RESULTS

The findings of the present work cover four major aspects, viz. Study of wetlands, Study of macrophytes and Resolution of remedial measures to restore wetlands and optimize their use. These aspects have been dealt with separately in the following.

4.1. STUDY OF WETLANDS

4.1.1. PREPARATION OF INVENTORY OF WETLANDS, THEIR CHARACTERIZATION AND CLASSIFICATION:

4.1.1.1. A brief resume of wetlands studied.

The wetlands covered in this work are as many as 38 (Table 23) which belong to 19 blocks (Table 24). An inventory of these wetlands with a brief description of each is presented in the following:

1. Adra Sahebbundh: Sahebbundh was constructed by the Sahebs (Lord) of South Eastern Railway in Adra during British administration in 1901-1902. Accordingly the wetland was named Sahebbundh. It is located at 86°70′E longitude and 23°48′N latitude. It covers about 11 acres of land. Rain water from adjoining villages like Mohanpura, Metyalsahar, Sarberiya, Kalikend, Doulatpur etc flow through a jore to the place on which the wetland was constructed. This perennial, Government owned wetland was constructed for the supply of water in Railway station, water shed, steam engines. The water of Darakeshwar River from Kapista (Kashipur) was linked with it in 1964-65 by pipe line to increase the water capacity of Sahebbundh (Plate 4).

Water supply office was constructed in Adra in 1973. There are two pump houses viz. upper pump house and lower pump house. Unfiltered water is supplied to different Railway quarters from upper pump house which are used for purpose other than drinking water. Lower pump house is situated below the Sahebbundh. Water of Sahebbundh enter lower pump house through pipe lines and the water is filtered by filter bed, filter pump, rapid gravity filter, slow set filter etc (Plate 32 & Plate 33). The filtered water is distributed to different rail offices and rail quarters of Adra as drinking water. This perennial wetland is also used for domestic purposes.

2. Angarkhuri: The wetland is situated at Chharra in the block of Puruliya II. Raghunathpur-Puruliya main road and Chharra high school are situated on the northern side of the wetland, Bouri Para of Chharra is located at its south and agricultural fields are located in the east and west of the wetland. It is a private and perennial wetland which is located at 86°47′E longitude and 23°21′N latitude. It occupies about 10 acres of land which is surrounded by villages like Chharra, Podra, Daxminbahal, Bundhgarh and Khannadi. A group of kaibartiya community
looks after the cultivation of fishes. This wetland is also used for domestic purposes and irrigation.

3. Babirbundh (Sabirbundh): Babirbundh is located at 86°75’E longitude and 23° 37’N latitude in Babiddi mouza in the Kashipur Block. The name of this wetland is based on Babri Devi who was the wife of the king who had created this wetland for the welfare of the local people. It is also familiar as Sabirbundh. It is a perennial and Government owned wetland which occupies about 18 acres of land. On the north bank of the wetland, there is a small temple dedicated to God Shiva with regular worship. The wetland has no way for removal of water and has no facility to cut the bank because Indrabil–Adra road stand on the north bank of the wetland. So, the wetland is also called akat bundh. There was a system that after bathing on the wetland and offering worship in a temple dedicated to Shiva the devotees pass over through a narrow way (Magraduara) located on the north bank of the wetland. This worship is still in vogue on every Sunday. This wetland is also used for pisciculture, irrigation and domestic purposes (Plate 6 & Plate 7).

There was a belief prevalent in tribal communities that if a maiden girl offers prayer in the temple dedicated to Shiva and passes over through the narrow way after bathing on the wetland, she would receive blessing of God and get married soon.

Babirbundh was established as a sacred bundh in the locality because, there was also a custom prevalent in tribal group that the abdomen of a new born child if dipped in the water of wetland immediately after cutting the umbilical cord, the baby is likely to be beautiful and healthy. Women from the localities of Chhatna, Jhantipahari, Sirjam, Kapista, Majramura, Sutaboy, Roytora, Sihika, Babiddi, Talajuri, Gourangadi etc come to this wetland for worship.

4. Barikbundh: Barik (Tantubay) is a self-owned, perennial wetland, located at 86°67’E longitude and 23°55’N latitude in Raghunathpur town near the forest office under the control of the local municipality. It covers about 4 acres of land. Drinking water is supplied in the entire township from this wetland by municipality in summer when other sources of drinking water dry up. The water of this wetland is beneficial as drinking water for containing some lime stone (ghusik pathar) in the bank and substratum of the wetland. The water is believed locally to promote digestion of food. The wetland also has prohibitions to bathing, washing of clothes, vehicles, cattle etc. There is some kind of dispute in matters of ownership between Bariks and municipality of Raghunathpur (Plate 27).

5. Benabundh: Benabundh is a seasonal wetland which covers about 3 acres of land. It is located at 86°37’E longitude and 23°27’N latitude at the centre of Manbazar in the block of Manbazar–I. The wetland is privately owned by Bijoy Dutta and Ganesh Dutta.
(via Khariduara) main road is located at the south-west side of the wetland and agricultural fields are located at the eastern and northern sides of the wetland. Manbazar, Patharmura, Barokuri and Salpara are the surrounding villages of the wetland. This wetland is used for domestic purposes and pisciculture.

6. Benagora: Benagora is a man-made seasonal, privately owned wetland which occupies about 3 acres of land. This wetland is situated at 86°49'E longitude and 23°50’N latitude at Sankra in the block of Para in Puruliya district. The surrounding villages of this seasonal wetland bear the names Sankra, Jabarra, Jhapra, loyara, Ranipur and Mahadebpur. This wetland is surrounded by agricultural land. This private wetland is used for domestic purposes, pisciculture and irrigation of the adjoining agricultural lands.

7. Burosayar: The wetland Burosayar, which occupies about 14 acres of land, is dedicated to Buroraj or lord Shiva. It is a perennial and privately owned wetland which is located at 86°68’E longitude and 23°56’N latitude. At present, it is under the control of Puja committee of Buroraj. Burosayar sustains itself with the money earned during the worship and prayer of Buroraj in the month of chaitrya (i.e. April-May). It is noteworthy that this wetland is sustained under the guidance of the people of Mangalda village. This wetland is also used for irrigation and domestic purposes.

8. Desh bundh: Desh bundh is located in Kharbar Mouza in the Santuri Block. It is situated at 86°85’E longitude and 23°51’N latitude and covers about 11 acres of land. Sristidhar Mandal was the single owner of the wetland who was a resident of Shaltora in the district of Bankura. He was a tax-collector (Tohsilder) of Nilmani Singha the Prince of Kashipur. He used to collect revenue from Hasdima, Tiyashi, Kharbar, Marbeda, and Kendthole and while doing so he informed the king to about the sufferings of people especially regarding water. The king constructed this wetland and handed over to Sristidhar Mandal as the remedial measure. This perennial wetland was further developed by the provision of Lothar Scheme in 1972-73. Extensive areas of four mouzas viz., Tiyashi, Kendthole, Kharbar and Ghoramurga are irrigated by canals from this wetland (Plate 18).

9. Dewan bundh: Dewan bundh lies in Siyada which is located beside Ahalya Road near Kalidaha jore. It occupies about 3 acres of land. This is a perennial and privately owned wetland located at 86° 75’E longitude and 23° 37’N latitude which is used only for irrigation purpose. This wetland is named after the ‘Dewan’ who was officially given the responsibility to look after the locality and this waterbody was dug in the agricultural field under his ownership.

10. Dhanarbundh: Dhanar bundh is situated at 86° 67’E longitude and 23° 55’N latitude in Akunja, a place near Raghunathpur town. The king of Akunja was called Gosai (Goswami). The
king created several wetlands in Akunja like Dhanarbundh, Namobundh, Ramsagar etc to enable the people to overcome the problems of water crisis. Presently the wetland is under the category of ‘vested land’ covering about 5 acres of land. The water of this perennial wetland is used for domestic purposes, cultivation of carp like fishes, and irrigation (Plate 17 & Plate 34).

11. Ganakbundh: It is a ‘L-shaped, man-made wetland which is located at 86°36’E longitude and 23°34’N latitude in Damda mouza near Tamna rail-gate in Puruliya I Block of the district of Puruliya. Joydeb Kundu is the single owner of the wetland which is about 7 acres in area. Puruliya Manbazar road lies in its west, Puruliya–Tata Railway track at its north, and agricultural land at south east. Agricultural lands in the vicinity are irrigated by the water of this perennial wetland. Some crops of winter like wheat, potato, onion, cucumber are also irrigated with water from the wetland. The wetland is given to the people of Bauri community of Damda and Durku for pisciculture and to others including Bauri, Sain, Sadder, Mahato, Muslim who live in Damda to utilize the wetland for domestic purposes (Plate 8 & Plate 9).

12. Gayerbundh: Nilmani Singha was the Prince of Kashipur who dug a pond in the area covering 15 areas in Tiyashi Mouza in the block of Santuri before the British rule. It is a perennial, privately owned wetland which is located at 86°85’E longitude and 23°51’N latitude. Main objective of digging this large pond was to promote irrigation in Tiyashi Mouza, overcome crisis of drinking water, and ensure pisciculture and domestic activities. Gayerbundh was dedicated to the Goddess Durga by the Prince of Kashipur and the villagers arrange Durga puja in Tiyashi. The people of a Tiyashi are the ‘sebaits’ (worshipper) of the puja committee who enjoy the present royalty of the wetland.

13. Gaylabundh: Gaylabundh is located at 86°65’E longitude and 23°30’N latitude beside Lalpur market in the block of Hura. It is a private perennial wetland which covers about 3 acres of land. At the South of the wetland, lies the Lalpur market and the remaining sides are covered by patches of crop fields. The villages connected with this wetland are Lalpur, Chakalta, Daldali and Katagora. Resident of Lalpur market utilized this perennial wetland for domestic purposes and pisciculture. About 15 acres of land is irrigated by the water of the wetland for production of winter crops.

14. Ghosalpukur: This private wetland, a property of Ghosal Community covers about 6 acres of land and is surrounded by cultivated lands and the Puncha market is located very close to it. It is located at 86°65’E longitude and 23°15’N latitude. Parui, Banga, Saragara, Barramesha are the associated villages of the wetland. This perennial wetland is poor in macrophytes and is used for domestic purposes and pisciculture.
15. Gobindasayar: Gobinda Sayar was established by the king Mukunda Narayan Deb in 1700, when there was a tradition in royal family to dig ponds and dedicate it to some a pond is established it is named after God and name it accordingly for the welfare of the people. So, Gobindasayar was associated with the Radha Gobindaji, a God worshipped in Manbazar. It occupies about 9 acres of land and is located at 86°37’E longitude and 23°27’N latitude. This wetland is a property of the God worshiped traditionally by the royal family (Plate 10 & Plate 11). ‘Sebayet’ have become the subsequent owner of this perennial wetland. This wetland is also used for domestic purposes.

16. Gorsaibundh / Namobundh: It is a perennial wetland which covers about 5 acres of land at 86°36’E longitude and 23°30’N latitude towards the end of Gorsai Village located beside Puruliya-Barabazar main road in the block of Barabazar of Puruliya District. It is a privately owned wetland which covers the villages like Barabazar, Gorsai, Ragma, Dumurdi and Shakari. At its north-west a canal is cut out which is used to promote irrigation especially during dry summer. This wetland is used for pisciculture, domestic purposes and irrigation.

17. Guniyara Barabundh: Muralidhar Garai, a land holder whose present residence is at Chirkunda, Dhanbad, Jharkhand, constructed Barabundh at Guniyara which is very large in area being about 11 acres. It is a privately owned wetland which is located at 86°71’E longitude and 23°58’N latitude. Main objective of this man-made perennial wetland was to ensure supply of water for drinking, bathing and other domestic purposes, irrigation and for supply of fishes in festivals etc.

18. Hanumatadam: Hanumatadam is located at 86°26’E longitude and 23°12’N latitude in the area in touch with Mudidi, Dumari, Khairadi, Tetlo, Amruhasa and Namsole mouza in the block of Balarampur. It is a Government owned wetland which covers about 200 acres of land. It is surrounded by cultivated and grass lands. People of several communities like Dhibar, Sardar, Mudi and Majhi utilize this natural wetland for pisciculture and fishing purposes. During winter, ‘Balihans’ (migratory bird) visit the place in large flocks. It is a perennial wetland which takes part in irrigation and domestic activities. Fields of winter crops and vegetables are irrigated by the water of this wetland.

19. Joypur Ranibundh: Chhutku Singha was the king of Joypur when this wetland was constructed. While the princess was going to her husband’s house, a calf, she found getting stuck up in muddy soil while attempting to get drinking water because, there was a lack of drinking water in the summer. Seeing this, the Princess ordered creation of the wetland which gradually became familiar as Ranibundh. Puruliya–Ranchi main road (Via Jhalda) is situated on the east bank of this perennial wetland. This privately owned wetland located at 86°32’E longitude and
23° 36’N latitude which covers about 120 acres of land. There are 3 concrete bathing places and 2 concrete bath-houses on east of the wetland.

On the south-east side, there is a fishery farm for rearing and breeding of carp during rainy season. There are 19 hatcheries and a large breeding chamber. Fishery department has also provided facility to the guard to watch Ranibundh. Fish cultivation and marketing is done by a Co-operative Society. The wetland is also used for cremation of deadbodies of the royal family, immersion of image of God and Goddess, domestic purposes, washing of vehicles etc.

