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A Preliminary Survey of Traditional Organic Piscicides from Local Flora of Paschim Medinipur District, West Bengal, India

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ABSTRACT

The present work is an extensive field work in different Blocks of Paschim Medinipur district and review of published literature concerning piscicidal properties of locally available plants growing in this district. It will provide comprehensive information for further research. Due to presence of safe phyto-chemical, these plants would be an eco-friendly alternative of synthetic chemical substances to reduce the chemical hazards in the environment. The present study provides only preliminary report and may be the source for further scientific and analytical research to evaluate the efficacy of the toxic as well as safe properties of these plants. Total 90 no. of plant species belonging to 81 no of Genus, 46 no of Families are enumerated alphabetically with scientific names, common Names, ecological status, parts used and chemical nature. Traditional plant piscicides used by tribes in this district has also been studied. No such work has yet been done in this district.

KEYWORDS: *Herbal Piscicides, Traditional plant piscicide, Paschim Medinipur District, West Bengal*

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INTRODUCTION

A piscicide is a chemical substance, which stupefy and or poison the fish. Though traps and nets are important tools used for capture fishes from rivers and streams but use of various plants as fish poison (called Herbal piscicide) is also a very old practice in the history. The main objective of this work is to provide information of unknown or less known Piscicidal plant taxa and their botanical identities in the district of Paschim Medinipur and to give information about the effects of these herbal fish toxins to human beings and other carnivores. It would be important to have an awareness regarding the poisonous plants which, when used in the proper, prescribed dose, for stupefying fishes and would be ready information to the fishermen for fish farming and partsused as piscicide. This data will help Botanist, Ethno-Botanists, Fishermen, Biochemists and Scientists of other allied disciplines for their research programme. Herbal piscicides are also the best eco- friendly alternative of unsafe chemical pesticide in aquaculture to control fish fry predators and unwanted fishes from aquaculture ponds. These are valuable one due to the properties of eco -friendly, ease of availability, high efficiency, less toxicity to non-targeted animals and rapid biodegradability (Yunis Aj *et al,* 2014). Plant parts of different Piscicidal plants can be applied directly in the form of aqueous extract or extract dissolved in alcohol (Ekpendu EA, *et al*., 2014). In some cases dried plant products are applied after soaking in water overnight as piscicidal. Generally plnat extracts are called botanicals but when toxic to fish called Piscicide (Fafioye OO, 2005). Indigenous people of all over the world use various fish poisons to kill or stupefy the fishes (Jeremy So.2002). In India, most rural communities depend on the wild resources to meet their food needs during food crisis period and also use as additional food supplements (Jawale CS, 2018).

Since ancient periods Tribal people used to use various plant products for fish poisoning (Murthy EN *et al.*, 2010). Though at present some unhealthy chemicals are used for this purpose, but still tribals are using this easy and simple method for fishing in remote areas (Kumar V. et al, 2003). Many research works are going on for documenting many fish toxins and their use (Sharma S.K 1997). So far literature surveyed, no such information about picicidal plants has yet been published. The tribal communities in this district are Santal, Lodha (Sabar), Munda, Oraon, Bhumijs and Kherias. Besides agriculture, hunting and the collection of forest products, fishing is an alternative source of food for Tribes in this district. They not only collect fish for food but also earn money by selling them in daily markets. During field survey, it has been noted that Tribal of this district use indigenous knowledge by using plant products available surround the areas for fish stupefying and fish killing purpose and poisoning is generally done in stagnant pools or slow flowing streams and rivers which allow the pounded part of plant to concentrate without being washed away or diluted by current. Sometimes streams are partly blocked to slow down the flow of water. During the survey period, five no. plant species like *Persicaria orientalis* (L.)Spach, *Euphorbia antiquorum* L., *Euhorbia nerrifolia* L., *Acacia auriculiformis* A.Cunn ex Benth., *Croton banplandianum* Baill. have been identified which are traditionally used by the Tribes in this district as fish toxin. Among these five plant species, *Persicaria orientalis* L and *Acacia auriculiformis* A. Cunn ex Benth. are used profusely by the tribes. During conversation with the Ethnic people, it has also been noted that now- a- days they are very much interested to use the chemical piscicide rather herbal one due to unavailability of some plants and quick action of chemical piscicide. Many fishermen of this district are generally using unhealthy chemicals like agriculturally used pesticides in pond for fish poisoning. Piscicidal plants products actually stupefy the fishes without killing the whole fish stock when these are used in limited dose in limited time (Kamal kishor HN, *et al*. 2009). Biochemical compounds present in piscicidal plants stun the fishes when it passes through its gills or ingested directly. The fishes come to the surface because of lack of dissolved oxygen and during this period fishes exhibit abnormal behaviours due to asphyxia, haemorrhages in internal organs or nervous breakdown. (Das SK, *et al*. 2018, Murthy EN *et al.*, 2010). Generally Saponin and Rotenone containing plants are used for this purpose. Chopra *et al.* reported 112 species of plants having piscicidal action from different states of India. (Chopra RN, *et al*. 1958) and 90 no. of plants have been identified as piscicidal plants in Paschim Medinipur District, West Bengal. Several plants belonging to different families, having a number of compounds (Saponins; tannins, alkaloids, steroids, alkenylphenols; di and tri terpenoids; and others) with high pesticidal activity are used to control predatory fish; disease causing insects such as mosquito larvae and harmful fresh water snails (Tiwari S., *et al.*2003). It has been proved that saponin and rotenone are not harmful to human beings if they are used scientifically. The plant products degrade easily within 7-12 days and are considered environment friendly as they act as manures following biodegradation (Chakroff M. 1976). But when chemicals like agriculture pesticides are used for this purpose, it creates health hazards. Poisoning is generally done in stagnant pools or slow flowing streams and rivers which allow the pounded part of plant to concentrate without being washed away or diluted by current. Sometimes streams are partly blocked to slow down the flow of water. Most icthiotoxic plant poisons initially works as stupefying or paralysing agent and later lead to death of the fish. Piscicidal plants used in fishing actually stupefy the fishes without killing the whole fish stock (Dalela, R.C. *et al.*, 1978). Saponin is one of the group of glucosides found in many plant species with known foaming properties when mixed with water Saponins, toxins normally break down in the digestive system and enter the bloodstream. Fishes take in saponins directly into their blood stream through their gills. The toxins act on the respiratory organs of the fish. Saponins also cause the breakdown of red blood cells that help the toxin to spread quickly. Fishes that are washed away into fresh water revive and can return to their pre-toxic condition. Because of this, the fisherman would have to gather the stunned fish quickly as they floated to the surface. Neuwinger postulated that saponins permeabilize the gill epithelial cells of fish allowing essential electrolytes to escape (Neuwinger, H. D. 1994). Plants containing rotenones are the second utilized fish poison. Rotenone is an alkaloid toxin, in a group called flavonoids and stuns fish by impairing their oxygen consumption. Vickery and Vickery claims that saponins are generally only toxic to cold-blooded animals (Vickery, M.L. *et al.* 1981) and saponins may offer an attractive alternative for Rotenone in fish management projects since the latter is somewhat toxic to small mammals. Relatively little is known about how most fish poisons work on a molecular level, with the possible exception of rotenone. Rotenone is known to inhibit NADH-Q reductase in the mitochondrial electron transport chain (Stryer, L., 1995), and this prevents the mitochondria from using

NADH as a substrate. Electron transfer is virtually halted, and the organism cannot produce enough ATP, which leads to asphyxia and paralysis, followed by death (Neuwinger, H.D, 1994). Although rotenone is known to be toxic to nearly all animals, but it decays in Sunlight and in air (Merck Index, 1989), so do not cause much harm to mammals and other non-target species. When rotenone is used to treat large reservoirs, the treatment is carried out at times of low water, and out flow from the reservoir is cut off so that the rivers or waterways are not poisoned. According to literatures surveyed (Bhattacharya, S, (1976-93); Kirtikar, K. R *et al.*,1935; Chopra, R.N *et al.*, 1956; Chopra, R.N., *et al.* 1969; Chatterjee, A., *et al.*1991-2001; Pal, D.C. *et al.*1998; Negi, S,S. *et al.* 2007) these Piscicidal plants have immense medicinal values.

