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# Treasuring the Ethno-botanical Knowledge of the Tribes across the Globe on Plant Toxins: A Review

**Running Title:** Treasuring the Ethno-botanical Knowledge on Plant Toxins

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## ABSTRACT
Over the centuries, humans have harnessed various natural resources for survival, including plants and plant-derived products for trapping animals and pest control across the globe. Traditional knowledge systems—including Unani medicine, ancient Indian and Chinese medicinal practices, indigenous African ethnomedical traditions, as well as certain historical practices from early American and European societies—have documented the use of plant-derived toxins for purposes such as sedation, insect management, and animal capture. This review aims to explore the diverse traditional applications of 81 predominant plant species identified worldwide, focusing on their frequently used roles as fish poisons, insect repellents, and tools for capturing animals utilizing plant toxins. In Nepal, 6 plant species are used as fish poisons, while in Kenya, 3 species are used for hunting and bird trapping due to their potent toxins. China employs 4 species to create poisoned arrows for hunting, and Pakistan utilizes 12 species as fish poisons and 7 species as insect repellents and pest control agents. In India, 10 species serve as fish poisons and insecticides, with some also used to repel mosquitoes. The Andaman & Nicobar Islands, distinct from the mainland due to the presence of ancient indigenous tribes, use 11 species primarily for fishing and pest control. This investigation highlights the extensive traditional knowledge in these regions regarding the use of local flora for practical purposes in pest control, hunting, and fishing, underscoring the importance of these practices in local cultures and their potential applications in modern animal management strategies. The study reflects the field of ethno-botany, emphasizing the intersection of cultural knowledge and botanical science in understanding plant uses across different societies across the globe.
**Keywords:** Ethno-botany, Toxins, Tribes, Poisons, Repellents, Poisoned arrows

## INTRODUCTION
Throughout history, plants have been used for survival strategies across the world by providing food, medicine, shelter, and tools, allowing humans to thrive in diverse environments. Among these plants it has been identified that some specific plants also aid in fishing, hunting animals, and are even used to make poisonous weapons. From traditional fishing and hunting methods to modern pest control strategies, plants and plant-derived materials have been employed globally by various local communities for capturing a diverse range of animals. Although contemporary trapping methods frequently incorporate advanced tools and mechanisms, traditional approaches utilizing plants for trapping represents a method of hunting and animal control that required careful planning and execution. Such plant-based techniques are not merely anecdotal; they reflect extensive indigenous knowledge developed through generations of observation and experimentation. This diverse indigenous knowledge from around the world underscores the profound impact of human observation across different environments and highlights a rich history of experimental exploration. This observation of the surroundings and experimentation reveals that these kinds of plants have some toxic effects, which in turn proved effective for fishing and hunting [1]. The toxic effects they show is because of the toxins they contain. Toxins are harmful substances that, upon introduction into an organism via ingestion, inhalation, injection, or contact disrupts normal organ system functioning, leading to adverse effects [2]. Toxins encompass a diverse range of compounds capable of inducing poisoning through various mechanisms [3]. Therefore, the plants containing these toxins are called poisonous plants.

Under particular circumstances and when ingested or contacted in sufficient quantities, certain parts or the entire structure of a poisonous plant can cause harmful and life-threatening effects, either immediately or through the cumulative impact of their toxic properties. These effects are not solely due to mechanical action but rather result from the presence of various chemical substances, both known and unknown, within the plant. These substances exert their toxic effects on organisms, interrupting normal bodily functions and resulting in negative health consequences [4]. They are characterized by the presence of specific chemical within its structure that when animals consume these plants, even in seemingly insignificant quantities, the toxins can disrupt various physiological processes, leading to adverse health outcomes ranging from mild discomfort to severe illness or death, depending on factors such as the species of plant, the concentration of toxins ingested, and the susceptibility of the animal consuming them. These substances can vary widely in their chemical composition and potency [5]. The diversity and potency of plant toxins make them both dangerous and therapeutically promising, highlighting their dual significance in ethno-botany and pharmacology.

Across ages humans have harnessed the power of these natural toxins for their own purposes. In various ancient cultures, the use of toxins for hunting and other practices were common. One of the notable examples was the use of poison-tipped arrows or blow darts. These projectiles were coated with toxic substances extracted from plants to immobilize or kill prey**.** In South American mythology a plant named Curare which is a poisonous substance, a collective term for alkaloid toxins derived from plant extracts of *Chondrodendron tomentosum, Menispermaceae, or Strychnos* initially gained recognition as "arrow poison" due to its historical use in hunting by indigenous populations. Its mechanism involves the inhibition of muscle contraction upon nerve stimulation when injected [6]. Many indigenous forest people in the Amazon like the yanomami also used curare, on their blowgun darts and arrows for hunting [7]. In the rich tapestry of Indian mythology, toxins often appear as powerful weapons and mystical elements woven into tales of valor and cosmic conflict. During the epic Kurukshetra War, warriors like Karna wielded arrows laced with deadly poisons, unleashing devastation upon their enemies. Similarly, in the enchanting narrative of *Chandrakanta*, snakebite toxins induce vivid hallucinations, blurring the boundaries between reality and illusion. The legend of Barbarika tells of divine arrows possessing not only destructive force but also imbued with the venomous potency of ancient serpents. Throughout these mythical sagas, the principles of Dhanurveda-the science of archery, are interwoven, guiding warriors in the art of combat, including the crafting and application of toxic weaponry. These stories, steeped in symbolism and cultural significance, illuminate the complex relationship between humans, nature, and the supernatural, shaping beliefs and practices, including the use of toxins in hunting and warfare. Notably passages in the Rig Veda and Atharva Veda indicate that poison was used in warfare. Certain hymns in the Atharva Veda point to aconite tubers as a source of this poison. Later Sanskrit literature also show that poisoned arrows continued to be used in conflicts [8].

