

Review on Ethnomedicinal, Phytochemical and Toxicological Approaches of *Xanthium* Species

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ABSTRACT

Genus *Xanthium* (*Asteraceae* family) consists of 25 species that are distributed worldwide. Among these, only a few species, such as *Xanthium strumarium* and *Xanthium spinosum* have been extensively investigated for their pharmacological and phytochemical properties. These studies have revealed various activities, including analgesic, anti-inflammatory, anti-arthritis, cytotoxic, anti-angiogenic, and antiviral effects. This review covers most of the identified chemical constituents of plants from the genus *Xanthium* reported in literature between the years 2000 and 2026. In addition, the biological activities of the different species of genus *Xanthium* are presented and discussed too. Researchers will be able to examine the potential of the *Xanthium* genus in order to improve human health through more *in vivo* human studies. A search was performed across different databases, including, Scopus, Science Direct and PubMed from the year 2000 mostly till 2026. Second, articles were chosen based on specific related criteria. As this is a review article, we include most types of articles relevant to our subject. Lastly, the pertinent data for the review was arranged in a methodical manner. In addition, this study is descriptive, qualitative and not quantitative. **Inclusion Criteria:** Original research articles and comprehensive reviews published in peer-reviewed journals. Studies focused explicitly on *Xanthium* species, reporting phytochemical profiling and biological activity. *In vitro* or *in vivo* pharmacological evaluations conducted under standardized conditions. Investigations into structure-activity relationships. **Exclusion Criteria:** Non-English articles without verified translations. Case reports or opinion pieces without original data. The relevant information for the review was systematically organized. Sesquiterpenes and flavonoids as main active constituents are cited and discussed due to their important anti-oxidant activities. This literature review discussed the biological constituents and pharmacology of genus *Xanthium*. We recommend to carry out more studies in order to isolate more compounds from this genus exerting remarkable pharmacological activities and to study their mechanism of action.

Keywords: Anti-cancer activity, Antidiabetic activity, Phytochemistry, Toxicity, Xanthatin, *Xanthium* species.

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Received: 09-07-2026;

Revised: 19-08-2026;

Accepted: 23-10-2026.

INTRODUCTION

Genus *Xanthium*, often referred to as cocklebur, is part of the *Asteraceae* family and encompasses species like *Xanthium strumarium*. These plants are commonly found throughout various regions including Iran; Lebanon; Syria; Palestine; Sinai; Turkey; eastern Asia and some parts of south Asia, Europe, and the Americas. Characterized by their spiny seed pods, they have

long been utilized in traditional medicine to manage conditions such as arthritis, headaches, skin infections and rhinitis.^[1,2] Flavonoids, and sesquiterpenoids have been discovered in this plant, contributing to its therapeutic potential.^[3]

The leaf-derived essential oil of *X. strumarium* includes constituents such as cis- β -guaiene, limonene, and borneol showing antimicrobial properties against multiple microorganisms.

The genus *Xanthium* comprises approximately 5 distinct species, with *Xanthium strumarium* being the most widespread and thoroughly investigated due to its extensive global presence and medicinal importance.^[3,4] Additional well-documented species include *X. spinosum*, *X. orientale*, *X. italicum*, *X. ambrosioides*, *X. sibiricum*, *X. chinense*, and *X. cavanillesii*. Both molecular research



DOI: 10.5530/phrev.20270001

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and morphological observations have been used to identify them in several studies.^[5]

This article aims to provide an overview of chemical constituents, medicinal uses, pharmacological activities and safety of most common *Xanthium* species indicating their impact in phytotherapy and the possibility of including some of them in the field of drug industry.

METHODOLOGY

A search was performed across different databases, including, Scopus, PubMed and Web of Science. Tables 1-3 presented below list the most prevalent *Xanthium* species and the isolated compounds (Figure 1).

