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PHYTOCHEMICAL AND BIOLOGICAL STUDIES OF THE GENUS *RANUNCULUS* SPECIES IN KAZAKHSTAN

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SUMMARY

This review provides a comprehensive overview of the phytochemical composition and biological activity of *Ranunculus* species distributed in Kazakhstan, highlighting their pharmacological significance and research potential. *Ranunculus* is an important and widespread genus of the family Ranunculaceae Juss. The genus comprises approximately 600 species distributed worldwide. About 57 species exist in Kazakhstan, wherein more than 10 species are medicinal and distributed around the country. More than 85 bioactive compounds have been identified in *Ranunculus*, including flavonoids, flavonones, alkaloids, saponins, and other bioactive compounds. Several species of this genus have been widely used in traditional medicine for anti-inflammatory, anti-cancer, anti-tuberculosis, antibacterial, and anti-malarial treatments. This review aims to summarize current knowledge on *Ranunculus* species, including their traditional uses and biochemical compounds, and recognize the biological activity of raw medicinal plants. The novelty of this study lies in summarizing, for the first time, all available data on *Ranunculus* species of Kazakhstan, including their phytochemistry, traditional uses, and biological properties, forming a foundation for further pharmacological and toxicological research.

Keywords: *Ranunculus* L.*,* species, biochemical composition, biological activities, ranunculin, traditional uses, protoanemonin

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Key findings: Genus *Ranunculus* extracts display diverse biological activities, including antibacterial, antiviral, antioxidant, hepatoprotective, and anti-inflammatory effects, with potential in treating tuberculosis and pharyngitis. However, limited clinical evidence and insufficient data on safety highlighted the urgent need for further pharmacological, toxicological, and pharmacokinetic studies.

INTRODUCTION

Practical healthcare is indicative of a growing interest in medicinal plants and their use in medicines from centuries worldwide (Zahra *et al*., 2023; Imanaliyeva *et al*., 2024). Currently, it is a fact that around 20,000 species of plants contribute directly to scientific and folk medicine uses (Rajkovic *et al*., 2023). Therefore, the study of medicinal plants used in folk medicine is greatly crucial in modern pharmaceuticals (Molsadykkyzy *et al*., 2025). The introduction of these plants into medical practice requires comprehensive studies of their phytochemical composition, their species affiliation, and establishing the species boundaries (Bissa and Bohra, 2012; Rahman *et al*., 2024).

Species of the genus *Ranunculus* are characterized by diverse medicinal properties. The family Ranunculaceae Juss is a known taxon, with the most famous genus, *Ranunculus* L., recognized with various poisonous species. These include *Ranunculus sceleratus* L.*, Ranunculus acris* L., *Ranunculus arvensis* L., and *Ranunculus chinensis* L. Previous studies also established that all these above plant species contain toxic substances belonging to different groups. Some are alkaloids (aconitine), saponins, glycosides (ranunculin), cyanoglycosides, lactones (anemonin), and flavonoids (Turner, 1984).

Ranunculus is a cosmopolitan genus characterized by considerable genetic variation and adaptability. Numerous species of the genus *Ranunculus* have been beneficial in traditional medicines to treat various diseases, such as jaundice, edema, malaria, asthma, pain, gout, rheumatism, inflammatory skin diseases, cancer, and hypertension. Moreover, past studies believed buttercup extracts have medicinal properties, such as antioxidant, anti-inflammatory, antimutagenic, antimalarial, antibacterial, antitumor, cardioprotective, and wound-healing (Wang *et al*., 2004; Wang and Gao, 2009; Gulnaz, 2025). Reports on a wide range of pharmacological activities have now come out in various species of Ranunculaceae, including anti-inflammatory, analgesic, antimicrobial, antiparasitic, and antitumor properties. Presently, numerous bioactive compounds isolated from species belonging to this family (cimifugaside, hellebrigenin, hydrastine, and thymoquinone) are in use to treat several health conditions, including cancer, heart failure, and various types of inflammation (Karaca *et al*., 2005).

