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An Investigation on the Effects of *Xanthium Strumarium* on the Central Nervous System (CNS) in Albino Mice

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Abstract:
The common weed Xanthium strumarium L. (Family: Asteraceae) is a medicinal plant found in North America, Brazil, China, Malaysia, and the drier parts of India. Many ailments have traditionally been treated using the plant. Whole plant extracts, especially from the leaves, roots, fruits, and seeds, have been used in traditional medicine to treat a variety of ailments, including rheumatism, tuberculosis, salivation, leucoderma, epilepsy, rheumatism, urticaria, allergic rhinitis, sinitis, lumbago, pruritis, leprosy, and bacterial and fungal infections. In this present study, we investigated neurobehavioral activity of ethanol extract of Xanthium strumarium L in mice as a part of a psychopharmacological screening of this plant. The effects of the plant extract on CNS were studied by using Elevated plus maze test. The overall results suggest that the ethanol extract of Xanthium strumarium has significant effect on CNS. However, future efforts should concentrate more on in vitro and in vivo studies in order to confirm traditional insight in the light of a rational research.

Key words:
Xanthium strumarium, EPM test, Pharmacological effect, Attractyloside, Therapy

1. Introduction: Nature has always been the most dependable source of potential pharmaceutical substances. A "lead" source for the development of innovative drugs with superior pharmacological activity and fewer side effects is the vast structural diversity of molecules originating from natural sources. It is now evident that neurological disorders represent a significant worldwide health concern. The World Health Organization and other organizations together produced the Global Burden of Disease Study, which reflects this. Thus, for the creation of innovative pharmaceutical medicines, there is a critical need for new antioxidants, anti-nociceptives, and CNS depressants derived from natural sources. The word "xanthium" refers to the seedpods, which change from green to yellow as they ripen (later they become deep yellow to brown), and is derived from the ancient Greek words "xanthos," which means yellow, and "strumarium," which means "cushionlike swelling."[1]. Because of the way its fruit, which resembles a cow's toe, is shaped, it is frequently referred to as chotagokhru. Due to its usage in treating the common condition hemicrania, this weed is known as adhasisi in various parts of India. There are 25 species in the genus Xanthium, all of which are native to America. In Europe, North America, and Brazil, Xanthium spinosum Linn. and X. strumarium Linn. are used as medicines; *Xanthium canadens* Mill. is used in North America and Brazil,

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and X. strumarium Linn. in China, India, and Malaysia [2]. More than 170 chemical compounds, including sesquiterpene lactones, phenols, glycosides, alkaloids, fatty acids, and others, have been extracted and identified from the plant X. strumarium as a result of the numerous research that have been done thus far on its pharmacology and phytochemistry[3]. Additionally, growing proof suggests that X. strumarium has a broad range of pharmacological effects, including effects on the nervous and digestive systems, as well as analgesic and anti-inflammatory, antioxidant, hypoglycemic, anti-cancer, antibacterial and antifungal, anti-trypanosomal, and anti-tussive activities [4]. The herb itself is thought to be harmful, however washing and cooking get rid of the poisonous elements [5]. Attractyloside and chlorogenic acid are employed as the quality indicator substances for evaluating the quality of the fruits of X. strumarium, which are still often used in Traditional Chinese Medicine (TCM) and are mentioned in the CHP [6, 7]. As part of a psychopharmacological screening of this plant, we examined the neurobehavioral activity of an ethanol extract of *Xanthium strumarium* L in mice in the current investigation. The Elevated Plus Maze Test was used to examine the effects of the plant extract on the central nervous system. Overall, the findings point to a strong impact of X. strumarium ethanol extract on the central nervous system. However, in order to validate conventional knowledge in the context of a logical phytotherapy, future efforts should focus more on in vitro and in vivo investigations.

