EXPLORING THE THERAPEUTIC POTENTIAL OF CISTANCHE SALSA: AN OVERVIEW OF ITS CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITIES

Berdimbetova G.E
PhD Senior Researcher, Academy of Sciences of the Republic of Uzbekistan Karakalpak Branch
Tlegenov U.R
PhD doctoral student, Academy of Sciences of the Republic of Uzbekistan Karakalpak Branch

Introduction:

Certain plant gems have stood the test of time in traditional medicine, where old civilizations' wisdom meets modern scientific study. Cistanche salsa stands out as a treasured herb with a long history of medicinal use. Cistanche salsa has long been revered in traditional Chinese medicine (TCM) and other ancient healing systems as a powerful cure for a wide range of diseases[1].

Cistanche salsa, also known as Rou Cong Rong or Desert Living Cistanche, is a member of the Orobanchaceae family that survives in the severe, dry environments of Central Asia and Northwestern China. Despite its tough environment, this hardy plant has attracted herbalists and academics alike with its extraordinary medical capabilities. In this detailed examination, we will look into Cistanche salsa's historical significance, traditional usage, chemical makeup, pharmacological effects, and emerging scientific research. As we weave our way through the vast tapestry of information surrounding this botanical marvel, we discover the mysteries that have made it a mainstay in ancient civilizations' pharmacopeias and a focus of modern scientific investigation.

Cistanche salsa has long been regarded as a tonic plant, known for its capacity to energize and regenerate the body. Its traditional use include a wide range of health issues, from increasing energy and sexual function to strengthening the immune system and supporting lifespan. As we go further into the historical foundations of its usage, we acquire knowledge.

Furthermore, contemporary scientific studies have shed light on the complex bioactive chemicals found in Cistanche salsa, revealing the processes underlying its medicinal properties. These phytochemicals, which include phenylethanoid glycosides, echinacoside, and acteoside, are the key to unlocking the herb's therapeutic potential. Researchers are starting to understand the molecular mechanisms that Cistanche salsa uses to produce its many pharmacological effects via laboratory investigations and clinical trials.



Figure 1. Cistanche Salsa which grow in the territory of the Aral Sea

1. Botanical Overview:

The size of a Cistanche species varies based on several factors, including weather conditions, soil quality, and plant age. Cistanche plant is a small to medium-sized perennial herbaceous plant that can reach heights of 30 centimeters (12 inches) to 100 centimeters (39 inches). However, under ideal conditions, it can occasionally reach heights of 150 cm (59 inches). The plant has thin, upright stems with little scale-like leaves and produces clusters of tubular blooms ranging from yellow to orange[2].

Cistanche salsa (C.A. Mey). Beck - Cistanche salsa. Orobanchaceae is a perennial plant belonging to the Zarazichaceae family. Stem 15-30-(40)cm tall, 10-12 mm thick, greatly enlarged at the base, covered with many, overlapping, oblong or oval-long, blunt, glabrous, or fuzzy white, membranous scales along the edge. The inflorescence is cylindrical or oval-cylindrical, 8-20-(25) cm long, and densely packed with sessile or practically sessile flowers[3].

Cover scales are oblong-lanceolate, blunt, with more or less woolly hair on the dorsum, webbed, indistinctly serrated, and ciliated along the border. Bracts range from linear to narrowly elliptic, blunt, more or less hairy on the dorsum, narrowly webbed along the border, and equal to or slightly shorter than the calyx length. Calyx tubularly bell-shaped, 10-14 mm long, glabrous or more or less woolly hairy, up to

1/3 split into semi-round, equal-sized, blunt, membranous along the border, woolly ciliate lobes.

Corolla 25-35 mm long, more or less outwardly bent or sometimes almost straight, tubular below, whitish, inside under the stamen attachment usually hairy, above middle gradually broadened purple bend with semicircular, almost equal to each other, deflected or bent, along the margin more or less ciliate-cut lobes. The stamens are linked to the bottom portion of the corolla tube and have hairy filaments that are thin and flat at the base, as well as yellow densely woolly anthers with short acuminate nests. The ovary is elongated ovoid, equivalent to the corolla tube, and glabrous, leading to a slender, curving column with a nearly spherical, somewhat bilobed stigma.