TRADITIONAL USES

X. strumarium has been used for centuries, primarily because of its wide therapeutic and biological effects. The fruit is the main part used and has long been one of the most frequently employed remedies for treating headaches, rhinitis.^[4] and rheumatoid arthritis.^[17]

Xanthium strumarium is first recorded in one of the foundational texts on herbal medicine, where it was recommended for treating headaches and joint complaints.^[17] Subsequent medical texts expanded on its uses, citing its effectiveness for ailments affecting eye and nervous system in traditional Chinese pharmacological literature.^[9] Its benefits also extend to treating pulmonary phlegm retention associated with conditions like acute and chronic bronchitis.^[9-11]

In a detailed ethnomedicinal survey conducted in 2021 in the central Syrian regions of Hama and Homs, the survey included 151 individuals, comprising 35 traditional herbalists and 10 medical professionals. It concentrated on remedies made from single plant species, intentionally excluding traditional mixtures. Through this approach, 76 medicinal plant species from 39 different families were identified, each used in the treatment of 106 distinct medical conditions with *Xanthium* species identified as one of the important traditional remedies used in the region. The fact that *Xanthium* is still used shows how important it is as a natural remedy that is inherent in the cultural and medical traditions of the Middle East.^[18,19]

PHARMACOLOGICAL ACTIVITIES

Antifungal activity

A study carried out in 2022 in Taif, Saudi Arabia, explored the antifungal activity of *Xanthium strumarium* L. leaf extracts against fungal species isolated from infected pomegranate fruits. This study revealed that both methanolic and ethanolic extracts of the plant inhibited the growth of *Aspergillus niger*, *Penicillium implicatum*, *Alternaria alternata*, and a variety of *Fusarium*

species. The inhibition levels vary from 40% up to 70%, indicating that it possesses strong antifungal properties.^[20] This effect is correlated to the presence of xanthanolide sesquiterpene lactones in addition to ferulic acid and beta-sitosterol.^[21]

Antidiabetic activity

In 2022, a study performed in Iraq investigated the effects of *Xanthium strumarium* L. extract on blood glucose levels in healthy and alloxan-induced diabetic mice. This research demonstrated that the aqueous extract of *X. strumarium*, rich in phenols, flavonoids such as Quercetin-3-O-glucuronide, tannins, terpenes, and glycosides, noticeably reduced blood glucose levels in diabetic mice. No major changes were observed in healthy mice treated with the extract. These findings support its traditional use for the control of diabetes and showed its potential as a natural antidiabetic agent.^[22]

Antioxidant and Anti-Inflammatory

A study guided by Abd El-Gawad *et al.* In 2019 focused on the essential oil obtained from *Xanthium strumarium* leaves harvested in Egypt. The analysis determined the presence of 43 chemical compounds, notably sesquiterpenoids, eudesmol, l-borneol, 1,5-dimethyltetralin and caryophyllene oxide. This study compared the Egyptian oil's chemical profile to those from other areas. The essential oil demonstrated moderate antioxidant properties and exhibited considerable inhibitory effects on the growth of *Bidens pilosa*. These results highlight the importance of *X. strumarium* essential oil in the development of natural products.^[23]

Antimalarial activity

A study by Sahoo *et al.* In 2020 investigated the chemical composition of *Xanthium strumarium* L. and evaluated its effects against malaria. The researchers identified several active compounds, including sesquiterpene lactones like xanthatin and isoxanthol associated with antimalarial effects. When tested against *Plasmodium falciparum* that is responsible for the most severe form of malaria, the plant extracts demonstrated significant inhibitory effect in comparison to antimalarial drugs. These result highlight *Xanthium strumarium* as a promising source of natural compounds.^[24]

Anticancer activity

Most plants including *Xanthium spinosum* L. were used in the treatment of cancer.^[25,26] A study carried out in 2022 demonstrated that, it inhibits breast cancer in mice by apoptosis induction and immune system modulation as it showed the highest antiproliferative activity.^[26] Moreover, another study performed by Romero *et al.* In 2015 isolated the sesquiterpene lactone xanthatin from *X. spinosum* that exhibited a notable antitumor result against diverse cancer cells (Table 1).^[27]

Anti-arthritic activity

Lin *et al.* Conducted an experimental investigation in 2014 on *Xanthium strumarium* L. fruit proving its use in rheumatoid arthritis as it reduced swelling of the paws of rats.^[28] Furthermore, Fruit extract from *Xanthium strumarium* L. was found to have immune-modulatory potential to prevent rheumatoid arthritis when adjuvant-induced rats were given 300-75 mg/kg of extract once daily along with methotrexate twice weekly. A noticeable reduction in paw swelling and arthritis takes place confirming its use in rheumatoid arthritis.^[29]