The relevant research review aimed to substantiate the possibility of using genus *Ranunculus* medicinal plant extracts with antibacterial, anti-inflammatory, and anti-cancer properties grown on the territories of Kazakhstan (Louaar *et al*., 2012). The medicinal plant's utilization as a stand-alone remedy and as raw material for the production of various drugs has a centuries-old history. However, to date, the genus *buttercup,* with some plants, has relatively few studies of its properties. Complexes comprising dozens of biochemical compounds contained in various plants and their extracts explained how the natural preparations can have a positive effect as compared to their individual isolated bioactive compounds. Therefore, studies concerning the medicinal plant's use in folk medicines for various diseases' treatment revealed relevant and effective results (Polat, 2016).

Databases studied

The literature search covered studies published between 1978 and 2024. In total, about 40 scientific sources in English, Russian, and Kazakh reached analysis. The searched and studied scientific databases included PubMed/MedLine, Scopus, Web of Science, ScienceDirect, Google Scholar, Springer, and Wiley, using the following MeSH terms: Biological Products/pharmacology, Drug Discovery/methods, Ethnopharmacology, Medical, Traditional/methods, *Ranunculus*/

chemistry, Plant Extracts/pharmacology, and Phytochemicals/chemistry, Phytochemicals/ pharmacology, Plants, and Medicinal. Inclusion requirements consist of a) pertinent works comprising contemporary pharmacological investigations, phytochemistry, and traditional usage, and b) English, Kazakh, and Russian-language research publications. Exclusion criteria include a) duplicate and incomplete information, b) abstracts, c) letters to the editor, and d) experiments employing linked homeopathic medications.

Botanical features and geographical location

Ranunculus represents a diverse genus occurring in a wide range of habitats worldwide. This extensive distribution contributes to the high level of genetic diversity within the genus. Similarly, in Kazakhstan, the genus *Ranunculus* is widespread, with 57 species grown in different regions of the country, with more than 10 species recognized as medicinal plants (Figure 1) (Emadzade *et al*., 2010; 2011).

Ranunculus transiliensis is an endemic perennial plant with a height between 6 and 11 cm, comprising a long, dark root and a mass of thin and wire-like leaves, with one or more stems. It has one flower covered at the base with dark brown sheaths of dead petals, bare, with small, prickly hairs under the flower. The said species grows near glaciers and snow-covered areas. Distribution is prevalent in the Ile Alatau and Terskey Alatau regions of Kazakhstan (Smirnov *et al*., 2023).

***Ranunculus sceleratus* L.** is a medicinal plant with a plant height of 10–50 cm and sometimes even reaching up to 120 cm. The stem base has bunches of thin, glabrous roots, very rarely sparsely pubescent, with one and several, often many, stems. Its leaves are slightly fleshy, lower long-petioled, three-lobed, and divided into three parts. It is a perennial plant with fragrant flowers that grows in damp meadows, swamps, and shallow water. It frequently occurs near the banks of