20. Kalidaha jore: Kalidaha jore, located at 86º75’E longitude and 23º37’N latitude in Kalidaha in Kashipur Block, was constructed from Kankrijura jore which was situated between Lahat under the Anchal of Kalidaha and Metyalsahar under the anchal of Gourangadihi. It occupies about 9 acres of land. On both sides of the Kankrijura jore there were some low-lying cultivated lands and some low lands through which all rain water used to run-off. Villages like Lahat, Sija, Kalidaha, Siyada, Bhalurdihi, Kelahi, and Uluberia occur on the north of the wetland and Indrabil, Pathuriyagora, Babiddi, Indurbil, Talajuri, Jagannathdi on the south. To establish an interconnection of these villages through waterways the Government constructed this wetland in 1964-65 which became popular as Kalidaha jore. The wetland also has the facility for removing its redundant water during rainy season by revolving wheels which are connected by strong wires to three iron gates and a canal. It is a conserved wetland where hunting of migratory birds is completely prohibited. A hermitage was established by Satchidananda Bramhachari on a barren land surrounding the cultivated field beside the north bank of the wetland where a fair is organized every year for 3-4 days subsequent to Pous sankranti i.e. in the last day of the Poush, a month in the Bengali calendar. Water of this perennial wetland is used for domestic purposes, irrigation, fishing, washing of vehicles. A part of the wetland is directly used for cultivation of rabi crops during winter.

21. Kamalabundh: Kamalabundh is located at 86º06’E longitude and 23º19’N latitude in Baghmundi beside the royal palace near Ajodhya hill in the block of Baghmundi. It is a public owned wetland. The area of wetland is about 4 acres. Royal palace is situated in its west, Ajodhya hill at south-east and Ranibundh at the north. Kamalabundh is a very important perennial wetland among others like Sayerbundh, Nutanbundh, etc in Baghmundi and is used mainly for household purposes.

22. Ketankiyari Jore: Ketankiyari Jore, a perennial wetland located at 86º76’E longitude and 23º38’N latitude in Siyada-Ketankiyari area was constructed on a narrow jore (drain) with Ketankiyari village in the east and Siyada in the west. It is a Government owned wetland which is spread over 9 acres and used for irrigation, fishing and domestic purposes with its water.
23. Khagerbundh: This perennial wetland is situated at 86º65’E longitude and 23º15’N latitude at the centre of Puncha market in the district of Puruliya which contain a large rock on its one side. This is a privately owned waterbody occupies about 11 acres of land and is fed by water of springs. It is abundantly used in pisciculture and for domestic purposes.

24. Kumaridam: Kumaridam was formed in Ajodhya hill. The river which runs over Barabazar, Manbazar, Balarampur Block in Puruliya, then enters with the water of the river Kumari in Bankura district. It is a natural wetland fed by the river of Kumari. It is a perennial, 21 acres, Government owned wetland which is located at 86º29’E longitude and 23º16’N latitude. The familiar jainya documents are found on both sides of the river. It confluences with Kasai near Mukutmanipur Kangsabati water bodies. The principal tributaries of the river are Tatko, Nensai, Hanumata, Amruhasa, Chaka, Jam, Jamuna etc. This wetland is used to promote irrigation.

25. Lihirbundh: Lihirbundh is situated at 85º97’E longitude and 23º37’N latitude near the Municipality office of Jhalda. It covers about 6 acres of land. It is the most ancient wetland of Banerjee Community of Jhalda. Sasiprasad Jaisawal and Badriprasad Jaisawal took up the wetland from Banerjee community of Ilu in 1898. At present the wetland is fed by the sewage of Jhalda town. Nibaran Chandra Poddar and Swadhin Koyel became the subsequent private owners of this perennial wetland. The wetland is surrounded partially by some residences and by a factory on its north-east side. The wetland is used for domestic purposes, like cleaning of utensils, bathing and laundering. The water of the wetland is very much polluted and not consumable.

26. Mahatobundh: Mahatobundh is located at 86º36’E longitude and 23º32’N latitude in Pithati mouza near Kantadi library in the block of Arsha. At present the wetland is under joint ownership of Pravakar Mahato, Ajit Mahato, Ranjit Mahato, Sushil Mahato and Golok Mahato. The wetland was set up covering about 11 acres of land by Mahato Community of Korang. Accordingly it is called Mahato bundh. This perennial wetland is utilized for domestic purposes mainly by the student of Kantadi hostel, shop-keepers and resident of Kantadi. Some agricultural lands are irrigated by the water of this wetland near Kalbhat during summer and rainy seasons. This wetland is given on lease to Nabakishore Mahato, a resident of Ukhramura for pisciculture (Plate 24).

27. Maidhara: Maidhara is a man-made wetland situated at 86º37’E longitude and 23º27’N latitude in Patharmura of Manbazar I Block. It occupies about 5 acres of land. Kishori Sen and Nibaran Sen were original owners of this wetland. Subsequently three queens of Garpatharmura (Rajbala Debya, Menaka Sundari Debya and Charubala Debya) merged it with the
Saopukur (a pond) of Kishori Sen. This wetland was acquired by the Government when Manbazar Agricultural Seed Farm was established in 1962-63. This perennial wetland is used mainly for pisciculture.

28. Nutanbundh: The area of the wetland, located at 86°36’E longitude and 23°34’N latitude covers 6.57 acres and is connected with Sahebbundh/Nibaransayar. It is a perennial, privately owned wetland. It was dug in the memory of the prince Edward and commemorated as Edward memory Sayar and now named as Nutanbundh. The wetland is extensively utilized for pisciculture and domestic purposes (Plate 38). There is a concrete bathing place and several residences are located on the northern side. An stretch of waste low-land lies in the southern side. Tikiya para and Atakal para are located in its east and there is a concrete bathing place familiar as ‘Rajarghat’ at its west (Plate 25).

29. Pokabundh: It is a man made, privately owned perennial wetland, situated at 86°50’E longitude and 22°88’N latitude at the centre of Banduan in the block of Banduan. It covers about 4 acres of land. Chila and Mangla are the nearest villages of this wetland. Banduan-Kuilapal main road is situated at the south of the wetland. Several concrete residences are situated in the directions of north and east bank of the wetland. The wetland is encroached in the north-east by construction of human settlements. Main use of this wetland concerns domestic uses, pisciculture and washing of clothes by washermen.

30. Puranosayar: It is a perennial, privately owned wetland which occupies about 30 acres of land. It is located at 86°47’E longitude and 23°21’N latitude. The wetland contains two islands which are located in Chharra in Puruliya II Block. The wetland is visited during winter by ‘Balihans’, a kind of migratory bird. Men of Kaibartya community utilize this wetland for cultivation of fishes after getting permission from the owner of the wetland. The wetland is also used for domestic purposes and irrigation by the residents of Chharra.

31. Rajabundh: It is a perennial Government owned wetland which is located at 86°37’E longitude and 23°32’N latitude. Formerly it was known as ‘Madhabbundh. Deputy Commissioner George Bekar(Bekar Saheb) had given a grant of 10,000/- during Bengal famine from which Rs 6000/- was used in constructing a wetland of 21 acres. At that time there was no road from Ketika to Radhakrishna more. So, a bank of the wetland was constructed by using the remaining Rs 4000/- whose present name is Sashadhar Ganguly Road. In recognition of George Bekar the wetland received the name Bekarbundh or Rajabundh. Bekar bundh is utilized as a source of drinking water and for domestic purposes (Plate 39).
Two outlets of this wetland are connected with Rajabundh. There is input of drainage water from human habitations of Bhuyapara, Sindurpatri, Domepara, Chunabhatri, and Bundhkal. Skin diseases and malaria have gradually been spreading among the users of this wetland. Water hyacinth, Leech and worm float on the surface of water. Dwellers appeal from time to time to the authorities of Municipality of Puruliya, for remediation of Rajabundh. According to the Municipality authority remediation and restoration programmes for Nibaran Sayar, Nutanbundh and Bhatbundh of Puruliya are under consideration.

32. Rampur Barabundh: It is a perennial, privately owned wetland which is located at 86°76’E longitude and 23°38’N latitude. It covers about 27 acres of land. The name ‘Rampur’ has been derived from the name of Ram Mandal who has donated the land for this waterbody. The wetland is large in size than other wetlands in Rampur like Sayar, Gosaybundh, Nachna, Nutan bundh etc. This wetland at one time was the only source of drinking water in the entire village. The main utility of the wetland are as domestic uses and irrigation (Plate 12 & Plate 13).

33. Ranibundh: Ranibundh, a wetland of 6 acres was created by Madan Mohan Singhadeb, a prince of Baghmundi who dedicated the bundh to the honour of Rani or the queen and named it as ‘Ranibundh’. It is a perennial, privately owned wetland which is located at 86°06’E longitude and 23°19’N latitude. The objective of the wetland was to supply water for irrigation, pisciculture and domestic purposes (Plate 19). A concrete bathing place was constructed for users at its western part.

34. Ruknibundh: It is a perennial privately owned wetland which is located at 86°71’E longitude and 23°58’N latitude. Muralidhar Garai was a Zemindar who built a residence in Guniyara and felt the necessity of constructing a waterbody for drinking water, pisciculture, and irrigation and created it. It occupies about 5 acres of land. The Ruknibundh is presently used for bathing, pisciculture, supply of drinking water and irrigation.

35. Sahebbundh/Nibaransayar: Many waterbodies like Nutanbundh, Rajabundh, Bhatbundh were dug in Puruliya city for irrigation and supply of drinking water among which Sahebbundh is the most famous wetland. It is a perennial Government owned wetland which is located at 86°21’E longitude and 23°20’N latitude. There was a want of drinking water in Puruliya when the supreme portfolio of Manbhum district was transferred from Manbhum to Puruliya. So, a wetland of around 70 acres was dug by prisoners by the order of Deputy Commissioner Conl. Tikal Saheb during 1838-1843. Sahebbundh was named after Tikal Saheb. Subsequently, Sahebbundh was also named as Nibaransayar in accordance with the name of Nibaran Chandra Dasgupta, a freedom fighter and great patriot and India from Puruliya district. Sahebbundh covers a large area of the
Puruliya city. The Science Centre, a glory of the district, was established beside this wetland on the 15th day of December, 1982. Subhas Park was established on the west side of the wetland in 1975. Sahebbundh engulfs two islands located near Puruliya bus-stand. The islands and the wetland attract cuckoo, swallow, sling and different migratory birds.

Sahebbundh was designated as a ‘national wetland’ in February 2001 by Sri Deba Prasad Jana, the District Magistrate of Puruliya. Being a nature lover he did a lot for raising greenery around this perennial wetland, reducing eutrophication and removal of excess of water hyacinth and algal bloom from the wetland (Plate 28 & Plate 29).

36. Sankra Barabundh: This wetland is located at 86°49’E longitude and 23°50’N latitude at Sankra in the Para Block of Puruliya district. It is a perennial, privately owned wetland which occupies about 18 acres of land. It is situated about 3 Kilometers away from Jhapa bus stoppage. The wetland receives water of approaching springs. At winter Balihans (a migratory bird) visit the wetland in large groups. The wetland is exclusively utilized for domestic purposes, pisciculture and irrigation. About 1000 acres of land is irrigated by its water during summer and winter for growing crops and vegetables.

37. Sayerbundh: Sayerbundh is a man-made perennial wetland which covers about 7 acres of land. It is located at 86°39’E longitude and 23°24’N latitude towards the end of Khariduara village in the block of Manbazar II in the district of Puruliya. Khariduara, Kumari, Tilabani, Noida, and Chilka are the associated villages. Sayerbundh is surrounded by cultivated fields and grass lands. Mahato community of Khariduara (Bhaskar Chandra Mahato) happen to be the joint private owners of the wetland which is used for domestic purposes and pisciculture. In summer, about 20 acres of land is irrigated by the water of the wetland by using water pump or breaking the embankment.

38. Sindripathar: A large wetland was built near Karangberiya which is known as Karangberiya jore for ensuring availability of water throughout the year. In course of time, the wetland became popular as Sindripathar because there is a large red coloured rock like ‘sindur’ adnate to the wetland. This is a seasonal and Government owned, 14 acre- wetland which is located at 86°76’E longitude and 23°38’N latitude. There are some adibasi villages adjoining the wetland like Karangberiya, Uluberiya, Kelahi, Bhalurdihi etc. The water of the wetland are used for domestic purposes, irrigation, fishing, washing of motor vehicle etc. There is a burning ghat very close to this wetland.
4.1.1.2. Block wise distribution of wetlands studied:

The wetlands covered in this work are located in 19 out of 20 composing the district of Puruliya. A single wetland was selected from eight of the Blocks Arsha, Banduan, Barabazar, Hura, Jhalda II, Joypur, Raghunathpur II and Manbazar II (Table 24). Two wetlands were studied from each of eight Blocks, viz. Baghmundi, Balarampur, Neturiya, Para, Puncha, Santuri, Raghunathpur I and Puruliya II. From Manbazar I, Puruliya I and Kashipur Blocks respectively 3, 4 and 7 wetlands were studied (Fig. 2).

