

## Traditional knowledge and ethnobotanical uses of piscicidal plants of Nagaland, North east India

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Harvesting of fish using piscicidal (fish poisoning) plants has been a common practice by the tribal people of Nagaland. The present study documents the piscicidal plants and their usage based on the information acquired from the local community. Many of these plants besides piscicidal property possess other therapeutic properties which are used in traditional medicines. Seventeen piscicidal plants which are traditionally used for fish catching and in preparation of local medicine from the state of Nagaland have been recorded, along with plant parts, viz. roots, bark, leaves, fruits and seeds. The paper enumerates and discusses the piscicidal and ethnobotanical utilization of these plants and their bio-active compounds. Some of these plants may have application in fish nursery management by local farmers substituting for rotenone.

**Keywords:** Fishery, Piscicidal, Nagaland, Ethnobotanical, Bio-active compounds.

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### Introduction

Fish poisons of plant origin are widely used for cultural, commercial and environmental reasons, in waterways management for the control of non-game fish species<sup>1</sup>. Chopra *et al* have reported 112 plants having piscicidal action, out of these, more than 40 plants occur in North-east India<sup>2,3</sup>. Synthetic piscicides are most prominently used to remove predatory and weed fishes from rearing ponds<sup>4</sup>. However due to their acute toxicity on fishes, sustained residual toxicity and their side effects on other aquatic organisms, they are not generally acceptable<sup>3</sup>. Synthetic piscicides become readily available in the food chain and subsequently bioaccumulate in both aquatic and terrestrial flora and fauna, which can cause a disastrous consequence on the ecosystem<sup>5</sup>. Unlike synthetic chemical which leave harmful residues in the aquatic environment<sup>6</sup>, botanical piscicides are believed to be more environment friendly because they are easily biodegraded leaving no residues in the environment.

Nagaland is situated between 25°06'N-27°04'N latitude and 93°20'E-95°15'E longitude and covers an

area of 16,579 sq. km. The state is bounded on the North by Arunachal Pradesh, West by Assam, South by Manipur and East internationally by Myanmar. The altitude varies between 194-3048 m. Nagaland consists of eleven districts i.e., Kohima, Dimapur, Mokokchung, Phek, Wokha, Zunheboto, Tuensang, Mon, Peren, Longleng and Kiphirie which are inhabited by 14 tribes, viz. Angami, Ao, Chakhesang, Chang, Khiamniungam, Konyak, Lotha, Phom, Pochury, Rengma, Sangtam, Sumi, Yimchungrü and Zeliang.

Many plants having piscicidal property have been reported from different States of India and around 15 species of plants are used by Bhil tribe of Ratlam district, Madhya Pradesh<sup>7</sup>. The main active compounds in these plants responsible for piscicidal actions are reported to be triterpenoid saponins and rotenoids, out of which plants having rotenone are most widely used commercially. Some other fish poisons include sesquiterpenes, diterpenes, furanocoumarins, triterpene, prenyl phenyl propanoids, quinones, sterol acylglucosides<sup>1</sup>. Ethnobotanists from different parts of India have documented plants species employed as fish poison<sup>8</sup> and medicinal properties of these plants are exploited by the local people in treatment of various diseases. The aim of this study is to document the plant species used as piscicidal

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agent in fish catching and also in medicinal practices by the local community of Nagaland.

### Materials and Methods

The piscicidal plants were collected from five districts of Nagaland, viz. Dimapur, Kohima, Peren, Mokokochung and Zunhuboto. The collection of plants was done after getting the preliminary information from local people (Table 1). Prior informed consent (PIC) for the publication and sharing of information regarding plant materials used in the present study was taken from the person concerned and the village chief (“Gaon Burah”) of the respective location. The availability of

*Diospyros lanceaefolia* Roxb. is highest during monsoon season coinciding with abundant availability of fish and is most commonly used piscicide. The fruit of this plant has to be used only in its fresh state as its effectiveness degrades with time. *Catunaregam uliginosa* (Retz) Manilal & Sivar, *S. mukorossi* Gaertn. and *Juglans regia* Linn. are mostly available during late monsoon. *J. regia* is also generally used fresh as its effectiveness is maximum when still in fresh state. *C. uliginosa* and *S. mukorossi* Gaertn. on the other hand are found effective both in fresh and dry state. Among these fruits *C. uliginosa* and *S. mukorossi* can be stored for later use in dry condition and its effectiveness lasts for few years.

