REVIEW ARTICLE

Phytochemistry and Ethno Biological discussion of Ajos sacha

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Abstract

Introduction: Plants have been utilized as a source of medicine for a long time. Scientists have successfully mended several abnormal health disorders by boosting traditional pharmaceuticals since the beginning of time. This implies concentrating on a wide range of biological activities to illuminate potential secondary metabolite modes of action. **Materials and Methods:** The study was carried out using literature review using keywords such as Ajos sacha, *Adenocalymma alliaceum* Miers through search engine Google Scholar, Science direct, PubMed, and Elsevier. **Result and Discussion:** The Ajos Sacha has many active metabolites and sulfur compounds similar to garlic. Furthermore, due to biologically abundant active secondary metabolites such as polyphenol, flavonoid, tannic acid, and sulfur compounds, the plant has been documented for numerous biological activities such as antibacterial activity, anti-inflammatory activity, antifungal activity, anticancer activity, anthelmintic activity, larvicidal activity, and hypocholesterolemic activity. Due to the presence of sulfur in garlic creeper, the plant has shown inhibition of tubulin polymerization or impedes the G2-M phase via Cdc25C signaling. In addition, the Ajos Sacha flower extract inhibits phosphatidylserine translocation, and caspase-3 activation causes apoptosis. The Ajos Sacha was also documented due to its inhibition characteristic on tubulin polymerization or blocking the G2-M phase via Cdc25C signaling. **Conclusion:** This review presents the role of Ajos Sacha on biological activities, including free radical scavenging property. Henceforth, this plant can be utilized in clinical screening too.

Key words: Ajos Sacha, polyphenol, sulfur compounds, caspase-3

INTRODUCTION

Plants have been utilized as medicine for many years. Ayurvedic herbal medicine has been used since the dawn of time.[1] Scientists have succeeded many times in curing abnormal health ailments by improving conventional medicines. The beneficial therapeutic effects of the herbal world are usually due to the existence of numeric major active principles.[2] These naturally generated active secondary principles successfully impact different health difficulties in developed and developing countries. It is thought and proven to have fewer side effects while treating plant-derived medicines. It also helped patients save money by reducing their length of stay in the hospital.[3]

However, succeeding standardizing procedures, isolating pure bioactive components, and elucidating biological mechanisms have posed significant challenges to accepting a new natural product.[4] To overcome such challenges, nations consistently focus on advancing analytical and genetic technologies.[5] India is one of such developing nations with rich natural resources. The forests in India are reported to comprise hundreds of therapeutical plant varieties.[6] The World Health Organization (WHO) listed 2500 species; 150 species are on the market.[7] The therapeutic blooming plant *Adenocalymma alliaceum* Miers is found in many different parts of India, primarily with more rainfall. It has also known as Ajos Sacha, which means "forest garlic," "wild garlic," "false garlic," "garlic vine, "or" garlic creeper" in Spanish. These names were given because its leaves have a pungent garlic-like odor.[8] As per the reported literature of Ajos Sacha,

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many active secondary metabolites exist in this plant. These secondary metabolites kept the plant highly demandable in research. However, to get the greater quantity of active metabolites, parts of the plant need to be collected while the leaves are green and flowers are violet.[9] The present review explains the detailed profile of phytochemistry and pharmacology of the Ajos Sacha.

MATERIALS AND METHOD

The keywords "Ajos Sacha," "*A. alliaceum* Miers," "Amazon rain forest," "Garlic vine," "sulfur compounds," and "Garlic" were used to search peer-reviewed literature in databases such as Elsevier, Web of Science, Scopus, PubMed, and Google Scholar with no time constraints.