Methodology: During the survey period, from June, 2019 to May, 2020, extensive field studies were carried out in more tribal reach areas of this district. For betterment regular field visits were carried out in the study area. Selection of area was based on tribal population or tribal richness. Near about twenty blocks of this district have been covered for this survey work. Data were collected on seasonal basis, i,e. pre monsoon, monsoon, post monsoon and winter during the survey period. Standard questionnaire were used. Information was collected by conversation with the knowledge providers. Plants use in fishing were collected and identified on the basis of vernacular name, regional floras and published literature (Prain, D, 1963; Bennet, S.S.R, 1987). They are enumerated alphabetically with scientific names, vernacular names, family and used parts (Table-1&2). Extensive literature survey was done to verify the name of plants and their use in fish poisoning. The methodologies described by Jain (1999), Chadwick D.J. *et al.* (1994) were adopted for this investigation. By using the standard methods (Martin, 1995) of semi structured questionnaires, interviews and participatory appraisals, collection of information from the tribes (Santals, Lodhas and Oraon) and local communities of this region was carried out. Herbarium sheets of all collected specimens have been prepared according to standard method (Jain S K, *et al.*, 1977) and preserved in the Herbarium of Dept. of Botany, Midnppore College (Autonomous), Midnapore for further study.

Study area: The District of Paschim Medinipur is located in the South- Western part of West Bengal. It is at 23 meters above Sea level. The climate of this district follows a hot tropical monsoon weather pattern. Soil types near Kangsabati River are alluvial, whereas towards Rangamati are lateritic. Vegetation includes Species of *Eucalyptus* and Sal (*Shorea robusta* L). Forest is located on the North West side of the Midnapore Town. The average annual precipitation is 2,111mm. According to the 2011 census Paschim Medinipur district has a population of 5,943,300 (Wikipedia 2018; District Census 2011; Census 2011). Schedule Caste (SC) constitutes 19.1 % while Schedule Tribes (ST) are upto 14.9% of total population of the District. 12.2% people live in urban areas while 87.8% live in the rural areas. (Census, 2011). Fig 1,2 show the location of West Midnapore District in West Bengal & Figure 3 shows the Blocks of Paschim Medinipur District(mapsofindia,2020).

Fig- 1 West Bengal in India

Fig-2 Location of Paschim Medinipur district

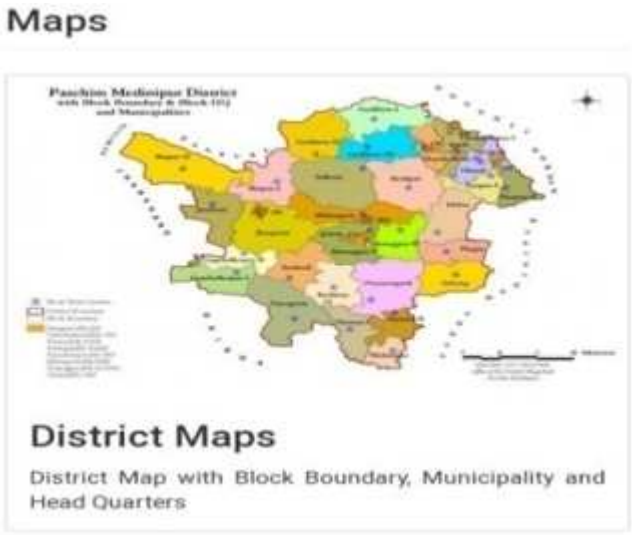


Fig-3 Blocks of Paschim Medinipur district

Fig-4 *Croton banplandianum* Baill

Fig-5 *Euhorbia nerrifolia* L

Fig-6 *Persicaria orientalis* (L.)Spach

Fig-7 Acacia *auriculiformis* A. Cunnex Benth.

Fig-8 *Euphorbia antiquorum* L

Results:

Table 1: List of available Piscicidal Plant in Paschim Medinipur District with their Family, Habit, Habitat, Ecological Status, Flowering and Fruiting Period and Used Parts

Sl. No.	Scientific Name of Plants	Family	Habit	Habitat	An/B/Per	Ecological status	Fl & Fr. Period	Used Part	Reference
1.	*Justicia adhatoda* L.	Acanthaceae	S	T	Per	Common, Cultivated,Wild	Dec-Apr	Leaves	Petr T. T.(1999)
2.	*Alangium salvifolium* (L.f.) Wang.	Alangiaceae	U T	T	Per	Common,Wild	Mar-July	Root bark	Agharkar S.P.(1991)
3.	*Achyranthes aspera* L.	Amaranthaceae	H	T	An to per	Common, Wild	Sept-Apr	Whole plant	Ashraf, M. *et al.*. (2010).
4.	*Agave sisalana* Perr.	Amaryllidaceae	S	T	Per	Frequent, Cultivated	Oct-Mar	Leaves	Chiotha SS *et al.*(1991)
5.	*Crinum asiaticum* (L.)		H	T	Per	Frequent, Wild	April – July	Roots, Leaves	Pedro (1990)
6.	*Anacardium occidentale* L.	Anacardiaceae	S	T	Per	Frequent, Cultivated	Dec-May	NR	Agharkar (1991), Bombay (1953)
7.	*Semecarpus anacardium* L.f.		T	T	Per	Frequent, Wild, Cultivated	June-Feb	NR	Agharkar S.P.(1991)
8.	*Centella asiatica* L.(Urb.)	Apiaceae	H	T	Per	Common, Cultivated,Wild	July – Jan	NR	Chopra R.N. *et al.* (1933)
9.	*Adenium obesum* Roem & Schett	Apocynaceae	C H	T	Per	Frequent, Cultivated	Whole year	Bark, Leaves	
10.	*Alstonia scholaris* (L.) R.Br.		U T	T	Per	Common, cultivated,Wild	Oct-Feb	Latex	Bandaru N. *et al.*, (2016)
11.	*Holarrhena pubescens* Wall. Ex G.Don.		T	T	Per	Frequent, Wild, Cultivated	Oct – Mar	Stem bark	Murthy E.N. *et al.* (2010)
12.	*Nerium oleander* L.		S	T	Per	Common, Cultivated	Feb – Oct	Leaf,Fruit,Bark	Ashraf M. *et al.*, (2010)
13.	*Plumeria rubra* L.		U T	T	Per	Frequent, Cultivated	Apri-Sept	Leaves	Dey Abhijit, *et al.* (2015).
14.	*Rauwolfia serpentina* (L.) Benth. Ex Kurz.		S	T	Per	Frequent, Wild, Cultivated	Mar – Dec	Stem, Leaves	Sinha M.K. *et al.* (2010), Pedro (1990)
15.	*Cascabela thevetia* (L.) H. Lippold		S	T	Per	Common, Cultivated	Whole year	Pericarp, stem, leaf,Bark	Envis (2017), Singh S.K. *et al.*, (2010)
16.	*Amorphophallus campanulatus* Blume. ex. Decne.	Araceae	S	T	Bi	Common, Wild, Cultivated	Apri-Dec	Corn	Agharkar S.P. (1991)
17.	*Calotropis procera* Aiton	Asclepiadaceae	U S	T	Per	Common, Wild, Cultivated	Jan-Aug	Root, Latex	Ashraf M. *et al.*, (2010), Katewa SS. *et al.*,(2008)
18.	*Yucca filamentosa* L.	Asparagaceae	S	T	Per	Frequent, Cultivated	Apr-June	NR	Sinha M.K. *et al.* (2010)