In the book "*Certain Facts Regarding the Poison-Lore of the Hindus*" by Aiyar in 1896, various toxic substances and their antidotes as understood by the early Hindus are outlined. These include the roots of plants like *Vatsa nablii (Aconitum nepalensis)* and *Langali (Gloriosa superba)*, the seeds of *Karaskara (Strychnos Nux Vomica)*, and the fruit of *Kaythaki (Pandanus odoratissimus)*, among others. The text describes the poisonous effects of these substances. Aiyar emphasizes the need for systematic study of Indian poisons, indicating the complexity and importance of understanding their effects and remedies. This highlights the significance of toxicology in ancient Indian culture and the recognition of the potential dangers posed by various natural substances [10].

Medea, a sorceress in Greek mythology, made a special poison called Echidnaicios. This poison contained meadow saffron, a type of flower; marine molluscs, which are sea creatures like snails or clams; psychotropic mushrooms, which can affect the mind, causing hallucinations or alter states of consciousness; and viper venom, which is poison from a type of snake. Medea also had a special antidote called galene, which she administered at the same time as the poison to reduce its harmful side effects [9].

Ancient Persia (modern-day Iran), was a hub for the development of toxicology and the use of poisons and chemical warfare was highly advanced. Under Mehrdad VI (67 BCE), Persians used ***mad honey*** (Grayanotoxin) to incapacitate Roman troops. Later, during the siege of Dura-Europos (256 CE) under Shapur I, they used petroleum-based pitch and sulphur gases, killing 19 Roman soldiers. Persian expertise in toxicology was so impressive it fueled the Roman perception of them as masters of "magic" [11]. Persian scholars like Avicenna documented the effects of various poisons and their antidotes.

The "*Canon of Medicine*" by Avicenna in 1025 CE and translated by Laleh Bakhtiar in 1999 was the first book dealing with evidence-based medicine, experimental medicine, clinical trials, randomized controlled trials, efficacy tests, risk factor analysis, and phytotherapy [12].

Medieval Chinese medicine (3rd to 10th centuries) placed poisons at the core of its practices, emphasizing drug toxicity for classification and innovating methods to mitigate harmful effects while preserving therapeutic benefits, often viewing adverse reactions as indicators of efficacy [13]. Studies show that ancient Chinese medicine employed toxic plants like *Aconitum species* (aconite) used as arrow poison by inhabitats of ancient china, containing toxic alkaloids such as aconitine, which caused severe cardiac and neurological toxicity if improperly processed [14, 15]. *Strychnos nux-vomica* (strychnine tree), contains high concentrations of strychnine and brucine, which poses severe toxicological risks, including convulsions and respiratory failure [16]. *Rhus toxicodendron* (poison ivy) produced urushiol, a potent irritant causing painful skin reactions [17]. *Datura species*, with tropane alkaloids like atropine and scopolamine, were associated with hallucinations, delirium, and severe poisoning in high doses [18, 19].

Ancient Unani medicine, rooted in Greco-Arabic traditions, extensively utilized toxic plants for therapeutic purposes. Toxic plants like *Abrus precatorius* (rosary pea), *Ricinus communis* (castor plant), and *Strychnos nux-vomica* (also used in ancient Chinese medicinal practices) were commonly employed in Unani medicine [20]. The use of these toxic plants demonstrates a sophisticated understanding of pharmacology, combining Greek humoral theories with Persian advancements in processing techniques. This approach was further enriched by incorporating local elements, which resonated strongly with both Indian physicians and the general populace [21, 22].

Although ample information exists regarding toxins of plant origin, research in this specific area remains limited. Despite the prohibition of using plant toxins for hunting wildlife in modern world due to conservation and ethical concerns, certain traditional practices of using toxic plants still persist among local communities across the world. In countries with greater plant biodiversity, there tends to be a higher prevalence of toxic plants. This is why vast majority of plant species worldwide are considered inedible, as they pose risk for the animals primarily due to the toxins they synthesize. Interestingly certain plants also have sedative and anxiolytic effects [23, 24]. Thus, making plants use very interesting not only for medicinal purposes but also for fishing and capturing other animals.

Plants and plant-derived products require stringent quality control to ensure safety and effectiveness. Understanding the mode of action of plant compounds is essential for assessing their risks and developing safe applications. Standardization and quality control play a pivotal role in ensuring the reliability of plant-based products. Rigorous scientific evaluations help mitigate risks, ensure consistent outcomes, and protect human and animal health. Furthermore, research in this field is highly essential to advance our understanding, refine safety measures, and develop innovative applications for plant-based products. These efforts are increasingly vital for the development and regulation of such products. [25, 26].

