



A Review- on *Xanthium strumarium* Linn to use as traditional Plant of Herbal Medications

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Abstract:

Xanthium Strumarium L. (Family: Asteraceae/ Compositae) a medicinal plant commonly found as a weed, folklore medicine and is found to be an ancient Ayurvedic remedy. *Xanthium strumarium* L. (Asteraceae) is a common and well-known traditional Chinese herbal medicine usually named Cang-Er-Zi, and has been used for thousands of years in China. *Xanthium strumarium* L. is an annual herb which reproduces solely by seed. So far its centre of origin was considered Central or South America. The plant occurs all over Pakistan, India, China, Eurasia and also in America. The trade name is Cocklebur and Chota dhatura while generally known as Chota gokhru. *Xanthium strumarium* L. is studied for different pharmacological and phytochemical activities. The pharmacological activity of *Xanthium strumarium* L. are antibacterial, antitumor, antitussive, antifungal, anti-inflammatory, antinociceptive, hypoglycaemic, antimutagenic, antioxidant, antitrypanosomal, CNS depressant activity, diuretic effects, contact dermatitis and insecticidal. The phytochemical present in plant sesquiterpenoids, phenylpropanoids, lignanoids, coumarins, steroids, glycosides, flavonoids, thiazides, anthraquinones, naphthoquinones and other compound.

Introduction:

Xanthium strumarium L. common medicinal plant belongs to family asteraceae. The plant occurs all over Pakistan, India, China, Eurasia and also in America. Local name of *Xanthium*

strumarium L. is Common Cocklebur and Chota dhatura. The 20,000 species of its 950 genera are found worldwide as herbs, shrubs, trees and climbers (Chopra, 1994). It is a commonly found as a weed in roadsides, rice fields, hedges throughout the tropical parts of India. *Xanthium strumarium* is an annual herb, up to 1 m in height. *Xanthium strumarium L.* has stout stems, green, brownish or reddish-brown in color, often red-spotted that are rough and hairy. Fruits are cylindrical to ovoid, two-chambered bur, 1 to 4 cm long, glandular, covered with hooked prickles, with two larger, longer incurved prickles projecting from the apex of the bur. A decoction of the root has been used in the treatment of high fevers. These medicinal properties are due to presence of chemical constituents such as steroids, alkaloids, flavonoids, triterpenoids, terpenoids, tannins, saponins, quinone, coumarin, protein, sugar and gum. It has many medicinal properties like antibacterial, antitumor, antitussive, antifungal, anti-inflammatory, antinociceptive, hypoglycaemic, antimitotic, antioxidant, antitrypanosomal, CNS depressant activity, diuretic effects, contact dermatitis, insecticidal and herbicidal activities.

Description:

Xanthium strumarium L. is an annual herb, up to 1 m in height. *Xanthium strumarium L.* has stout stems, green, brownish or reddish-brown in color, often red-spotted that are rough and hairy. The first true leaves are opposite, all subsequent leaves are alternate. Leaves are triangular to ovate in outline, have stiff hairs, and are approximately 2 to 7 inches long. Leaves are irregularly lobed with leaf margins that have relatively inconspicuous teeth.



Xanthium strumarium L.

Stems are round or slightly ribbed, often speckled with purple and have short white hairs scattered across the surface; flower heads are in terminal and axillary racemes, and are white or green; numerous male uppermost, female ovoid, covered with hooked bristles [Figure 1].

Fruits are obovoid, enclosed in the hardened involucre, with two hooked beaks and hooked bristles. Flowering time in India is August-September. This weed is easily dispersed through animals as the fruits have hooked bristles and two strong hooked beaks. It flowers from July to October, and the seeds ripen from August to October. The flowers are monoecious and are pollinated by insects. The plant is self-fertile. The fruits are harvested when ripe and dried for use.