RESULTS AND DISCUSSION

Plant Profile

Ajos Sacha belongs to the Plantae kingdom, Tracheophyta division, Eqisetopsida c. Agardh class, Lamiales order, Bignoniaceae family, Adenocalymma genus, *Alliaceum* species. The vernacular names are garlic vine, Ajos Sacha in English, naharu lata in Assamese, lata parul in Bengali, Chanamlei in Manipuri.[10,11]

Morphological Features

Ajos Sacha stands about three meters tall. From March to August, it blooms. Simple, ovate to lanceolate leaves about 7–15 × 4–5 cm in length. The apex is mucronate, and the entire margin is mucronate. The surface is glabrous, glaucous, and papery, textured with a green tint. Their venation is reticulate, with asymmetric and tapering bases. Petioles are green and circular. When crushed, the leaves emit a garlic-like odor and flavor. The lavender bell-shaped flowers are medium violet in color and have a garlic-like smell. The corolla is 6–9 cm long. The calyx is 5–8 cm long. The stems are slender and cylindrical. Approximately 7–8 cm long with a 10–20 mm diameter. Due to microscopic pits, the stem's surface is rough. The young and elderly stems are green and light brownish in hue. It smells and tastes like garlic.[12] A typical part of Ajos Sacha containing flowers, leaves, and stems is shown in Figure 1.

Distribution, Cultivation, or Agricultural Aspects

Ajos Sacha can be found in both dry and wet woods in the Amazonian region of South America, including Brazil, Peru, Argentina, Thailand, and Southern Mexico. It can also be found in India's equatorial area. The best soil condition for this plant is stable ground away from water bodies. The plant requires 1800–3500 mm of rainfall per year and temperatures between 20 and 30°C.[12] Cropping branch stakes are used for propagation, and the plant is taken when the color is in the middle of its life cycle. Retaining humidity necessitates achieving a light level of 40%. Therefore, seeding the plant with or without biofertilizer is best done during the wet season. The collection is carried out manually. The flowers and foliage are shadows dried to avoid denaturation of secondary active components. Under sunlight, the stems and roots are mostly dried.[13]

Traditional Therapeutic Uses

Ajos Sacha has a wide range of herbal properties and applications. Whole parts of Ajos Sacha were used in treating bodily complications. In addition, Ajos Sacha had been found to use airway, breathing, circulation, digestion, and pain reliever purposes. The traditional uses of Ajos Sacha are listed below in Table 1.

Phytochemical Profile

Ajos Sacha has a garlic-like flavor and odor. Two lapachone are found in the wood pieces. Beta-sitosterol, daucosterol, fucosterol, and stigmasterol are all found in flowers. The following chemicals were found in Ajos Sacha: 24-ethyl-cholest-7-en-3-beta-ol, 3-beta-hydroxyurs-18-en-27-oic acid, alliin, allyl sulfides, alpha 9-methoxylapachone, alpha 4-hydroxy-9-methoxylapachone, apigenin, aspartic acid, beta-sitosterol, beta amyrin.[18-21] The molecular formula and structure of biochemical components found in Ajos Sacha are shown in Table 2.

Pharmacological Activities

Antibacterial activity

Ajos sacha shows antibacterial properties against *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus subtilis*, *Staphylococcus*

Figure 1: A specific part of Ajos Sacha contains flowers, leaves, and stems

aureus, *Streptococcus marceius,* and *Proteus vulgaris*.[22] Methanol and ethanol extracts produce a maximal inhibitory zone against all the test organisms. The chloroform extract exhibited minor activity amongst all the sections.[2] The plant is a good choice for human therapy due to the evidence of exhibiting antibacterial properties. The zone of inhibitions is noted to be 12 mm, 9 mm, 8 mm, and 5 mm in methanol, aqueous, ethanol, and chloroform extracts, respectively, against microbes.[23] Antibacterial activity is shown in Figure 2.

Anti-inflammatory activity

The hydroalcoholic extract of dry Ajos sacha powder is more effective at scavenging free radicals. The carrageenan-induced rat paw edema method was given orally at 100 mg and 200 mg to rats. Inflammatory mediators such as histamine, serotonin, bradykinin, prostaglandins, and tumor necrosis factor might be inhibited in acute phases, which could be the mechanism of action. The anti-inflammatory effect of the hydroethanolic Ajos sacha extract was tested in mice with complete Freund's adjuvant-*induced inflammation*, a chronic inflammatory pain model with features similar to those seen in arthritic sufferers. The Ajos sacha aqueous leaf extract has been shown to help with several chronic diseases, such as arthritis, and it has few side effects that interfere with patients' quality of life. As a result, this plant's extract is widely used as an analgesic, and other species have anti-inflammatory properties in humans.[24,25] Anti-inflammatory activity is shown in Figure 3.