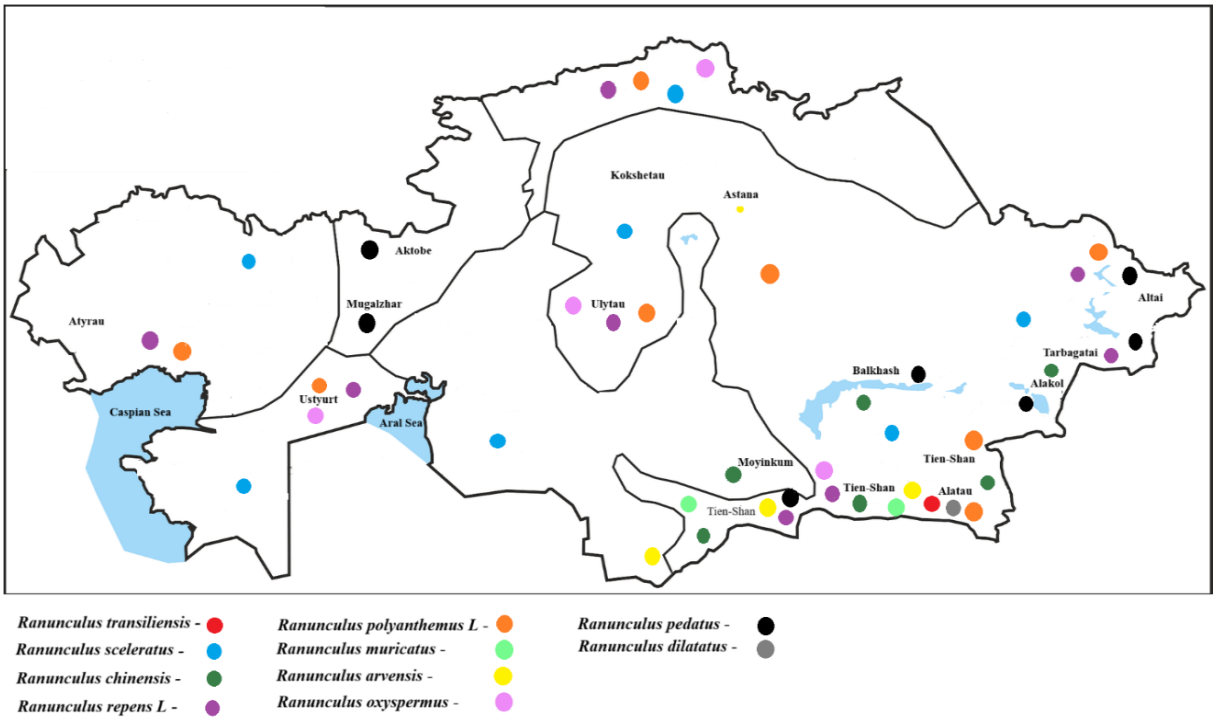

Figure 1. Distribution of the genus *Ranunculus* species in Kazakhstan.

small bodies of water, on plains, and in foothills at an altitude of up to 1800 m above sea level (masl). Distribution is throughout Kazakhstan. A very poisonous plant, and even its juice causes burns (Misra and Dixit, 1978, 1980; Li *et al*., 2005; Serag *et al*., 2020).

Ranunculus chinensis **Bunge** is the poisonous plant with heights of 15–45 cm; the roots are fringed, whitish, cord-like, and form a bundle. It is an annual and biennial plant with one or more erect stems, slightly branched above, with aerial parts covered with yellow hairs. It grows on wet meadows, in hollows between meadows, in thickets of forests, and on sandy and clayey shallow waters. For distribution, it grows in the areas of Moyinkum, Balkhash, Alakol, Jungar Alatau, and Western Tien-Shan regions of Kazakhstan (Samarakoon and Horton, 1981).

Ranunculus repens **L.** is a poisonous plant with a height ranging from 15 to 80 cm, a shortened rhizome, and a system of lacy, fringed roots. It has a weak, erect stem, rooted in nodes. It has lower, glabrous leaves (3–15 cm) and is a perennial plant with brilliant golden-yellow flowers. The plant grows on wet meadows, near streams and ditches, and on the edges of woods and forests in the western regions, up to an altitude of 2750 masl, where it inhabits high mountain woods. For distribution, it grows in the areas of Ustyurt, Tobol-Esil, the Caspian Sea, Ulytau, Turgen, Eastern small hills, Karkara, Altai, Tarbagatai, Jungar Alatau, and Kungei-Ili Alatau regions of Kazakhstan (Noor *et al*., 2006).

Ranunculus polyanthemos **L.** is a poisonous plant with a height of 30–80 cm, comprising a thin, cord-like, fringed root bundle and a short, poorly developed rhizome. The stem is straight, branched, multi-flowered, and embossed in a perennial plant with golden-yellow flowers of 2–3 cm in diameter. It grows in dry meadows, steppe lowlands, along the banks of rivers and lakes, and in swampy areas of groundwater. Likewise, it prevails in pine forests and on the edges of groves, near roads and banks, and in plain places that rise into the forest belt of mountains. Its distribution occurs in Ustyurt, Tobol-Esil, the Caspian Sea, Betpakdala, Ulytau, Teriskey Alatau, the Eastern small hills, Karkara, Altai, Tarbagatai, Jungar Alatau, Kungei-Ilisky Alatau, and the Western Tien-Shan regions of Kazakhstan (Ydyrys *et al*., 2024).