Also, Documenting and analysing such practices from an ethno-botanical perspective not only preserves traditional ecological knowledge but also highlights the advantages of using herbal toxicological products over synthetic toxic drugs [27, 28]. These culturally-rooted practices emphasize sustainable and eco-friendly animal management strategies that leverage the rich biodiversity of various regions. Furthermore, exploring these traditional applications provides valuable insights into the mechanisms of plant toxicity, paving the way for innovative approaches in pest management and environmental conservation while reducing dependence on synthetic chemicals. [29, 30].

This review examines and documents the utilization of predominant toxic plants by diverse communities worldwide, emphasizing their traditional knowledge regarding various botanical species. It explores the role of these plants in animal entrapment, highlighting the specific parts of the plants utilized, such as leaves, seeds, roots, fruits, and bark. Additionally, the review emphasizes the practical applications of these plants in addressing everyday needs, showcasing their continued use in traditional practices across different cultures.

## MATERIAL AND METHODS

Relevant literatures were consulted from academic journals, books, articles, and research papers for the collection of data. Literatures were also search online in GoogleScholar and ScienceDirect using the terms like "Plant toxins", "Plant poison" and "Ethno-botany". Information was collected and presented in tabular format. An analysis of the data was also made highlighting the related issues. The global plant distribution data were sourced from the Global Biodiversity Information Facility (GBIF) and compiled into a table. This table (Table 1) was then used to create graphical representations in Microsoft Excel to illustrate the distribution patterns of the plant species (Fig 1)

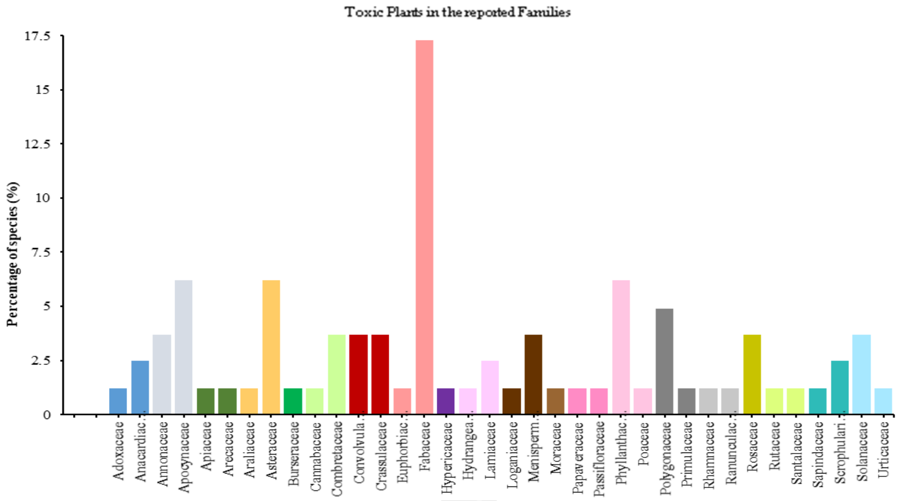


**Fig. 1** Graphical representation of the species reported from plant families

**Table 1** Ethnobotanical uses of plants across the globe

| Plant Name | Family | Habit | Parts used | Reported location | Distribution across globe | Use | References |
|---|---|---|---|---|---|---|---|
| 1. *Acokanthera oppositifolia (Lam.) Codd* | Apocynaceae | shrub | Roots, stems, leaves, twigs and fruits (edible) | Kenya | Africa | The extract is used as arrow poison, Fruits are used by hunters for bird trapping | [39] |
| 2. *Acokanthera schimperi (A.DC.) Schweinf.* | Apocynaceae | Tree | Leaves, roots, bark, young twigs, branches & latex | Kenya | East Africa | The poisonous extract is smeared in arrow tips for hunting, The latex is used as arrow poison | [39, 40] |
| 3. *Aconitum kongboense Lauener* | Ranunculaceae | Herb | Root tubers | China | China (Tibet) | used to make poisoned arrows for hunting | [41] |
| 4. *Adenia cardiophylla (Mast.) Engl.* | Passifloraceae | Shrub | Tubers and stem | Andaman & Nicobar | Africa, Andaman | Fish poison | [42] |
| 5. *Ageratum conyzoides L.* | Asteracea | Herb | Leaves | India | Tropical Americas, Asia | Insect repellent | [43] |
| 6. *Ainsliaea aptera DC.* | Asteraceae | Herb | Root | Pakistan | East Asia | Used as wormicide | [44] |
| 7. *Albizia chinensis (Osbeck) Merr.* | Fabaceae | Tree | Bark, Seed | Pakistan, India | South Asia, Southeast Asia | Fish poison | [44, 45] |
| 8. *Alstonia scholaris (L.) R.Br.* | Apocynaceae | Tree | Leaves | India | Southeast Asia, South Asia | Pest repellent | [43] |
| 9. *Artemisia vulgaris L.* | Asteraceae | Herb | Whole plant | Pakistan, India | Europe, Asia, North America | Fish poison | [44] |
| 10. *Brachypterum scandens (Roxb. Wight & Arn. Ex Miq (Roxb.) Benth.* | Fabaceae | Climbing vine or Liana | Roots | Andaman & Nicobar, India | South Asia, Southeast Asia | Contains rotenone, fish poison, insecticides | [42, 45] |
| 11. *Bridelia cinnamomea Hook.f.* | Phyllanthaceae | Tree | Bark and roots | Andaman & Nicobar | Southeast Asia | Piscicide | [42] |
| 12. *Buddleja asiatica Lour.* | Scrophulariaceae | Shrub | Young branches and leaves | Pakistan | Asia | Fish poison | [44] |
| 13. *Canarium euphyllum Kurz* | Burseraceae | Tree | Resin and trunk | Andaman | Southeast Asia | Repel mosquito | [46] |
| 14. *Cannabis sativa L.* | Cannabinaceae | Herb | Leaves | Nepal | Central Asia, widespread | Fish poison | [47] |
| 15. *Catharanthus roseus (L.) G.Don* | Apocynaceae | Herb | Whole plant | Pakistan | Madagascar, tropical regions | Poisonous, used to remove maggots from ulcers in animals | [44] |
| 16. *Chromolaena odorata* (L.)R.M.King & H.Rob. | Asteraceae | Shrub | Leaves | India | Tropical and subtropical regions | Leaf juice is used as insect repellent | [43] |
| 17. *Cissampelos pareira L.* | Menispermaceae | Climbing vine | Roots and leaves | Andaman & Nicobar | Tropical and subtropical regions | Fish poison | [42] |
| 18. *Colubrina asiatica (L.) Brongn.* | Rhamnaceae | Shrub or small tree | Leaves and bark | Andaman & Nicobar | Tropical and subtropical regions | Fish poison | [42] |
| 19. *Conium maculatum L.* | Apiaceae | Herb | Whole plant | Pakistan | Europe, North America | Used as a poison to kill human being and animals by enemies | [44] |
| 20. *Cuscuta reflexa Roxb.* | Convolvulaceae | Vine | Whole plant | Pakistan | South Asia, Southeast Asia | Fish poison | [44] |