Classification:

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|-----------------------|---|--------------------------------|
| Common Name | : | Common Cocklebur |
| Local Name | : | Chota dhatura/Common Cocklebur |
| Botanical Name | : | Xanthium strumarium |
| Kingdom | : | Plante |
| Phylum | : | Magnoliophyta |
| Class | : | Magnoliopsida |
| Order | : | Asterales |
| Family | : | Asteraceae |
| Genus | : | Xanthium |
| Species | : | X.Strumarium |

Distribution:

Xanthium strumarium L. is distributed worldwide but is most common in the temperate zone. It is a serious weed in Australia, India, South Africa, and the Americas. *Xanthium strumarium L.* is found throughout the United States and is primarily a weed of agronomic and horticultural crops, nurseries, and occasionally pastures.

Uses:

The *Xanthium strumarium L.* whole plant, especially root and fruit, is used as medicine. According to Ayurveda, the plant has cooling, laxative, fattening, anthelmintic, alexiteric, tonic, digestive, antipyretic activities and improves appetite, voice, complexion and memory. It cures leucoderma, biliousness, and poisonous bites of insects, epilepsy, salivation and fever. The plant is considered to be useful in treating long-standing cases of malaria and is used as an adulterant for *Datura stramonium*. The leaves and roots are used for their anodyne, antisyphilitic, appetizer, diaphoretic, diuretic, emollient, laxative and sedative activities. An infusion of the plant has been used in the treatment of rheumatism, diseased kidneys and tuberculosis. They are anodyne, antibacterial, antifungal, antimalarial,

antirheumatic, antispasmodic, antitussive, cytotoxic, hypoglycemic and stomachic. They are used internally in the treatment of allergic rhinitis, sinusitis, urticaria, catarrh, rheumatism, rheumatoid arthritis, constipation, diarrhoea, lumbago, leprosy and pruritis.

The burs are used in china as a tonic, diuretic and sedative. A decoction of the root has been used in the treatment of high fevers, leucorrhoea and to help a woman expel the afterbirth. A decoction of the seeds has been used in the treatment of bladder complaints.

Phytochemicals:

The phytochemical screening of various solvent extracts of this herb has determined the presence of various classes of organic compounds mainly flavonoids, alkaloids, tannins, anthraquinones, terpenoids, glycosides, ascorbic acid, organic acids and others. Chemical studies on the composition of the stem oil differed two main groups of compounds: monoterpenes (49.4 %) and sesquiterpenes (29.1 %). The leaf oil has similar composition: monoterpenes (55.8 %) and sesquiterpenes (26.4 %). The major components in both oils were identified as: limonene (35.0 %), carveol (25.0 %), α -ionone (10.5 %), β -caryophyllene (6.0 %) and p-cymene (5.0 %). So far, many phytochemical studies of *Xanthium Strumarium L.* have been conducted, and more than 170 compounds have been isolated and identified from this plant. Among them, sesquiterpenes and phenyl propanoids are the most abundant and major bioactive constituents in *Xanthium strumarium L.*, and are considered as the characteristic constituents of this plant. In addition to the chemical constituents found in fruits, constituents in other parts of *Xanthium strumarium L.* were also comprehensively reported, including leaves, roots and stems, etc.

The aerial parts of the plant contain a mixture of unidentified alkaloids, which are said to be toxic. Besides alkaloids, the aerial parts of the plant contain sesquiterpene lactones, viz. xanthinin; its stereoisomer, xanthumin, xanthatin (deacetyl xanthinin); a toxic principle, a sulphated glycoside: xanthostrumarin, atractyloside, carboxyatractyloside; phytosterols, xanthanol, isoxanthanol, xanthinosin, 4-oxo-bedfordia acid, hydroquinone; xanthanolides, caffeoylquinic acids; α and γ -tocopherol, thiazinedione, 4-oxo-1(5),2,11,(13)-xanthatriene-12,8-olide, known as "deacetyl xanthumin" an antifungal compound; linoleic acid.