Ranunculus muricatus **L.** is a medicinal plant with a height of 10–30 cm, with thin, cord-shaped, fringed roots collected in a bundle. It is an annual plant with numerous yellow flowers up to 10–13 mm in diameter. It grows like a weed along roads, in fields and gardens, in wet places, and on the banks of rivers and streams. For its distribution, it grows in Turkestan, Karatau, and the Western Tien-Shan regions of Kazakhstan (Nasreen *et al*., 2020).

Ranunculus arvensis **L.** is a medicinal plant with a height of 10-30 cm, but during the fruiting stage, it reaches 45 cm. Roots gather in a thin, fringed bunch, and its stem is erect on an annual plant with petiolate, entire, and opposite-ovate lower leaves. The plant grows on dry slopes, sometimes as a weed in old cattle-breeding settlements, in fields and fallow lands, and in damp places near rocks and streams. Its distribution grows in Shu-Ili, Kyrgyz Alatau, Karatau, and the Western Tien-Shan regions of Kazakhstan (Sayhan *et al*., 2009).

Ranunculus oxyspermus **M.B.** is a medicinal, perennial plant with heights ranging from 20 to 36 cm and tuberous-thick, oblong roots. The upper part of the stem is highly branched and multi-flowered. Basal leaves are lanceolate, oval in outline, with a wedge-shaped base, sometimes rounded, less often almost cordate, with truncated and obtusely toothed segments. The flowers measure 2–3 cm in diameter. It grows as a weed in dry meadows, old fallow lands, sometimes in fields, and along roadsides. For its distribution, it abounds in regions of Ustyurt, Tobol-Yesil, Karatau, and the Western Tien-Shan of Kazakhstan (Ydyrys *et al*., 2024).

Ranunculus pedatus **Waldst.& Kit** a medicinal, perennial plant, has a height of 6–32 cm, thick, tuberous-oval roots, with a simple or

weakly branched, bare stem, and few flowers. It grows in steppes and steppe depressions, in meadows, and among the bushes. For distribution, it grows in the regions of Ustyurt, Tobol-Esil, Irtysh, Aktobe, Turgen, Ulytau, the Western and Eastern small hills, Mugalzhar, Karkara, Balkhash, Alakol, Altai, Tarbagatai, and Jungar Alatau of Kazakhstan (Erdogan *et al*., 2012).

***Ranunculus dilatatus* Ovchz.** is an endemic plant with a height of 25–55 cm, thickened roots, a taproot with a fringe collected at the root collar, and an erect, densely branched stem. As a perennial plant of golden-yellow color, it reaches 2 cm in diameter. It grows in the forest-shrub belt of mountains, in old steppe meadows, and along roads. Its distribution abounds in the Ile Alatau region of Kazakhstan (Ydyrys *et al*., 2024).

Phytoconstituents

The genus *Ranunculus* has the characteristic of a wide variety of secondary metabolites, which determine both the pharmacological activity and toxicity of these plants. Interest in the biochemical composition of this genus relied on the rich history of its use in folk medicines and the prospects for finding new biologically active compounds. Among the main groups of identified bioactive compounds, representing the flavonoids, were apigenin and tricin glycosides, orientin, isoorientin, and vitexin. Coumarins (isoscopoletin and scoparone) and various other phenolic compounds, including protocatechuic and p-hydroxybenzoic acids and their aldehydes, also play a pivotal role. Steroid structures, such as stigmasterol and β-sitosterol, as well as fatty acids, including myristic acid, have also received recognition in some species of the genus *Ranunculus* (Figure 2) (Goo, 2022).