Table 1: Traditional applications of Ajos sacha

Part of plant	Uses
Leaf[14,15]	Cold and fevers, analgesic for headache, anti-rheumatic Malaria, as an insecticidal Pneumonia, Vermifuge Cough, nausea, and constipation In respiratory disorders, purgative, depurative Anti-amoebic, flu, cough, the pain of the head Magical and ritual use, air diseases Body aches and pain, muscle aches
Stem[16]	A piece of stem is kept in a glass of water, and then the water can be drunk for healthy labor during the last month of pregnancy
Whole plant[17,18]	Flu, fever, fatigue, cramps, body aches, and pain Aggressive dementia Fly repellant Ritual and magical uses Infections, muscular system disorders, respiratory diseases Muscle weariness, anti-analgesic. Rituals involving magic and riddles ward off the specter of evil.
Bark, Root[19]	Tincture or decoction of barks. Tincture or cold maceration of roots. Antirheumatic and anti-arthritic

Antifungal activity

Several fungi were tested against Ajos sacha. The extract had broad-spectrum toxicity on fungi, as measured by spore germination inhibition. Various dilutions of Ajos sacha aqueous leaf extracts have different effects on spore germination. Five concentrations of extract, namely 1:0, 1:1, 1:2, 1:3, 1:4, and one control, were examined for spore germination in a study. The leaf extract had a substantial inhibitory effect on fungus spore germination at various dilutions. The quotation completely inhibited all fungi observed for spore germination in a 1:1 dilution. *Colletotrichum acutatum* funguses are inhibited by crude Ajos sacha leaf extracts. The leaf extract was fungal toxic, suggesting that it could help prevent biodeterioration in rice, wheat, grain, peas, dried fruits, and raw herbal medications, improving their market value. Extract's superiority over routinely used synthetic fungicides at the low minimum inhibitory concentration further supports its use as a fungal toxicant alternative.[26,27] Antifungal activity is shown in Figure 4.

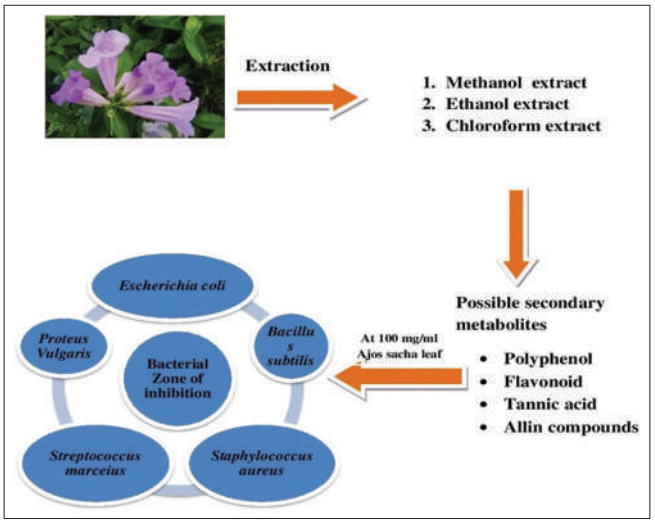


Figure 2: Antibacterial activity of Ajos sacha

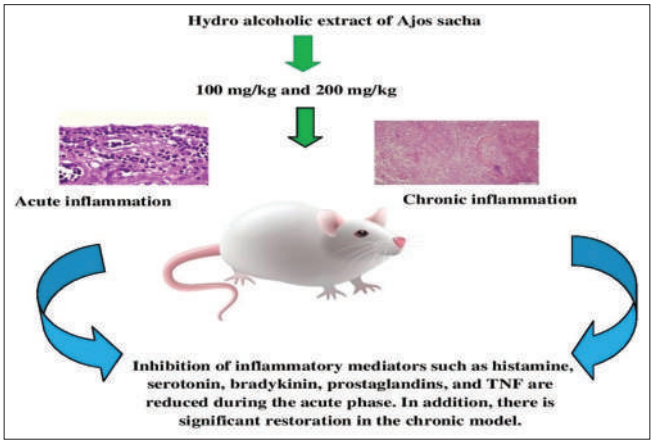


Figure 3: Anti-inflammatory activity of Ajos sacha

Table 2: Molecular formula and structure of biochemical components found in Ajos Sacha