<table>
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<th>Sl.No</th>
<th>Name of the wetland</th>
<th>Mouza</th>
<th>Block</th>
<th>Latitude</th>
<th>Longitude</th>
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<td>Adra Sahebbundh</td>
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<td>86° 70’E</td>
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<td>Chharra</td>
<td>Puruliya II</td>
<td>23° 21’N</td>
<td>86° 47’E</td>
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<td>3.</td>
<td>Babirbundh (Sabir bundh)</td>
<td>Babiddi</td>
<td>Kashipur</td>
<td>23° 37’N</td>
<td>86° 75’E</td>
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<td>Barikhund</td>
<td>Raghunathpur</td>
<td>Raghunathpur I</td>
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<td>86° 67’E</td>
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<td>6.</td>
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<td>Kharbar</td>
<td>Santuri</td>
<td>23° 51’N</td>
<td>86° 85’E</td>
</tr>
<tr>
<td>9.</td>
<td>Dewanbundh</td>
<td>Kalidaha</td>
<td>Kashipur</td>
<td>23° 37’N</td>
<td>86° 75’E</td>
</tr>
<tr>
<td>10.</td>
<td>Dhanarbundh</td>
<td>Akunja</td>
<td>Raghunathpur</td>
<td>23° 55’N</td>
<td>86° 67’E</td>
</tr>
<tr>
<td>11.</td>
<td>Ganakbundh</td>
<td>Damda</td>
<td>Puruliya I</td>
<td>23° 34’N</td>
<td>86° 36’E</td>
</tr>
<tr>
<td>12.</td>
<td>Gayerbundh</td>
<td>Tiyashi</td>
<td>Santuri</td>
<td>23° 51’N</td>
<td>86° 85’E</td>
</tr>
<tr>
<td>13.</td>
<td>Gaylabundh</td>
<td>Lalpur</td>
<td>Hura</td>
<td>23° 30’N</td>
<td>86° 65’E</td>
</tr>
<tr>
<td>14.</td>
<td>Ghosal Pukur</td>
<td>Puncha</td>
<td>Puncha</td>
<td>23° 15’N</td>
<td>86° 65’E</td>
</tr>
<tr>
<td>15.</td>
<td>Gobinda Sayar</td>
<td>Patharmura</td>
<td>Manbazar I</td>
<td>23° 27’N</td>
<td>86° 37’E</td>
</tr>
<tr>
<td>16.</td>
<td>Gorsai bundh/ Namobundh</td>
<td>Barabazar</td>
<td>Barabazar</td>
<td>23° 30’N</td>
<td>86° 36’E</td>
</tr>
<tr>
<td>17.</td>
<td>Guniyara Bara bundh</td>
<td>Guniyara</td>
<td>Neturiya</td>
<td>23° 58’N</td>
<td>86° 71’E</td>
</tr>
<tr>
<td>18.</td>
<td>Hanumata dam</td>
<td>Mudidi</td>
<td>Dumarai, Khairadi</td>
<td>Balarampur</td>
<td>23° 12’N</td>
</tr>
<tr>
<td>20.</td>
<td>Kālidaha (jore)</td>
<td>Kālidaha</td>
<td>Kashipur</td>
<td>23° 37’N</td>
<td>86° 75’E</td>
</tr>
<tr>
<td>21.</td>
<td>Kamalabundh</td>
<td>Baghmundi</td>
<td>Baghmundi</td>
<td>23° 19’N</td>
<td>86° 06’E</td>
</tr>
<tr>
<td>22.</td>
<td>Ketankiyari (Jore)</td>
<td>Ketanki</td>
<td>Kashipur</td>
<td>23° 38’N</td>
<td>86° 76’E</td>
</tr>
<tr>
<td>23.</td>
<td>Khagerbundh</td>
<td>Puncha</td>
<td>Puncha</td>
<td>23° 15’N</td>
<td>86° 65’E</td>
</tr>
<tr>
<td>24.</td>
<td>Kumaridam</td>
<td>Baraurma, Dubrajpur, Panjanbera</td>
<td>Balarampur</td>
<td>23° 16’N</td>
<td>86° 29’E</td>
</tr>
<tr>
<td>25.</td>
<td>Lihirbundh</td>
<td>Jhalda</td>
<td>Jhalda I</td>
<td>23° 37’N</td>
<td>85° 97’E</td>
</tr>
<tr>
<td>26.</td>
<td>Mahatobundh</td>
<td>Kantadi, Pithati</td>
<td>Arsha</td>
<td>23° 32’N</td>
<td>86° 36’E</td>
</tr>
<tr>
<td>27.</td>
<td>Maidhara</td>
<td>Patharmura</td>
<td>Manbazar I</td>
<td>23° 27’N</td>
<td>86° 37’E</td>
</tr>
<tr>
<td>28.</td>
<td>Nutanbundh</td>
<td>Puruliya</td>
<td>Puruliya I</td>
<td>23° 34’N</td>
<td>86° 36’E</td>
</tr>
<tr>
<td>29.</td>
<td>Pokabundh</td>
<td>Banduan</td>
<td>Banduan</td>
<td>22° 88’N</td>
<td>86° 50’E</td>
</tr>
<tr>
<td>30.</td>
<td>Purano Sayar</td>
<td>Chharra</td>
<td>Puruliya II</td>
<td>23° 21’N</td>
<td>86° 47’E</td>
</tr>
</tbody>
</table>
### Table 23: An inventory of wetlands occurring in different blocks of Puruliya district, West Bengal.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the wetland</th>
<th>Mouza</th>
<th>Block</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.</td>
<td>Rajabundh</td>
<td>Puruliya</td>
<td>Puruliya I</td>
<td>23° 32'N</td>
<td>86° 37'E</td>
</tr>
<tr>
<td>32.</td>
<td>Rampur Barabundh</td>
<td>Rampur</td>
<td>Kashipur</td>
<td>23° 38'N</td>
<td>86° 76'E</td>
</tr>
<tr>
<td>33.</td>
<td>Ranibundh</td>
<td>Baghmundi</td>
<td>Baghmundi</td>
<td>23° 19'N</td>
<td>86° 06'E</td>
</tr>
<tr>
<td>34.</td>
<td>Ruknibundh</td>
<td>Guniyara</td>
<td>Neturiya</td>
<td>23° 58'N</td>
<td>86° 71'E</td>
</tr>
<tr>
<td>35.</td>
<td>Sahebbundh / Nibaran Sayar</td>
<td>Puruliya</td>
<td>Purulia I</td>
<td>23° 20'N</td>
<td>86° 21'E</td>
</tr>
<tr>
<td>36.</td>
<td>Sankra Barabundh</td>
<td>Sankra</td>
<td>Para</td>
<td>23° 50'N</td>
<td>86° 49'E</td>
</tr>
<tr>
<td>37.</td>
<td>Sayarbundh</td>
<td>Khariduara</td>
<td>Manbazar II</td>
<td>23° 24'N</td>
<td>86° 39'E</td>
</tr>
<tr>
<td>38.</td>
<td>Sindripathar</td>
<td>Karangberiya</td>
<td>Kashipur</td>
<td>23° 38'N</td>
<td>86° 76'E</td>
</tr>
</tbody>
</table>

### Table 24: Block wise distribution of wetlands in Puruliya District.

<table>
<thead>
<tr>
<th>Number of wetlands studied</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.Manbazar I</td>
<td>1.Puruliya I</td>
<td>1.Kashipur</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.2. GENERAL CHARACTERISTICS OF WETLANDS AND THEIR CLASSIFICATION:

The 38 wetlands entered in the inventory (Table 23) were further described in the context of nine parameters (Table 25). On the basis their general characteristics, the wetlands were further classified parameterwise, as given hereunder.

**i. Location:** Of the 38 wetlands studied 17 wetlands are located in urban areas, 17 wetlands in rural areas and all the rest (Burosayar, Kumaridam, Mahatobundh and Sayerbundh) are located in semi-urban areas of the district (Table 25).

**ii. Ownership pattern:** Only 9 wetlands viz. Adra Sahebbundh, Barikbundh, Hanumatadam, Kalidaha (Jore), Ketankiyari (Jore), Kumaridam, Rajabundh, Sahebbundh/Nibaransayar and Sindripathar are under Government ownership and only one wetland (Barikbundh) is a disputed wetland.
covering which there is conflict over use and only one wetland (Dhanarbundh) belongs to the vested category. All the remaining 27 wetlands are privately owned (Table 25).

**iii.Size:** Wetlands studied were variable in size. As many as seven size classes the size class of 3 to < 5 acres includes six wetlands while those with area between 5-10 acres are 14 in number. The wetland areas ranging between 11-15 acres, 16-20 acres, 21-25 acres, 26-30 acres include nine, two, two, and two wetlands respectively. Only one wetland (Sahebbundh/Nibaransayar) 65-70 acres and two wetlands (Hanumata dam and Joypur Ranibundh) spread over 100 acres. The total area covered by the 38 wetlands studied is 354.57 acres and the average area of each wetland is about 19.857 acres (Table 25).

**iv.Water regime:** All wetlands excepting three viz. Benabundh, Benagora and Sindripathar, are perennial so far water regime is concerned (Table 25).

**v.Origin:** Only five wetlands were seen to be of natural origin (Hanumatadam, Kalidaha (Jore), Ketankiyari (Jore), Kumaridam and Sindripathar) and all the rest were man-made (Table 25).

**vi.Source of water:** Only five wetlands are linked with river (Hanumatadam, Kalidaha (Jore), Ketankiyari (Jore), Kumaridam and Sindripathar), all the rest being rain fed (Table 25).

**vii.Use pattern:** Only three wetlands, viz. Deshbundh, Dewanbundh and Kumaridam are used exclusively for irrigation purposes and 31 wetlands have no specific use or in other words they have various types of use including pisciculture, four wetlands viz. Kamalabundh, Sahebbundh/Nibaransayar, Babirbundh/Sabirbundh and Barikbundh are used mainly to meet domestic needs, to get aesthetic pleasure, sacred wetland and drinking water respectively (Table 25). In spite of constraints almost all the wetlands are used to grow fishes. In as many as 20 out of 38 wetlands presently pisciculture is very poorly practiced so that the yield per annum hardly exceeds 25 quintals. 12 wetlands at present produce more than 25 quintals but less than 100 quintals per annum. Each of these wetlands, viz. Adra Sahebbundh, Babirbundh and Puranosayar have annual production ranging from 100 to 200 quintals and finally each of the three wetlands, viz. Hanumata dam, Joypur Ranibundh and Sahebbundh has an annual production exceeding 200 quintals but usually within 400 quintals.

**viii.Source of pollution:** Agricultural run-off is the main source of pollution in case of fourteen wetlands. In nineteen wetlands domestic use and domestic sewage are the main sources of pollution. Urban sewage is the main source of pollution for five wetlands (Table 25). Other problems associated with wetlands Shrinkage of wetland mainly due to encroachment for human settlement is a major in case of such wetlands as Angarkhuri, Barikbundh, Lihirbundh, Nutanbundh, Pokabundh and Rajabundh (Plate 39).
Construction of roads depleted as many as 16 out of 38 wetlands e.g. Babirbundh, Barikbundh, Dewanbundh, Sindripather (Table 26).

Siltation has been causing great problem in such wetlands as Babirbundh, Burosayar, Dewanbundh, Dhanarbundh, Ganakbundh, Gayalabundh, Gorsaibundh, Guniyara Barabundh and Joypur Ranibundh. Conflict over use, has been posing threat to sustainability of the wetland familiar as Barikbundh.

Conversion to agricultural fields has been the major problem in 10 wetlands(Angarkhuri, Babirbundh, Dhanabundh (Plate 17), Gosaibundh, Guniyara Barabundh, Joypur Ranibundh, Kaildaha, Ketankiyari (Plate 36), Sankra Barabundh and Sindripather). Furthermore four wetlands are seasonally used in cultivation of vegetables, viz. Joypur Ranibundh, Kaildaha(Jore), Ketankiyari(Jore) and Sindripather.

ix. Biodiversity Status: Plant diversity: Plant diversity is rich in six wetlands, viz. Adra Sahebbundh, Burosayar, Joypur Ranibundh, Kalidaha(Jore), Rampur Barabundh, Sahebbundh and moderate in twenty five wetlands. In seven wetlands plant diversity is relatively poor (Table 25).

Animal diversity: Animal diversity is rich in nine and moderate in twenty two wetlands. Seven wetlands have association with relatively poor animal diversity (Table 25).

x. Successional characteristics: On the basis of successional characteristics, the study wetlands can be put into four categories, a brief account of each of which is presented in the following:

a). Waterbodies rich in rooted submerged hydrophytes like Hydrilla verticillata, Potamogeton crispus, P. nodosus, Ottelia alismoides, Vallisneria spiralis, Utricularia aurea, U. australis, U. stellaris, Ceratophyllum demersum, C. muricatum etc which grow at various depths. To this category belong such wetlands as Dewanbundh, Guniyara Barabundh, Adra Sahebbundh, Angarkhuri, Gorsaibundh, Kalidaha(Jore), Rampur Barabundh, Sahebbundh, Sayarbundh, Babirbundh, Burosayar, Dhanarbundh etc.

b). Waterbodies dominated by plant species rooted in the mud with their leaves reaching water surface to float e.g. Nelumbo nucifera, Nymphaea pubescens, Monochoria hastata, M. vaginalis, Trapa natans var bispinosa etc and by free floating plants that are not fixed in the mud e.g. Spirodela intermedia, Salvinia natans etc e.g. Nutanbundh, Sankra Barabundh, Babirbundh, Ganakbundh, Rajabundh, Ketankiyari(Jore), e.g. Kumari Dam, Sahebbundh, Barikbundh, Joypur Ranibundh, Ruknibundh etc.

c). Waterbodies in reed-swamp stage with plants that are amphibious being mostly rooted with most parts of their shoots remaining exposed e.g. Typha domingensis, Sagittaria
**Survey of Wetlands in Puruliya District**

_sagittifolia, S.guyanensis, Schoenoplectus articulatus, S.grossus, Polygonum hydropiper, P.orientale, P.pulchrum_ etc. These plants tend to retain sedimentary material washed into the waterbody and rapidly accumulating plant remains. These plant populations are much denser. To this category belong such wetlands as Adra Sahebbundh, Dewanbundh, and Kalidaha (Jore), Joypur Ranibundh, Rampur Barabundh, Barikbundh, Gorsaibundh, Hanumata Dam, Kumari Dam, Sindripathar etc.

d). Wetlands in sedge-meadow stage which represent a condition of poorly hydric swamps that are marching towards a meadow of grasses (_Leersia hexandra_, _Echinochloa crassgalli_) and sedge (Sp of _Cyperus_). Adra Sahebbundh, Dewanbundh, Kalidaha (Jore), Joypur Ranibundh, Rampur Barabundh, Barikbundh, Gorsaibundh, Hanumata Dam, Kumari Dam, Sindripathar etc. belong to this category.