Of particular interest are specific bioactive compounds, such as protonemonin, anemonin, ranuculosides, and ranuculon, which are the basic features of the genus *Ranunculus* and largely determine the toxicological properties of the different species. Additionally, unique anthraquinones, lignans, and terpenoids, with the highest pharmacological potential, have undergone isolation in the species *R. muricatus* and *R. chinensis* (Dai *et al*., 2024).

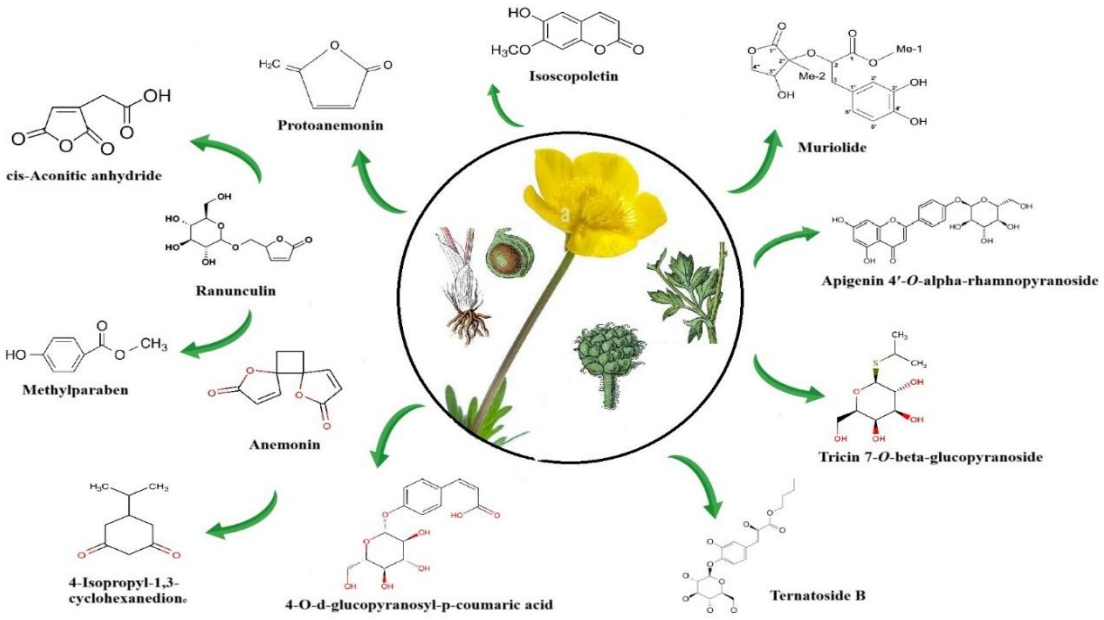

Figure 2. Chemical structure of the important bioactive compounds from the genus *Ranunculus.*

Muriolide—a new aromatic lactone isolated from the ethyl acetate fraction of the plant species *R. muricatus*. Structural characterization of the compound occurred using UV-visible, IR spectroscopy, and mass spectrometry, as well as one-dimensional and two-dimensional NMR data (Didry *et al*., 1993).

Anemonin exhibited anti-inflammatory properties different from the vesicant characteristics of its parent monomer. Numerous studies have confirmed its potential efficacy in the treatment of diseases, such as ulcerative colitis, cerebral ischemia, and arthritis (Hoffmann *et al*., 2010).

Protoanemonin is a toxic substance found in all members of the buttercup family (Ranunculaceae). The toxin is most abundant in the roots, which can be consumed by herbivorous animals (Müller *et al*., 2020).
Thus, the genus *Ranunculus* combines a wide range of biochemical compounds—ranging from common flavonoids and phenolic acids to the rare and unique molecules—authenticating it as a promising subject for further biochemical and pharmacological research (Hussain *et al*., 2020).