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| *21.* | *Dasymaschalon dasymaschalum (blume)* I.M. Turner | Annonaceae | Shrub | Branches | Andaman | Southeast Asia | Arrows for fish hunting | [46] |
| *22.* | *Datura stramonium L.* | Solanaceae, | | Whole plant | Pakistan | Worldwide | Used to poison Animals | [44] |
| *23.* | *Derris andamanica Prain* | Fabaceae | Climbing vine | Roots | Andaman & Nicobar | Andaman Islands | Contains rotenone, fish poison, insecticides | [42] |
| *24.* | *Derris elliptica (Wall.) Benth.* | Fabaceae | Shrub | Bark, roots, stems & seeds | India | Southeast Asia | Fish poison and insecticide | [45] |
| *25.* | *Derris scabricaulis (Franch.) Gagnep. ex F.C.How* | Fabacae | Liana | Roots | China | Southeast Asia | Fish poison | [48] |
| *26.* | *Derris taiwaniana (Hayata) Z.Q.Song* | Fabaceae | Climber, Liana | Pods, Seeds and roots | China, India | Southeast Asia | Insect killing, Fish poison | [48, 45] |
| *27.* | *Dinochloa scandens (Blume ex Nees) Kuntze* | Poacae | Climbing bamboo | Stem, twig pieces | Andaman | Southeast Asia | Fishing harpoons | [46] |
| *28.* | *Entada abyssinica Steud. ex A.Rich.* | Fabaceae | | Stem, Bark | Africa | Southeast Asia, Africa | Fish poison | [49] |
| *29.* | *Erythrophleum suaveolens (Guill. & Perr.)* | Fabaceae | Tree | Leaves | Nigeria | Africa | Arrow and fish poison | [49] |
| *30.* | *Euphorbia purpurea (Raf.) Fernald* | Euphorbiaceae | Herb | Latex | Pakistan | Europe, Asia | Wormicide | [44] |
| *31.* | *Ficus benjamina L.* | Moraceae | Tree | Milky sap | Pakistan | Worldwide | Bird traps | [50] |
| *32.* | *Girardinia diversifolia subsp. Diversifolia* | Urticaceae | Herb | Whole plant | Pakistan | Asia, Africa | Fish poison: used to stupefy fish | [44] |
| *33.* | *Haematocarpus validus (Miers) Bakh.f. ex Forman* | Menispermaceae | Woody climber or Liana | Flexible stems | Andaman | Southeast Asia | Hunting deer and Boars | [46] |
| *34.* | *Hedysarum longigynophorum C.C.Ni* | Fabaceae | Shrub | Roots | China | East Asia | Used as firelock for hunting purpose | [48] |
| *35.* | *Huberantha jenkinsii* (Hook.f. & Thomson) Chaowasku | Annonaceae | Shrub | Leaves | Andaman | South Asia, Southeast Asia | Honey bee repellant | [46] |
| *36.* | *Hydrangea febrifuga* Lour. | Hydrangeaceae | Shrub | Branches | China | East Asia, Southeast Asia | Mosquito repellent | [48] |
| *37.* | *Hydrocotyle javanica Thunb.* | Araliaceae | Herb | Whole plant | China | Asia | Fish poison | [48] |
| *38.* | *Hyoscyamus niger L.* | Solanaceae | Herb | Whole plant | Pakistan | Europe, Asia | Though the plant is known to have medicinal properties, all the parts of the plant is poisonous. The seeds and the seedpods have poisoning effect on children. | [44] |
| *39.* | *Hypericum veronense Schrank* | Hypericaceae | Herb | Flowers | Pakistan | Europe, Asia, North America | Used as sedatives | [44] |