The boll is ovoid or oval-ovoid, equivalent to or somewhat longer than the calyx, glabrous, smooth, leathery, bivalve, and contains many oval or oval-pear-shaped extremely tiny seeds.

It blooms in April and produces fruit from March to July[4].

When mature, Cistanche salsa has slender, upright stems that are frequently woody at the base. The stems are often branching and contain little, scale-like leaves that have been reduced to microscopic structures as a result of the plant's adaptation to dry environments. The leaves are frequently grouped in pairs along the stems or in whorls.

One of the most distinguishing characteristics of Cistanche salsa is its inflorescence. The plant produces dense clusters of tubular blooms that form spikes at the tips of the stalks. These blossoms range in hue from pale yellow to vivid orange, offering a burst of color to the arid environment where the plant flourishes.

Cistanche salsa has a large root system that is frequently firmly entrenched in the soil, letting it to endure the extreme circumstances of its dry environment. The roots are fleshy and tuberous, and they act as the principal storage organs for nutrients and water.

Overall, Cistanche salsa's appearance reflects its adaption to desert conditions, with thin stems, decreased leaves, and colorful tubular blooms, making it a distinctive and attractive botanical specimen.

2. Phytochemical composition

Cistanche salsa's phytochemical profile contains bioactive components such phenylethanoid glycosides, echinacoside, acteoside, iridoids, lignans, polysaccharides, and amino acids, which contribute to its medicinal potential. Among these compounds, phenylethanoid glycosides have been extensively studied for their antioxidant, anti-inflammatory, and neuroprotective capabilities, while polysaccharides have immunomodulatory actions, which contribute to the herb's overall health advantages[5].

3. Traditional Uses in Chinese Medicine:

Cistanche salsa has been used in traditional Chinese medicine for generations to restore vital energy, improve sexual health, and promote longevity. It is often used to treat impotence, infertility, exhaustion, renal shortage, and constipation. According to TCM principles, Cistanche salsa is said to feed the kidneys, increase Yang energy, and stimulate blood circulation, restoring the body's balance and vitality[6].

4. Bioactive compounds

4.1. Phenylethanoid Glycosides: Phenylethanoid glycosides are a key bioactive ingredient in Cistanche salsa. These phytochemicals, which include echinacoside and acteoside, are known for their antioxidant, anti-inflammatory, and neuroprotective effects. Echinacoside, in particular, has received attention due to its capacity to scavenge free radicals, protect against oxidative stress-induced damage, and modify inflammatory pathways, all of which have a protective effect on many organs and tissues[7].