Biological and pharmacological activities

Species of the genus *Ranunculus* have attractedvsignificant attention from researchers in various fields due to their unique properties. However, many species still require comprehensive studies for their biochemical traits. The genus *Ranunculus* species' toxicity issues also face a huge challenge. Fortunately, the management of toxicity can undergo special processes, such as drying and heating, and by choosing a safe extraction solvent, such as water, which ensures the safety of drugs. Pharmaceuticals containing the genus *Ranunculus* plant species have satisfactory clinical values; however, they have not received full exploration. Therefore, further research is essential to popularize the said genus for its health benefits in the future (Jiang *et al*., 2022).

Like other medicinal plants, the genus *Ranunculus* species has its own unique bioactive substances. One of the bioactive substances, called ranunculin, is an unstable glucoside. It exists in plants of the genus *buttercup* (Ranunculaceae). However, when the maceration process occurs and wounds the plant, it undergoes an enzymatic breakdown into glucose and protoanemonin. Ranunculin is the glycoside precursor of the vesicant protoanemonin, evident in some species of buttercups, and particularly associated with the burning sensation that occurs by chewing their leaves. The origin of this substance has several versions. According to one, Hill and van Heiningen obtained its crystalline form. They also determined its general structure and reported it undergoing enzymatic cleavage by β-glucosidase to form aglucon and dehydrating to protoanemonin. These processes have appeared to occur readily under autolytic conditions. The S-stereochemistry of the dihydrofuranone ring entailed deduction from Benn, Yelland, and Ball, as shown in the schematic diagram, and was later confirmed by the synthesis (Oztas *et al*., 2006).

The genus *Ranunculus* species plant parts are poisonous, and their toxic components are those of protoanemonin (anemonol) and ranunculin. In grinding plant tissues, ranunculin underwent hydrolysis to protoanemonin. Protoanemonin is irritating to the skin, eyes, and mucous membranes; it binds sulfhydryl groups and breaks disulfide bonds, resulting in skin disruption and blistering. Contact with protoanemonin causes dermatitis, burning, and itching, accompanied by rashes and blisters. If humans and animals chew the leaves, blisters may occur on the lips and face. The toxic oil is also a strong eye irritant. If ingesting some buttercups accidentally, patients may experience abdominal pain, diarrhea, vomiting, dizziness, and even paralysis. Given the diversity and complexity of its phytochemical composition, the genus *Ranunculus* demonstrates significant pharmacological potential, which further reflects its wide range of traditional medicinal applications. (Bhatti *et al*., 2015).

Traditional uses

The genus *Ranunculus* species contains flavonoids, organic acids, coumarins, lactones, glycosides, sterols, polysaccharides, and other trace elements. These biochemical compounds complement the pharmacological action and work synergistically to exert anti-inflammatory, anticancer, antitubercular, antibacterial, antimalarial, and other therapeutic effects. The traditional Chinese medicine characteristics, such as heat-clearing and detoxifying properties, authenticate the genus *Ranunculus* species as considerable in ethnic medicines. Progress in research and development of various pharmaceutical preparations has allowed the presence of this genus in epidemiological and clinical studies (Hwu *et al*., 2012).

Given the greater importance of medicinal plants in traditional medicines, herbal medicines play a key role in global healthcare in the health care of the large population worldwide. Phytochemical studies based on various plant species of the genus *Ranunculus* revealed several groups of secondary metabolites. Preliminary screening of the species *Ranunculus arvensis* disclosed bioactive components, such as carbohydrates, proteins, amino acids, glycosides, phenolic compounds, steroids, di- and triterpenes, coumarins, and flavonoids. In crude medicinal plants' biological activities, the effects of different types of microorganisms incurred investigations, and the results revealed considerable antifungal activities. However, more profound research is essential to comprehensively explore the bioactive molecules (Kaya *et al*., 2010).