Table 25: General characteristics of wetlands in Puruliya District, West Bengal.

<table>
<thead>
<tr>
<th>Name of the Wetlands</th>
<th>Blocks</th>
<th>Parameters</th>
<th>L</th>
<th>Op</th>
<th>Size (acres)</th>
<th>Wr</th>
<th>o</th>
<th>Sw</th>
<th>up</th>
<th>pmf</th>
<th>Pd</th>
<th>ad</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Angarkhuri</td>
<td>Puruliya II</td>
<td>RI P.W.</td>
<td>10</td>
<td>P.</td>
<td>Mm</td>
<td>R.W</td>
<td>N.S.</td>
<td>A.F</td>
<td>P.M</td>
<td>A.Mo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Babirbundh (Sabir bundh)</td>
<td>Kashipur</td>
<td>RI G.W.</td>
<td>18</td>
<td>P.</td>
<td>Mm</td>
<td>R.W</td>
<td>S.W.</td>
<td>A.F</td>
<td>P.M</td>
<td>A.Ri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Benabundh</td>
<td>Manbazar I</td>
<td>Ul P.W.</td>
<td>3</td>
<td>S</td>
<td>Mm</td>
<td>R.W</td>
<td>N.S.</td>
<td>A.F</td>
<td>P.P</td>
<td>A.Po</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Benagora</td>
<td>Para</td>
<td>RI P.W.</td>
<td>3</td>
<td>S</td>
<td>Mm</td>
<td>R.W</td>
<td>N.S.</td>
<td>A.F</td>
<td>P.M</td>
<td>A.Mo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Deshbundh</td>
<td>Santuri</td>
<td>RI P.W.</td>
<td>11</td>
<td>P.</td>
<td>Mm</td>
<td>R.W</td>
<td>I.</td>
<td>A.F</td>
<td>P.P</td>
<td>A.Mo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Dhanarubundh</td>
<td>Raghunathpur II</td>
<td>Ul V.W.</td>
<td>5</td>
<td>P.</td>
<td>Mm</td>
<td>R.W</td>
<td>N.S.</td>
<td>A.F</td>
<td>P.M</td>
<td>A.Mo</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[119] Results
### Table 25: General characteristics of wetlands in Puruliya District, West Bengal.

<table>
<thead>
<tr>
<th>Name of the Wetlands</th>
<th>Blocks</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>Op</td>
</tr>
<tr>
<td>16. Gorsaibundh / Namobundh</td>
<td>Barabazar Ul P.W</td>
<td>5</td>
</tr>
<tr>
<td>17. Guniyara Barabundh</td>
<td>Neturiya RI P.W</td>
<td>11</td>
</tr>
</tbody>
</table>

**Legend of abbreviations used**

- L = location
- Op = ownership pattern
- Wr = water regime
- o = origin
- Sp = source of pollution
- up = use pattern
- pmf = pollution mainly from
- Pd = plant diversity
- ad = animal diversity

### Table 25: General characteristics of wetlands in Puruliya District, West Bengal (Contd).

<table>
<thead>
<tr>
<th>Name of the Wetlands</th>
<th>Blocks</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>Op</td>
</tr>
<tr>
<td>20. Kalidaha (Jore)</td>
<td>Kashipur RI G.W</td>
<td>9</td>
</tr>
<tr>
<td>24. Kumaridam</td>
<td>Balarampur Ul G.W</td>
<td>21</td>
</tr>
<tr>
<td>25. Lihirbundh</td>
<td>Jhalda I Ul P.W</td>
<td>6</td>
</tr>
<tr>
<td>29. Pokabundh</td>
<td>Banduan Ul P.W</td>
<td>4</td>
</tr>
<tr>
<td>30. Purano Sayar</td>
<td>Puruliya II RI P.W</td>
<td>30</td>
</tr>
<tr>
<td>31. Rajabundh</td>
<td>Puruliya I Ul G.W</td>
<td>21</td>
</tr>
<tr>
<td>32. Rampur</td>
<td>Kashipur RI P.W</td>
<td>27</td>
</tr>
</tbody>
</table>
### Table 25: General characteristics of wetlands in Puruliya District, West Bengal (Contd).

<table>
<thead>
<tr>
<th>Name of the Wetlands</th>
<th>Blocks</th>
<th>L.</th>
<th>Op</th>
<th>size (acres)</th>
<th>Parameters</th>
<th>Wr</th>
<th>o</th>
<th>Sw</th>
<th>up</th>
<th>pmf</th>
<th>Pd</th>
<th>Ad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barabundh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.Ruknibundh</td>
<td>Neturiya</td>
<td>RL</td>
<td>P.W</td>
<td>5</td>
<td>P.</td>
<td>Mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R.W.</td>
<td>N.S.</td>
</tr>
<tr>
<td>35.Sahebbundh/ Nibaran Sayar</td>
<td>Puruliya</td>
<td>Ul</td>
<td>G.W</td>
<td>70</td>
<td>P.</td>
<td>Mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R.W.</td>
<td>A.U</td>
</tr>
<tr>
<td>37.Sayarbundh</td>
<td>Manbazar II</td>
<td>Sul</td>
<td>P.W</td>
<td>7</td>
<td>P.</td>
<td>Mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R.W.</td>
<td>N.S.</td>
</tr>
<tr>
<td>38.Sindripathar</td>
<td>Kashipur</td>
<td>RL</td>
<td>G.W</td>
<td>14</td>
<td>S.</td>
<td>N.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R.Wa.</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

**Legend of abbreviations used**

l=location; op=ownership pattern; wr=water regime; o=origin; sp=source of pollution; up=use pattern; pmf=pollution mainly from; pd=plant diversity; ad=animal diversity.

Table 26: Response of wetlands to 2state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1 Location in rural setting</td>
<td>0</td>
</tr>
<tr>
<td>2 Ownership under Government</td>
<td>1</td>
</tr>
<tr>
<td>3 Wetland of natural origin</td>
<td>0</td>
</tr>
<tr>
<td>4 Area within 10 acres</td>
<td>0</td>
</tr>
<tr>
<td>5 Wetlands perennial</td>
<td>1</td>
</tr>
<tr>
<td>6 River as the main water source</td>
<td>0</td>
</tr>
<tr>
<td>7 Rain water as the only water source</td>
<td>1</td>
</tr>
<tr>
<td>8 Agricultural fields present in the vicinity</td>
<td>0</td>
</tr>
<tr>
<td>9 Forest present in the vicinity</td>
<td>1</td>
</tr>
<tr>
<td>10 Wetland used exclusively for pisciculture</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 26: Response of wetlands to 2-state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 Wetland used exclusively for domestic purposes</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>12 Wetland used exclusively in irrigation</td>
<td>0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>13 Household water supply from wetland</td>
<td>1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>14 Wetland used seasonally for cultivation</td>
<td>0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 1 1</td>
</tr>
<tr>
<td>15 Wetland used for aesthetic pleasure and recreation</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>16 Wetland with multiple uses</td>
<td>1 1 0 0 1 1 1 0 0 1 1 1 1 1 1 1 1 1 1 1</td>
</tr>
<tr>
<td>17 Wetland treated as sacred</td>
<td>0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>18 Cremation of deadbodies</td>
<td>0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1</td>
</tr>
<tr>
<td>19 Conflict over wetland</td>
<td>0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

Results
Table 26: Response of wetlands to 2state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
</tr>
<tr>
<td>use</td>
<td></td>
</tr>
<tr>
<td>20 Problem of shrinkage from encroachment</td>
<td>0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>21 Problem of shrinkage conversion into crop</td>
<td>0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 1</td>
</tr>
<tr>
<td>fields</td>
<td></td>
</tr>
<tr>
<td>22 Problem of shrinkage from road construction</td>
<td>0 0 1 1 0 0 0 0 1 0 1 1 0 1 1 0 1 1 1 0 1 0 1 1</td>
</tr>
<tr>
<td>23 Problem from siltation</td>
<td>0 0 1 0 0 0 1 0 1 1 1 1 1 0 0 0 1 1 1 0 1 0 1 0</td>
</tr>
<tr>
<td>24 Influx of agricultural run-off</td>
<td>0 1 1 0 1 1 0 1 1 1 1 1 0 0 0 0 0 0 1 0 1 0 1</td>
</tr>
<tr>
<td>25 Input of domestic sewage</td>
<td>1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 1 1 1 1 0 1 0</td>
</tr>
<tr>
<td>26 Problem from Eutrophication</td>
<td>0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>27 Richness of plant diversity</td>
<td>1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1</td>
</tr>
<tr>
<td>28 Macrophytic algae</td>
<td>1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

Results
Table 26: Response of wetlands to state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>29 Richness of animal diversity</td>
<td>1</td>
</tr>
<tr>
<td>30 Biodiversity depletion from pisciculture</td>
<td>1</td>
</tr>
<tr>
<td>31 Financial support received from Government</td>
<td>1</td>
</tr>
<tr>
<td>32 Garden around wetland</td>
<td>1</td>
</tr>
<tr>
<td>33 Involvement of Fishery department</td>
<td>0</td>
</tr>
<tr>
<td>34 Facility of watch-man</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 26: Response of wetlands to 2state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21</td>
</tr>
<tr>
<td>1 Location in rural setting</td>
<td>1</td>
</tr>
<tr>
<td>2 Ownership under Government</td>
<td>0</td>
</tr>
<tr>
<td>3 Wetland of natural origin</td>
<td>0</td>
</tr>
<tr>
<td>4 Area within 10 acres</td>
<td>1</td>
</tr>
<tr>
<td>5 Wetlands perennial</td>
<td>1</td>
</tr>
<tr>
<td>6 River as the main water Source</td>
<td>0</td>
</tr>
<tr>
<td>7 Rain water as the only water source</td>
<td>1</td>
</tr>
<tr>
<td>8 Agricultural fields present in the vicinity</td>
<td>0</td>
</tr>
<tr>
<td>9 Forest present in the vicinity</td>
<td>1</td>
</tr>
<tr>
<td>10 Wetland used exclusively</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 26: Response of wetlands to 2state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21</td>
</tr>
<tr>
<td>for pisciculture</td>
<td></td>
</tr>
<tr>
<td>11 Wetland used exclusively for domestic purposes</td>
<td>1</td>
</tr>
<tr>
<td>12 Wetland used exclusively in irrigation</td>
<td>0</td>
</tr>
<tr>
<td>13 Household water supply from wetland</td>
<td>0</td>
</tr>
<tr>
<td>14 Wetland used seasonally for cultivation</td>
<td>0</td>
</tr>
<tr>
<td>15 Wetland used for aesthetic pleasure and recreation</td>
<td>0</td>
</tr>
<tr>
<td>16 Wetland with multiple uses</td>
<td>0</td>
</tr>
<tr>
<td>17 Wetland treated as sacred</td>
<td>0</td>
</tr>
<tr>
<td>18 Cremation of deadbodies</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 26: Response of wetlands to 2state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21</td>
</tr>
<tr>
<td>19 Conflict over wetland use</td>
<td>0</td>
</tr>
<tr>
<td>20 Problem of shrinkage from encroachment</td>
<td>0</td>
</tr>
<tr>
<td>21 Problem of shrinkage from conversion into crop fields</td>
<td>0</td>
</tr>
<tr>
<td>22 Problem of shrinkage from road construction</td>
<td>0</td>
</tr>
<tr>
<td>23 Problem from siltation</td>
<td>0</td>
</tr>
<tr>
<td>24 Influx of agricultural run-off</td>
<td>0</td>
</tr>
<tr>
<td>25 Input of domestic sewage</td>
<td>1</td>
</tr>
<tr>
<td>26 Problem from Eutrophication</td>
<td>0</td>
</tr>
<tr>
<td>27 Richness of plant diversity</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 26: Response of wetlands to 2-state unit characters. (Contd.)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Serial number of Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21</td>
</tr>
<tr>
<td>28 Macrophytic algae</td>
<td>0</td>
</tr>
<tr>
<td>29 Richness of animal diversity</td>
<td>0</td>
</tr>
<tr>
<td>30 Biodiversity depletion from pisciculture</td>
<td>0</td>
</tr>
<tr>
<td>31 Financial support received from Government</td>
<td>0</td>
</tr>
<tr>
<td>32 Garden around wetland</td>
<td>0</td>
</tr>
<tr>
<td>33 Involvement of Fishery department</td>
<td>0</td>
</tr>
<tr>
<td>34 Facility of watch-man</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 27: An account of the macrophytes characteristic of different wetlands under study