19.	*Ageratum conyzoides* L.	Asteraceae	H	T	Ann	Abundant, Wild	Aug-Nov	Whole Plant	Tag Hui., *et al.* (2005), Das S. *et al.*(2003)
20.	*Chromolaena odorata* (L.)R.M. King &H. Rob.		S	T	Per	Abundant, Wild	Sept-Feb	Leaves	Envis (2017), Lamba S.S. (1970),
21.	*Acmella oleracea* (L.) R.K.Jansen.		H	T	Ann	Abundant, Wild	Aug-Jan	Whole plant, leaves, twigs	Tag Hui., *et al.* (2005), Namsa Nima D,*et al.* (2011), Nimachow G. *et al.*(2008)
22.	*Tridax procumbens* L.		H	T	Ann	Abundant, Wild	Whole year	Leaves	Ambasta S.P. (2006),
23.	*Senna alata* (L.)Roxb.	Caesalpiniaceae	S	T	Per	Wild, common	Aug-Mar	Leaves	Ayyanar M. *et al.* (2010), Colonel B. *et al.,* (1955)
24.	*Cassia fistula* L.		UT	T	Per	Common, Wild	Mar – Dec	Stem bark	Sinha M.K. *et al.* (2010), Ayyanar M. *et al.*(2010)
25.	*Senna sophera* (L.) Roxb.		WH	T	Ann	Abundant, Wild	July – Dec	NR	Sinha M.K. *et al.* (2010)
26.	*Carica papaya* L.	Caricaceae	S	T	Per	Common, Cultivated	Whole year	Seed	Ayotunde E.O. *et al.* (2011)
27.	*Calophyllum inophyllum* L.	Calophyllaceae	H	T	Per	Frequent, Cultivated	Apri-Nov	NR	Colonel B. *et al.,* (1955)
28.	*Terminalia arjuna* (Roxb.) Wight & Arn.	Combretaceae	T	T	Per	Common, Cultivated	Mar – Dec	Stem bark	Joshi P. (1986)
29.	*Terminalia bellirica* (Gaertn.) Roxb.		T	T	Per	Frequent, Wild, Cultivated	Mar – Feb	Karnel, Bark	Pedro (1990), Chopra R.N. *et al* (1933)
30.	*Cuscuta reflexa* Roxb.	Convolvulaceae	CH	T	Per	Common, Wild	Nov – Mar	NR	Malla B. *et al.* (2011)
31.	*Ipomoea carnea* Jacq.		S	Aq.	Per	Common Wild	Whole year	Leaves	Hazarika R. *et al.,* (2015), Wanule D.D.(2012)
32.	*Costus speciosus* (J. Koenig) Sm.	Costaceae	H	T	Per	Frequent, Wild	June – Nov	Tuberous root stock	Heda N.K. *et al.* (2009), Kulkarni D.K.*et al.* (1990)
33.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	CH	T	Ann/Per	Frequent, Wild	Oct – Dec	NR	Malla B. *et al.* (2011)
34.	*Shorea robusta* Gaertn.	Dipterocarpaceae	T	T	Per	Common, Wild,Cultivated	Feb – July	Stem bark	Mishra R. *et al.,* (2014)
35.	*Diospyros melanoxylon*	Ebenaceae	T	T	Per	Frequent, Wild, cultivated	Mar – July	Fruit	Murthy E.N, *et al.* (2010)

	Roxb.								
36.	*Chrozophora rottleri* (Geiseler) A.Juss. ex Spreng.	Euphorbiaceae	H	T	Ann	Abundant, Wild	Feb – April	Leaves	Joshi P. (1986)
37.	*Euphorbia antiquorum* L.		S	T	Per	Frequent, Wild	Jan-July	Whole plant	Satya V. *et al.* (2010), Ramanayaka J.C. *et.al.* (2006)
38.	*Euphorbia hirta* (L.)		H	T	Ann	Abundant, Wild	Feb – Dec	Latex	Yadav R.P. *et al.* (2013)
39.	*Euphorbia neriifolia* (L.)		U S	T	Per	Common, Wild, Cultivated	Jan-June	Whole plant, Latex	Das S. *et al.,* (2003),
40.	*Euphorbia pulcherrima* Willd. Ex Klotzsch		S	T	Per	Frequent, Cultivated	Oct – Jan	Stem bark, Latex	Yadav R.P. *et al.* (2013)
41.	*Euphorbia tirucalli* L.		W S	T	Per	Infrequent, cultivated	May-Oct	Latex	Kumar A. *et al.,* (2010), Tiwari S. *et al.*(2006)
42.	*Jatropha curcas* L.		S	T	Per	Frequent, wild	Mar – Oct	NR	Chopra R.N. *et al.* (1933)
43.	*Jatropha gossypifolia* L.		U S	T	Per	Common, Wild	Apr – Aug	Leaf, Stem, Bark	Singh D. *et al.* (2002)
44.	*Ricinus communis* L.		S	T	Per	Common, Wild, Cultivated	Sept-Mar	Leaves, Seeds	Ashraf M.,*et al.* (2010), Pedro (1990)
45.	*Abrus precatorius* L.	Fabaceae	C S	T	Per	Common, wild	Oct-May	Seed	Ferdous, Zannatul *et al.* (2018)
46.	*Acacia auriculiformis* Benth		T	T	Per	Common, Cultivated	Dec-Mar	Fruit	Mishra *et al.*(2014)
47.	*Albizia lebbeck* (L.) Benth.		T	T	Per	Common, Wild, Cultivted	Mar-Dec	Bark,Leaf	Dominic R. *et al.*(2012)
48.	*Albizia procera* (Roxb.) Benth.		T	T	Per	Common, Cultivated, Wild	July-Aug	Leaf,Stem bark	Sinha M.K. *et al.*(2010), Rai P.K. *et al.* (2010)
49.	*Lathyrus sativus* L.		H	T	Ann	Frequent Cultivated,	Oct. - Nov.	NR	Agharkar S.P. (1991)
50.	*Butea monosperma* (Lam.) Taub.		T	T	Per	Frequent, Wild	Mar-Oct	Whole plant, Stem, Bark	Patil M. V., *et al.* (2006), Mishra R. *et al.,* (2014)
51.	*Acacia pennata* (L.) Willd.		SS	T	Per	Frequent Wild	Oct-Jan	Seed	Negi KS. *et al.* (2009)
52.	*Guilandina bonduc L.*		CS	T	Per	Frequent, Wild.	Mar – May	Pulped fruit, stem	Chopra R.N. *et al.* (1933), Lamba S.S.(1970)
53.	*Entada scandens* (L.) Benth.		T	T	Per	Infrequent Wild.	Dec.-April	Seeds	Nadkarni K.M. (1996)
54.	*Erythrina suberosa* Roxb.		UT	T	Per	Frequent, Cultivated	Feb – July	Bark	Pawar S.,*et al.* (2004)