2. *Xanthium strumarium* side effects: Mammals can be harmed by X. strumarium. It is said to have moderate to severe allergic reactions. Carboxyatractyloside, a sulphated glycoside present in seeds and throughout the two-leaf seedling stage, is the poisonous principle. Although toxicosis has been documented in calves that have consumed mature plants with burs, the mature plant is said to be non-toxic. This is contrary to the popular idea that burs intake should be restricted by mechanical damage during mastication [8-9]. It is known to result in losses in cattle, horses, goats, pigs, sheep, and swine, as well as reduced weight gain in poultry [9-10]. The plant is a potential cause of sudden death in pigs extensively reared in Zimbabwe, which is revealed by an investigation in which six healthy porkers of the Mukota breed were fed and libitum either crushed burs (fruits) or the two-leaf seedling stage of Xanthium.

3. Botanical description of plant: Warmer climates are where X. strumarium typically thrives. It is an annual herb that can grow up to 1 m tall and has a short, sturdy, hairy stem. The leaves are broadly alternating and triangular-ovate or suborbicular in shape, with irregular lobes and rather inconspicuous teeth. They are 5–15 cm long, frequently three-lobed, have prominent veins, a long petiole, and are scabrous on both sides. Fruits have two hooked beaks and hooked bristles and are obovoid in shape. They are surrounded in a hardened involucre. August through September are India's flowering months. Due to the fruits' hooked bristles and two robust hooked beaks, this plant is easily spread by animals. The seeds ripen from August to October, and it blooms from July to October. Insects fertilize the monoecious flowers, which are. The plant reproduces on its own. When the fruits are ready, they are picked and dried for use[11].

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4. Materials and methods

4.1 Plant material: The plant samples were collected from the fruit of *Xanthium strumarium*

4.2 Preparation of the extract: We dried The fruits parts at room temperature under shade for between 10 to 12 days and then crushed into coarse powder with a pestle and mortar. The powdered fruit was exhaustively extracted with methanol using soxhlet apparatus. The solvent in both cases were removed at reduced pressure.

4.3 Animals: We used Swiss albino mice (28-35g) of male sex for the study. The animals were kept and maintained under laboratory conditions of temperature, humidity and light, and were allowedfree access to food and water. All experiments were conducted in accordance with animal use ethics as accepted internationally.

4.4 Drug: We used Benzodiazepum tablet (5mg/body weight) as a standard.

4.5 Dose and Route of Administration: The mice were administered at a dose of 250 mg/kg body weight of *Xanthium strumarium* which considered as 1X dose and another 500 mg/kg body weight of *Xanthium strumarium* which considered as 2X dose. The route of administration was per oral (per oral).

4.6 Experimental procedures: The elevated plus maze (EPM) is a test that assess**es** anxiety in lab animals that often employs rats as a screening test for potential anxiolytic or anxiogenic substances and as a general research tool in studies of neurobiological anxiety, including PTSD and TBI [12]. The elevated plus maze (EPM) is an anxiety test for lab animals that often employs mice as a screening test for potential anxiolytic or anxiogenic substances and as a general research tool in studies of neurobiological anxiety, such as PTSD and TBI. The model is based on the test animal's aversion to open spaces and tendency to be thigmotaxic. In the EPM, this anxiety is expressed by the animal spending more time in the enclosed arms.

4.7 Statistical Analysis: Data were analyzed by One way ANOVA following Dunnet's post hoc test using SPSS 16.0 and presented as Mean±SEM, (n=6). * ($p<0.05$) = significance, ** ($p<0.01$) = highly significance, and *** ($p<0.001$) = very highly significance as compared to control group.

5. Result and discussion:

5.1 In open arm: During 1 hour later for standard dose, the result was highly significant. And during 2 hours and 3 hours later for standard doses, the result was very highly significant. This indicates, it has better effects on CNS system. During 2 hours and 3 hours later for 1X and 2X doses, the result was very highly significant.This also indicates, the medicinal plant *Xanthium strumarium* has the best effects on CNS system (Fig. 1 & Table. 1).