Around 20 plant species of the buttercup family (Ranunculaceae) have reached extensive uses medicinally by 19 different indigenous groups in British Columbia and neighboring regions. Reports on these species have expressed they contain the irritant compound protoanemonin, which can cause skin blisters when fresh. It is likely that protoanemonin is the main active ingredient used in most of these medicinal practices. The plants' main use was as an external topical dressing to treat boils, cuts, abrasions, and other skin lesions. Other disorders, such as muscle pain, colds and various respiratory ailments, and unspecified medical conditions, often entailed treatments with the buttercup species. In other regions of North America, the indigenous peoples also applied various buttercup plants to make lotions, as well as to treat colds, headaches, and other ailments. Some plants also served to stimulate and revitalize unconscious people. Presumably, the protoanemonin found in these plants may have a positive effect on the healing process from a physiological perspective rather than a purely psychological aspect. If future research confirms this assumption, plants containing protoanemonin may be beneficial in modern healing techniques (Goo, 2022).

The species *Ranunculus sceleratus* plant parts are poisonous in their fresh form; nevertheless, this plant finds use in folk medicines to treat various ailments after heat treatment and drying. From previous decades, ethnopharmacological properties confirmation was successful from several past experimental studies. In different countries, two components of ranunculins, protoanemonin and anemonin, have demonstrated fungicidal, antimicrobial, antimutagenic, and antipyretic activities and have found application in ethnopharmacology. Moreover, the therapeutic effects of the species *R. sceleratus* extract appeared in the fresh form of this plant. When used in therapy with the addition of Chinese medicinal herbal paste to specific acupuncture points, it displayed a considerable positive therapeutic effect on intrahepatic cholestasis in rats. However, one should note that the fresh species *R. sceleratus* L. is typically useful for its irritant effects (Misra and Dixit, 1978, 1980).

In Asian countries, *Ranunculus sceleratus* has traditionally been effective to treat blood stasis, abscesses, malaria, scrofula, snake and scorpion bites, and acute icteric hepatitis. The plant synthesizes key bioactive compounds, such as ranunculin, protoanemonin, and anemonin, associated with its anti-inflammatory and antibacterial properties. In Iraq, it has also been applicable as an anti-inflammatory and anti-diarrheal remedy, as well as to alleviate mastitis and joint effusion. These ethnomedicinal applications support the plant's therapeutic potential against

infections and inflammatory disorders (Bernard *et al*., 1960).

The species *Ranunculus repens* L., also called creeping buttercup, a herbaceous plant belonging to the family Ranunculaceae, has a rich history of use in traditional medicines. It is often a component in different traditional medicines for its various medicinal properties. In the traditional use of the species *R. repens* L., its extracts have demonstrated their effectiveness in reducing inflammation and relieving pain. In folk medicines, the genus *Ranunculus'* use typically treats the inflammatory skin conditions. It has also been remarkable to treat ailments, such as jaundice, wet eczema, gout, and rheumatism. Research confirms this plant has antioxidant and antimicrobial properties, which help combat infections and improve overall health. In some traditional practices, genus *Ranunculus* extracts have emerged to stimulate the healing of wounds (Bylka *et al*., 2004).

The species *R. chinensis,* better known as the hairy buttercup, has been in use by various cultures for its medicinal properties for centuries. The said species has some traditional uses, i.e., anti-inflammatory properties (it helps reduce inflammation and relieve pain), antimicrobial properties (the plant serves to treat bacterial infections), and antioxidant activity (helps protect the body from oxidative stress). Likewise, it causes wound healing (traditionally used to accelerate the healing process of skin injuries) and detoxification (serves to eliminate toxic substances from the body). These traditional uses highlighted the potential of hairy buttercup in the field of phytotherapy (Mares, 1987).

Anti-inflammatory and antimicrobial properties

Inflammation is a normal immune response; however, in the body the dysregulation of this process can lead to negative consequences. Although modern anti-inflammatory drugs have particular mitigating effects, their effectiveness remains unsatisfactory. Moreover, the emergence of drug-resistant strains and new microorganisms contributes to increased morbidity and mortality. In the recent past, a growing interest in phytotherapy has emerged for the treatment of various diseases due to the ability of herbal remedies to affect multiple target signaling pathways and provide diverse mechanisms of action (Lovett-Doust *et al*., 1990).