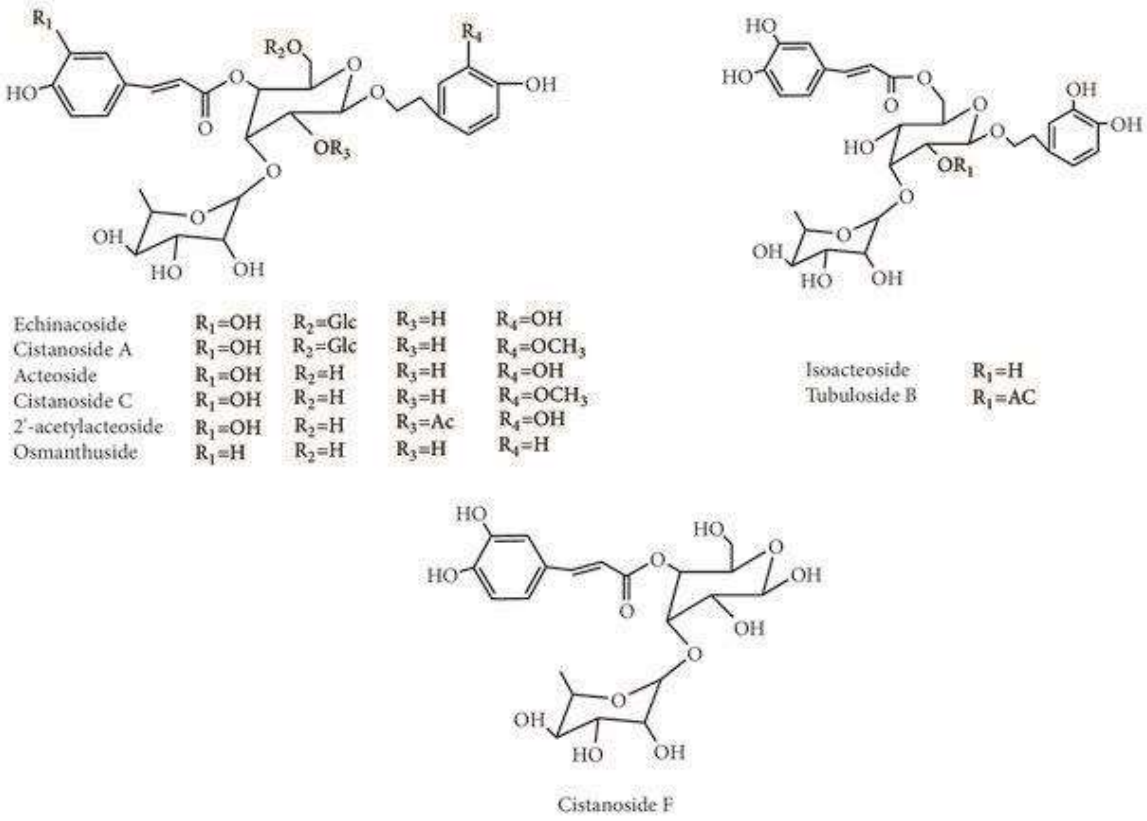


Figure 2. Bioactive components in the Cistanche Salsa which considered the main bioactive component in the plant.

4.2. Iridoids: Cistanche salsa includes iridoids, a class of bioactive chemicals with various pharmacological properties. Among these chemicals, loganin and catalpol are notable for their anti-inflammatory, analgesic, and neuroprotective properties. According to research, catalpol may improve cognitive function, boost

neuronal survival, and reduce neuroinflammation, potentially providing therapeutic benefits for neurological illnesses such as Alzheimer's and Parkinson's[7].