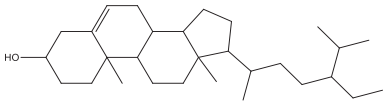
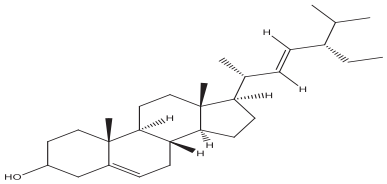
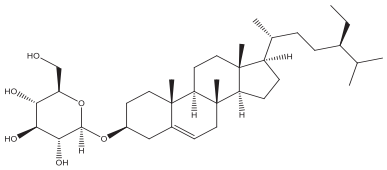
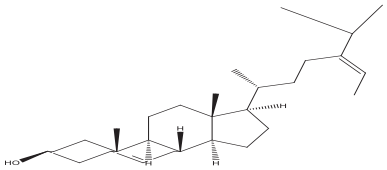
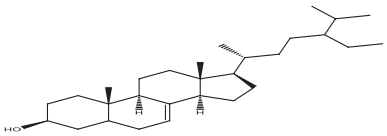
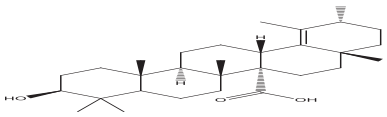
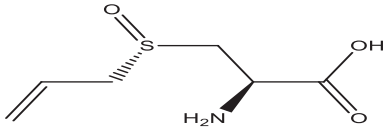
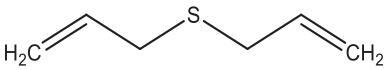
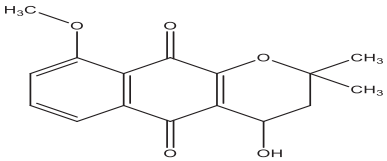
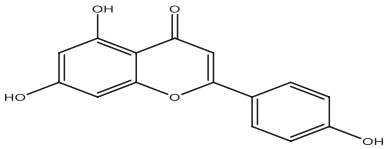
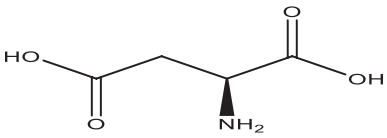
Compounds	Molecular formula	Structure
Beta-sitosterol	$C_{29}H_{50}O$	
Stigmasterol	$C_{29}H_{48}O$	
Daucosterol	$C_{35}H_{60}O_6$	
Fucosterol	$C_{29}H_{48}O$	
24-ethyl-cholest-7-en-3-beta-ol	$C_{29}H_{50}O$	
3-beta-hydroxyurs-18-en-27-oic acid	$C_{30}H_{48}O_3$	
Alliin	$C_6H_{11}NO_3S$	
Allyl sulfides	C_4H_8S	
Alpha 4-hydroxy-9-methoxy-lapachone	$C_{16}H_{16}O_5$	
Apigenin	$C_{15}H_{10}O_5$	
Aspartic acid	$C_4H_7NO_4$	