55.	*Crotalaria spp*		H	T	Ann	Frequent, Wild.	Oct – Dec	Leaves	Ramanayaka J.C. *et al.*(2006)
56.	*Mimosa pudica* L.		H	T	Per	Comon, Wild	Whole year	Leaves	Sinha M.K. *et al.*(2010)
57.	*Pongamia pinnata* (L.) Pierre		UT	T	Per	Frequent, Wild, Cultivated	Arpi-Dec	Root, Leaves	Ambasta S.P. (2006)
58.	*Pterocarpus marsupium* Roxb.		T	T	Per	Frequent, Wild, Cultivated	Aug-April	Bark	Heda N.K. *et al.* (2009)
59.	*Tamarindus indica* L.		T	T	Per	Common, Cultivated, Wild	April – Mar	Seed husk	Singh N.P. (1988)
60.	*Tephrosia purpurea* (L.) Pers.		S	T	Per	Abundant, Wild	Oct – Mar	Beans,Roots ,Seeds	Bhagya B. *et al.*(2009), Lamba S.S.(1970)
61.	*Juglans regia* L	Juglandaceae	T	T	Per	Infrequent, Cultivated	March-June	Bark, leaves, rind of unripe fruit	Pradhan B.K.*et al.* (2008), Negi KS. *et al.* (2009)
62.	*Clerodendrum infortunatum* L.	Lamiaceae	S	T	Annual	Frequent,Wild	Feb – July	NR	Colonel *et al.,* (1955),
63.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	T	T	Per	Frequent, Wild	May-Oct	Seed,Root, Bark, Fruit	Yumnam J.Y. *et al.* (2013), Moyon W.A. *et al.* (2017)
64.	*Careya arborea* Roxb.		UT	T	Per	Frequent, Wild,	Feb-July	Root, Bark, Leaves	Tag Hui., *et al.* (2005), Heda N.K. *et al.* (2009)
65.	*Gloriosa superba* L.	Liliaceae	CH	T	Per	Infrequent, Wild	July-Dec	Leaves	Chopra R.N. *et al.* (1933)
66.	*Strychnos nux-vomica* L.	Loganiaceae	UT	T	Per	Frequent,Wild	Mar-Dec	Seeds,Fruits	Sinha M.K. *et al.* (2010), Ashraf M. *et al.,* (2010)
67.	*Ammannia baccifera* L.	Lythraceae	H	S.Aq	Annual	Common, Wild,	Sept-Dec	Whole plant	Bombay (1953), Agharkar S.P. (1991)
68.	*Grewia asiatica* L.	Malvaceae	UT	T	Per	Frequent, Wild, Cultivated	Whole year	NR	Pedro (1990)
69.	*Martynia annua* L.	Martyniaceae	H	T	Annual	Frequent, Wild	July – Aug	Leaves	Sinha M.K. *et al.* (2010)
70.	*Azadirachta indica* A. Juss.	Meliaceae	T	T	Per	Common, Wild,Cultivated,	Mar-July	NR	Malla B., *et al.* (2011)
71.	*Tinospora cordifolia* (Willd.) Miers	Menispermeceae	CH	T	Per	Common, Wild	Mar – Dec	Branches	Pedro (1990)
72.	*Moringa oleifera* Lam.	Moringaceae	UT	T	Per	Common, Cultivated,	Jan – May	Seed, Root bark	Kamble Manoj T., *et al.* (2014).
73.	*Olax scandens* Roxb.	Olacaceae	SS	T	Per	Frequent, Wild,	April-December	Leaves	Heda N.K. *et al.*(2009)
74.	*Ludwigia perennis* L.	Onagraceae	WH	S.Aq.	Per	Common, Wild	Whole year	Whole plant	Mishra Rajni.,*et al.* (2014)

75.	*Argemone mexicana* L.	Papaveraceae	H	T	Annual	Common, Wild	Whole year	Bark, Leaf, Fruit	Sinha M.K. *et al.* (2010),
76.	*Cleistanthus collinus* (Roxb.) Benth.ex Hook.f.	Phyllanthaceae	UT	T	Per	Frequent, Wild	Sept-April	Young tender shoot, Fruit, Bark	Heda N.K. *et al.* (2009), Nadkarni K.M.(1996)
77.	*Plumbago indica* L.	Plumbaginaceae	S	T	Per	Frequent,Cuultivated, Wild	Sept-Mar	NR	Agharkar S.P. (1991)
78.	*Polygonum hydropiper* L.	Polygonaceae	H	Aquatic	Annual	Frequent, Wild	Oct – Dec	Whole Plant	Petr T.T. (1999), Tag Hui., *et al.* (2005)
79.	*Persicaria orientalis* (L.) Spach		H	T	Per	Common, Wild	Aug-Dec	Whole Plant	Choudhary R.K. *et al.,* (2011)
80.	*Haldinia cordifolia* (Roxb.) Ridsdale	Rubiaceae	T	T	Per	Frequent, Cultivated	June-May	Bark	Murthy E.N. *et al.* (2010).
81.	*Randia spinosa* (Poir.)		S	T	Per	Frequent, Wild	April-Dec	Fruit, Unripend fruit	Nagi K.S.*et al.*(2009), Ignacimuthu S. *et al.*(2006)
82.	*Aegle marmelos* (*L.*) Correa	Rutaceae	T	T	Per	Common, Cultivated, Wild	May-Mar	Root bark	Envis (2017), Narasimhan P.L. *et al.,* (1991), Joshi P. (1986)
83.	*Sapindus mukorossi* Gaertn.	Sapindaceae	T	T	Per	Common,Cultivated	Apr-Dec	Fruit	Lamba S.S. (1970), Pedro (1990)
84.	*Schleichera oleosa* (Lour.) Oken		T	T	Per	Frequent, Wild,	Feb – Aug	Fruit	Joshi P. (1986),
85.	*Madhuca longifolia* (J.Konig) J.F. Macbr.	Sapotaceae	T	T	Per	Frequent, Wild, Cultivated	Dec – July	Seeds,Oil cake,Stem	Nagi K.S.*et al.* (2009), Kulkarni, D. K.,*et al.* (1990)
86.	*Datura metel* L.	Solanaceae	H	T	Per	Common, Wild, Cultivated	Aug-May	Leaves	Mahajan R.T.*et al.,* (1989), Sinha M.K. *et al.* (2010)
87.	*Cestrum nocturnum* L.		H	T	Per	Frequent, Cultivated	July – Nov	Leaves	Jawale C.S.,*et al.*(2012). Jawale C.S. *et al.* (2010)
88.	*Solanum nigrum* L.		H	T	Ann	Common, Wild	Whole year	Berries	Mahajan R.T. *et al.*(1989),
89.	*Holoptelea integrifolia* Planch.	Ulmaceae	T	T	Per	Frequent, Cultivated	Sept – Feb	Leaves, Stem bark	Kulkarni, D. K.,*et al* (1990), Joshi P.(1986)
90.	*Lantana camara* L.	Verbenaceae	S	T	Per	Abundant, Wild	Whole year	NR	Khare C.P. (2007)