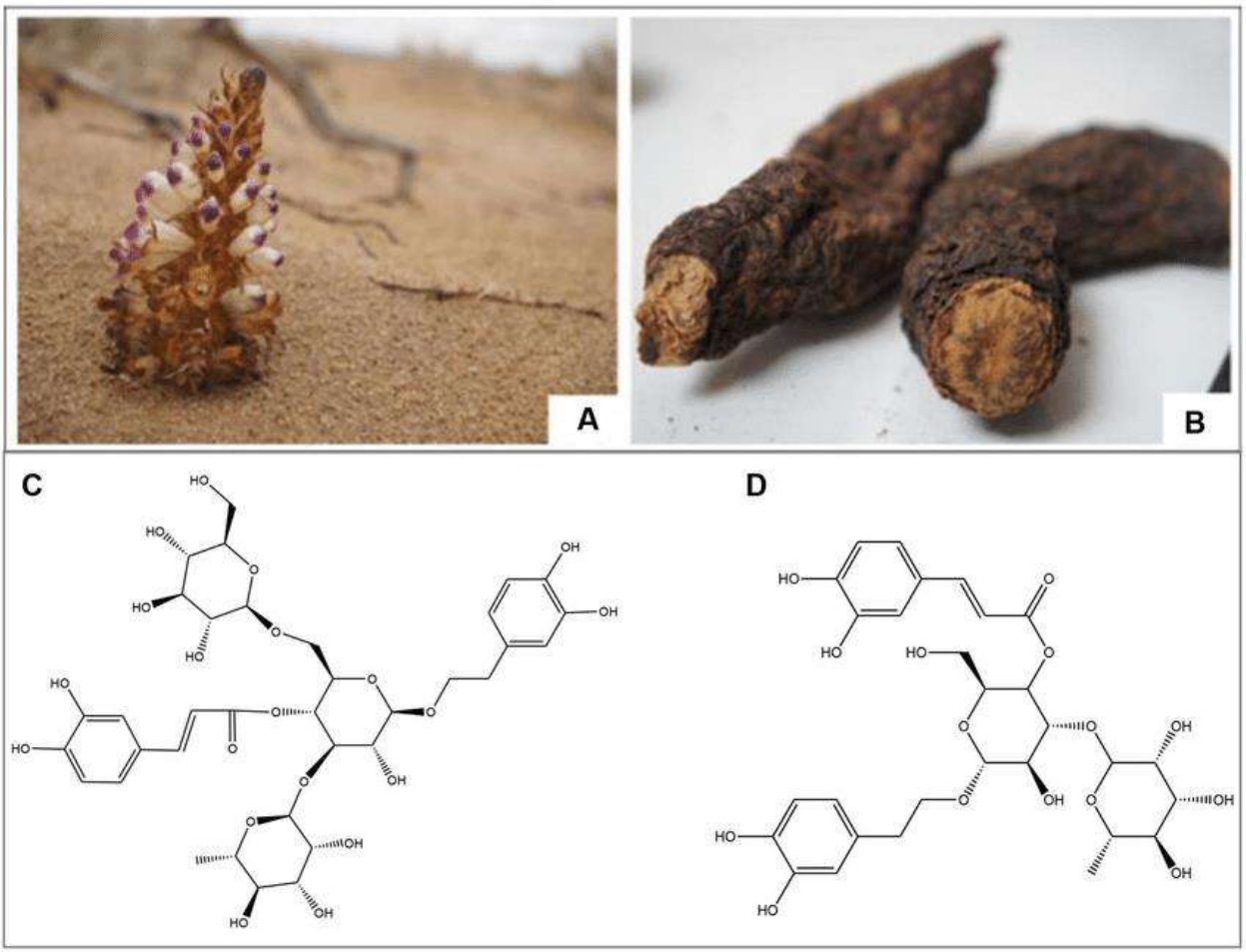


Figure 3. Structure formulae of iridoids in the Cistanche Salsa

4.3. Lignans: Cistanche salsa contains lignans, which contribute to its pharmacological flexibility. These chemicals have antioxidant, anti-inflammatory, and estrogenic properties, making them useful for maintaining hormonal balance, improving cardiovascular health, and preventing age-related oxidative damage. Secoisolariciresinol diglucoside (SDG), a lignan found in Cistanche salsa, has been investigated for its possible involvement in lowering the risk of chronic diseases and increasing longevity[7].

4.4. Polysaccharides: Cistanche salsa contains polysaccharides that boost immune function and overall wellness. These complex carbohydrates have immunomodulatory qualities, which stimulate immune cell activity, increase cytokine synthesis, and promote immune surveillance against infections and cancer cells. Polysaccharides may also have prebiotic effects, which nourish good gut microorganisms and improve gastrointestinal health[8].

4.5. Amino Acids: Cistanche salsa contains a variety of amino acids, which enhance its nutritional worth and medicinal benefits. These amino acids, which include proline, alanine, and glutamine, are needed for protein synthesis, tissue repair, and metabolic functions. Furthermore, some amino acids may have specialized

physiological activities, such as arginine, which acts as a precursor for nitric oxide synthesis, so improving cardiovascular health and vascular function[8].