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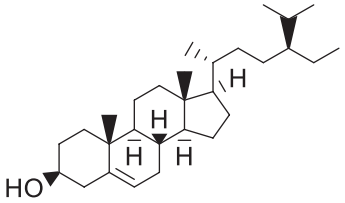
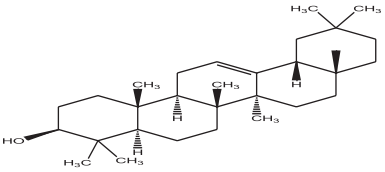
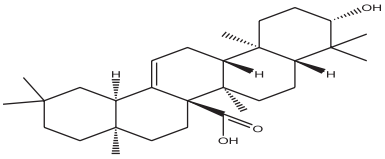
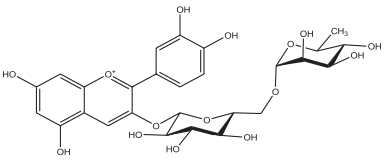
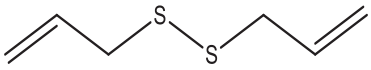
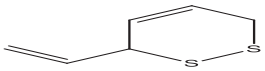
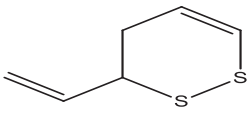
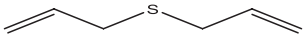
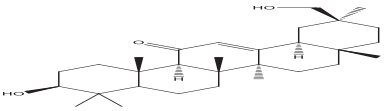
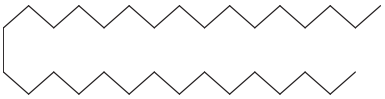
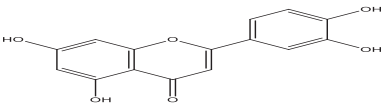
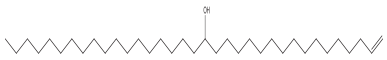
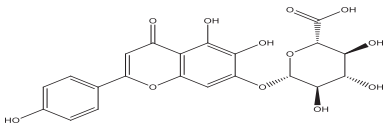
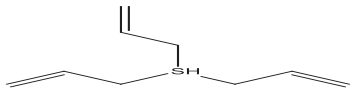
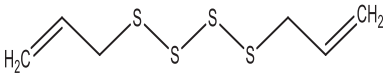
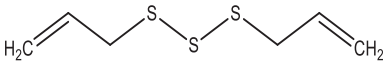
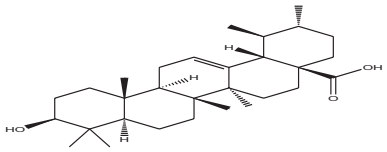
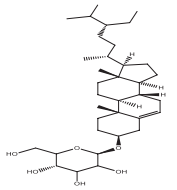
Table 2: *(Continued)*

Compounds	Molecular formula	Structure
Beta-sitosterol	$C_{29}H_{50}O$	
Beta amyrin	$C_{30}H_{50}O$	
Beta-peltoboykinolic acid	$C_{30}H_{48}O_3$	
Cyanidin-3-o-beta-d-rutinoside	$C_{27}H_{31}O_{15}^+$	
Diallyl disulfide	$C_5H_4S_2$	
3-vinyl-3,6-dihydro-1,2-dithiine	C_6HS_2	
3-vinyl-3,4-dihydro-1,2-dithiine	$C_6H_8S_2$	
Dithiacyclopentene	$C_3H_4S_2$	
Glutamic acid	$C_5H_9NO_4$	
Glycyrrhetol	$C_{30}H_{48}O_3$	
Hentriacontanes	$C_{31}H_{64}$	
Leucine	$C_6H_{13}NO_2$	
Luteolin	$C_{15}H_{10}O_6$	
N-nonacosane	$C_{29}H_{60}$	

(Contd...)

Table 2: *(Continued)*

Compounds	Molecular formula	Structure
Octacosan-1-ol	$C_{28}H_{58}O$	
Pentatriacont-1-en-17-ol	$C_{35}H_{70}O$	
Scutellarein-7-o-beta-d-glucuronide	$C_{21}H_{18}O_{12}$	
Triacontan-1-ol	$C_{30}H_{62}O$	
Triallyl sulfides		
Diallyl tetrasulfide	$C_6H_{10}S_4$	
Diallyl trisulfide	$C_6H_{10}S_3$	
Ursolic acid	$C_{30}H_{48}O_3$	
Beta sitosteryl d glucoside	$C_{35}H_{60}O_6$	