Aerial parts contain three xanthanolide and xanthanetype sesquiterpenoids, 11 α , 13-dihydroxanthatin, 4 β , 5 β -epoxyxanthatin-1 α , 4 α -endoperoxide, 1 β , 4 β , 4 α , 5 α -diepoxy xanth-11(13)-en-12-oic acid, a dimeric xanthanolide, sesquiterpene lactones, 8-epixanthatin, 2-epixanthumin and 8-epi-xanthatin-5 β -epoxide. The phenols isolated are caffeic acid, potassium 3-O-caffeoylquinic acid, 1-O-caffeoyl quinic acid, chlorogenic acid, 4-O-

caffeoylquinic acid, 1,4-di-O-caffeoylquinic acid, 1,5-di-O-caffeoylquinic acid, 3,5-di-O-caffeoylquinic acid, 4,5-di-O-caffeoylquinic acid, 1,3,5-tri-O-caffeoylquinic acid, 3,4,5-tri-O-caffeoylquinic acid, and cynarin.

The fruits are rich in vitamin C. Thiiazinediones isolated from the fruits are 7-hydroxy methyl-8,8-dimethyl-4,8-dihydrobenzol[1,4]thiazine-3,5-dione-11-O- β -dglucopyranoside, 2-hydroxy-7-hydroxymethyl-8,8-dimethyl-4,8-dihydrobenzol[1,4]thiazine-3,5-dione-11-O- β -dglucopyranoside, 7-hydroxymethyl-8,8-dimethyl-4,8-dihydrobenzo[1,4]thiazine-3,5-dione, 7-hydroxymethyl-8,8-dimethyl-4,8-dihydrobenzol[1,4]thiazine-3,5-dione-(2-Ocaffeoyl)- β -dglucopyranoside, ferulic acid, formononetin and ononin.

Traditinal Usages:

Xanthium strumarium L. has a long history for utilization as a medicinal plant in China due to its extensive biological and pharmacological activities. In particular, the fruit is the predominant medicinal part of *X. strumarium*, and is one of the most common used herbal medicines to treat rhinitis and headache for thousands years. Before clinical use, the fruits of *Xanthium strumarium L.* are often processed by stir-baking to a yellowish color, which aims to reduce toxicity and enhance efficacy. The first record of the pharmacological effects of this plant can be traced back to ShenNong BenCaoJing, which is the earliest monograph of TCM during the Eastern Han dynasty. In this monograph, it was used for the treatment of anemofrigid headache and rheumatic arthralgia. Then, in Mingyi BieLu which is another known TCM monograph, *Xanthium strumarium L.* was recorded as an effective herbal medicine with the function of curing gonyalgia. In Yaoxinglun, *X. strumarium* was described as an agent for treating hepatic heat and eye diseases. Subsequently, another famous monograph, Xinxiu Bencao, described *Xanthium strumarium L.* with improving eyesight, antiepileptic and antirheumatic properties. Besides, *Xanthium strumarium L.* was also listed in some other classical monographs of materia medica in China, such as Bencao Shiyi, Bencao Mengquan, and Depei Bencao, Caomu Bianfang, Tianbao Bencao and others.

Currently, the fruits of *Xanthium strumarium L.* have become an important traditional Chinese medicine commonly used in clinic for the treatment of nasal diseases (including acute and chronic rhinitis, allergic rhinitis (AR), nasosinusitis, and nasal obstruction), itching diseases, and painful diseases. In order to meet clinical needs better, various forms of formulas are developed, such as pills, tablets, granules, oral liquid, powders and others (Table 1). Furthermore, in India, *Xanthium strumarium L.*, commonly known as Chotagokhru or Chota dhatura, are usually used to cure leucoderma, poisonous bites of insects, epilepsy, and biliousness. In addition, several North American Indian tribes and Zuni tribes apply this plant

to relieve constipation, diarrhoea and vomiting. Besides, *Xanthium strumarium L.* is also reported as a folk herbal medicine in Bangladesh for the treatment of urinary disorder, ear infection, diabetic, and gastric disorder

Apart from clinical application, its potential capacity as a biodiesel feedstock has been proven. *Xanthium strumarium L.* has very strong environmental adaptability and thus has numerous wild resources. The seed has high oil content (42.34%) which gives potential annual output of 100,000 tons just in China Furthermore, the research in Pakistan also found the prospects of non-edible seed oils for use as biodiesel to solve the serious energy crisis.