<table>
<thead>
<tr>
<th>Name of the wetland</th>
<th>Nearest village/town</th>
<th>Blocks</th>
<th>Name of the species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adra Sahebbundh</td>
<td>Manpura</td>
<td>Kashipur</td>
<td><em>Aponogeton appendiculatus,</em> <em>Aponogeton natans,</em> <em>Merremia gangetica,</em> <em>Centella asiatica,</em> <em>Heliotropium strigosum.</em></td>
</tr>
<tr>
<td>2. Angarkhuri</td>
<td>Chharra</td>
<td>Puruliya-II</td>
<td><em>Ammania baccifera,</em> <em>Croton onplandianum.</em></td>
</tr>
<tr>
<td>3. Babirbundh/Sabirbundh</td>
<td>Babiddi</td>
<td>Kashipur</td>
<td><em>Ceratophyllum demersum,</em> <em>Sagittaria sagittifolia,</em> <em>Limnophila repens,</em></td>
</tr>
<tr>
<td>6. Benagora</td>
<td>Sankra</td>
<td>Para</td>
<td><em>Vallisneria spiralis.</em></td>
</tr>
<tr>
<td>8. Deshanbundh</td>
<td>Kharbar</td>
<td>Santuri</td>
<td><em>Nymphaea pubescens.</em></td>
</tr>
<tr>
<td>9. Dewanbundh</td>
<td>Kalidaha</td>
<td>Kashipur</td>
<td><em>Drosera burmanni,</em> <em>Drosera indica,</em> <em>Cyperus iria,</em> <em>Cyperus haspan ssp. haspan,</em> <em>Utricularia bifida.</em></td>
</tr>
<tr>
<td>10. Dhanarbundh</td>
<td>Akunja</td>
<td>Raghunathpur-I</td>
<td><em>Nymphoides hydrophylla,</em> <em>Utricularia aurea,</em> <em>Limnophila heterophyla.</em></td>
</tr>
<tr>
<td>14. Ghoshal Pukur</td>
<td>Puncha</td>
<td>Puncha</td>
<td><em>Croton bonplandianum</em></td>
</tr>
</tbody>
</table>
Table 27: An account of the macrophytes characteristic of different wetlands under study

<table>
<thead>
<tr>
<th>Name of the wetland</th>
<th>Nearest village/town</th>
<th>Blocks</th>
<th>Name of the species</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. Khager bundh</td>
<td>Puncha</td>
<td>Puncha</td>
<td>Croton bonplandianum</td>
</tr>
<tr>
<td>24. Kumari Dam</td>
<td>Baraurma,Dubrajpur, Panjanbera</td>
<td>Balarampur</td>
<td>Verbascum chinense,Cyperus difformis.</td>
</tr>
<tr>
<td>26. Mahatobundh</td>
<td>Kantadi,Pithati</td>
<td>Arsha</td>
<td>Nymphaea pubescens,Nymphoides hydrophylla,Hydrilla verticillata</td>
</tr>
<tr>
<td>27. Maidhara</td>
<td>Patharmura</td>
<td>Manbazar-I</td>
<td>Lindernia parviflora,Nymphaea pubescens, Nymphoides hydrophylla,Hydrilla verticillata</td>
</tr>
<tr>
<td>29. Pokabundh</td>
<td>Banduan</td>
<td>Banduan</td>
<td>Eichhornia crassipes,Colocasia esculenta</td>
</tr>
<tr>
<td>30. Puranoseayar</td>
<td>Chharra</td>
<td>Puruliya II</td>
<td>Nymphaea pubescens,Croton bonplandianum</td>
</tr>
<tr>
<td>31. Rajabundh</td>
<td>Puruliya</td>
<td>Puruliya I</td>
<td>Eichhornia crassipes,Paspalum conjugatum</td>
</tr>
<tr>
<td>32. Rampur Barabundh</td>
<td>Rampur</td>
<td>Kashipur</td>
<td>Ottelia alismoides,Eleocharis atropurpurea, Ammannia baccifera, Utricularia stellaris</td>
</tr>
<tr>
<td>33. Ranibundh</td>
<td>Baghmundi</td>
<td>Baghmundi</td>
<td>Cynodon dactylon</td>
</tr>
<tr>
<td>34. Ruknibundh</td>
<td>Guniyara</td>
<td>Neturiya</td>
<td>Ludwigia adscendens,Trapa natans var. Bispinosa</td>
</tr>
<tr>
<td>35. Sahebbundh/Nibaranaysar</td>
<td>Puruliya</td>
<td>Puruliya I</td>
<td>Turnera ulmifolia,Leersia hexandra, Spirodela intermedia</td>
</tr>
<tr>
<td>36. Sankra Barabundh</td>
<td>Sankra</td>
<td>Para</td>
<td>Oldenlandia brachypoda, Nymphoides hydrophylla</td>
</tr>
<tr>
<td>37. Sayarbundh</td>
<td>Khariduara</td>
<td>Manbazar II</td>
<td>Limnophila heterophylla,Nymphoides hydrophylla</td>
</tr>
<tr>
<td>38. Sindripathar</td>
<td>Karangberiya</td>
<td>Kashipur</td>
<td>Desmodium gangeticum,Typha domingensis</td>
</tr>
</tbody>
</table>
4.1.3. CLASSIFICATION BASED ON THE CONCEPT OF NUMERICAL TAXONOMY:

The principle of numerical taxonomy as given by Sokal and Sneath (1963) and Sneath and Sokal (1973) was applied for classification of the 38 wetlands of Puruliya district studied using their 34 two-state characters (Table 20) and as many as 38 initial single-point clusters each with a single wetland (Fig. 4) could be obtained at at linkage distance ‘0’ (Zero). These initial clusters could be progressively grouped step by step with increase in linkage distance into larger (in content) but lesser number of clusters so that ultimately a single cluster is obtained for all wetlands at linkage distance of 4.6. At the linkage distance of 4.0, three major clusters or MAJOR GROUPS (MG) could be recognized as given hereunder. MAJOR GROUP-I (MGI) with 14 wetlands, viz. Sindripathar, Ketankeyari, Kalidaha, Kumari dam, Hanumata Dam, Ganakbundh, Dhanarbundh, Babirbundh, Gayalabundh, Dewanbundh, Deshbundh, Benagora, Benabundh, Angarkhuri.

MAJOR GROUP- II(MGII)- with 18 wetlands, viz., Ranibundh, Kamalabundh, Sankra Barabundh, Guniyara Barabundh, Gorsaibundh, Pokabundh, Nutanbundh, Sayarbundh, Ruknibundh, Gobinda Sayar, Purano sayar, Ghosal Pukur, Khagerbundh, Gaylabundh, Rajabundh, Maidhara, Lihirbundh and Barikbundh. MAJOR GROUP –III(MGIII)—with 6 wetlands viz., Joypur Ranibundh, Sahebbundh, Rampurbarabundh, Mahatobundh, Buro Sayar and Adra Sahebbundh. These major groups get further classified into subgroups based on intra-cluster overall similarities and inter-cluster linkage distance (Fig.4). The ultimate natural system of classification, thus objectively obtained is likely to have considerable practical applications. The cluster diagram (Fig 4) can be helpful in planning identical restorative, management and utilization strategies.
4. Dwarakeshwar river is the main source of water in Adra Sahebbundh.

5. *Nymphoides hydrophylla*, one of the dominant macrophytes in Adra Sahebbundh.
6. A view of Babirbundh with emerging individuals of *Limnophila heterophylla*.

7. Bathing, a common affair at Babirbundh.
8. Puruliya-Manbazar road beside the Western side of Ganakbundh.

10. A view of Royal house (Rajbari) at Patharmura.
12. Rampur Barabundh located at Kashipur Block (Rampur).
4.1.4. PHYSICO-CHEMICAL CHARACTERISTICS OF WATER SAMPLES COLLECTED FROM SELECTED WETLANDS.

The physico-chemical characteristics of water samples were determined in case of three wetlands viz, Adra Sahebbundh, Joypur Ranibundh and Nibaran Sayar. Each of the ten parameters considered (Table 28) showed certain variations in the three wetlands studied a precise account of which is presented in the following.

i. pH: Value of pH of water sample was found to be 7.634 in case of Adra Sahebbundh which in cases of Joypur Ranibundh and Nibaran Sayar or Saheb bundh were 6.561 and 7.383 respectively.

ii. Electrical Conductivity (EC): Values of EC were the same (0.692 µmho/cm) in case of water samples collected from Adra Sahebbundh and Nibaran Sayar and higher (1.00 µmho/cm) in case of Joypur Ranibundh.

iii. Transparency: In case of Adra Sahebbundh transparency of water sample was 104.83 cm. In case of Joypur Ranibundh its value was 87.50 cm while for that of Nibaran Sayar it was 86.66 cm.

iv. Turbidity: So far the values of turbidity are concerned the highest value was scored in case of water samples from Joypur Ranibundh (14 cm) which was followed in the decreasing order by those from Nibaran Sayar (13.33 cm) and Adra Sahebbundh (13.25 cm).

v. Acidity: Values of total acidity of water samples ranged from 21.66 mg/litre (Adra Sahebbundh) to 43.33 mg/litre (Joypur Ranibundh) which was 30 mg/litre in case of Nibaran Sayar.

vi. Alkalinity: In case of Adra Sahebbundh, the value of alkalinity of water samples was found to be 30.66 mg/litre which was higher in case of Joypur Ranibundh (34.66 mg/litre) and highest in case of Nibaran Sayar (46.66 mg/litre).

vii. Dissolved Oxygen (DO): Values of DO were found to be 2.048, 2.188 and 2.2 mg/litre for water samples collected from Joypur Ranibundh, Nibaran Sayar and Adra Sahebbundh respectively.

viii. Biological Oxygen Demand (BOD): Biological Oxygen Demand (BOD) values were determined to be 0.364, 0.324 and 0.516 mg/litre in case of water samples collected from Nibaran Sayar, Joypur Ranibundh and Adra Sahebbundh respectively.

ix. Total Dissolved Solids (TDS): The values of TDS found out in case of water samples collected from Adra Sahebbundh was 119.06 mg/litre which was somewhat lower in case of Joypur Ranibundh (113.33) and lowest in case of Nibaran Sayar (110 mg/litre).
Results

x. Total Hardness (TH): Total hardness value of water sample from Adra Saheb bundh was determined to be 8 mg/litre which in case of Joypur Ranibundh was 5 mg/litre and in case of Nibaran Sayar or Saheb bundh 4.66 mg/litre.

Table 28: Physico-chemical characteristics of water samples from three selected wetlands.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name of the wetland</th>
<th>Joypur Ranibundh</th>
<th>Nibaran Sayar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Maxi.</td>
<td>Mean</td>
</tr>
<tr>
<td>pH</td>
<td>7.53</td>
<td>7.69</td>
<td>7.634</td>
</tr>
<tr>
<td>Transparency (cm)</td>
<td>80.5</td>
<td>116</td>
<td>104.83</td>
</tr>
<tr>
<td>Turbidity (cm)</td>
<td>8.0</td>
<td>18</td>
<td>13.25</td>
</tr>
<tr>
<td>Acidity (mg/l)</td>
<td>15</td>
<td>30</td>
<td>21.66</td>
</tr>
<tr>
<td>Alkalinity (mg/l)</td>
<td>30</td>
<td>32</td>
<td>30.66</td>
</tr>
<tr>
<td>DO (mg/l)</td>
<td>2.0</td>
<td>2.4</td>
<td>2.2</td>
</tr>
<tr>
<td>BOD (mg/l)</td>
<td>0.4</td>
<td>0.6</td>
<td>0.516</td>
</tr>
<tr>
<td>TDS (mg/l)</td>
<td>117.5</td>
<td>120</td>
<td>119.06</td>
</tr>
<tr>
<td>Electrical conductivity(µmho/cm)</td>
<td>0.66</td>
<td>0.74</td>
<td>0.692</td>
</tr>
<tr>
<td>Total hardness (mg/l)</td>
<td>7</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

4.1.5. PHYSICO-CHEMICAL CHARACTERIZATION OF SEDIMENT SAMPLES (SOILS):

For studying physico-chemical characteristics of wetland sediments three sampling sites were selected (Table 29) and only eight important parameters of the samples collected there from were studied, a brief account of which is given in the following (Table 30).

i. pH: The values of pH were found to be 5.75, 5.85 and 6.03 for sediment samples collected from Joypur Ranibundh, Adra Saheb bundh and Nibaran Sayar respectively.

ii. Conductance: In cases of both Adra Saheb bundh and Joypur Ranibundh values of specific conductance of soil samples were found to be the same i.e. 2.11 µmho/cm. It was 2.95 µmho/cm for sediment samples procured from Nibaran Sayar or Saheb bundh.

iii. Acidity: Acidity of soil samples was found to be 38.33 mg/litre in case of Adra Saheb bundh which got lowered to 31.66 mg/litre in case of Joypur Ranibundh and to 28.33 mg/litre in Nibaran Sayar or Saheb bundh.
iv. **Alkalinity**: Alkalinity of soil samples was determined to be 28.33 mg/litre both for Joypur Ranibundh and Adra Sahebbundh which got reduced to 21.66 mg/litre in samples from Nibaran Sayar.

v. **Organic Carbon (%):** In case of Adra Sahebbundh the organic carbon content of soil samples thus determined was 2.19 % of which in case of the Joypur Ranibundh was 3.27 % and in case of Nibaran Sayar 2.77 % of soil sample.

vi. **Total Nitrogen (%):** The values of total nitrogen was somewhat similar in case of the three wetlands. However, the mean values of total nitrogen ranged from 0.325% (Joypur Ranibundh) to 0.37% of sediment (Nibaransayar). The value was 0.345% in case of Adra Sahebbundh.