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| *40.* | *Ipomoea hederacea Jacq.* | Convolvulaceae | Herb | Whole plant | Pakistan | Tropical regions | Smoke of the plant is used as mosquito repellent | [44] |
| *41.* | *Ipomoea nil (L.) Roth* | Convolvulaceae | Climbing vine | | Andaman & Nicobar | Tropical regions | Insecticide | [42] |
| *42.* | *Isodon rugosus* (Wall ex Benth.) Codd | Lamiaceae | Herb | Leaves and flowers | Pakistan | Asia | Mosquito repellent and mite repellent | [44] |
| *43.* | *Lannea coromandelica (Houtt.) Merr.* | Anacardiaceae | Tree | Bark, Fruit | Nepal, India | South Asia, Southeast Asia | Fish poison | [51, 47] |
| *44.* | *Leptopus cordifolius* Decne. | Phyllanthaceae | Shrub | Leaves | Pakistan | Mediterranean region | Used as a fish poison and is also used to poison terrestrial animals | [44] |
| *45.* | *Lysimachia arvensis* (L.) U.Manns & Anderb | Primulaceae | Herb | Whole plant | Pakistan | Europe, Asia, Africa | Fish poison | [44] |
| *46.* | *Melilotus albus Medik.* | Fabaceae | Herb | Whole plant | Pakistan | Europe, Asia | Sedative | [44] |
| *47.* | *Nerium oleander Mill.* | Apocynaceae, | Shrub | Whole plant | Pakistan, India | South Asia, Mediterranean region | Rat poison, Destroy moggaots, Fish poison | [44] |
| *48.* | *Orophea katschallica* Kurz. | Annonaceae | Shrub | Leaves | Andaman | Andaman Islands | Honey bee dispersal | [46] |
| *49.* | *Papaver somniferum* Linn | Papaveraceae | Herb | Latex | Pakistan | Mediterranean region, Asia | Used as sedative | [44] |
| *50.* | *Persicaria capitata* (Buch.-Ham. ex D. Don.) H. Gross | Polygonaceae | Herb | Whole plant | Pakistan | Asia | Fish poison | [44] |
| *51.* | *Persicaria hydropiper* (L.) Delarbre | Polygonaceae | Herb | Whole plant | Pakistan, India | Worldwide | Fish poison:used to stupefy fish | [44, 45] |
| *52.* | *Persicaria maculosa* Gray | Polygonaceae | Herb | Whole plant | Pakistan | Worldwide | Fish poison: used to stupefy fish | [44] |
| *53.* | *Persicaria pubescens* Bl. | Polygonaceae | Herb | Whole plant | India | Asia | Fish poison | [45] |
| *54.* | *Phoenix dactylifera* | Arecaceae | Tree | Fruit | Iran | Asia(Middle East), North Africa | Toxic to ruminants | [52, 53] |
| *55.* | *Phyllanthus emblica L.* | Phyllanthaceae | Small decidous tree | Bark | Nepal | India, Southeast Asia | Fish poison | [47] |
| *56.* | *Phyllanthus niruri* | Phyllanthaceae | Herb | Leaves | India | Tropical regions | Leaf juice is used as fish poison | [43] |
| *57.* | *Phyllanthus nubigenus Hook.f.) Chakrab. & N.P.Balakr*. | Phyllanthaceae | Large shrubs | Bark | Nepal | Southeast Asia | Fish poison | [46] |
| *58.* | *Piptanthus nepalensis* (Hook.) D. Don | Fabaceae | Shrub | | China | Himalayas | It is a medicinal plant but also deemed poisonous due to its toxic properties, requiring caution in use. | [41] |
| *59.* | *Pongamia pinnata var. pinnata* | Fabaceae | Shrub | Seeds | India | Southeast Asia, South Asia | Fish poison | [45] |
| *60.* | *Prunus Arabica (Olivier)* | Rosaceae | Shrub | Fruit | Iran | Asia (Middle East), North | Sedative | [52] |