DISCUSSION

Plants are a rich source of phytochemicals and exert several pharmacological activities depending on different secondary metabolites presented in Tables 2 and 3 and playing a vital role in human health.^[30] This is due to their reliable antioxidant activity and thus play an important role in treating cancer

and cardiovascular diseases.^[31] Flavonoids have been proven to be of great importance because they help the human body to fight diseases by inhibiting a number of enzymes such as xanthine oxidase and thus can treat several diseases.^[32] Moreover, sesquiterpenes are bitter substances and a class of terpenes consisting of three isoprene units with a molecular formula $C_{15}H_{24}$ with an α , β -unsaturated- γ -lactone as a main structural feature. In most studies, sesquiterpenes have been allied with anti-tumor and anti-microbial activities.^[33] *X. strumarium* methanol leaf extracts showed a remarkable antimicrobial activity provoked mainly by flavonoids, sesquiterpenes and tannins.^[34] Consequently, we suggest to prepare antibacterial drugs from the leaves *X. strumarium*.

This paper revealed their phytochemical and pharmacological properties including analgesic, anti-inflammatory, and antiviral effects. All these activities are correlated to the presence of volatile oils, flavonoids and sesquiterpenes mainly. It showed that *Xanthium strumarium* is the most widespread in the Middle East regions including Egypt, Lebanon, Syria and China too. Genus *Xanthium* was investigated due to its extensive global presence and medicinal importance.^[34,35]

In a detailed ethnomedicinal survey conducted in 2021 in Hama, the information gathered from herbalists indicated that the genus *Xanthium* is primarily used to treat inflammatory conditions, and many other health problems as a natural therapy. Furthermore, a study carried out in 2022 in Saudi Arabia, demonstrated that both methanolic and ethanolic extracts of *X. strumarium* significantly

Table 1: The most common Xanthium species.

<i>Xanthium</i> Species	Reference(s)
<i>Xanthium ambrosioides</i>	[6]
<i>Xanthium italicum</i>	[7]
<i>Xanthium orientale</i>	[8]
<i>Xanthium sibiricum</i>	[2]
<i>Xanthium spinosum</i>	[1]
<i>Xanthium strumarium</i>	[9]