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Group	Time Spent in Open Arm (Mean±SEM)			
	30 min	1 Hour	2 Hours	3 Hours
Control	61.23±4.49	52.57±1.87	49.33±2.03	60.1±1.88
STD (Benzodiazepum 5mg/kg)	59.33±2.87	175.0±45.83**	13.36±4.90***	16.33±4.98***
XS 1x	57.00±7.57	18.67±4.50	11.67±2.69***	9.50±1.73***
XS 2x	56.83±3.55	28.17±5.09	21.67±5.19***	30.17±6.37***

Table 1: Effect of XS 1x and XS 2x on the time spent in Open arm in Elevated plus Maze test in mice.

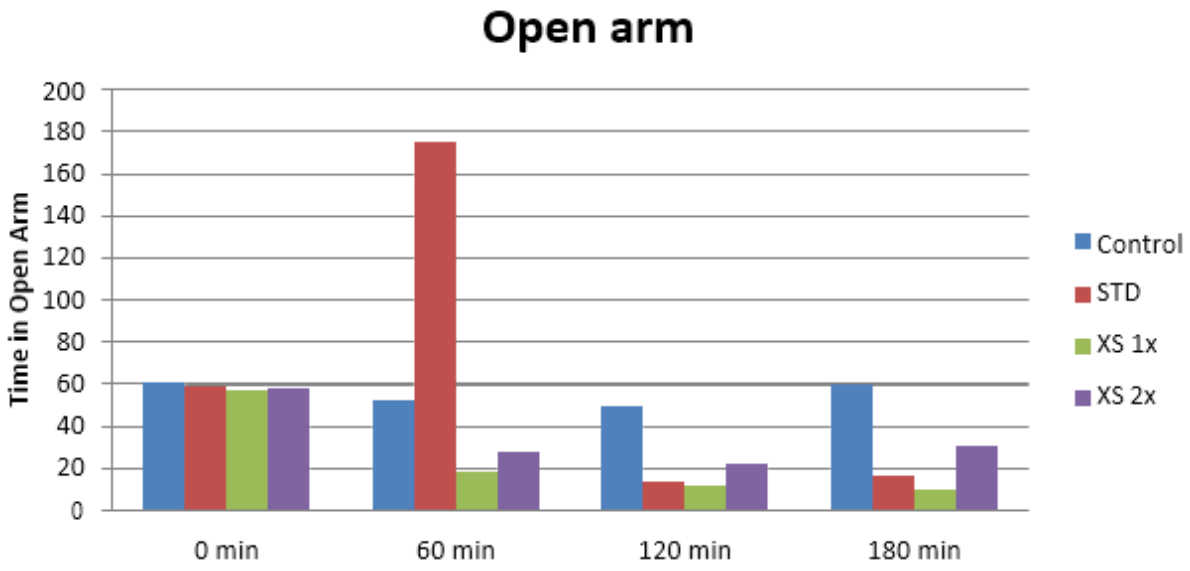


Figure 1: Effect of XS 1x and XS 2x on the time spent in Open arm in Elevated Plus Maze test in mice.

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Group	Time Spent in Close Arm (Mean±SEM)			
	-30 min	1 Hour	2 Hours	3 Hours
Control	116.67±4.49	127.33±1.87	130.67±2.03	120.0±1.98
STD (Benzodiazepum 5 mg/kg)	120.67±2.87	160.33±2.75	165.67±4.90***	162.0±4.32***
XS 1x	121.33±8.04	161.33±4.49	169.33±2.68***	170.50±1.73***
XS 2x	121.17±3.55	154.50±5.16	158.33±5.19***	149.83±6.37***

Table 2: Effect of XS 1x and XS 2x on the time spent in Close arm in Elevated Plus Maze test in mice