Available nitrogen: The mean values of available nitrogen ranged from 24.18 mg/100g (Joypur Ranibundh) to 28.30 mg/100g of sediment (Nibaransayar). The value was 26.68 mg/100g in case of Adra Sahebbundh.

vii. **Available Phosphorus (PO₄):** The mean value of this parameter ranged from 12.63 mg/100g (Nibaransayar) to 19.08 mg/100g (Joypur Ranibundh). For Adra sahebbundh, the PO₄ concentration was 18.72 mg/100g of sediment.

viii. **Available Potassium**: The value of this parameter was highest in case of Adra Sahebbundh (17.76 mg/100g) and lowest in case of Joypur Ranibundh (12.16 mg/100g). In case of Nibaransayar the concentration of available potassium was 14.59 mg/100g of the wetland sediment.

<table>
<thead>
<tr>
<th>Sites</th>
<th>Name of wetlands</th>
<th>Block</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Area in acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adra Sahebbundh</td>
<td>Kashipur</td>
<td>86°70´E</td>
<td>23°48´N</td>
<td>11</td>
</tr>
<tr>
<td>2.</td>
<td>Joypur Ranibundh</td>
<td>Joypur</td>
<td>86°32´E</td>
<td>23°36´N</td>
<td>120</td>
</tr>
<tr>
<td>3.</td>
<td>Nibaransayar/ Sahebbundh</td>
<td>Puruliya I</td>
<td>86°21´E</td>
<td>23°20´N</td>
<td>70</td>
</tr>
</tbody>
</table>

Table 29: Details of sampling sites.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name of the wetland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adra Sahebbundh</td>
</tr>
<tr>
<td></td>
<td>5.721</td>
</tr>
<tr>
<td>Conductance (µmho/cm)</td>
<td>2.11</td>
</tr>
<tr>
<td>Acidity (mg/l)</td>
<td>30</td>
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</tbody>
</table>

Table 30: Physico-chemical characteristics of sediment samples collected from three selected wetlands
Survey of Wetlands in Puruliya District

### Results

<table>
<thead>
<tr>
<th>Alkalinity (mg/l)</th>
<th>25</th>
<th>35</th>
<th>28.33</th>
<th>20</th>
<th>45</th>
<th>28.33</th>
<th>20</th>
<th>25</th>
<th>21.66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Carbon (%)</td>
<td>2.18</td>
<td>2.20</td>
<td>2.19</td>
<td>3.00</td>
<td>3.80</td>
<td>3.27</td>
<td>2.72</td>
<td>2.80</td>
<td>2.77</td>
</tr>
<tr>
<td>Total Nitrogen (%)</td>
<td>0.34</td>
<td>0.35</td>
<td>0.345</td>
<td>0.32</td>
<td>0.33</td>
<td>0.325</td>
<td>0.36</td>
<td>0.38</td>
<td>0.37</td>
</tr>
<tr>
<td>Mean C/N ratio</td>
<td>6.35</td>
<td>10.06</td>
<td>7.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available Nitrogen (mg/100g)</td>
<td>26.32</td>
<td>27.04</td>
<td>26.68</td>
<td>23.48</td>
<td>24.88</td>
<td>24.18</td>
<td>28.16</td>
<td>28.44</td>
<td>28.30</td>
</tr>
<tr>
<td>Available Phosphorus (mg/100g)</td>
<td>13.66</td>
<td>13.78</td>
<td>13.72</td>
<td>18.72</td>
<td>19.44</td>
<td>19.08</td>
<td>12.50</td>
<td>12.76</td>
<td>12.63</td>
</tr>
<tr>
<td>Available Potassium (mg/100g)</td>
<td>16.89</td>
<td>18.72</td>
<td>17.76</td>
<td>11.66</td>
<td>12.66</td>
<td>12.16</td>
<td>14.48</td>
<td>14.70</td>
<td>14.59</td>
</tr>
</tbody>
</table>

### 4.2. STUDY OF MACROPHYTES

#### 4.2.1. Taxonomic study:

The taxonomic account presents at first a key to the identification of three concerned division of macrophytes, viz. Angiosperms, pteridophytes and Algae. Artificial keys to the identification of families of the three groups are given separately to facilitate ready identification which is followed up by keys to the genera and species and the systematic account of the concerned species.

**WETLAND MACROPHYTES**

Key to the Divisions

1. Sex organs exposed and borne in flowers .................................. 1. Angiosperms

1. Sex organs cryptic and never borne in flowers:

   2. Plants thalloid, nonarchegoniate, vascular tissues i.e.
      xylem and phloem absent ........................................... 3. Algae

   2. Plants well differentiated into roots, stems and leaves, archegoniate,
      xylem and phloem present ........................................... 2. Pteridophytes

**ANGIOSPERMS (MAGNOLIOPHYTA)**

Key to the Families

1. Venation reticulate; flower pentamemous; cotyledons two:

2. Flower epigynous:

3. Stem erect; leaves opposite or whorled; fruit capsule or berry:

   4. Flowers in capitulum; involucral bract present......................... Asteraceae

   4. Flowers not in capitulum; involucral bract absent:

      5. Interpetiolar or intrapetiolar stipule present; petals united to a tube below,
         relatively small, whitish................................................... Rubiaceae.
5. Interpetiolar or intrapetiolar stipule absent; petals free to the base, petals showy, yellow or white ................................................... .......................... Onagraceae
3. Stem creeping, leaves alternate; fruit schizocarpic with 2 mericarps.............. Apiaceae
2. Flowers hypogynous or perigynous:
6. Perianth dry, membranous........................................................ Aamaranthaceae
6. Perianth never dry and membranous:
7. Sepals united into a perigynous tube; petals free up to the base............ Lythraceae
7. Sepals free or united only at base; petals united and tubular towards the base:
8. Bracts and bracteoles copious; seeds inserted on hardened, hook-like outgrowths from the central placenta .............................................................. Acanthaceae
8. Such bracts and bracteoles absent; seeds inserted directly on the central placenta, hard, hook-like out growth absent .................... Scrophulariaceae
9. Plants insectivorous:
10. Roots absent; plant submerged; bladder present for trapping insects .............................................................. Lentibulariaceae.
10. Roots present; plants on wet soils; such bladder absent .............................................................. Droseraceae
9. Plants not insectivorous:
11. Roots absent; leaves submerged; 1-4 time forked; flowers unisexual .............................................................. Ceratophyllaceae
11. Roots present; leaves floating, not forked; flowers bisexual:
12. Petiole sheathing at the base; flowers heterostylos ................................ Menyanthaceae
12. Petiole not sheathing at the base; flowers not heterostylos:
13. Petioles inflated; fruit with 2 or 4 lateral hard horns......................... Trapaceae
13. Petioles not inflated; fruit without such lateral hard horns:
14. Plants with milky latex; leaf blade without spines; flowers with perianth .............................................................. Nelumbonaceae
14. Plants without milky latex; leaf blade with spines on the under surface; flowers with sepals and petals .............................................................. Nymphaeaceae
15. Carpel-1; leaves compound ................................................. Fabaceae
15. Carpel more than 1; leaves simple:
16. Watery latex present; inflorescence androgynous raceme; fruit regma .............................................................. Euphorbiaceae
16. Watery latex absent; inflorescence of bisexual flowers; fruits of other types:
17. Leaves with ochreacte stipule: Polygonaceae

17. Leaves without such stipule:

18. Flower trumpet like; corolla tube much longer than lobes: Convolvulaceae

18. Flowers never trumpet like; petals free or corolla tube shorter than the lobes:

19. Perianth undifferentiated; ovule campylotropous; fruits covered by persistent perianth base: Nyctaginaceae

19. Perianth differentiated into sepals and petals; ovule anatropous or orthotropous; fruits not covered by such perianth base:

20. Stem with ridges and furrows; corolla bilabiate: Verbenaceae

20. Stem without ridges and furrows; corolla free or rotate:

21. Corolla rotate; anthers free from each other; ovary superior: Solanaceae

21. Corolla 2-lipped; anthers united in a ring around the style; ovary inferior: Lobeliaceae

22. Style gynobasic; inflorescence scorpioid cyme: Boraginaceae

22. Style terminal; inflorescence racemose:

23. Flowers large, solitary or racemose; ovule anatropous; fruits capsular: Turneraceae

23. Flowers minute, catkin like spike; ovule orthotropous; fruits follicular: Piperaceae

1. Venation parallel; flower trimerous; cotyledon one:

24. Carpels free; fruit a head of 1-seeded nutlets: Alismataceae

24. Carpels united; fruit a many seeded capsule:

25. Ovary superior; stems usually emergent with self supporting leaves: Commelinaceae

25. Ovary inferior; stems submerged with submerged or floating leaves: Hydrocharitaceae

26. Leaves radical, in basal rosette:

27. Inflorescence with a spadix; spathe present: Araceae
27. Inflorescence without a spadix; spathe absent ………… Aponogetonaceae
26. Leaves cauline, not in basal rosette ………………………… C.C. Eriocaulaceae
28. Stem solid, triangular; leaves in 3 rows …………………………… Cyperaceae
28. Stem fistular, cylindrical; leaves alternate or in 2 rows……… Poaceae
29. Plants usually submerged; petiole not inflated; perianth not petaloid:

30. Flowers hermaphrodite; fruits a druplet

…………………………………... Potamogetonaceae
30. Flowers 1- sexual; fruits an achene ……………… Najadaceae
29. Plants usually floating; petiole often inflated; perianth petaloid………………………………………… Pontederiaceae
31. Flowers bisexual ……………………………… Juncaceae
31. Flowers unisexual:
32. Plants emergent, not thalloid; perianth present; gynophores present……………………… Typhaceae
32. Plants free floating, thalloid; perianth absent; gynophore absent……… ……………….. Lemnaceae

DICOTYLEDONS (MAGNOLIOPSIDA)

1. Nymphaeaceae Salisb.

1. Nymphaea L.


[144]
Vernacular name: Saluk

A perennial herb, aquatic. Leaves usually floating, peltate, ovate-orbicular, 9-11x12–15 cm, dentate, pubescent, petiolate; reticulate, divergent, green above, purple below, ovate; petiole strong, fistular, pubescent; reddish brown, 5 cm. Flower incomplete, haploclamydous, hypogynous, pedicilate; pedicel 3 x 0.6 cm, fistular, pubescent; perianth- numerous, segments lanceolate, entire-serrate, acute, red, 3-4x0.5-2.1 cm; stamens numerous; filament-red, 1.2 cm; anther 2-lobed, 2 cm.

Fl. & Fr.: May–June.

Propagation by: Rhizome.

Field notes: Common in bundh, jore, sayar etc.

Growth-form: Nymphaeids.

Status: Very common.

Distribution: S and SE Asia.

Specimens examined: Damda (Ganakbundh), MM-412; Lalpur (Gaylabundh), MM-505; Patharmura (Gobindasayar), MM-506; Barabazar (Gorsaibundh), MM-571; Balarampur (Hanumatadam), (MM-508); Baraurma (Kumaridam), MM-509; Kantadih (Mahatobundh), MM-527; Puruliya (Sahebbundh) MM-511; Chharra (Puranosayar), MM-512; Babiddi (Sabirbundh), MM-528; Guniyara (Barabundh), MM-541; Guniyara (Ruknibundh), MM-543; Mangalda (Burosayar), MM-545; Raghunathpur (Barikbundh), MM-547; Kharbar (Deshbundh), MM-550; Tiyashi (Gayerbundh), MM-551; Kalidaha (Jore), MM-553; Karangberiya (Sindripatar), MM-554; Patharmura (Maidhara), MM-558; Puruliya (Rajabundh), MM-556; Manbazar (Benabundh), MM-576; Tiyashi (Gayerbundh), MM-581; Chharra (Puranosayar), MM-583.

(Plate 21)

2. *Nelumbonaceae* Dunn.

1. *Nelumbo* Adanson


Vernacular name: Padma.

A perennial, aquatic herb. Leaves floating, peltate, glabrous; venations reticulate, convergent;
Petiole submerged, spongy, cylindrical, pubescent, herbaceous. Flower large; petals numerous; segment lanceolate, membranous, entire, acute; stamens numerous, many seriate; carpel many, discrete.

Fl. & Fr.: May-June.

Propagation by: Rhizome and seeds.

Field notes: Abundantly grows on bundh, jore, and sayar.

Growth-form: Nelumbids.

Status: Very common.

Distribution: Warm Asia and Australia, naturalized elsewhere.

Specimens examined: Guniyara (Barabundh), MM-500; Joypur (Ranibundh), MM-501; Puruliya (Nutanbundh), MM-502; Sankra (Barabundh), MM-503; Puruliya (Nibaransayar), MM-504; Raghunathpur (Barikbundh), MM-557.