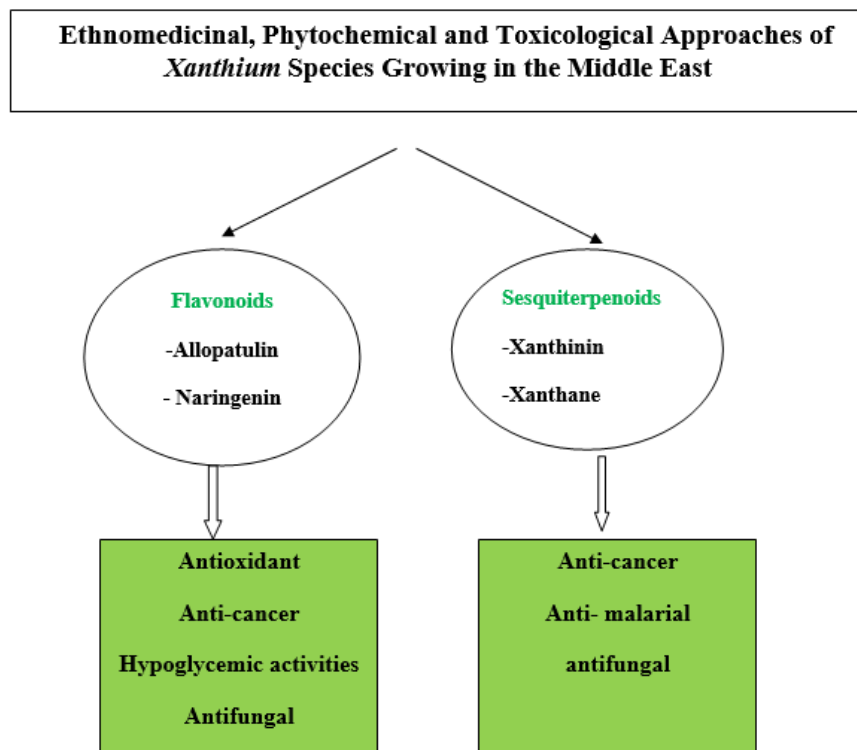
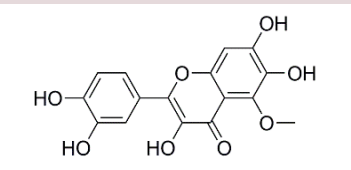
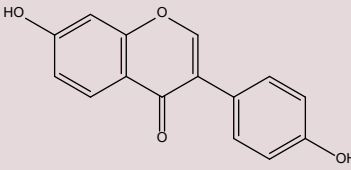
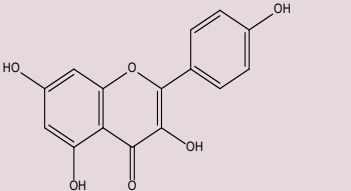
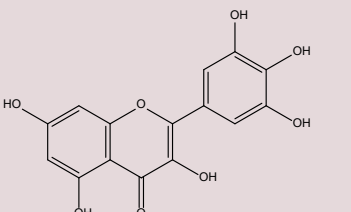
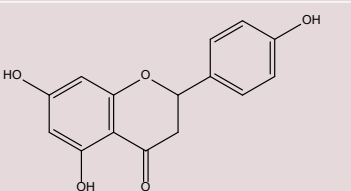
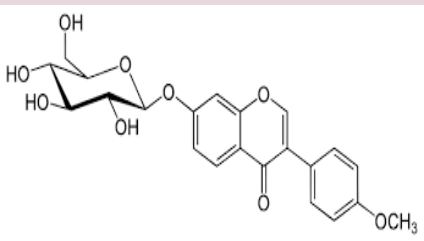
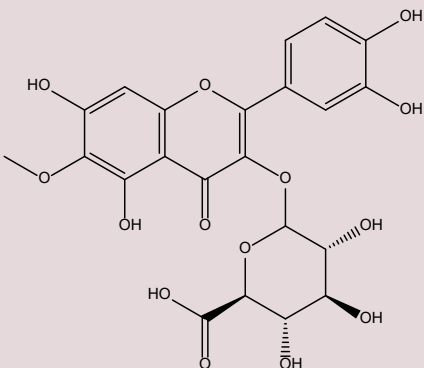


Figure 1: The flow diagram of the chemical constituents and biological activities.

Table 2: Flavonoids isolated from the genus *Xanthium*.

Name	<i>Xanthium</i> species (Part used)	Structure	References
Allopatulin	<i>X. strumarium</i> fruit		[9]
Formononetin	<i>X. strumarium</i> fruit		[1]
kaempferol	<i>X. strumarium</i> aerial parts		[10]
Myricetin	<i>X. strumarium</i> aerial parts		[10]
Naringenin	<i>X. strumarium</i> aerial parts		[4]
Ononin	<i>X. strumarium</i> fruit		[9]
Patuletin-3-glucuronide	<i>X. strumarium</i> fruit		[1]