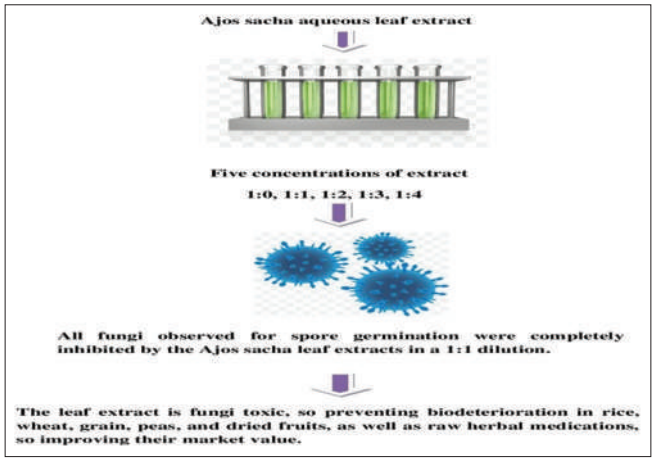


Figure 4: Antifungal activity of Ajos Sacha

Anticancer activity

The presence of naphthoquinone in Ajos Sacha could explain its anticancer action. The leaf extract has the most substantial anticancer potential. The quote from this plant has an inhibitory effect on the proliferation of non-cancerous NIH Swiss cells without eliminating or considerably reducing their population number. The Ajos Sacha extract targets T3-HA cancer cells but not NIH. Swiss outbred mice cells.[9] T3-HA cancer cells were discovered in the Ajos sacha leaf extract at low concentrations, while the cytotoxic effect was found at greater concentrations.[28] After treatment with methanolic flower extract of Ajos sacha, the M.T.T. 3-(4, 5-dimethylthiazole-2-yl)-2,5-diphenyl tetrazolium bromide assay revealed an inhibitory effect on breast cancer growth. Furthermore, the floral extract triggered apoptosis in MCF-7 and MDA-MB231 carcinomas via phosphatidylserine translocation and caspase-3 activation in a dose-dependent manner.[29] Anticancer activity is shown in Figure 5.

Antioxidant activity

Phenols, carotenoids, anthocyanins, and tocopherols, among other antioxidant compounds, were reported to the Ajos Sacha. In addition, saponins, flavonoids, alkaloids, steroids, sugars, and phenolic compounds are all found in the ethanolic leaf extract of Ajos Sacha.[30] Antioxidant activity is shown in Figure 6.

Anthelmintic activity

In-vitro and *in-silico* tests of Ajos Sacha's antihelmintic activity against *Pheretima posthuma* were done. Research reveals that methanolic extract was the most crucial