4.6. Other Bioactive Compounds: Cistanche salsa contains a variety of bioactive components, including secondary metabolites, flavonoids, vitamins, and minerals, each with specific health benefits. Flavonoids, such as quercetin and kaempferol, have antioxidant and anti-inflammatory properties, whereas vitamins and minerals contain critical nutrients for cellular function, energy metabolism, and overall health[9].

5. Health Benefits and Therapeutic Applications:

a. Improving Sexual Health: Cistanche salsa is well-known for its aphrodisiac effects, and it is commonly used to boost libido, erectile function, and overall sexual performance in both men and women[10]. According to studies, its bioactive ingredients may increase nitric oxide generation, improve blood flow to the vaginal organs, and control hormonal balance, all of which promote sexual vigor and reproductive health.

b. Boosting Energy and Stamina: Cistanche salsa, a potent adaptogen, aids the body's adaptation to stimuli and increases energy levels by restoring vital essence (Jing) and feeding the kidneys. It is often used by athletes, fitness enthusiasts, and anyone looking to reduce fatigue, increase physical endurance, and improve exercise performance[11].

c. Supporting Cognitive Function: New research suggests that Cistanche salsa may have neuroprotective properties and improve cognitive function. Its antioxidant and anti-inflammatory characteristics serve to reduce oxidative stress and neuroinflammation, potentially lowering the risk of neurodegenerative diseases including Alzheimer's and age-related cognitive decline[11].

d. Immune System Modulation: Cistanche salsa polysaccharides' immunomodulatory activities have piqued the curiosity of immunotherapy researchers. Preclinical studies indicate that these polysaccharides have immune-enhancing qualities, boosting the activity of immune cells like macrophages, T lymphocytes, and natural killer cells, so strengthening the body's defense against infections and diseases[11].

e. Managing Aging-Related Issues: Cistanche salsa, with its diverse array of bioactive components, shows promise in treating a variety of aging-related illnesses and encouraging healthy aging. By countering oxidative stress, inflammation, and cellular damage, it may aid in the prevention of age-related degenerative diseases, improve skin health, and increase overall wellbeing[12].

6. Research Insights and Clinical Studies:

In recent years, there has been an increase in scientific research into the pharmacological properties and medical applications of Cistanche salsa. Clinical

trials have shown that it is effective in treating erectile dysfunction, cognitive impairment, fatigue, and immunological malfunction, with encouraging outcomes. Furthermore, preclinical studies using animal models have elucidated the underlying mechanisms of action and highlighted Cistanche salsa's multiple health benefits[13].

7. Safety Profile and Considerations:

While Cistanche salsa is generally considered safe to consume, it is important to take caution and follow suggested quantities, particularly when using concentrated extracts or supplements. Individuals with pre-existing medical conditions, pregnant or breastfeeding women, and those using medications should seek medical advice before introducing Cistanche salsa into their diet to avoid any interactions or side effects[14].

8. Formulations and Delivery Methods:

Cistanche salsa is available in a variety of forms, including dry herbs, powders, capsules, tinctures, and extracts. Individual preferences, therapeutic goals, and desired potency all influence the formulation selection process. Some formulations may go through extraction or concentration operations to increase bioavailability and standardize bioactive ingredient dosage[15].

9. Future Directions and Potential Applications:

As scientific interest in Cistanche salsa grows, future research efforts may concentrate on elucidating its mechanisms of action, conducting large-scale clinical trials to validate its efficacy and safety, and investigating novel applications in preventive healthcare, integrative medicine, and pharmaceutical development. Furthermore, synergistic combinations with other herbs or chemicals may improve therapeutic outcomes and widen the field of administration[10].

Conclusion:

Finally, Cistanche salsa is a magnificent plant gem with enormous medicinal potential and a wide range of health advantages. From its original use in Chinese medicine to its modern applications in wellness and illness management, this amazing herb continues to excite academics, healthcare practitioners, and people looking for natural ways to improve their health. With ongoing scientific advancements and a deeper understanding of its pharmacological properties, Cistanche salsa holds promise as a valuable resource for promoting holistic well-being and enhancing the quality of life.

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