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|---|---|---|---|---|---|---|---|---|
| | *Meikle* | | | | | Africa | | |
| 61. | *Prunus rufa Wall. ex Hook.f.* | Rosaceae | Tree | fruits | China | East Asia | Used as bait for Bears | [41] |
| 62. | *Rhodiola bupleuroides* (Wall. ex Hook. f. & Thoms.) S. H. Fu | Crassulaceae | Herb | Whole plant | China | Himalayas | Hunting plant: used as food for lizards and then local people can collect lizard eggs | [41] |
| 63. | *Rhodiola quadrifida* (Pall.) Fisch. et. Mey. | Crassulaceae | Herb | Whole plant | China | Asia | Hunting plant: used as food for lizards and then local people can collect lizard eggs | [41] |
| 64. | *Sapindus trifoliatus* L | Sapindaceae, | Tree | Fruit | Pakistan | South Asia, Southeast Asia | Fish poison | [44] |
| 65. | *Scrophulaia koelzii* Pennel. | Scrophulariaceae | Herb | Whole plant | Pakistan | Himalayas | Expel worms | [44] |
| 66. | *Semecarpus anacardium* | Anacardiaceae | Small tree | Fruit | Nepal | South Asia | Fish poison | [47] |
| 67. | *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. | Fabaceae | Small tree | Bark | Nepal | India, Southeast Asia | Fish poison | [47] |
| 68. | *Siegesbeckia pubescens* Makino | Asteracae | Herb | | China | East Asia | It is a medicinal plant but also deemed poisonous due to its toxic properties, requiring caution in use. | [41] |
| 69. | *Sinocrassula densirosulata* (Praeg.) Berger | Crassulaceae | Herb | Whole plant | China | China | Hunting plant: used as food for lizards and then local people can collect lizard eggs | [41] |
| 70. | *Solanum virginianum* L. | Solanaceae | Shrub | Fruit | India | Asia | Fish poison | [43] |
| 71. | *Sorbus rehderiana* Koehne | Rosaceae | Tree | fruits | China | China | Used as bait for Bears | [41] |
| 72. | *Stephania andamanica* Diels | Menispermaceae | Climbing vine | Tubers and roots | Andaman & Nicobar | Andaman Islands | Sedative | [42] |
| 73. | *Strychnos anandamanensis* Hill. | Loganiaceae | Shrub | Seeds and bark | Andaman & Nicobar | Andaman Islands | Contains strychnine, Arrow poison | [42] |
| 74. | *Terminalia bellirica* Roxb. | Combretaceae | Tree | Fruit, Kernel, Bark | Nepal, India | South Asia, Southeast Asia | Fish poison | [47] |
| 75. | *Terminalia chebula* Retz. | Combretaceae | Tree | Pericarp of green fruit | Nepal | South Asia, Southeast Asia | Fish poison | [47] |
| 76. | *Terminalia elliptica* Willd. Heyne ex Roth var. | Combretaceae | Tree | Bark | Nepal | South Asia, Southeast Asia | Fish poison | [47] |
| 77. | *Viburnum cylindricum* Buch.-Ham. ex D. Don | Adoxaceae | Tree | Burgeons | China | Asia | Flea repellent | [48] |
| 78. | *Viscum album* | Santalaceae | Shrub | Stem and Leaf | Iran | Asia, Europe | Sedative | [52] |
| 79. | *Vitex negundo* Linn. | Lamiaceae | Shrub or small tree | Leaves | Pakistan | Asia, Africa | Powdered leaves repel insects. Fresh leaf extract is sprayed on crops to kill | [44] |

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|---|---|---|---|---|---|---|---|---|
| | | | | | | | pests. Also removes maggots | |
| *80.* | *Xanthium strumarium* Linn | Asteraceae | Herb | Leaves | Pakistan | Worldwide | Expel maggots | [44, 45] |
| *81*. | *Zanthoxylum armatum* Roxb | Rutaceae | Shrub or small tree | Seed, Fruit | Pakistan, India | Asia | Fish poison (seed crushed and thrown in water) | [44] |

## RESULTS

The study identified 81 plant species used globally for hunting, fishing and other purposes. The tables below present a comprehensive overview of the ethno-botanical uses, detailing their scientific names, families, growth habits, parts utilized, reported locations, and specific applications, as well as its broader global distribution. The accompanying graphs illustrate the distribution of reported plant species across different families, continents, and specifically within Asia, which accounted for more than 60% of the reported species. This data underscores the extensive reliance on and rich diversity of plant species in traditional practices worldwide.

## DISCUSSION

### Fish Poisons

Various plants across different regions have been traditionally utilized for their toxic properties to stupefy and capture fish. In Nepal, *Senegalia catechu* (Fabaceae, small tree) and *Phyllanthus emblica* L. (Phyllanthaceae, small deciduous tree) have been mostly used as fish poisons, employing the bark of the plants. In China, *Derris scabricaulis* (Franch.) Gagnep. (Fabaceae, liana) and *Hydrocotyle javanica* Thunb. (Araliaceae, herb) have traditionally been used as fish poisons, utilizing the roots of the former and the entire plant of the latter. This practice extends to the Andaman and Nicobar Islands, where *Cissampelos pareira* L. (Menispermaceae, climbing vine) and *Derris andamanica* Prain (Fabaceae, climbing vine) are employed, with the roots and leaves of *C. pareira* and only the roots of *D. andamanica* used for poisoning fish. In Pakistan, several plant species have been documented for similar uses, including *Albizia chinensis* (Osbeck) Merr. (Fabaceae, tree), *Leptopus cordifolius* Decne. (Phyllanthaceae, shrub), *Artemisia vulgaris* L. (Asteraceae, herb), *Buddleja asiatica* Lour. (Scrophulariaceae, shrub), and various members of the Polygonaceae family such as *Persicaria capitata* (Buch-Ham. ex D. Don) H. Gross, *Persicaria hydropiper* (L.) Delarbre, and *Persicaria maculosa* Gray. Different parts of these plants have been used depending on the species, reflecting region-specific ethnobotanical knowledge.

Similarly, a study has examined the toxicological properties of five ethno-fishery plants using the Brine Shrimp Lethality Assay (BSLA). All species have demonstrated high toxicity ($LC50 \leq 100$ μg/ml), with *D. scandens* exhibiting the highest toxicity ($LC50 = 0.14$) after 12 hours of incubation. These toxic plants have played a vital role in rural livelihoods, but excessive concentrations in biological systems have posed significant health risks to frequent consumers [31]. These findings have highlighted the importance of traditional knowledge in identifying plants with piscicidal properties and their potential applications.