Table 1 — Distribution of commonly used piscicidal plants of Nagaland with their vernacular name

Botanical name	Habit and parts used	Vernacular name	Name of the Tribes using the plant/part	Collection site
<i>Acacia pennata</i> (Linn.) Willd.	Climbers, whole plant	Sako (Angami), Phitsu (Lotha)	Angami, Ao, Chakhesang, Lotha, Pochury, Rengma, Sumi, Zeliang	Kohima, Zunhuboto
<i>Albizia chinensis</i> (Osborne) Merr.	Tree, bark	Mego (Angami), Khokshithera(Lotha), Mokok(Ao), Amwosü (Sumi)	Angami, Ao, Chakhesang, Lotha, Pochury, Rengma, Sumi, Zeliang	Kohima
<i>Albizia lebbek</i> (Linn.) Benth.	Tree, leaves, bark	Ze (Angami), Meristu sung (Ao-Changki), Zü (Chakhesang-Chokri), Khokshu (Lotha), Azuyisu (sumi)	Angami, Ao, Chakhesang, Lotha Pochury, Rengma, Sumi, Zeliang	Wokho, Dimapur
<i>Albizia procera</i> Benth.	Tree, bark	Peii (Angami), Sapanpai (Ao), Opyak (Lotha), Amkhu (Rengma), Sapotusu (sumi)	Angami, Ao, Chakhesang, Lotha Pochury, Rengma, Sumi, Zeliang	Wokho, Dimapur
<i>Catunaregam uliginosa</i> (Retz.) Manilal & Sivar	Shrub, fruit	Ntangdang (Zeliang)	Angami, Zeliang	Jalukie
<i>Diospyros lanceaefolia</i> Roxb.	Tree, bark and fruit	Ruja (Ao-Changki), Achi ithi(Sumi).	Ao, Sumi	Mokokchung, Zunhuboto
<i>Juglans regia</i> Linn.	Tree, bark and unripe fruit	Pfhii (Angami), Akhuchang (Ao-changki), Khushe (Chakhesang-chokri), Nothi (Lotha), Ajukha (Rengma), Ghakuthi (Sumi)	Angami, Ao, Chakhesang, Lotha, Pochury, Rengma, Sumi, Zeliang	Kohima
<i>Milletia pachycarpa</i> Benth.	Shrub, root	Mpe(Angami), Alingnengba(Ao), Suichi (Sumi), Ngeri(Lotha)	Angami, Ao, Chakhesang, Pochury, Rengma, Sumi, Lotha, Zeliang	Kohima, Zunhuboto
<i>Polygonum hydropiper</i> Linn.	Tree, young leaves	Uciipumithishe (Chakhesang-chokri), Echuimshi(Lotha), Nikchamerin(Ao-Changki).	Angami, Ao, Chakhesang, Pochury, Rengma, Sumi, Lotha, Zeliang	Kohima
<i>Sapindus mukorossi</i> Gaertn.	Tree, fruits	Khorcii (Angami), Ruhjanjang (Ao), Khrovatishe(Chakhesang-Chokri), Achancha(Rengma), Sapunbo(Sumi), Khekhi(Lotha)	Angami, Ao, Chakhesang, Pochury, Rengma, Sumi, Lotha, Zeliang	Dimapur
<i>Thelypteris herbacea</i> Holttum.	Fern, whole plant	Ayechu(sumi), Matsoru (Lotha)	Ao, Lotha, sumi	Dimapur, Zunhuboto

The ethnobotanical/therapeutic uses of these plants/plant parts by the respective tribes have been recorded. The plants were identified with the help of expertise available at the Departments of Botany, North Eastern Hill University, Shillong; Nagaland University, Lumami and at the Botanical Survey of India, Shillong<sup>9-11</sup>. The voucher herbarium specimens of eleven species are deposited in the Department of Zoology, North Eastern Hill University, Shillong. Some of the plants/plant parts which are identified and reported have been photographed and presented. The bioactive constituent of the species is obtained from the literature<sup>12-24</sup>.