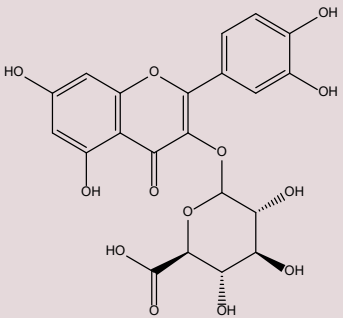
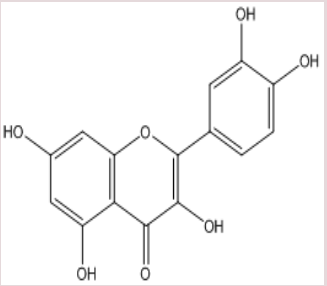
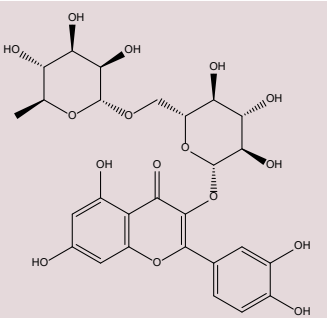
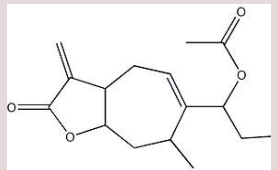
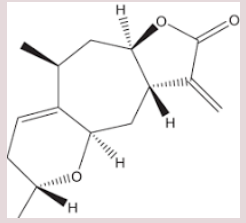
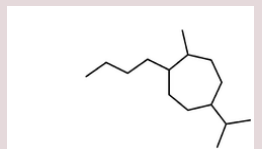
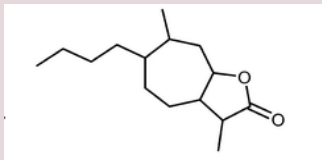
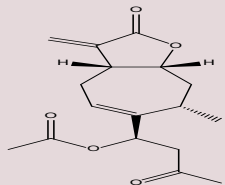
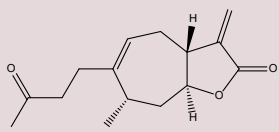
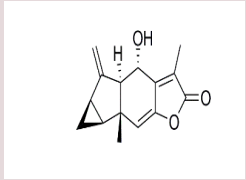
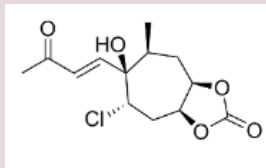
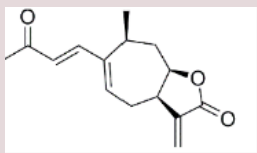
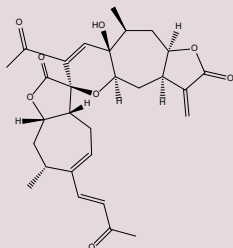
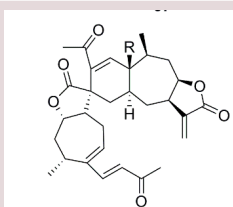
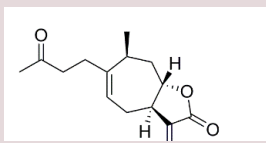
Name	<i>Xanthium</i> species (Part used)	Structure	References
Quercetin-3-O-glucuronide	<i>X. strumarium</i> fruit		[1]
Quercetin	<i>X. strumarium</i> aerial parts		[4]
Rutin			

Table 3: Sesquiterpenoids compounds isolated from the genus *Xanthium*.

Name	<i>Xanthium</i> species (Part used)	Structure	References
Xanthinin	<i>X. strumarium</i> leaves		[1]
Isoxanthanol	<i>X. strumarium</i> leaves		[2]
Xanthane	<i>X. strumarium</i> fruits		[12]

Name	<i>Xanthium</i> species (Part used)	Structure	References
Xanthanolides	<i>X. strumarium</i> fruits		[12]
Xanthumin	<i>X. strumarium</i> fruits		[4]
Xanthinosin	<i>X. strumarium</i> fruits		[4]
Sibirolide B	<i>X. strumarium</i> fruits		[11]
1 β -hydroxyl-5 α -chloro-8-epi-xanthatin	<i>X. strumarium</i> aerial parts		[13]
11a,13-dihydro-8-epi-xanthatin	<i>X. strumarium</i> aerial parts		[13]
Pungiolide A	<i>X. sibiricum</i> fruits		[14]
Pungiolide E	<i>X. sibiricum</i> fruits		[15]
8-epi-tomentosin	<i>X. strumarium</i> leaves		[16]

inhibited the growth of *Aspergillus niger*, and *Fusarium* species proving its strong antifungal properties.^[36,37]

In 2019 a study guided by Abd El-Gawad *et al.* Focused on the essential oil obtained from the leaves of *Xanthium strumarium* harvested in Egypt. It showed significant inhibitory effects on the growth of *Bidens pilosa*, indicating its potential as a natural herbicide.^[9,23] Moreover, in 2020, Sahoo *et al.* Identified the sesquiterpene lactone named xanthatin, which has been associated with the antimalarial effects of *X. strumarium*. Hopefully, based on the promising results collected in this study, we recommend additional research to be conducted on different species of the genus *Xanthium*. Moreover, we need to do more researches to ensure the safety of the use of volatile oils in agriculture in the future.