Ethnopharmacological Activity

The *Xanthium strumarium L.* is used a reputed medicine in Europe, China, Indo-China, Malaysia and America. The *Xanthium strumarium L.* plant, especially root and fruit, is used as medicine. According to Ayurveda, the plant has cooling, laxative, fattening, anthelmintic, alexiteric, tonic, digestive, antipyretic activities and improves appetite, voice, complexion and memory. It cures leucoderma, biliousness, and poisonous bites of insects, epilepsy, salivation and fever. The plant has been reported as fatal to cattle and pigs. It is used by various native American tribes to relieve constipation, diarrhoea and vomiting. Indigenous Chinese applications are as a headache remedy and to assist with cramping and numbness of the limbs, ulcers and sinus problems. The plant is considered to be useful in treating long-standing cases of malaria and is used as an adulterant for *Datura stramonium*.

The leaves and roots are used for their anodyne, antirheumatic, antisymphilitic, appetiser, diaphoretic, diuretic, emollient, laxative and sedative activities. An infusion of the plant has been used in the treatment of rheumatism, diseased kidneys and tuberculosis. It has also been used as a liniment on the armpits to reduce perspiration. The fruits contain a number of medically active compounds including glycosides and phytosterols. They are anodyne, antibacterial, antifungal, cytotoxic, hypoglycaemic and stomachic. They are used internally in the treatment of allergic rhinitis, sinusitis, urticaria; catarrh, rheumatism, rheumatoid arthritis, constipation, diarrhoea, lumbago, leprosy and pruritis. They are also used externally to treat pruritis and small pox. The ashes are applied to sores on the lips and mucous membrane of the mouth. The root is a bitter tonic and febrifuge. It has historically been used in the treatment of scrofulous tumours and used locally on ulcers, boils and abscesses. The paste of green spiny fruits is used against migraine and the juice of leaves and fruits are believed to be useful for smallpox and the roots are used for cancer. The burs are used in china as a tonic, diuretic and sedative. A decoction of the root has been used in the treatment of high fevers, leucorrhoea and to help a woman expel the after birth.

Pharmacology:

The herb has several health-promoting benefits, including antibacterial, antitumor, anticancer, antifungal, anti-inflammatory, antinociceptive, antitussive, hypoglycemic, antimitotic, antitrypanosomal, antimalarial, diuretic, antioxidant, analgesic, repellent and insecticidal activities.

Antibacterial, Antitumor and Anticancer Activities:

The xanthinin contained in plant acts as a plant growth regulator and has antibacterial activity. The plant extract exhibited antimicrobial activity against *Proteus vulgaris*, *Staphylococcus aureus*, *Bacillus subtilis*, *Candida albicans* and *Candida pseudotropicalis*. Two xanthanolide sesquiterpene lactones, 8-epi-xanthatin and 8-epi-xanthatin-5 β -epoxide, isolated from the leaves demonstrated significant inhibition on the proliferation of cultured human tumour cells, i.e. A549 (non-small cell lung), SK-OV-3 (ovary), SK-MEL-2 (melanoma), XF498 (CNS) and HCT-15 (colon) in vitro activity. Seed yields semi-dry edible oil (30–35%) which resembles sunflower oil and is used in bladder infection, herpes, and erysipelas.

Antifungal Activity:

The plant *Xanthium strumarium L.* has potent antifungal activity against pathogenic as well as non-pathogenic fungi due to the presence of terpenes, d-limonene and d-carveol. The leaf extract of plant may be used as a potent fungi toxicant against the mycelial growth of *Fusarium moniliforme*. The antifungal compound from plant was identified as 4-oxo-1(5), 2, 11, (13)-xanthatriene-12, 8-olide, known as “deacetyl xanthumin.” Alcoholic extract showed an inhibition only against *S. aureus* at a concentration of 200 μg /disc. The plant possesses significant potency against *C. neoformans* and *Candida* species with low toxicity to brine shrimps.

Antimitotic Activity

Xanthium strumarium L. may possess antimitotic components. In a study, the plant was screened for its antimitotic activity using the microtubule-tubulin system isolated from mammalian tissue. The separated fractions obtained were identified and used for in vitro polymerization studies. The whole as well as partially separated chemical constituents showed effective inhibition of tubulin polymerisation.