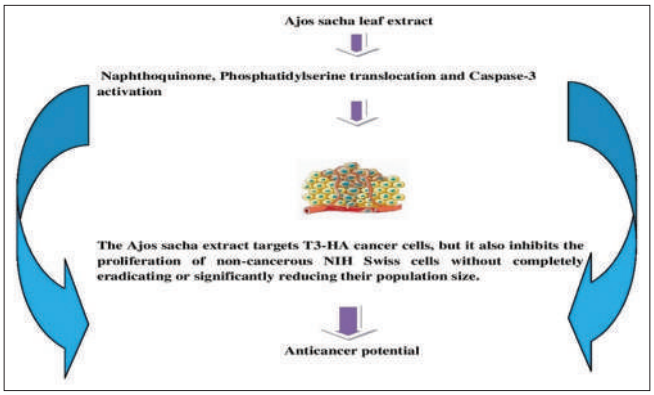


Figure 5: Anticancer activity of Ajos sacha

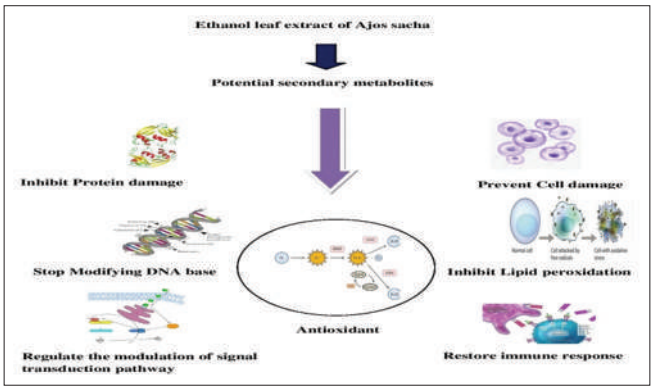


Figure 6: Antioxidant activity of Ajos sacha

dose-dependent anthelmintic at different levels. The four phytoconstituents of Ajos Sacha, Apigenin 7-O-methyl glucuronide, luteolin, scutellarin, and ursolic acid, have been found as potential anti-tubulin in *in-silico* research. These picture components from a natural provenance could be used to develop a dependable treatment or strengthen lead detection using cutting-edge techniques.[31] Anthelmintic activity is shown in Figure 7.

Larvicidal activity

In aqueous, ethanolic, and methanolic extracts, the essential oils and hydrolase of Ajos Sacha indicate larvicidal activity. The 10% extracts suppressed mosquito larvae's average growth and development in 6.15, 3.42, and 5.57 days, extending and delaying the larval and pupal duration. In addition, significant compounds such as diallyl sulfide and diallyl disulfide have larvicidal action.[32] Larvicidal activity is shown in Figure 8.

Hypocholeteromic activity

A 6-week investigation on rats fed a diet with 2% dried Ajos Sacha flower resulted in hypocholesterolemic action. The flower had the same blood cholesterol-lowering effect as the 0.002% dietary amount of garlic oil-fed rats. The flower also increased the excretion of acidic and neutral sterols in the feces, similar to asafoetida or onion-fed rats fed a 2% dietary amount of Asafoetida or onion. In addition,