CONCLUSION

This article highlights a number of active constituents specifically flavonoids and sesquiterpene lactones playing an important role in treating several diseases as discussed in folk medicine and thus can play an extraordinary role in drug manufacturing from a natural source. Based on the above presented results we conclude that *Xanthium* species exert a strong antitumor effect on cancer cells specifically on breast cancer and exert antibacterial and antifungal activity too.

ABBREVIATIONS

A. niger: *Aspergillus niger*; **A. alternata:** *Alternaria alternata*; **B. pilosa:** *Bidens pilosa*; **C₁₅H₂₄:** Molecular formula of sesquiterpenes consisting of fifteen carbon and twenty-four hydrogen atoms; **P. falciparum:** *Plasmodium falciparum*; **X. ambrosioides:** *Xanthium ambrosioides*; **X. chinense:** *Xanthium chinense*; **X. cavanillesii:** *Xanthium cavanillesii*; **X. italicum:** *Xanthium italicum*; **X. orientale:** *Xanthium orientale*; **X. sibiricum:** *Xanthium sibiricum*; **X. spinosum:** *Xanthium spinosum*; **X. strumarium:** *Xanthium strumarium*; **α, β-unsaturated-γ-lactone:** Alpha, beta-unsaturated gamma-lactone structural moiety; **mg/kg:** Milligrams per kilogram; **L.:** Linnaeus (taxonomic authority designation); **et al.:** And others; **vs.:** Versus; **No.:** Number.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR'S CONTRIBUTION

RB, ZO, AFH, AA, AI, AJ, AH, FN, JR, MG, YZ, ZF, MH, AL, and MAO were remarkably involved in the work reported. They provided concept and design, data collection, analysis and interpretation of results. They were also involved in drafting and evaluating the manuscript. All supervised and granted the final acceptance of the manuscript before it was published.