H- Herb, S= Shrub, T= Tree, S.Aq- Semi aquatic, Aq- Aquqtic, Per- Perenial, Ann- Annual, Bi- Bi annual, NR- Not Reported

Key: R-rare(less than 5 trees per 100m²); C-common (between 5-15 trees per 10mt²); Abundant (above 15 trees per 100mt²)

Table 2: List of Common name and Chemical Ingredients of Piscicidal Plant in Paschim Medinipur District

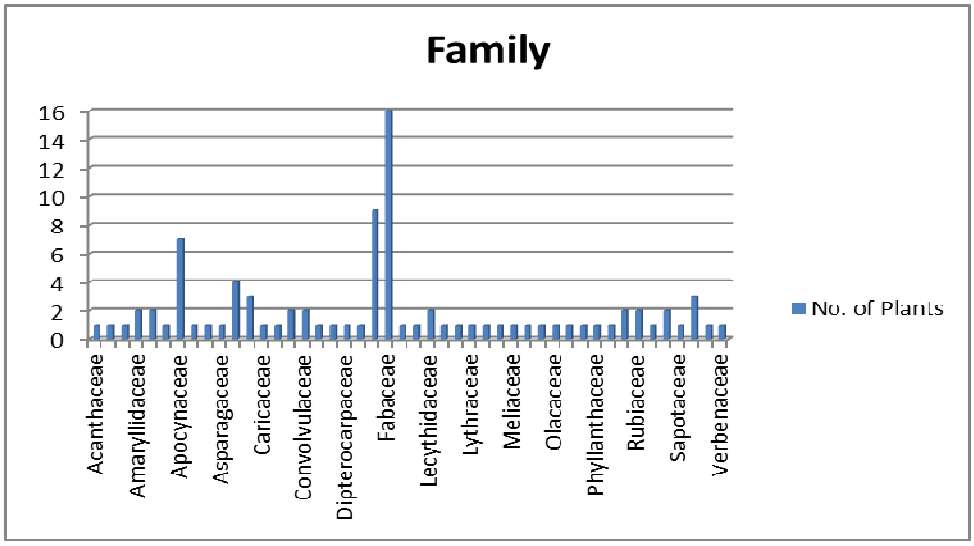
Sl. No	Scientific Name of Plants	Common Name		
1.	*Abrus precatorius* L.	Kuch phal, Latumoni, Ratti	Alka, Flav, Sapo	Hussain A. Zahir, *et al.* (2014).
2.	*Acacia auriculiformis* Benth	Akash moni, Australian wattle, Bengali babul	Flav, Sapo, Ster	Sharma, Nidhi, *et al.*(2017
3.	*Acacia pennata* (L.) Willd.	Rusty mimosa, Agla bel, Biswal	Flav, Ster	Zothantluanga James H. *et al.*(2020).
4.	*Achyranthes aspera* L.	Apang, Prickly chaff flower, Puth kanda	Alk, Flav, Sapo	Srivastav Praven Kumar.(2014).
5.	*Acmella oleracea* (L.)R.K.Jansen.	Toothache plant, Akarkara, Para cress	Alka, Flav, Sapo, Ster, Triter	Tiwari.H.P. *et al* (1990).
6.	*Adenium obesum* Roem & Schett	Adenium, Desert rose, Kudu	Alk, Flav, Sapo	Kalva S. *et al.* (2019).
7.	*Aegle marmelos* (L.) Correa	Bel, Wood apple, Holy fruit tree	Alka, Flav, Sapo, Ster	Veer Babita, *et al.* (2019).
8.	*Agave sissalana* Perr.	Bans keora, Sisal	Sapo, Ster	Santos J.D.G.*et al.* (2015).
9.	*Ageratum conyzoides* L.	Dochunti, Uchunti, Appa grass, Visadodi	Alka, Flav, Sapo, Ster, Triter	Jadav N *et al.* (2019).
10.	*Alangium salvifolium* (L.f.) Wang.	Ans phal, Sageleaved alangium, Akola	Alka, Flav, Sapo, Triter	Ratra M. *et al.* (2105).
11.	*Albizia lebbeck* (L.) Benth.	Sirish, Frywood	Alka, Flav, Sapo	Lawan, S. A. *et al.* (2017).
12.	*Albizia procera* (Roxb.) Benth.	Sada Sirish, White siris, Koroi	Alka, Flav, Sapo, Ster, Triter	Wankhade, M.S. *et al.* (2015).
13.	*Alstonia scholaris* (L.) R.Br.	Chatim, Devil tree, Chitvan	Alka, Flav, Sapo, Ster	Mistry Dhruti, *et al.* (2016).
14.	*Ammannia baccifera* L.	Banmarich, Blistering ammania, Dadmari,	Alka, Flav, Sapo	Aiyalu Rajasekaran, *et al.* (2011).
15.	*Amorphophallus campanulatus* Blume. ex. Decne.	Mancachu, ole	Alka, Flav, Sapo, Ster	Firdouse S. *et al.* (2011).
16.	*Anacardium occidentale* L.	Kaju badam, Cashew nut	Alka, Flav, Sapo, Ster	Bastos T M, *et al.* (2019).
17.	*Argemone mexicana* L.	Seal kanta, Satyanashi, Mexican poppy	Alka, Flav, Sapo, Triter	Hossain, Md Faruq, *et al.*(2012).
18.	*Azadirachta indica* A. Juss.	Nim, Nimbay	Alka, Flav, Sapo, Ster	Ramadass N, *et al.* (2018).
19.	*Barringtonia acutangula* (L.)Gaertn.	Hijal, Nichul, Indian oak	Alka, Flav, Sapo, Ster	Arumugam Kathirvel, *et al.* (2012).
20.	*Butea monosperma* (Lam.) Taub.	Palash, Dhak, Flame of the forest	Alka, Flav, Sapo, Ster	Padghan Santosh V. (2018).
21.	*Calophyllum inophyllum* L.	Kathchampa, Sultan champa, Indian laurel	Alka, Flav, Sapo, Ster	Umamagheswari K. (2017).
22.	*Calotropis procera* Aiton	Akanda	Alka, Flav, Sapo, Ster, Triter	Moustafa A M Y. *et al.* (2010).
23.	*Careya arborea* Roxb.	Kamber, Kumbi, Pilu	Alka, Flav, Sapo, Ster, Triter	Matte R. S. *et al.* (2015).
24.	*Carica papaya* (L.)	Penpe, Papaya, Papita	Alka, Flav, Sapo	Alorkpa Esther Jemima, *et al.* (2016).
25.	*Cascabela thevetia* (L.) H. Lippold	Kalke, Peeli kaner, Yellow oleander	Alka, Flav, Sapo	S Seetharaman *et al* (2017).
26.	*Cassia fistula* L.	Bandarlathi, Amaltash, Indian laburnum	Alka, Flav, Sapo, Ster	Bargah Rohit Kumar, *et al.* (2017).
27.	*Centella asiatica* L.(Urb.)	Thankuni, Brahma manduki, Spadeleaf	Flav, Sapo, Ster, Triter	Roy, Arpita, *et al.* (2018).
28.	*Cestrum nocturnum* L.	Hasnu hana, Rat ki rani, Night bloom jasmine	Alka, Flav, Sapo	Tyagi, Chandra, *et al.* (2017).
29.	*Chromolaena odorata* (L.)R.M. King &H. Rob.	Siam weed, devil weed	Alk, Flav, Sapo, Ster, Triter	Odutayo, Foluke Odunlami, *et al.*(2017).