### Results and Discussion

The different districts of Nagaland and commonly used piscicidal plants are shown in Plate 1 and 2. Of the seventeen species collected, eleven most commonly used piscicidal plants of Nagaland are presented in Table 1 and these species along with

their ethnobotanical uses by different tribes and identified bioactive compounds are shown in Table 2. Mimosaceae is represented by four species and the rest of the families with a single species. Piscicidal plants are widely used by traditional societies all over the world as a means of catching fish<sup>8</sup>. Plant piscicides are environmentally safer than synthetic piscicides as they are biodegradable. They are less expensive, readily available, easy to handle and safe for both mankind and environment<sup>25,26</sup>. Rotenone is one of the most commonly used piscicides for eradication of unwanted fish in nursery management but it is expensive and scarcely available as it has to be imported. A better alternative to the imported rotenone is the locally available natural rotenone found in the piscicidal plants which can be used in the management of fish nurseries. The putative piscicidal plants identified from the State with piscicidal activities may serve the purpose as they are environmental and health-friendly.

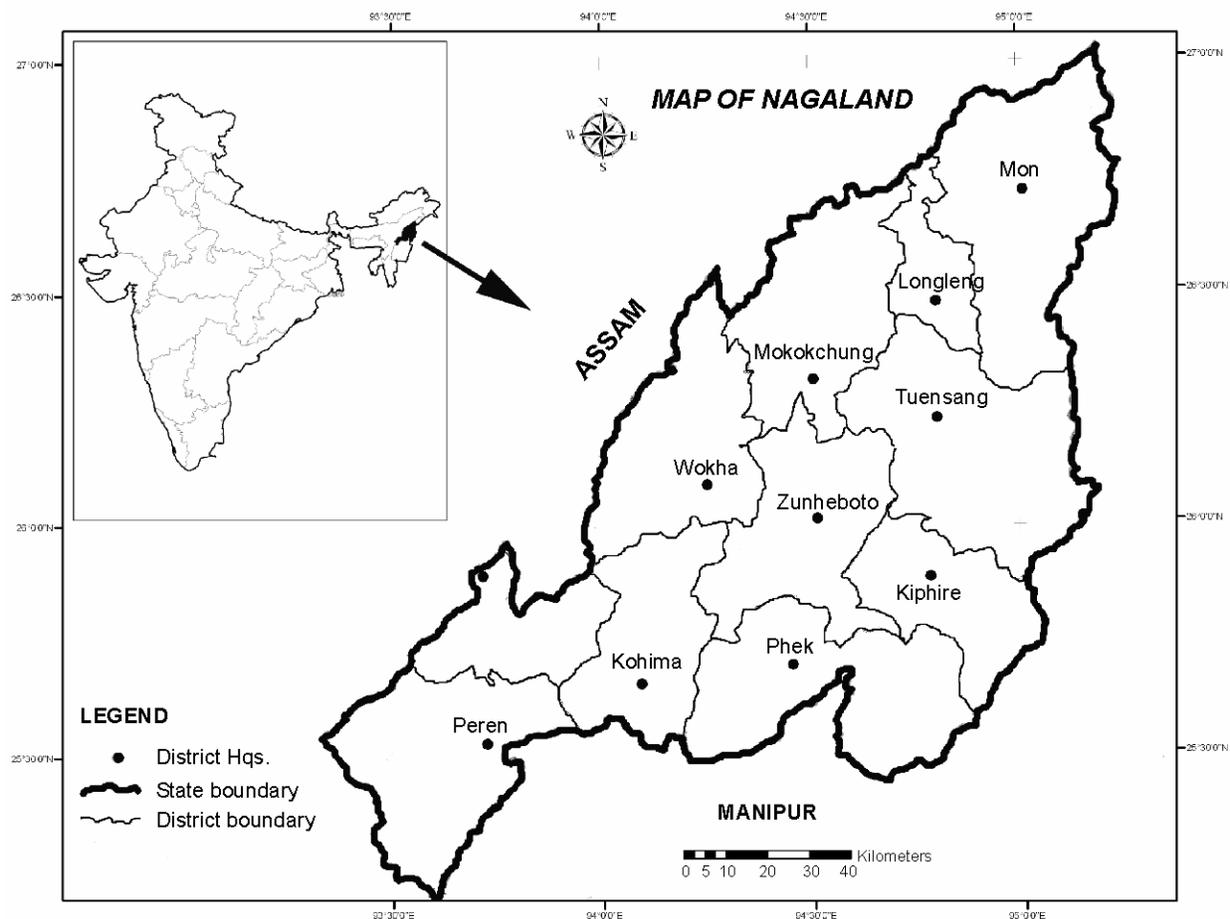


Plate 1 — Map showing the different districts of Nagaland

*Acacia pennata**Albizia procera**Catunaregam uliginosa**Diospyros lanceifolia**Jatropha curcas**Juglans regia**Milletia pachycarpa**Myrica esculenta**Polygonum hydropiper**Rhododendron arboreum**Sapindus mukorossi**Zanthoxylum armatum*

Plate 2 — Photographs showing piscicidal plants commonly used in Nagaland

The results have indicated that the stem bark is most commonly used plant part for fish catching by tribals. The plant part is pounded using a rock at the side of the river and the crushed pieces are then sprayed into small pools where the water is stagnant. Some of the common fishes caught using piscicidal plants are *Channa punctatus* (Bloch), *Botia dario*

(Ham.), *Barilius barila* (Ham.), *Barilius bendelisis* (Ham.), *Danio aequipinnatus* (Mc Clelland), *Labeo dero* (Hamilton), *Neolissocheilus hexagonolepis* (Mc Clelland), *Neolissocheilus heastichus* (Mc Clelland), *Tor progeneius* (Mc Clelland) and *Tor tor* (Hamilton). Sometimes, leaves, fruits are cut open and kept submerged in water bodies with the

Table 2 — Piscicidal Plants of Nagaland with their Ethnobotanical/Therapeutic Properties and Bioactive Compounds