REFERENCES

- Wang J, Wang D, Wu B, et al. Phytochemical and pharmacological properties of *Xanthium* species: a review. *Phytochem Rev.* 2025;24:773-844. doi:10.1007/s11101-024-09966-4
- Wang J, Wang H, Zhang H. A review on pharmacological and toxicological studies of *Xanthium strumarium* L. *Evid Based Complement Alternat Med.* 2019; 1-12.
- Strother JA. A new look at the *Xanthium* species of North America. In: *Flora of North America North of Mexico*. Oxford University Press; 2006:21:84-9.
- Fan W, Fan L, Peng C, Zhang Q, Wang L, Li L, et al. Traditional uses, botany, phytochemistry, pharmacology, pharmacokinetics and toxicology of *Xanthium strumarium* L.: a review. *Molecules.* 2019;24(2):359. doi:10.3390/molecules24020359
- Manzo E, Nillies S, Gutiérrez DG, Panero JL, Bräuchler C, Tomasello S. Species delimitation in *Xanthium* sect. *Acanthoxanthium* (Heliantheae, Asteraceae) and the neglected species *Xanthium argenteum*. *Taxon.* 2024;73(5):1251-71. doi:10.1002/tax.13245
- Fariba N, Jamil F, Sedigheh NS. Taxonomic investigation of the *Xanthium strumarium* L. complex (Asteraceae) distributed in Iran inferred from morphological, palynological and molecular data. *Biodivers J Biol Divers.* 2021;22(4). doi:10.13057/biodiv/d220444
- Sârbu A, Smarandache D. *Xanthium italicum*-anatomy and histology data. *Acta Horti Bot Bucurest.* 2013;40:5-18. doi:10.2478/ahbb-2013-0001
- Biljana K, Zlatan K, Siniša M, Sava V. Responses of seed germination of *Xanthium orientale* L. and *Xanthium spinosum* L. to temperature. *Plant Protect Sci.* 2024;60(3):295-304. doi:10.17221/124/2023-PPS
- Linh NTT, Son NT, Ha NTT, Tra Anh LT, Chen S, et al. Biologically active constituents from plants of the genus *Xanthium*. In: *Progress in the Chemistry of Organic Natural Products* 116. Springer International Publishing; 2021: 135-209. doi:10.1007/978-3-030-80560-94
- Beyatli A. Phytochemical analysis and antioxidant, antimicrobial, and cytotoxic activities of *Xanthium strumarium* L. (Asteraceae). *Turk J Biol.* 2025;49(1):127-37. doi:10.55730/1300-0152.2730
- Vasas A, Hohmann J. Xanthane sesquiterpenoids: structure, synthesis and biological activity. *Nat Prod Rep.* 2011;28:824-42. doi:10.1039/C0NP0011F
- Surabi C, Sanchita K, Khushbo B, Pekha J. A review on properties and applications of xanthan gum. In: *Microbial Polymers*. 2021: 87-107. doi:10.1007/978-981-16-0045-6_4
- Han T, Zhang H, Li HL, Zhang QH, Zheng HC, Qin LP. Composition of supercritical fluid extracts of some *Xanthium* species from China. *Chem Nat Compd.* 2008;6:814-6. doi:10.1007/s10600-009-9208-2
- Jiang H, Yang L, Liu C, Hou H, Wang Q, Wang Z, et al. Four new glycosides from the fruit of *Xanthium sibiricum* Patr. *Molecules.* 2013;18:12464-73. doi:10.3390/molecules181012464
- Jiang H, Yang L, Ma GX, Xing XD, Yan ML, Zhang YY, et al. New phenylpropanoid derivatives from the fruits of *Xanthium sibiricum* and their anti-inflammatory activity. *Fitoterapia.* 2017;117:11-5. doi:10.1016/j.fitote.2016.12.007
- Karmakar UK, Ishikawa N, Toume K, Arai MA, Sadhu SK, Ahmed F, et al. Sesquiterpenes with TRAIL-resistance overcoming activity from *Xanthium strumarium*. *Bioorg Med Chem.* 2015;23:4746-54. doi:10.1016/j.bmc.2015.05.044
- Surriya A, Barkatullah, Haroon HK. Pharmacology of *Xanthium* species: a review. *J Phytopharmacol.* 2016;5(3):126-7.
- Khatib C, Nattouf A, Agha MIH. Traditional medicines and their common uses in the central region of Syria: Hama and Homs - an ethnomedicinal survey. *Pharm Biol.* 2021;59(1):776-86. doi:10.1080/13880209.2021.1936078
- Hosakatte Niranjana Murthy. *Bioactive Compounds in Edible Flowers*. 1st ed. CRC Press; 2026. doi:10.1201/9781003645979
- Nguyen DMC, Luong TH. Chemical composition and antioxidant activity of the fruit essential oil of *Xanthium strumarium* L. cultivated in Hai Duong province, Vietnam. *Vietnam J Sci Technol Eng.* 2025. doi:10.31276/VJSTE.2025.0024
- Zahida P, Mazhar S, Saima S, Manzoor A, Ali Z. Chemical composition and antifungal activity of essential oil from *Xanthium strumarium* L. leaves. *Indian J Pharm Sci.* 2017;79(02):316-21. doi:10.4172/pharmaceutical-sciences.1000232
- Allami RH, Qader KO, Al-Saadi SAAM, Faraj IM, Mouhamad RS. Evaluate the influence of *Xanthium strumarium* L. extract on blood sugar levels in healthy and diabetic mice. *J Clin Cases Rep.* 2022;2:72-4. doi:10.46619/joccr.2022.5-2.1109
- El-Gawad AA, Elshamy A, El Gendy AE, Gaara A, Assaeed A. Volatiles profiling, allelopathic activity, and antioxidant potentiality of *Xanthium strumarium* leaves essential oil from Egypt: evidence from chemometrics analysis. *Molecules (Basel, Switzerland).* 2019;24(3):584. doi:10.3390/molecules24030584
- Sahoo RK, Tamuli KJ, Lhou N, Dutta D, Bordoloi M, Sharma HK, et al. Phytochemical constituents from *Xanthium strumarium* L. and evaluation of their *in vitro* antimalarial activities. *S Afr J Bot.* 2020;135:35-40. doi:10.1016/j.sajb.2020.08.006
- Talib WH, Mahasneh AM. Antiproliferative activity of plant extracts used against cancer in traditional medicine. *Sci Pharm.* 2010;78:33-46. doi:10.3797/scipharm.0912-11
- Al Kury LT, Taha Z, Mahmod AI, Talib WH. *Xanthium spinosum* L. extracts inhibit breast cancer in mice by apoptosis induction and immune system modulation. *Pharmaceuticals.* 2022;15(12):1504. doi:10.3390/ph15121504