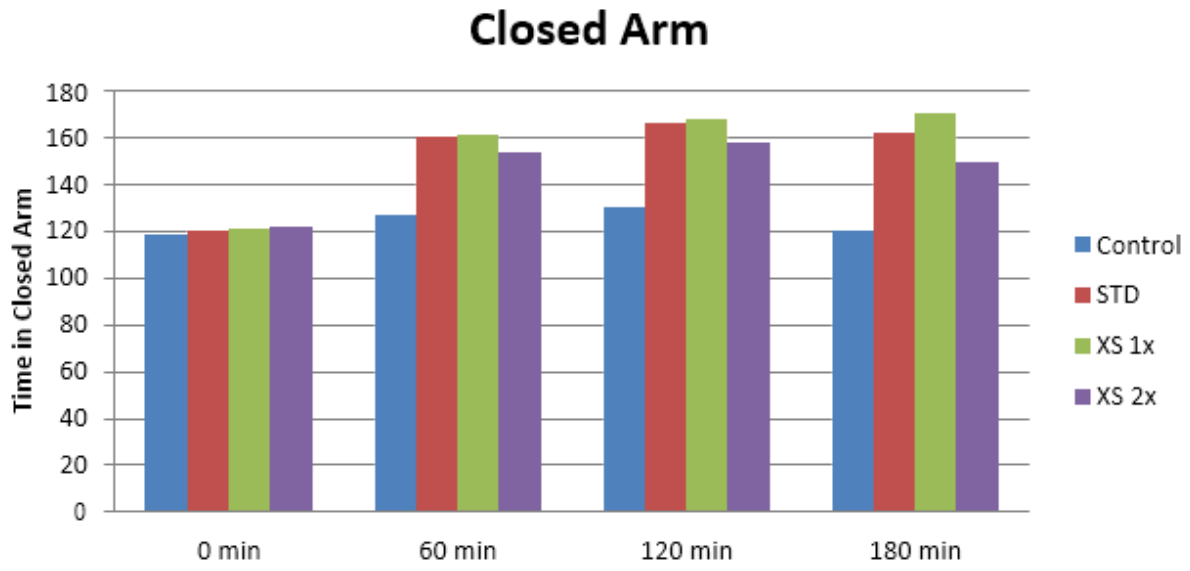


Figure 2: Effect of XS 1x and XS 2x on the time spent in Close arm in Elevated Plus Maze test in mice.

5.2 In closed arm: During 2 hours and 3 hours later for Standard dose, the result was very highly significant. This indicates the best CNS effects of the plant extract. During 2 hours and 3 hours later for 1X and 2X doses, the result was also very highly significant. This also indicates the best CNS effects of the plant extract (Fig. 2 & Table. 2).

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6. Discussion: X. strumarium's anti-inflammatory, anti-tumor, anti-AR, and analgesic properties have led to its widespread usage in clinical practice across several countries. Meanwhile, X. strumarium has been the subject of several recent studies, which have included early analyses of its chemical composition and pharmacological properties. Therefore, determining the mechanism of X. strumarium's pharmacological activities and related compounds, as well as developing the drug's clinical efficacy and assurance of pharmaceutical safety, remain crucial. This study examined some neuropharmacological effects of X. strumarium and established that it has anxiogenic- and antidepressant-like activities. One of the most extensively used tests with the highest level of sensitivity to the effects of both anxiolytic and anxiogenic medications is the EPM [13]. Normal mice prefer to spend the majority of their allowed time in the closed arms during EPM tests. This predilection seems to reflect a dislike of open arms that is brought on by apprehensions about wide-open areas. Drugs like diazepam that promote open arm exploration are referred to as anxiolytics, while anxiogenics are the opposite [14-17]. In this study, it was observed that the administration of different doses of test extract of X. strumarium induced an anxiogenic-like effect in mice, as it decreased open arm entries and the time spent in the open arms of the EPM when compared to the control animals.

7. Conclusion: Considering all of the pharmacological information gathered, the findings indicate that, *Xanthium strumarium* extract has a major impact on the central nervous system. More research will be needed to make this more clear, though. Modern plant science and agriculture are based on plant science, which is essentially the ongoing scientific investigation of plants and their chemical activity as well as interactions with the environment. More investigation and study are required in that area.

Competing interests: There is no competing interest.

Ethics approval and consent to participate: This paper did not contain any participation of any organization, nor did it take place on any private or protected areas.

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