(Plate 17 & Plate 35)

3. **Fabaceae** Lindley

Key to the genera.

1. Stem fistular, spongy; fruit with mucronate tip……………………………………1.Aeschynomene
2. Stem solid, not spongy; fruit without mucronate tip:
   2. Leaves digitately compound………………………………………………...3. Crotalaria
   3. Stipule scarious, acuminate………………………………………2. Alysicarpus
   3. Stipule free-lateral, acute………………………………………………...4. Desmodium

1. **Aeschynomene** L.

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Vernacular name: Sola.

A perennial/annual herb. Stem herbaceous, fistular, woody at base, cylindrical, branched, emergent, spongy, warty at base; wart with caducous glandular hairs, 31 cm; internode 3-4 cm. Leaves, compound, rachis slender, glabrous, 5-5.5 cm; unipinnate, paripinnate, pinna ovate; 4 x 1 mm, entire, obtuse, glabrous, sessile. Fruit lomentum, oblong, 28 x 4 mm, repand, flat, green, mucronate; pedicel slender, glabrous, 8 mm.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Common in Wetland, grows on bundh. Sayar and marshy places.

Growth-form: Aeschynomenids.

Status: Common.

Distribution: Pantropics, probably native to southeastern N America.

Specimens examined: Kalidaha (Dewanbundh), MM-262; Mangalda (Burosayar), MM-390.

( Fig.5)


Annual herb. Stem woody, slender, branched, solid, jointed, cylindrical, emergent, pubescent, decumbent, not spongy, 1.8 cm; internode 3-6 mm; branching lateral, stout. Leaves alternate, simple, ovate lanceolate, 8-14 x 5-6 mm, entire, obtuse, reticulate, pubescent; petiole slender, 6-7 mm; stipule scarious, hyaline, acuminate, connate, membranous, 3 x 1-5 mm. Flower 7 mm; calyx 5, connate at base; lobe unequal, lanceolate, 5 x 1 mm, entire, acute; corolla bilabiate; ovary oblong, 3 mm; style 4 mm; stigma capitate.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Not very common, found at the margin of jore.

Growth-form: Herbids.

Status: Rare.


Specimens examined: Ketankiyari (Jore) MM-249, MM-250.
3. **Crotalaria L.**

1. **Crotalaria incana** L. Prain, Bengal Pl.1 : 373.1903.

   Annual herb. Stem woody, branched, solid, cylindrical, emergent, pubescent, 25 cm; internode 4-8 cm; branching stout. Leaves alternate, digitately compound, 3-foliate; pinna obovate, 3.5-5.7 cm, entire, obtuse, caudate, glabrous; petiole 3 mm. Flower complete, bisexual, diplochlamydous, hypogynous, pedicel 2 mm; calyx 5, connate in a tube, unequal, hyaline; corolla 5, standard orbicular, 12x5 mm, yellow; wings 8x4 mm; keels 7x3 mm; stamens 10, diadelphous; filament filiform, hyaline, 8 mm; ovary-swellen, oblong, 8x2 mm; hyaline, pubescent; style-filiform, hairy, curved, hyaline, 13 mm; stigma capitate, yellow, 5 mm.

   **Fl. & Fr.**: October.

   **Propagation by**: Seeds.

   **Field notes**: Grows at the edge of water or bank of wetland.

   **Growth-form**: Herbids.

   **Status**: Rare.

   **Distribution**: Cultivated, also at times an escape.

   **Specimen examined**: Adra (Sahebbundh), MM- 454.

4. **Desmodium Desv.**


   A perennial herb. Stem somewhat woody, branched, slender, solid, cylindrical, emergent, pubescent, not spongy, 23 cm; internode 2 cm. Leaves alternate, simple, ovate, 2-3x1.5-2.5 cm, entire, acute, pubescent, venation reticulate, divergent; base cuneate; petiole slender, 1-2 cm, pubescent; stipule free-lateral, lanceolate, 4x2 mm, acute, membranous. Fruit lomentum, oblong, without mucro, 8x3 mm; jointed, repand; peduncle brown, slender, 4 mm.

   **Fl. & Fr.**: July–August.

   **Propagation by**: Seeds.

   **Field notes**: Rare in wetland, found at the margin of flow water of jore and shady wet places.

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Survey of Wetlands in Puruliya District

Growth-form: Herbids.
Status: Rare.
Distribution: India.common in Sri Lanka, Tropical Africa, Malaya, Philippines, China; introduced in West Indies.
Specimen examined: Karangberiya (Sindripathar), MM-495.

4. Droseraceae Salisb.
1. Drosera L.

Key to the Species
1. Stem leafless; leaves radical; flowers white ........................................1. D. burmanni
1. Stem leafy; leaves alternate; flowers pink ........................................2. D. indica


Vernacular name: Suryasisir.
A perennial herb, emergent, 7 cm. Leaves in basal rosettes; cauline leaves absent, simple, spathulate, 8 x 4 mm, entire, obtuse, glandular hairy, sessile, reddish. Inflorescence 4–7 flowered, 5.5 x 6.0 cm, slender, reddish-brown, glabrous. Fruit-capsule, 4 x 2 mm, 2-valved, hairy, brown, pediculate; pedicel-2 mm, brown, hairy; seeds numerous, black.
Fl. & Fr.: December–February.

Propagation by: Seeds.
Field notes: Very rare in this district, grows on marshy places near bundh and open rice field.

Growth-form: Herbids.
Status: Rare.
Distribution: W Africa to NE Australia.
Specimen examined: Kalidaha (Dewan bundh), MM–461. (Fig. 6 & Plate 2c.)


Vernacular name: Suryasisir.
A perennial or annual herb, 7–9.6 cm. Stem emergent, herbaceous, branched, solid, leafy decumbent, cylindrical; internode 3–6 mm. Leaves alternate, spreading, linear, 2.6–2.9 cm x 1 mm, coiled, glandular; Inflorescence 2.1–3.6 cm, with 1–7 flowered. Flower bisexual,
hypogynous, pink, pedicilate, 5 mm; pedicel slender, 7 mm; sepals ovate, entire; ovary swollen, 3 mm; style 3; capsule 3 mm long.

Fl. & Fr.: October–December.

Propagation by: Seeds.

Field notes: Rare in this district; grows at the fringe area of bundh, and wet places along with Drosera burmanni.

Growth form: Herbids.

Status: Rare.

Distribution: Tropical Africa to Australia.

Specimens examined: Kalidaha (Dewanbundh), MM–574, MM–575.

(Fig. 7 & Plate 3b.)

5. Lythraceae Jaume St. Hill.

Key to the genera

1. Stem prostrate, pubescent ................................................................. 2. Nesaea

1. Stem erect, glabrous ................................................................. 1. Ammannia

1. Ammannia L.

Key to the Species

1. Stem woody, solid:

2. Stem square; capsule 0.5 mm in diameter ........................................ 3. A. senegalensis

2. Stem cylindrical; capsule 1.5 mm in diameter ................................ 2. A. multiflora

1. Stem herbaceous, fistular .......................................................... 1. A. baccifera


Annual herbs. Stem decumbent or emergent, much branched, branches ascending and shorter than the main axis, herbaceous, fistular, cylindrical, glabrous, 27-37 cm; internode 2–3.4 cm. Leaves sometimes longer than internodes, opposite superposed, simple, lanceolate, 7-20 x 2-5 mm, entire,
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Acute, glabrous, cuneate, reticulate, midrib prominent; sessile. Flowers sessile, bisexual, actinomorphic, hypogynous; corolla 4; anther 4, yellow; ovary globose, hyaline–yellow, 1x1 mm; stigma capitate.

**Fl. & Fr.**: October–December.

**Propagation by**: Seeds.

**Field notes**: Abundantly grows in wetland and wet places of the district.

**Growth form**: Herbids.

**Status**: Common.

**Distribution**: Tropical and warm parts of Asia and Africa and perhaps also Australia, introduced in the New World (Caribbean) and Europe.

**Specimens examined**: Rampur (Barabundh), MM-266; Adra (Sahebbundh), MM-338, MM-342; Chharra (Angarkhuri), MM-433.


Annual herb. Stem woody, sparsely branched, solid, cylindrical, emergent, glabrous, green–purplered, 17–25 cm; internode 1.2–1.8 cm; branches lateral, stout. Leaves opposite decussate, simple, lanceolate, or elliptic, 1.8–2.5x.2–.6 cm, entire, acute/obtuse, pubescent, base auriculate veination reticulate, midrib prominent, sessile; Fruit capsule, 4 in each axil of leaf on each side, globose, axillary, greenish, peduncled, 2x1.5 mm.

**Fl. & Fr.**: May–October.

**Propagation by**: Seeds.

**Field notes**: Common in jore, river bank and marshy places.

**Growth-form**: Herbids.

**Status**: Common.

**Distribution**: Tropical and warm Old World.

**Specimens examined**: Ketankiyari (Jore), MM-244; Baraurma (Kumari), MM-418.

An annual herb. Stem woody, branched, emergent, solid, square, glabrous, greenish, 21 cm;
Branching lateral, stout; internode 1.5–2 cm. Leaves opposite decussate, simple, lanceolate, 2.7 x 7 cm, entire, acute, glabrous, sessile, midrib prominent. Fruit 2 in each axil of leaf; capsule, globose; triangular 5 x 5 mm, partly exerted from sepals lobe, purple to bright red; pedicel slender, 2 mm; seed globose - triangular, 0.5 x 0.5 mm, entire, obtuse, gray.

**Fl. & Fr.** October.

**Propagation by:** Seeds and cutting of lateral shoot.

**Field notes:** Occasionaly grows in wetland and wet places.

**Growth-form:** Herbids.

**Status:** Rare.

**Distribution:** Warm and tropical Africa, naturalized in Europe and India, apparently confined to the Pune and Satara Districts, discovered in 1895 persisting until at least 1948.

**Specimen examined:** Adra (Saheeb bundh), MM-447.

2. *Nesaea* J.V. Lamourous


   An annual or perennial herb. Roots adventitious from lower nodes, cluster, branched, blackish-green. Stem prostrate, decumbent, herbaceous, branched, fistular, cylindrical, pubescent, slender, 21 cm; internode 1.1–3.3 cm; branching lateral, slender. Leaves opposite decussate, simple, lanceolate, 0.8–1.4 x 2.3 cm, entire, acute, pubescent, cuneate, exstipulate; venation reticulate, midrib prominent, sessile.

   **Fl. & Fr.** December.

   **Propagation by:** Seeds.

   **Field notes:** Common at the periphery of bundh and marshy places.

   **Growth-form:** Herbids.

   **Status:** Common.

   **Distribution:** India, Sri Lanka and Australia

   **Specimens examined:** Rampur (Barabundh), MM-267; Adra (Saheeb bundh), MM-322.


1. *Ludwigia* L.

   **Key to the species**

   1. Stem herbaceous, pubescent, floating with pneumatophore; leaves ovate........ 1. *L. adscendens*

   1. Stem woody, glabrous, erect without pneumatophore; leaves lanceolate........ 2. *L. perennis*

**Vernacular name:** Keshra dam.

A perennial or annual herb. Stem prostrate, decumbent, usually floating, herbaceous, branched, fistular, angled, spongy, pubescent, brown, 23-28 cm, pneumatophore at nodes; internode 22.5 cm, floating root, gasfilled, white, 2-3 at each node, spongy, 1.3-4 x 2 cm, oblong–lanceolate. Leaves- alternate, simple, ovate, 2.8-6x1.1-1.4 cm, entire, obtuse, pubescent, caudate, reticulate, midrib prominent; petiole slender, pubescent, 6-1.5 cm; exstipulate.

**Fl. & Fr.:** June-September.

**Propagation by:** Seeds and offsets.

**Field notes:** Found as a floating herb on water in Sayar, bundh etc.

**Growth-form:** Decodontids.

**Status:** Common.

**Distribution:** Subtropical Himalayas. India, East to China, Malaysia and Australia.

**Specimens examined:** Puruliya (Nibaransayar), MM-301; Adra (Sahebbundh), MM-353; Guniyara (Ruknibundh), MM-383.


**Vernacular name:** Banlanga.

An annual herb. Stem emergent or prostrate, decumbent, woody, branched, solid/ fistular,
cylindrical / ribbed, glabrous, brown, 24-32 cm; internode 2-2.2 cm. Roots adventitious, branched reddish brown, 22 mm. Leaves alternate, simple, lanceolate, 2.3-4x0.6-1 cm, entire, acute, pubescent, caudate, petiolate, exstipulate, reticulate; petiole glabrous, brown, 8 mm. Fruit a capsule, oblong, 3x0.2 cm, blackish brown, thin walled with 4-5 floral leaves; floral leaves ovate, 6x4 mm, connate on fruit apex, entire, acute; pedicel slender, 4 mm.

Fl. & Fr.: May.

Propagation by: Seeds.

Field notes: Common in bundh, sayar and wet places.

Growth-form: Herbids.

Status: Common.

Distribution: Africa, Afghanistan, India, East to S. Japan, Malaysia, Australia and New Caledonia.

Specimens examined: Joypur (Ranibundh), MM-365; Barabazar (Gorsaibundh), MM-406; Patharmura (Gobindasayar), MM-439.