### Insect Repellents

Plants have also been traditionally used to repel insects. In India, the leaf of *Ageratum conyzoides* L. (Asteraceae, Herb) has been employed, and the leaf juice of *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae, Shrub) has been used as an insect repellent. In China, *Hydrangea febrifuga* Lour. (Hydrangeaceae, shrub) has traditionally been used for mosquito repellent purposes, with its branches employed to deter insects. In Pakistan, the smoke from burning the whole plant of *Ipomoea hederacea* Jacq. (Convolvulaceae, herb) has been used as a mosquito repellent. Additionally, *Isodon rugosus* (Wall. ex Benth.) Codd (Lamiaceae, herb) has been used for repelling both mosquitoes and mites, with its leaves and flowers being the active parts.

In line with traditional practices, a study has evaluated the toxic effects of plant extracts on various pests. Aphids have been found to be the most susceptible, with 100% mortality having been observed within 24 hours across all tested extracts. Bioassays with lower concentrations have identified specific extracts as highly toxic to aphids, with further fractionation having revealed the butanol fraction to be the most active. This fraction has exhibited high mortality in aphids at very low concentrations, demonstrating the insecticidal properties of plants and their potential for development as botanical insecticides, particularly against pests [32].

### Animal Entrapments

In various regions, plants are used for capturing other animals. In China, *Viburnum cylindricum* Buch-Ham. ex D. Don (Adoxaceae, Tree) employs burgeon to repel fleas, while *Sinocrassula densirosulata* (Praeg.) Berger (Crassulaceae, Herb) is used to attract lizards for egg collection. In Kenya, *Acokanthera oppositfoliu* (Apocynaceae, Shrub) uses roots, stems, leaves, twigs, and edible fruits as arrow poisons and bird trapping. In Pakistan, *Catharanthus roseus* L. (Apocynaceae, Herb) uses the whole plant to remove maggots from animal ulcers, and *Conium maculatum* Linn. (Apiaceae, Herb) is harmfull to humans and is used to kill animals. *Nerium oleander L.* (Apocynaceae, Shrub) employs the whole plant as a rat poison and to destroy maggots, and *Xanthium strumarium L.* (Asteraceae, Herb) uses leaves to expel maggots. Additionally, the latex from the bark of the *Ficus benjamina* (Moraceae) is used in bird traps.

*Prunus arabica Olivier* (Rosaceae, shrub) is reported in Iran, where its fruit is traditionally used for sedative purposes. Studies have shown that extracts from *Prunus arabica* exhibit concentration-dependent cytotoxic effects on breast and esophageal cancer cell lines [33]. Similarly, *Viscum album*, a shrub in the Santalaceae family, is used in Iran for its sedative properties, with research identifying viscumin, a toxic protein responsible for the cytotoxic activity in mistletoe extracts. These findings highlight the dual therapeutic and toxic potential of these plants [34].

Other than the plants listed above there are few tribal communities worldwide who utilizes plants for various purposes till date. *Phoenix dactylifera* (Arecaceae, tree), is reported in Iran, where its fruit is known to be toxic to ruminants. This is consistent with the study of the BaYaka pygmies of the Central African Republic who rely on plants in various ways for survival. They use certain plants to attract caterpillars or bees, making it easier to gather caterpillars for food or collect honey, which is an essential part of their diet. Additionally, the BaYaka utilize specific plants containing toxins to poison monkeys or fish for hunting. By applying these plant-based poisons to their tools or using them strategically, they secure important sources of protein. These practices, known as "foraging uses," are vital aspects of BaYaka life, involving the search, gathering, and hunting of food and resources from their natural environment. This demonstrates the BaYaka's deep connection and adaptation to their rainforest ecosystem [35]. Also, The Baka hunter-gatherers of Cameroon also use plants for hunting and fishing purposes [36].

The following statistical data (Fig. 1, 2 and 3) illustrate the distribution of reported plant species across different families, continents, and specifically within Asia, which accounted for more than 60% of the reported species. This data underscores the extensive reliance on and rich diversity of plant species in traditional practices worldwide.