Anti-oxidant activity:

The fruit of *Xanthium strumarium L.* possesses radical scavenging property. The potential was found 138.87 µg /ml in DPPH assay in contrast of Ascorbic acid in addition, 32.76 µmole activity/mg proteins were observed in catalase by measuring the initial rate of H₂O₂ disappearance. The antioxidant effect of extract fractions from plant on lens protein was estimated by cross-linking assay method. The cross-linking activities of extract fractions (crude, CHCl₃, EtAc and H₂O) on lens protein were determined by incorporation with N-formyl-lysine. Antioxidant activity was measured as follows:

$$\% \text{ inhibition (or \% scavenging)} = \frac{(\text{Absorbance of control sample} - \text{Absorbance of test sample})}{\text{Absorbance of control sample}} \times 100$$

Hypoglycemic Activity:

Cockleburs as such provide a relatively inexpensive source of raw material for worldwide production of a naturally occurring insulin substitute. The main advantage is that the product does not produce its results by causing production of insulin by stimulation of Islets of Lagerhans in the pancreas. The antihyperglycaemic effect of caffeic acid and phenolic compounds present in the fruit of *Xanthium strumarium L.* was investigated. Cockleburs as such provide a relatively inexpensive source of raw material for worldwide production of a naturally occurring insulin substitute. An insulin independent action of caffeic acid can thus be considered. Otherwise, this compound reduced the elevation of plasma glucose level in insulin-resistant rats receiving a glucose challenge test. Also, glucose uptake into the isolated adipocytes was raised by caffeic acid in a concentration-dependent manner. Increase of glucose utilization by caffeic acid seems to be responsible for the lowering of plasma glucose. Carboxyatractyloside also possesses hypoglycemic activity.

Contact Dermatitis

The plant *Xanthium strumarium L.* is suspected to cause air-borne contact dermatitis. In a study, patch tests with a 15% aqueous extract of air dried leaves showed a severe positive reaction. The titre of contact hypersensitivity with the plant extract was more than 1:100,000 and for *Parthenium hysterphorus* it was 1:10, indicating a high degree of hypersensitivity to *X. strumarium*. Further tests in 14 other patients revealed a high prevalence of cross sensitivity between the two plants. The antigens in the two plants seem to be very similar.

Anti-trypanosomal Activity:

The crude ethanolic extract of aerial parts of *X. strumarium* was analyzed for anti-trypanosomal behaviour in mice through vivo trial. The extract was effective at 100 and 300

mg/kg on specimen infected by trypanosome evansi. However, it was found toxic at 1000 mg/kg.

Insecticidal activity:

The crude methanol extract of whole plant exhibited 100% mortality for *Callosbruchusanalis* in comparison of standard drug Permethrin (100% activity at 235.7µg/cm). It proved *X.strumarium* as a natural insecticide.

Anti-arthritic activity:

The immune-modulatory potential to prevent rheumatoid arthritis was observed in extract of fruit *Xanthium strumarium L.* A significant suppress in paw swelling and arthritis level was observed upon administration of 300-75 mg/kg once a day of extract using methotrexate 3mg/kg/twice a week on Freund Adjuvant induced rats .

Diuretic activity:

The 65% hydroalcoholic solution of aerial parts of *Xanthium strumarium L.* was evaluated for diuretic potential in wistar rats. Similar effects to that of reference Furosemide (5mg/kg) was found at the dose of 100, 200 and 400mg/kg extract. The plant was found safe with no toxicity and death at 2000mg/kg, limited dose of standard.

Neuropharmacological Activity:

Earlier study reported that *X Xanthium strumarium L.* has significant anti-inflammatory and analgesic properties in mice. The whole plant used to treat cytotoxicity and antitumor activity. Furthermore, several investigations have reported that *X. strumarium* possesses anti-ulcerogenic, anthelmintic, diuretic, antimicrobial, antioxidant, and antilipidemic activity. *X. strumarium* traditionally used central nervous system (CNS) stimulant agent which may have potential antidepressant activity.

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