27. Romero M, Zanuy M, Rosell E, Cascante M, Piulats J, Font-Bardia M, *et al.* Optimization of xanthatin extraction from *Xanthium spinosum* L. and its cytotoxic, anti-angiogenesis and antiviral properties. *Eur J Med Chem.* 2015;90:491-6. doi:10.1016/j.ejmech.2014.11.060
28. Lin B, Zhao Y, Han P, Yue W, Ma XQ, Rahman K, *et al.* Anti-arthritis activity of *Xanthium strumarium* L. extract on complete Freund's adjuvant induced arthritis in rats. *J Ethnopharmacol.* 2014;155(1):248-55. doi:10.1016/j.jep.2014.05.023
29. Bhanoo PS, Garima G, Ranjeet S, Anil K. Review on *Xanthium strumarium* Linn to use as traditional plant of herbal medications. *Glob Sci J.* 2021;9(2).
30. Murugan R, Parimelazhagan T. Comparative evaluation of different extraction methods for antioxidant and anti-inflammatory properties from *Osbeckia parvifolia* Arn. - An *in vitro* approach. *J King Saud Univ Sci.* 2014;26(4):267-75. doi:10.1016/j.jksus.2013.09.006
31. Sell C. Terpenoids. In: Kirk-Othmer Encyclopedia of Chemical Technology. Wiley; 2006. doi:10.1002/0471238961.2005181602120504.a01.pub2
32. Ghassan MS, Assi M, Nada MS, Rima B, Mohamad R. Antioxidant activity, metal content, and essential oil composition of two desert truffles species: *Terfezia boudieri* and *Terfezia clavaryi*. *J Pharmacogn Phytochem.* 2022;11(4):10-9. doi:10.22271/phyto.2022.v11.i4a.14438
33. Eberhard B. Sesquiterpenes. In: Terpenes: Flavors, Fragrances, Pharmaca, Pheromones. Wiley; 2006: 24-51. doi:10.1002/9783527609949.ch3
34. Scherer R, Duarte MCT, Catharino RR. *Xanthium strumarium* L. antimicrobial activity and carboxyatractyloside analysis through electrospray ionization mass spectrometry. *Rev Bras Plantas Med.* 2009;11(2):159-63. doi:10.1590/S1516-05722009000200008
35. Taheri A, Dinarvand R, Ahadi F, Khorramizadeh MR, Atyabi F. The *in vivo* antitumor activity of LHRH targeted methotrexate-human serum albumin nanoparticles in 4T1 tumor-bearing Balb/c mice. *Int J Pharm.* 2012;431(1):183-9. doi:10.1016/j.ijpharm.2012.04.033
36. Hassan MM, Soliman MM, Al-Otaibi S, El-Shehawi AM, Taha EA, Sayed S. The effectiveness of *Xanthium strumarium* L. extract and *Trichoderma* spp. against pomegranate isolated pathogenic fungi in Taif, Saudi Arabia. *J King Saud Univ Sci.* 2022;34(6):102185. doi:10.1016/j.jksus.2022.102185
37. Amin N, Wu CH, Malak N, Khan A, Ullah S, Ahmad I, *et al.* *In vitro* bioassay and *in silico* pharmacokinetic characteristics of *Xanthium strumarium* plant extract as possible acaricidal agent. *Curr Pharm Des.* 2025;31(12):992-1005. doi:10.2174/0113816128317849241108064144

Cite this article: Boukhary RMKE, Omeiche Z, Assi AW, Ibrahim AR, Jundi AW, Hachichou AF, *et al.* Review on Ethnomedicinal, Phytochemical and Toxicological Approaches of *Xanthium* Species. *Pharmacogn Rev.* 2027;21(41):133-40.