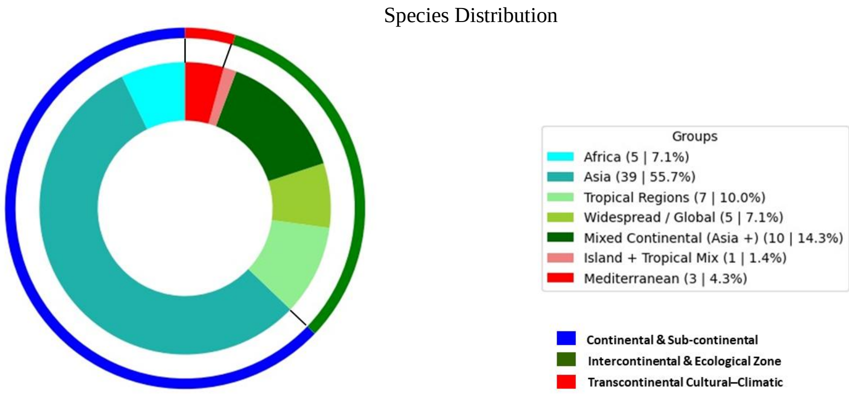


**Fig. 2** A Pie chart showing the reported species distribution

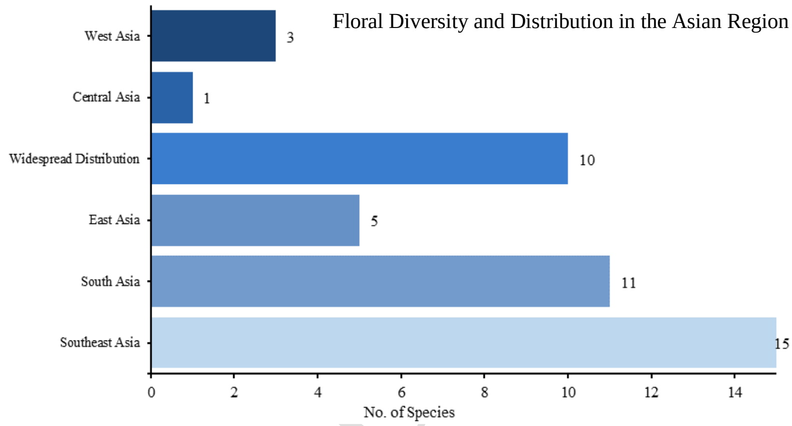


**Fig. 3** Graphical representation of plant species distribution in Asia

The plant inventory highlights a diverse range of species, shaped by ecological, historical, and human influences. Some plants adapt to specific environments, while others spread globally through natural dispersal and human activities like trade and cultivation. Historical events and invasive species further impact distributions, emphasizing the need for conservation to protect ecosystems amid global environmental changes [37].

Among the reported species in this paper the Fabaceae family exhibited the highest number of poisonous plant species, totaling 14. The Fabaceae family include plants like *Derris elliptica* and *Brachypterum scandens*, both of which are known for containing rotenone [38] [39]. Rotenone is a naturally occurring compound found in the roots of certain plants belonging to the genera such as *Derris*, *Lonchocarpus*, and *Tephrosia* of the same family. While rotenone is effective against certain pests and has been used traditionally for fishing, it's also highly toxic to a wide range of other organisms, including mammals, birds, and aquatic invertebrates [40]. Phyllanthaceae and Apocynaceae families featured 5 species each. Conversely, several families, such as Adoxaceae, Apiaceae, Arecaceae, Araliaceae, Burseraceae, Cannabinaceae, Euphorbiaceae, Hypericaceae, Hydrangeaceae, Loganiaceae, Moraceae, Papaveraceae, Passifloraceae, Poaceae, Primulaceae, Rhamnaceae, Ranunculaceae, Rutaceae, Santalaceae, Sapindaceae and Urticaceae each of them contributed only one plant species. Moreover, families like Annonaceae**,** Combretaceae**,** Convolvulaceae**,** Crassulaceae**,** Menispermaceae**,** Polygonaceae, Rosaceae**,** and Solanaceae showed moderate diversity, hosting 3 to 4 species.

Asia hosts the highest number of plant species recorded in the dataset, a result of its vast ecological diversity, complex climatic conditions, and extensive history of botanical exploration. Southeast Asia, in particular, stands out as a biodiversity hotspot, characterized by tropical rainforests, montane forests, and varied microclimates that support extensive plant endemism and speciation. The region's climatic factors, including high humidity, monsoonal rainfall, and temperature gradients, create optimal conditions for diverse plant growth and adaptation. Additionally, indigenous communities throughout the Asian subcontinent have contributed to plant conservation by integrating flora into cultural traditions, medicinal practices, and sustainable utilization, inadvertently protecting species from endangerment. Traditional ecological knowledge regarding toxic and medicinal plants has facilitated species persistence, influencing hunting techniques, ethno-botanical applications, and ecosystem interactions. Combined with Asia's vast geographical expanse, heterogeneous landscapes, and long-standing human interactions with plant diversity, these factors reinforce the continent's prominence in global botanical wealth and species richness.

### Limitations of the Study

The study raises ethical concerns regarding the use of toxic plants, especially in contexts involving animals, pest control, or traditional hunting practices. It emphasizes traditional uses over detailed phytochemical or toxicological analyses, which may limit scientific interpretation. Although the data is relevant, the ethno-botanical information is based on selective documented regions and may not fully reflect the global diversity of toxic plant use. Many indigenous practices remain underrepresented, particularly in areas where field research is yet to be conducted. Moreover, the dynamic nature of traditional knowledge—affected by modernization, habitat loss, and cultural assimilation—may limit the current relevance or continuity of some practices.

## CONCLUSION

The study highlights the significant role of plant species in traditional hunting and fishing practices worldwide, showcasing a rich diversity of ethnobotanical uses. Plants serve not only as fish poisons and insect repellents but also as tools for animal entrapment, reflecting a deep-rooted connection between indigenous communities and their natural environment [47] [48]. Also, the list of plant species that have been reported in this paper presents a diverse collection of species spanning continents, with the Fabaceae family containing the highest number of poisonous species. Asia, particularly Southeast Asia, stands out as the region with the highest occurrence of these plants, driven by its varied ecosystems, extensive history of botanical exploration, and the rich traditional knowledge of indigenous communities. This intricate knowledge underscores the importance of preserving traditional ecological wisdom and biodiversity, ensuring these practices and the species they depend on continue to thrive.

### Author's Contribution

Sanchari Bhattacharjee contributed to data curation, writing, and editing of the manuscript's original draft. Dr. Jyotchna Gogoi provided critical review and editing of the manuscript, along with supervision of the project. Dr. Indrani Barman also contributed to manuscript review and provided supervision throughout the project.

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### Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this review article.

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