30.	*Chrozophora rottleri* (Geiseler) A.Juss. ex Spreng.	Suryavarti	Alka, Flav, Sapo, Triter	Narmadaa, T., *et al.*(2012).
31.	*Cleistanthus collinus* (Roxb.) Benth.ex Hook.f.	Parasi, Garari	Alka, Flav, Sapo, Ster, Triter	Thamburaj, Suman, *et al.*(2013).
32.	*Clerodendrum infortunatum* L.	Ghentu, Bhant, Hill glory bower	Alka, Sapo, Ster, Triter	Hazarika, Animesh, *et al.* (2017).
33.	*Costus speciosus* (J. Koenig) Sm.	Kemuk, Kend	Alka, Flav, Sapo, Ster	Khayyat, Suzan, *et al.* (2017).
34.	*Crinum asiaticum* (L.)	Nagdal, Nagdan, Spiderlily, Ban lily	Alka, Flav, Sapo, Ster	Pittu, Vishnu, *et al.* (2018)
35.	*Crotalaria spp*	Shon, Ban sutra	Alka, Flav, Sapo	Soni Balram,. (2014).
36.	*Cuscuta reflexa* Roxb.	Swarnalata, Amar bel	Flav, Sapo, Ster, Triter	Gautam, Tapsya, *et al.* (2015).
37.	*Datura metel* L.	Dhutura	Flav, Sapo, Ster, Triter	Muthusamy Anitha, *et al.* (2014).
38.	*Dioscorea esculenta* (Lour.) Burkill	Kanta alu, Indiatic yam	Alka, Flav, Sapo, Ster	Salunke Chetana Anand, *et al.*(2018).
39.	*Diospyros melanoxylon* Roxb.	Kendu, Malabar ebony	Alka, Flav, Sapo, Ster	Janapati, Yasodha. (2012).
40.	*Entada scandens* (L.) Benth.	Gila, queensland bean	Alka, Flav, Sapo	Dey Sk. *et al.* (2013).
41.	*Erythrina suberosa* Roxb.	Palte madar/piri, Pangra	Alka, Flav, Sapo, Triter	Ahmed, Zubair, *et al.* (2020).
42.	*Euphorbia neriifolia* (L.)	Manasa sij, Patton ki send	Flav, Sapo, Triter	Swamy, Mallappa, *et al.* (2012).
43.	*Euphorbia tirucalli* L.	Lanka sij, Milk bush	Alka, Flav, Sapo, Ster	Sultan S, *et al.* (2016).
44.	*Euphorbia antiquorum* L.	Bajbaran, Tiktasij, Tridhara	Alka, Flav, Sapo,	Besagas, Ronnie, *et al.*(2018)
45.	*Euphorbia hirta* (L.)	Dudhilata/ bara dudhe, Barokarni, Asthema herb	Alka, Flav, Sapo, Ster, Triter	Asha S., *et al.* (2015).
46.	*Euphorbia pulcherrima* Willd. Ex Klotzsch	Lalpata	Alka, Flav, Sapo, Ster, Triter	Rauf Abdur, *et al.* (2013).
47.	*Gloriosa superba* L.	Ulat chandal/bishalanguli, Agnisikha,	Alka, , Flav, Sapo, Triter	Thirumal, Sivakumar, *et al.* (2019).
48.	*Grewia asiatica* L.	Phalsa	Flav, Sapo, Ster, Triter	Khanal Dharma Prasad, *et al.* (2016).
49.	*Guilandina bonduc* L.	Jangli bean, Kat karanj, Fever nut	Alka, Flav, Sapo, Ster	Mehra Bhavana, *et al.* (2015).
50.	*Haldinia cordifolia* (Roxb.) Ridsdale	Haldu, Kelkadam, Yellow teak	Alka, Flav, Sapo	Prakash Ved, et al. (2015).
51.	*Holarrhena pubescens* Wall. Ex G.Don	Kurchi/ Indra jab, Kutaja, Ivory tree	Alka, Flav, Ster, Triter	Saha Santanu, *et al.* (2019).
52.	*Holoptelea integrifolia* Planch.	Nata karaja, chilbil, badam tree, jungle corck tree,	Alka, Flav, Sapo, Ster, Triter	Kumar, Suman, *et al.* (2013).
53.	*Ipomoea carnea* Jacq.	Bara kalmi, Behaya	Alka, Flav, Sapo, Triter	Mascarenhas, M. E., *et al.* (2017).
54.	*Jatropha curcas* L.	Sada veranda, Bag veranda, Physic nut,	Alka, Flav, Sapo	Oyama, Mashanty, *et al.* (2016).
55.	*Jatropha gossypifolia* L.	Lal veranda, Ratanjoti, Cotton leaf	Alka, Flav, Sapo, Ster, Triter	Seth Ruchi *et al.*(2010), Saini Vijayta, *et al.* (2015).
56.	*Juglans regia* L.	Walnut	Alka, Flav, Sapo	Thakur NirmlaDevi, *et al.* (2011).
57.	*Justicia adhatoda* L.	Basak. Bakas	Alka, Sapo, Ster, Triter	Gupta Abhishek, *et al.* (2014).
58.	*Lantana camara* L.	Vut vairabi/sebani lata, Raimuniya, Lantana	Alka, Flav, Sapo, Ster	Raj, Sushma. (2017).
59.	*Lathyrus sativus* L.	Grass peaJangli matar,	Alka, Flav,	Al-Snafi, Ali. (2019).