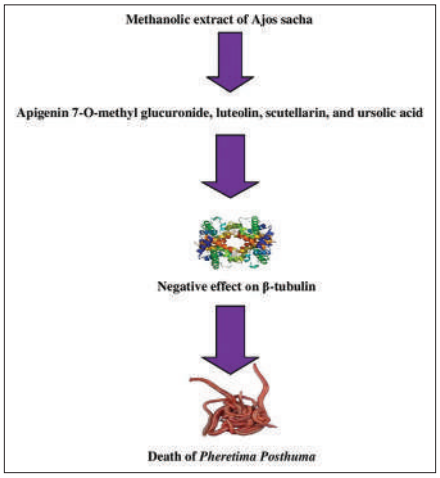


Figure 7: Anthelmintic activity of Ajos Sacha

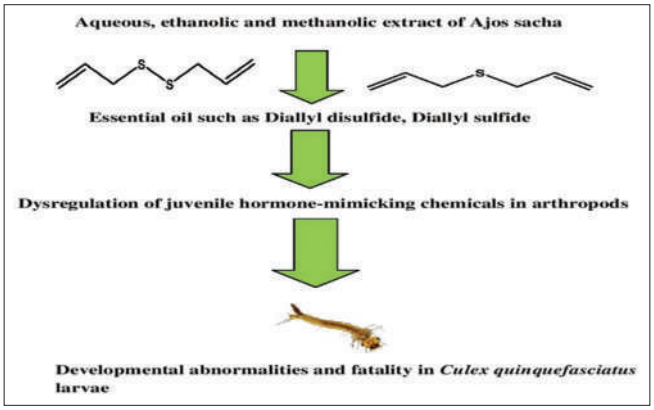


Figure 8: Larvicidal activity of Ajos sacha

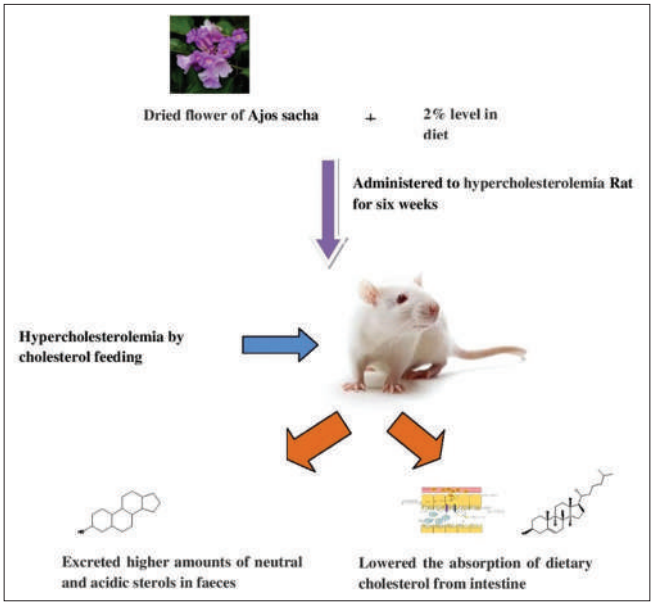


Figure 9: Hypocholeteromic activity of Ajos Sacha

such as garlic oil, asafetida, and onion, it significantly reduced intestinal cholesterol absorption. According to this study, the sulfur component of the flower, along with poor cholesterol absorption activity in the intestine, results in a

Table 3: Pharmacological screening of Ajos Sacha

Activity	Plant parts	Extract	Dose of drug	Animal/Host	Mode of action
Antibacterial activity[2,22,23]	Leaves, flowers	Methanolic plant extract	100 mg/ml	Bacteria and fungi	It could be related to the interplay of phytochemicals, which must be investigated further.
Anti-inflammatory activity[24,25]	Leaves	Hydroalcoholic extract	100 mg/kg and 200 mg/kg	Rat	During the acute phase, inflammatory mediators are suppressed.
Antifungal activity[26,27]	Leaves	Aqueous Extract	The extract at a 1:4 dilution with a suitable solvent	Fungi	The existence of ester or volatile substances may be the source of the molecular mechanism.
Anti-cancer activity[9,28,29]	Leaves	Water extract	1.254 to 10.04 mg/ml	Mouse cell line	Inhibition of cell growth and death could be one method. Sulfur-containing compounds, for example, may inhibit the G2-M phase via Cdc25C signaling, increase death via R.O.S., or reduce tubulin polymerization.
	Flowers	Methanolic extract	-	Breast cancer cells	Phosphatidylserine translocation and caspase-3 activation induce apoptosis.
Antioxidant activity[30]	Leaves	Ethanolic extract	-	Rat	Free radical scavenging activity.
Anthelmintic activity[31]	Roots	Petroleum ether extract, chloroform extract, ethyl acetate extract, methanol extract	5, 10, 15, and 20 mg/ml	Earthworm	Apigenin 7-O-ethyl glucuronide, Scutellarin, Luteolin, and Ursolic acid harm Tubulin.
Larvicidal activity[32]	Leaves	Essential oil, hydrolase, and botanical extracts	0.08% (800 ppm)	*Culex quinquefasciatus*	Juvenile hormone-mimicking chemicals in arthropods are dysregulated. This causes developmental abnormalities and, eventually, the insect's death.
Hypocholeteromic activity[33]	Flowers	Dried flower	2% level of diet	Rat	Reduce intestinal cholesterol absorption.

hypocholesterolemic effect.[33] Hypocholeromic activity is shown in Figure 9. The detailed pharmacological screening of Ajos Sacha is presented in Table 3.

CONCLUSION

Many geographical sources reflect the number of herbal properties and ethnopharmacological demand at various periods. The Ajos Sacha has many active metabolites and sulfur compounds similar to garlic. Furthermore, due to biologically abundant active secondary metabolites such as polyphenol, flavonoids, tannic acid, and sulfur compounds, the plant has been documented for numerous biological activities such as antibacterial activity, anti-inflammatory activity, antifungal activity, anticancer activity, anthelmintic activity, larvicidal activity, and hypocholesterolemic activity. This review presents that laboratory animals are also generous toward Ajos Sacha. Furthermore, a robust scientific search is required to explore each secondary metabolites and mode of molecular action documented so far.

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