The methanolic extract of *R. sceleratus* demonstrated a dual role in inflammatory processes, acting as either a pro-inflammatory or anti-inflammatory agent, depending on the context. When inflammation occurred by the arachidonic acid, the extract exhibited predominantly pro-inflammatory and neutral effects. In contrast, in models where irritation became triggered by agents, such as etradecanoylphorbol acetate, the extract counteracted the inflammation, displaying anti-inflammatory properties. This counterirritant effect suggests the extract can itself induce irritation under physiological conditions while simultaneously mitigating the effects of external irritants. These findings acquired support from both in vivo models of local inflammation and delayed contact hypersensitivity, as well as in vitro assays, which together provide cellular-level insight into the extract's modulatory role (Kim *et al*., 2022).

Anti-tumor properties

Research on the anticancer activity of plants is central in scientific endeavors, as many medicinal plants contain bioactive compounds capable of inhibiting cancer cell growth, inducing apoptosis, and influencing the mechanisms of carcinogenesis. The anti-cancer efficacy of plant extracts usually surfaces from their ability to inhibit tumor cell proliferation and eventually induce cell death. Previous studies have shown that at least 17 genera of the buttercup family Ranunculaceae contain anticancer phytometabolites, including alkaloids, terpenoids, saponins, and polysaccharides. The pharmacological action of these medicinal plants on cancer cells currently

has not received full exploration and necessitates further intensive research in this area (Prieto *et al*., 2003).

Safety, drug-drug interaction, and adverse effects

Phytotherapy seemed to be safe due to its availability and cost-effectiveness, having long uses to treat various diseases. However, the improper use of phytotherapy, such as incorrect dosages, may also cause side effects. Therefore, toxicological analysis is crucial for the safe use of phytotherapy in patients. Current clinical pharmacological studies have enunciated that anemonin and protoanemonin found in the genus *Ranunculus* species may cause toxicity. Protoanemonin, a toxic glycoside found in *Ranunculus* species, can cause different side effects, including gastrointestinal symptoms, tongue ulceration, and recurrent supraventricular tachyarrhythmia. Protoanemonin (γ-hydroxyvinylacrylic acid) is a characteristic component produced by many plants of the genus *buttercup* and has become a taxonomic marker (Mares, 1987).

These bioactive compounds do not only exist independently in plant material but come from its glycosidic precursor, ranunculin, by the action of endogenous plant enzymes during the process of plant tissue damage. Protoanemonin has irritant and acute properties, and its contact with skin and mucous membranes after interaction with damaged plant materials can lead to developing contact dermatitis accompanied by blistering and itching. With its antibiotic properties and high reactivity, protoanemonin is a component of both therapeutic and toxicological importance, which makes careful monitoring of its concentration necessary (Müller *et al*., 2020).

The relevant research review revealed these drugs have wide usage to treat tuberculosis, pharyngitis, and other diseases. However, no data on side effects in the available sources existed. Efforts should take place to relatively promote their clinical use. Therefore, the conduct of thorough studies is vital to investigate their pharmacological properties and toxicity and establish their usefulness.

CONCLUSIONS

The genus *Ranunculus* species exhibited diverse biological activities, including antibacterial, antiviral, antioxidant, antiprotozoal, and anticancer properties, alongside hepatoprotective, hypoglycemic, and thyroid-regulating effects. Their anti-inflammatory and analgesic actions, long recognized in traditional medicines, also scientifically confirmed and isolated molecules that demonstrated considerable pharmacological promise. Despite these findings, their clinical application remains limited due to insufficient data on efficacy, safety, and side effects. Therefore, comprehensive studies, including toxicological, pharmacokinetic, and clinical analyses, are essential to fully evaluate their therapeutic potential. Such research may pave the way for the development of novel therapeutic agents for the development of novel and effective drugs from the genus *Ranunculus* species**.** The present research was supported by the grant project "AP23484931", funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan. Further investigations in this area will be pursued to extend and refine the results obtained. Future prospects depend on comprehensive studies, including toxicological and clinical trials. Key research should focus on elucidating mechanisms of action, exploring synergistic effects between compounds, and developing standardized extracts. Ultimately, this provides the way for developing novel drugs from the genus *Ranunculus*.

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