Botanical name/Family	Ethnobotanical/ therapeutic properties	Bioactive compounds
<i>Acacia pennata</i> (Linn) Willd. Mimosaceae	The bark paste treats snake bite and scorpion sting. A mixture of leaf extract and milk treats indigestion in infants. The whole plant is crushed and powder sprayed into the stream to stupefy the fish.	Terpenoids, flavonoid glycoside <sup>12</sup> .
<i>Albizia chinensis</i> (Os.) Merr. Mimosaceae	The powder of bark is anthelmintic and used in fish poisoning. Leaf extract remedies skin diseases.	Oleanane triterpene saponins <sup>13</sup> .
<i>Albizia lebbek</i> (Linn.) Benth. Mimosaceae	It remedies breathing problems. The seeds are useful in inflammations, scrofula, skin diseases, leprosy, leucoderma and seminal weakness. Leaves are used as fish poison.	Alkaloids, glycoside, tannins, triterpenoids and triterpenoid saponins, flavonoids, oleanolic acid, albigenic acid, albigenin, acacic acid <sup>14</sup> .
<i>Albizia procera</i> Benth. Mimosaceae	Bark decoction is used in rheumatism and haemorrhage. Plant parts show anticancer property and used in intestinal diseases. Barks' paste is applied to treat backache; the plant is used as piscicide.	Bark contains $\beta$ -sitosterol, isoflavones, triterpene saponins <sup>15</sup> .
<i>Catunaregam uliginosa</i> (Retz.) Manilal & Sivar Rubiaceae	Unripe fruit acts as an astringent and are effective in killing fish. Root serves as a diuretic; used for treating biliousness, diarrhoea and dysentery.	Saponin of oleannolic acid, leucocyanidin, mannitol <sup>14</sup> .
<i>Diospyros lanceaefolia</i> Roxb. Ebenaceae	Crushed seeds used for skin diseases. Fruits are powdered and sprayed in streams to poison fish.	Plumbagin, 7- methyljuglone <sup>16</sup> .
<i>Jatropha curcas</i> Linn. Euphorbiaceae	Helps treat piles, enlarged spleen, skin diseases, promotes hair growth; helps in cancer. Stem bark is used in wounds, insect bites, ulcers, cuts and acts as a coagulant. The whole plant is used as fish poison.	Contain various flavonoids, saponin, phenolics and phorbol esters <sup>17</sup> .
<i>Juglans regia</i> Linn. Juglandaceae	Bark and unripe fruits have piscicidal properties. Leaves are astringenic, anthelmintic, used in eczema, herpes, syphilis and scrofula.	Juglansin, globulin, flavanoids, steroids, tannins, curcuminid, juglone, glycoside <sup>18</sup> .
<i>Milletia pachycarpa</i> Benth. Fabaceae	Used as a blood tonic and induces erythropoiesis. Helps in lowering the blood cholesterol. The crushed root is used as fish poison.	Isoflavonoids, rotenoids, isoflavone, barbigerone <sup>19</sup> .
<i>Myrica esculenta</i> Buch.-Ham. ex D. Don Myricaceae	The plant helps relief toothache. Decoction of the bark is used in asthma, diarrhoea, fever, affliction in lungs, chronic bronchitis, dysentery and dieresis. The crushed bark is used as fish poison.	Myricanol, $\beta$ -sitosterol, taraxerol, myricadiol <sup>14</sup> .
<i>Nerium indicum</i> Mill. Apocynaceae	It is a cardiac tonic and aids in curing ulcers, swellings, leprosy and skin diseases. Root bark is used to treat ringworm infection and it acts a piscicide.	Triterpenoids, steroids, nerizoside, odorside, neridiginoside, neriumin, ursolic acid, oleanolic acid <sup>20</sup> .