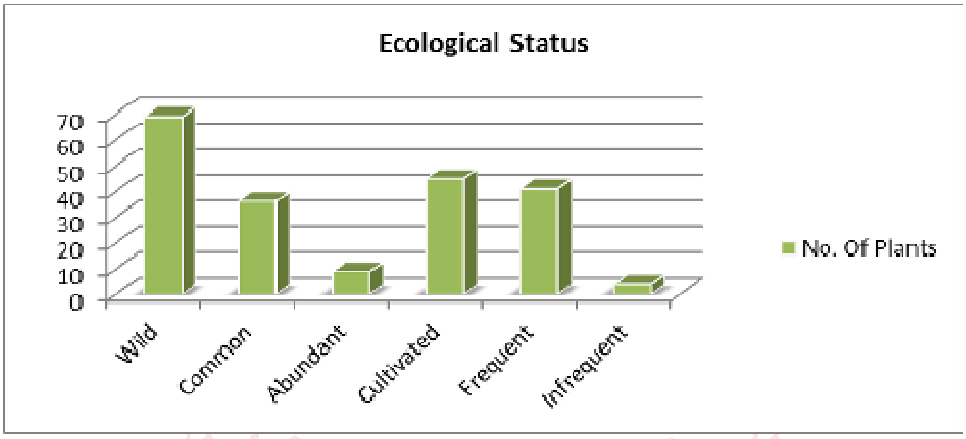
60.	*Ludwigia perennis* L. Ref	Ban labanga,	Alka, Flav, Ster	Giri R. S. *et al.* (2015).
61.	*Madhuca longifolia* (J.Konig) J.F. Macbr.	Mahul, Mahua, Mowra butter tree	Alka, Flav, Sapo, Ster, Triter	Annalakshmi, R. *et al.*(2012).
62.	*Martynia annua* L.	Bagh nakh, Hatha-jori, Snake's head	Alka, Flav, Sapo, Triter	Kalaichelvi, K *et al.* (2016).
63.	*Mimosa pudica* L.	Lajjabati, Chui mui, Touch me not	Alka, Flav, Rote	Mohan S.M, *et al.* (2015)
64.	*Moringa oleifera* Lam.	Sajne, Drum stick tree, Sohajna	Alka, Flav, Sapo, Ster, Triter	Gupta, Jaya. *et al.* (2014).
65.	*Nerium oleander* L	Karabi, Kaner, Sweet scented oleander	Alka, Flav, Sapo, Ster, Triter	Santhi, R. *et al.*(2011).
66.	*Olax scandens* Roxb.	Badru	Alka, Sapo, Triter	Naik, Raghavendra *et al.* (2014).
67.	*Persicaria orientalis* (L.) Spach	Panimarich, Bon kunhiar	Alka, Sapo	Ansari, Prawej *et al.*(2017)
68.	*Plumbago indica* L.	, Sadachita Chitrakmool, Fire plant	Alka, Flav, Sapo, Ster	Kaur Darshpreet. *et al.* (2016).
69.	*Plumeria rubra* L.	Kathgolap, Champa, Pagoda tree	Alka, Flav, Sapo, Ster, Triter	
70.	*Polygonum hydropiper* L.	Packurmul, Water pepper, Marshpepper	Flav, Sapo, Ster	Sharif, Shahjabeen. *et al.* (2014)
71.	*Pongamia pinnata* (L.) Pierre	Karanj, India beech tree	Alka, Flav, Sapo, Ster, Triter	Yadav, Rahul, *et al.* (2011), Dhandapani R. *et al.* (2008).
72.	*Pterocarpus marsupium* Roxb.	Piasal, Malabar kino, Indian kino tree.	Alka, Flav, Sapo, Triter	Subramanian, Ramya.*et al.* (2008).
73.	*Randia spinosa* (Poir.)	Maniphal, Kshudikarhar	Alka, Flav, Sapo	Sridhar V, *et al.* (2018).
74.	*Rauwolfia serpentina* (L.) Benth. Ex Kurz.	Sarpagandha, Chandra, Snake root	Alka, Flav, Sapo, Ster, Triter	Ramya Devi, K. A., *et al.* (2015).
75.	*Ricinus communis* L.	Rerhi, Eranda, Krapata, Castor oil plant	Alka, Flav, Sapo, Ster, Triter	More, Pushpalata *et al.* (2014).
76.	*Sapindus mukorossi* Gaertn.	Reetha, Indian soap berry,	Alka, Flav, Sapo, Ster	Bibi George *et al.* (2014).
77.	*Schleichera oleosa* (Lour.) Oken	Kusum, Ceylon oak	Alka, Flav, Sapo, Triter	Tiwari, Neha *et al.*(2017).
78.	*Semecarpus anacardium* L.f.	Bhela, Marking nut tree	Alka, Flav, Sapo, Ster, Triter	
79.	*Senna alata* (L.)Roxb.	Dadmari, Prapunnad	Alka, Flav, Sapo, Triter	Karthika, Ck. *et al.*(2016).
80.	*Senna sopheera* (L.) Roxb.	Kalkasunda	Flav, Sapo	Chavan Chetan, *et al.* (2011).
81.	*Shorea robusta* Gaertn.	Sal	Alka, Flav, Sapo, Ster, Triter	Marandi RR, *et al.* (2015).
82.	*Solanum nigrum* L.	Kakmachi, Mokoi, Black night shade	Alka, Flav, Sapo	Gogoi, Pronob. (2012).
83.	*Strychnos nux-vomica* L.	Kuchila, Snake wood	Alka, Flav, Ster	Patel, Dinesh, *et al.*(2012).
84.	*Tamarindus indica* L.	Tentul, Imli, Tamarind	Alka, Flav, Sapo	Gomathi A.C. *et al.* (2018).
85.	*Tephrosia purpurea* (L.) Pers.	Ban neel, Sarphanka, Wild indigo	Alka, Flav, Ster, Triter	Rayalu, Jayasimha. *et al.*(2013).
86.	*Terminalia arjuna* (Roxb.) Wight & Arn.	Arjun, Arjuna	Alka, Flav, Sapo, Ster, Triter	Mandal, Shreya *et al.* (2013).
87.	*Terminalia bellirica* (Gaertn.) Roxb.	Bahera, Belliric myrobalan	Alka, Flav, Sapo, Ster, Triter	Jalpa Ram, *et al.*(2015)
88.	*Tinospora cordifolia* (Willd.) Miers	Lata gulancha, guduchi, Giloy, Moon creeper	Alka, Flav, Sapo, Ster, Triter	Kaur, G. *et al.* (2016).
89.	*Tridax procumbens* L.	Tridaksha, Targanda, Coat-button	Alka, Flav, Sapo, Ster	Sawant, R. *et al.* (2013).
90.	*Yucca* sp. L.	Yucca	Alka, Flav, Sapo, Ster	Sobia, A. *et al.* (2013).

Alka: Alkaloid, Flav: Flavonoid, Sapo: Saponin, Ster: Steroid, Triter: Triterpenoid, Rote: Rotenone

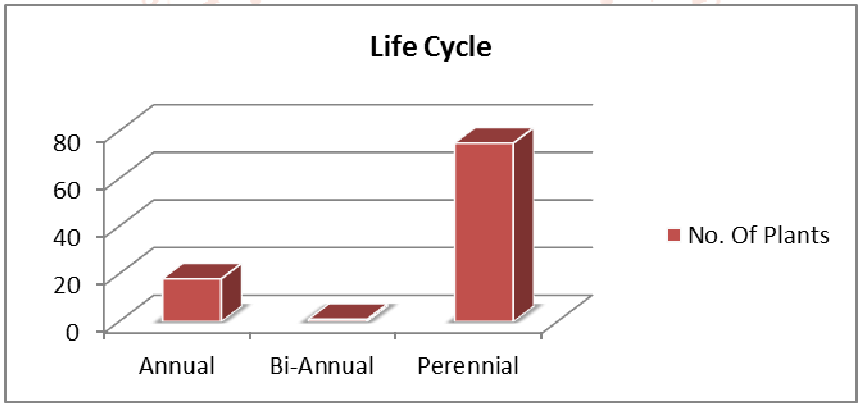
Graphical Representation:



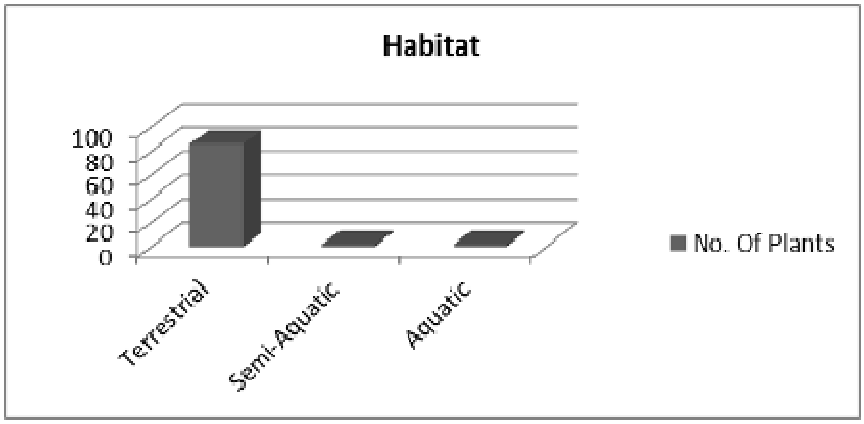
Graph 1: Graphical representation of no. of plants in families



