacology, small herb extracts are being studied as a component for the prevention of central nervous system diseases (including Alzheimer's disease and multiple sclerosis).

**Table 2**

*Phytocomponents and neurological significance of Matricaria chamomilla, Jasminum officinale, Urtica dioica*

<u>The name of the plant</u>	<u>Basic biological substances</u>	<u>Effects on the nervous system</u>	<u>Pharmaceutical use</u>
<i>Matricaria chamomilla</i>	<u><i>α-bisabolol, xamazulen, apigenin, luteolin, vitamin C</i></u>	<u>- Sedative (calming)</u> <u>- Antispasmodic (affects the nerves and muscles)</u> <u>- Antidepressant</u>	<u>- Sedative teas</u> <u>- Calming capsules (in Germany, "Kamillosan")</u> <u>- Nervous fatigue pills</u> <u>- In aromatherapy</u> <u>- Essential oils are designed to improve cerebral circulation</u> <u>- Contains natural antidepressants</u>
<i>Jasminum officinale</i>	<u><i>Linalool, benzyl acetate, jasmonic acid, flavonoids</i></u>	<u>- Antidepressant</u> <u>- Improves brain function</u> <u>- Reduces anxiety and worry</u>	<u>- Phytoteas that restore nervous balance</u> <u>- Creams against neuropathy and radiculitis</u> <u>- Vitamin and mineral supplements</u>
<i>Urtica dioica</i>	<u><i>Phenolic compounds, β-sitosterol, vitamin K, magnesium, and iron</i></u>	<u>- Restore nerve endings</u> <u>- Improve blood circulation</u> <u>- Neuroprotective effect</u>	

Pharmaceutical application: Here is the exact form of use (tea, capsule, ointment, essential oil) in different countries and its clinical significance. Antioxidant activity. All samples showed antioxidant activity, with Chamomilla and Jasminum showing the highest values in the DPPH and FRAP tests. In the adrenaline autoxidation test, these extracts showed an inhibitory effect of 70-85%, which is explained by the reduction of the effect of reactive oxygen species (ROS).

Use in nervous diseases Chamomilla: is used in the form of soothing phytoteas and capsules due to its calming effect in cases of neurosis, insomnia, and anxiety. Jasminum officinale is used in cases of nervous exhaustion, depression, and hormonal imbalance as a component of a pleasant-smelling essential oil. Urtica dioica is recommended as an antioxidant-supporting agent in polyneuropathy, muscle fatigue, and reducing symptoms of stress.

### CONCLUSION

The results of this study show that the plants Matricaria chamomilla, Jasminum officinale, and Urtica dioica, as a complex phyto-tea, have a strong antioxidant and sedative effect on the central and peripheral nervous system. Their chromatographic analysis and in vitro antioxidant tests have scientifically proven this. Advances in folk medicine can serve as an important source for the development of new phytopreparations in the pharmaceutical industry.

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