<i>Polygonum hydropiper</i> Linn. Polygonaceae	Aqueous extract of the plant is used as an oral contraceptive and infusion given in urine disorders. Leaves aid in healing toothache. The whole plant is used to poison fish.	Flavonoid, oxymthyl-anthraquinones, polygonic acid <sup>21</sup> .
<i>Rhododendron arboreum</i> (Smith) Ericaceae	Paste of flowers relieves headache and cures dysentery. Roots and bark (decoction) treats stomach ache. The young leaf is used to poison fish.	Cyanidin-3-galactoside and cyaniding-3-arbinoside are present in the pigment of flower. Leaves contain ursolic acid, friedelin, epifriedelanol, quercetin, triterpenoid, campanulin <sup>14</sup> .
<i>Sapindus mukorossii</i> Gaertn. Sapindaceae	Fruits are useful in excessive salivation, epilepsy and chlorosis. Powdered seeds have insecticidal properties. Naga tribes use them as substitute for soap. The crushed fruit is used as fish poison.	Fruit pericarp contains saponin, sesquiterpenes, oligoglycosides and mukuroziosides <sup>22</sup> .
<i>Schima wallichii</i> (DC.) Korth. Theaceae	Bark is an anthelmintic, rubefacient and skin irritant. Young leaves are used as antipyretic and the extract is used to cure flatulence. The plant is used as piscicide.	Tannin, octacosanol, phytol, alpha-spinasterol and a saponin, schiwallin <sup>14</sup> .
<i>Zanthoxylum armatum</i> DC. Rutaceae	Leaves and fruits are used for treating dental related disease, diarrhoea, hepatopathy, fever, leucoderma, leprosy, skin diseases, cough, paralysis, gout, convulsions, and diabetes. The crushed fruit is used to poison fish.	Sesquiterpenes, linalool, limonene, $\beta$ -phellandrene and methylcinnamate <sup>23</sup> .
<i>Taxus baccata</i> subsp. <i>wallichiana</i> (Zucc.) Pilger Taxaceae	Anticancerous particularly in case of breast and uterus tumors. Treats asthma, bronchitis, epilepsy, headache, giddiness, rheumatism and stomach pains. Bark and leaf have piscicidal properties.	Monoterpenes, sesquiterpenes, diterpenes, tetraterpenes, aliphatic compounds, alkane and alkenes, fatty acid and esters <sup>24</sup> .



Plate 3 — Photograph showing a group of local people preparing piscicidal plants for fishing

help of stones. The use of these plants both as fish poison and in medicine by tribes of the State is known time immemorial. 'Fishing festival' is celebrated every year where the local people gather together for fish catching using piscicidal plants (Plate 3). These plants have bioactive compounds which other than having piscicidal property also exhibit ethnobotanical properties as reported<sup>27-29</sup>. Information collected from the tribal people has suggested that most of these plants are highly effective as piscicides.

### Conclusion

The results obtained from this study will help in understanding the indigenous methods of fish catching and medicinal uses of these piscicidal plants. Further, since no work has been carried out on the study of piscicidal plants exclusively in the state of Nagaland, this study would be of significant help in fishery management.

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