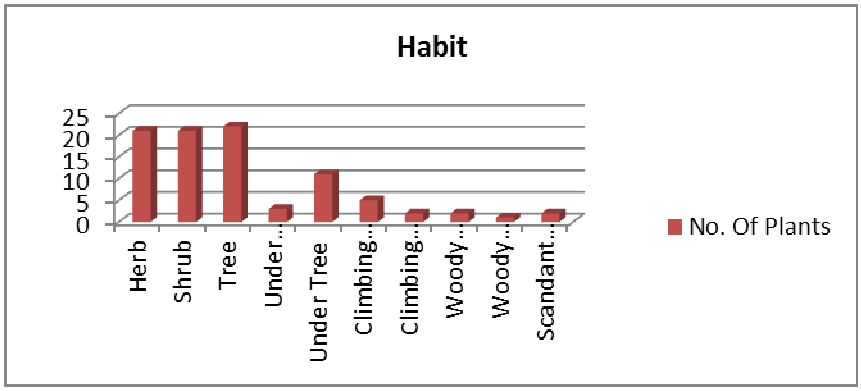
Graph 2: Graphical representation of Ecological Status



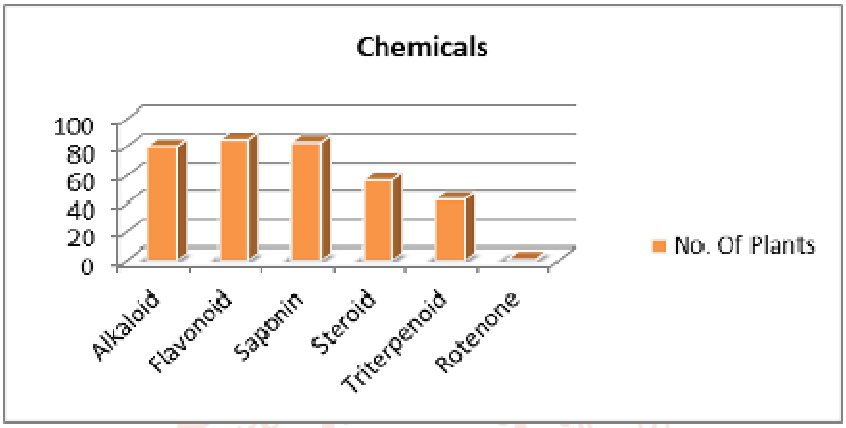
Graph 3: Graphical representation of Life cycle



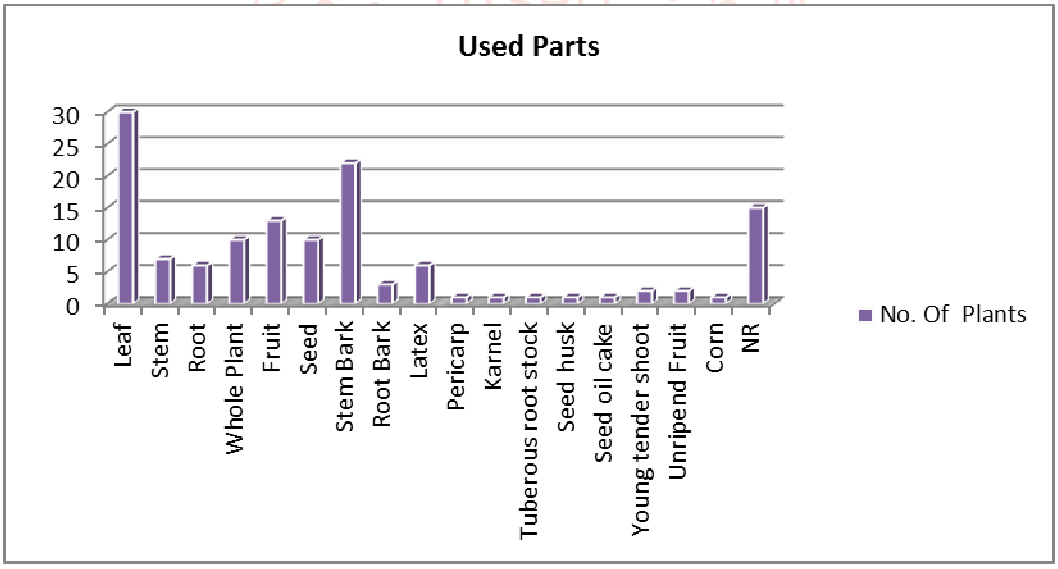
Graph 4: Graphical representation of habitat



Graph 5: Graphical representation of habitat



Graph 6: Graphical representation of Chemicals



Graph 7: Graphical representation of Used parts.

Discussions: From this survey 90 no of plant species belonging to 81 no of Genus and 46 no of families have been identified as piscicidal plants in Paschim Medinipur district. Most of the piscicidal plants are common, perennial, terrestrialand prefers to grow in wild condition represented graphically in Graph 2, 3, 4. In respect of family most of the plants are under Fabaceae followed by Euphorbiaceae and Asteraceae and has been represented in Graph-1. Among the prats used as piscicide leaves are in highest position represented in Graph 7. In respect of phytochemicals most of the plant contain saponin and flavonoid, represented in Graph 6. From grah-5 Herbs, Shrubs and Trees are in equal numbers which contain piscicidal chemical components. Again in respect of ecological status, most plants are common and found to grow in wild condition and some are locally threatened. So we should preserve these plants in their natural condition and become easily available to local fisherman as an alternative of harmful chemicals. It is important to note that, these piscicidal plants have more important medicinal values also. Thus the plants have potential use in medicines, agriculture and industry. After analysis, if any such compound is obtained could be commercially exploited in sustainable manner to improve the socioeconomic condition of the locals. The present study provides only preliminary report and leaves

room for further scientific and analytic research to evaluate the validity of the toxic as well as safe properties of these plants.

Conclusion: The present study aims to document the ethnobotanical knowledge of Santal and Lodha tribe of Paschim Medinipur district on fishing. These tribes have rich ethnobotanical knowledge of using plants in fishing. These plant/ plant products stupefied or killed fishes. Though it is a preliminary report, but extensive study is going on in our laboratory under the financial assistance of DSTBT, West Bengal. These studies will scientifically confirm the toxic property of these plants. As plant toxins have an impact on the wider aquatic environment, so precaution should be taken by using limited doses of plant products in a restricted area. This data regarding poisonous plants may be fruitful in developing an eco-friendly method to protect fishes from the aquaculture ponds without using any hazardous chemicals. Many more ethno-botanical piscicidal plants are yet to be reinvestigated with proper fish species and bioassay method in laboratory to verify their biocidal potential and poisonous phytochemicals. There is a huge scope for the researcher to study on piscicidal plants. Threats to biodiversity are a common feature in the last few decades. The above- mentioned plants are also not escape from various threats both anthropogenic and natural. Related government departments and NGOs should joined hand to give public awareness of the importance of diversified biodiversity, conservation of traditional indigenous knowledge on one hand and sustainable utilization of these bio-resources on other hand to improve the socio- economic condition of the locals.

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