7. Trapaceae Dun.

1. Trapa L.


Annual or perennial herbs. Stem elongate, herbaceous, unbranched, flexible, submerged, glabrous-pubescent, 23-32 cm. Roots adventitious, branched, blackish, 5-8 cm. Leaves alternate above; floating leaves in terminal rosette, simple, rhombic 23 cm x 1.52 cm, toothed margin, acute, pubescent, base cuneate, truncate, petiolate, exstipulate; venation reticulate, 4-5 main veined; petiole with an ellipsoidal, and spongy swelling, blackish-brown, pubescent, 4-5 cm.

Vernacular name: Paiphal.

Fl. & Fr.: August-November.

Propagation by: Seeds and stolon.

Field notes: Frequently grows in sayar, bundh etc throughout the district.

Growth-form: Trapids.

Status: Very Common.

Distribution: Old World. It is widely cultivated and it is difficult to say today where it is native, probably mostly introduced in tropical India.

Specimens examined: Puruliya (Nibaransayar), MM-306; Joypur (Ranibundh), MM-367; Guniyara (Ruknibundh), MM-382; Raghunathpur (Barikbundh), MM-405.
8. **Turneraceae** Kunth ex C.D.

1. **Turnera** L.


   An annual herb. Stem woody, branched, solid, cylindrical, warty, emergent, glabrous-pubescent, 18 cm; internode 4-6 mm. Leaves alternate, simple, lanceolate, 5-9.3x1.1-2.1 cm, serrate, acute, pubescent, reticulate, divergent, midrib prominent, base caudate; petiole pubescent, 10x2 mm; stipule lanceolate, 30 x 2 mm. Flower large, axillary, yellow, 14 mm; pedicel pubescent, 6 x 1.5 mm; corolla 5, yellow; stamen 3; filament filiform, yellow, 13 mm; anther sagittate, 5 x 1 mm, yellow, 2-lobed, dorsifixed extrose; ovary globose, 4x4 mm.

   **Fl. & Fr.:** August.

   **Propagation by:** Seeds.

   **Field notes:** Found in wet places and at the side of the sayar.

   **Growth-form:** Herbids.

   **Status:** Rare.

   **Distribution:** Tropical America, A pantropical yellow-flowered weed found in Wastelands (Bangalore, Dakshina Kannada, Mysore).

   **Specimen examined:** Puruliya (Nibaransayar), MM-437.

(Plate 2b. & Plate 35)


1. **Centella** L.


   **Vernacular name:** Thankuni.

   A perennial herb. Stem creeping, herbaceous, branched, solid, ribbed, pubescent, reddish, 55 cm; internode 9-12 cm; branching lateral, slender. Roots adventitious from nodes, reddish. Leaves rosetted, 2-5 in clusters, simple, cordate, 2.2-2.5x3.6-4.3 cm, crenate-dentate, pubescent, petiolate;
venation reticulate, divergent, main veins 6; petiole pubescent, 7.5-13.5 cm. Fruit-ellipsoid, flattened, pedicilate, 2x2.5 mm; pedicel-pubescent, 4 mm.
Fl.& Fr.: October.
**Propagation by:** Seeds and runner.
**Field notes:** Grows at the margin of bundh and on moist soils.
**Growth-form:** Herbids.
**Status:** Rare.
**Distribution:** Pantropics.
**Specimen examined:** Adra (Sahebbundh), MM–339.

Annual herbs. Roots adventitious, from lower nodes, branched, black. Stem floating decumbent, herbaceous, terete, slender, cylindrical, branched, glabrous, solid, blackish, 36 cm; internode 2.5-3 cm, lower stem submerged, pubescent; hair white, multicellular, branched, branching lateral, slender, longitudinally ribbed. Leaves opposite superposed, simple, lanceolate, 22-30x2 mm, entire, acute, base narrow, sessile, exstipulate. Flower solitary, axillary, white, 2x1 mm; pedicel slender, 6 mm long.
Fl.& Fr.: October.
**Propagation by:** Seeds.
**Field notes:** Common in bundh, marshy places etc.
**Growth-form:** Herbids.
**Status:** Common.
**Distribution:** Warm and tropical Asia, naturalized in America.
**Specimens examined:** Adra (Sahebbundh), MM-321; MM-340; Joypur (Ranibundh), MM-374; Sankra (Barabundh), MM-429.


**Vernacular name:**Khet-papra.

Annual herbs. Stem prostrate with ascending branches, herbaceous, solid, 4-angled, glabrous,slender,31 cm;internode 2-3.3 cm;Leaves lanceolate, 2.7-3x2-.4cm,entire,acute,pubescent,base narrow,venation reticulate, midrib prominent; sessile.Fruits capsule, erect,flattened,globose, 2x2mm, pedunculate; peduncle 5 mm long,slender.

**Fl. & Fr.:**October.

**Propagation by:**Seeds.

**Field note:**Grows on Jore,sayar etc.

**Growth-from:**Herbids.

**Status:**Common.

**Distribution:**Tropical Africa.S and SE Asia,probably naturalized in tropical America and Australia.

**Specimens examined:** Ketankiyari(Jore),MM-242;Mangalda(Burosayar),MM-387.


Key to the genera

1.Stem woody, fistular……………………………………………………………1.Eclipta
2.Stem herbaceous, solid:
3.Stem twining……………………………………………………………..3.Mikania
4.Stem erect:
    3.Leaves petiolate:
        4.Leaves lobed, serrate;flower on convex receptacle…………..……..4.Parthenium
        3.Leaves sessile…………………………………………………………….2.Enydra

1.Eclipta L.

Wet. Pl. India 69.1996.

**Vernacular name:** Kesuti, Lao–keshra.

Annual herbs. Stem woody, branched, fistular, cylindrical, emergent, pubescent, prostrate, 15-34 cm; internode 2-5.5 cm; hairs white, appressed, bristle-like; branching lateral, stout. Leaves opposite, simple, lanceolate, 2-5-6.3 x 1.4 cm, entire–undulate, acute, pubescent, reticulate, base cuneate; petiole pubescent, 2 mm. Fruit cypsela with persistent involucral bract; outer bract, lanceolate, 5 x 4 mm, entire, acute, pubescent; inner bract lanceolate, 3 x 1 mm, entire, acute, pubescent; seeds numerous, oblong, 3 x 0.5 mm, entire, acute with 2 projection, flat, brown; pedicel slender, pubescent, 1.5 cm.

**Fl. & Fr.:** August–October.

**Propagation by:** Seeds.

**Field notes:** Found in bundh, sayar and in wet places of the district.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** Cosmopolitan in warm and tropical conditions.

**Specimens examined:** Babiddi (Sabirbundh), MM-302; Joypur (Ranibundh), MM-362; Mangalda (Burosayar) MM–392.

(Fig. 9)

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2. *Enydra* Lour.


**Vernacular name:** Hincha.

**Propagation by:** Seeds.

A annual herb. Stem ascending, herbaceous, branched, solid, cylindrical, emergent, glabrous, purple red, 5 cm; internode 8-2.3 cm; branching lateral, slender. Roots from node, unbranched, brown, 5 cm. Leaves in opposite pair, simple, lanceolate, 10 x 3 mm, serrate, acute, glabrous, sessile.

**Fl. & Fr.:** January-April.
Field notes: Grows in marshy places.
Growth-form: Herbids.
Status: Rare.
Distribution: S and SE Asia, perhaps not a native of India.
Specimen examined: Rampur (Barabundh), MM-274.


Vernacular name: Rabanlata.

Annual, twining herb. Stem herbaceous, twining, branched, solid, cylindrical, glabrous, 30 cm; internode 6.5 -10 cm; branching lateral, slender. Leaves opposite supponsed, simple, hastate, 2.3-3.7x1-2.5 cm, serrate, acute, glabrous, reticulate, divergent, base hastate, petiolate; petiole slender, glabrous, 2–2.6 cm.

Fl. & Fr.: October-February.

Propagation by: Seeds.

Field notes: Found at the bank of the jore.

Growth-form: Ipomeids.

Status: Rare.

Distribution: A native of Tropical America, now Pantropic.

Specimen examined: Kalidaha (Jore), MM–264.

4. *Parthenium* L.


Annual herbs. Stem herbaceous, branched, solid, emergent, cylindrical, pubescent, 19 cm; internode 2 cm; branching stout. Leaves alternate, simple, lobed, 2x 0.5 cm, serrate, acute, pubescent; petiole 3 mm. Head terminal, flowers on convex receptacle; involucral bract 2–seriate; outer lanceolate, 3x 1 mm, entire, acute; inner ovate, 2x 1 mm, entire, obtuse, greenish; ray floret white; corolla-3, ligulate; stigma bifid, 1.5 mm, wide; disc floret tubular, 3x 2 mm, hyaline.

Fl. & Fr.: October–December.

Propagation by: Seeds.

Field notes: Found at the edge of water and bank of waterbodies.
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5. **Spilanthes L.**


   A decumbent, annual herb. Stem herbaceous, diffuse, emergent, cylindrical, solid, branched, glabrous to puberulous, 29 cm; internode 8.5-10.5 cm; branching stout. Leaves oppositesupperposed,simple,ovate,2.5-3.5x1.4-1.8 cm,entire,acute,glabrous,base caudate; petiole 3-6 mm, pubescent. Flower capitulum with an elongated receptacle and borne on long peduncle,7x5 mm; ray floret-1seriate, yellow,ovate, 2.5x 2 mm; receptacle 5 cm, slender, glabrous,involucral bract 2 seriate; outer lanceolate, 4x2 mm, entire,acute, greenish;inner-ovate,4x3 mm;seed numerous,flat,ovate,1x1 mm,black,hairy,hair white.

   **Fl. & Fr.:** October.

   **Propagation by:** Seeds.

   **Field notes:** Grows on wet places.

5. **Spilanthes L.**


   A decumbent, annual herb. Stem herbaceous, diffuse, emergent, cylindrical, solid, branched, glabrous to puberulous, 29 cm; internode 8.5-10.5 cm; branching stout. Leaves oppositesupperposed,simple,ovate,2.5-3.5x1.4-1.8 cm,entire,acute,glabrous,base caudate; petiole 3-6 mm, pubescent. Flower capitulum with an elongated receptacle and borne on long peduncle,7x5 mm; ray floret-1seriate, yellow,ovate, 2.5x 2 mm; receptacle 5 cm, slender, glabrous,involucral bract 2 seriate; outer lanceolate, 4x2 mm, entire,acute, greenish;inner-ovate,4x3 mm;seed numerous,flat,ovate,1x1 mm,black,hairy,hair white.

   **Fl. & Fr.:** October.

   **Propagation by:** Seeds.

   **Field notes:** Grows on wet places.

   **Growth-form:** Herbids.

   **Status:** Rare.

   **Distribution:** Throughout India; Ceylon, all warm countries.

   **Specimen examined:** Adra (Sahebbundh),MM– 452. (Fig. 10)

12. **Lobeliaceae** R.Br.

1. **Lobelia L.**


   Annual herbs. Stem prostrate, decumbent, herbaceous, unbranched, 3-sided and 3-winged,
glabrous, rooting at lower nodes, 13 cm; internode 1.1-1.7 cm. Roots adventitious, branched, brown, 3.3-3.5 cm. Leaves opposite decussate, simple, ovate, 10-12 x 4-6 mm, entire-undulate, acute, glabrous, petiolate, exstipulate; petiole 1 mm.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Rare in wetland, but grows in marshy places.

Growth-form: Herbids.

Status: Rare.

Distribution: S and SE Asia.

Specimen examined: Ketankiyari (Jore), MM-248.


1. Heliotropium L.

Key to the Species

1. Fruits glabrous, ribbed; leaves ovate-oblong, obtuse ........................................ 1. H. indicum
1. Fruits hairy, not ribbed; leaves lanceolate, acute ........................................ 2. H. strigosum


Vernacular name: Hatisur.

Annual herb. Stem hispid, emergent, woody. Leaves alternate, petiolate, ovate, acute, subserrate, 5-8 x 5-7 cm, pubescent, acute. Flower 2-ranked, elongated, scorpioid cyme, white-pale, violet. Fruit deeply bifid, each lobe 0.5 mm long; divided into 2-seeded mericarp.

Fl. & Fr.: March–May.

Propagation by: Seeds.

Field notes: Found at the fringe area of wetland.

Growth-form: Herbids.

Status: Common.

Distribution: This is a pantropic species.

Specimens examined: Puruliya (Sahebbundh), MM-466; Jhalda (Lihibundh), MM-464.


Annual or perennial herb, small, mush branched, usually procumbent, perennial herb. Stem slender, woody. Leaves lanceolate, acute, entire. Spikes up to 6 cm long; bracts small, linear, the lower bracts larger, leafy. Fruit subglobose, depressed; nutlets 4, hairy, more or less united, slightly hairy.
Fl. & Fr.: July–September.

**Propagation by:** Seeds.

**Filed notes:** Found at wetplaces of Adra Sahebbundh, rare in the district.

**Growth-from:** Herbids.

**Status:** Rare.

**Economic use:** Raw juice of the plant used in diuretic cases.

**Distribution:** Throughout India extending to Pakistan and North Africa; Burma, Malaya, China and Australia.

**Specimens examined:** Adra (Sahebbundh), MM-567; MM-568. (Plate 1d.)

14. **Menyanthaceae** Sequier

1. **Nymphoides** Segu.


**Vernacular name:** Panhar.

Annual or perennial herb. Shoot petiole-like, slender, cylindrical, fistular, 7–9 cm. Leaves floating, cordate/oval-orbicular, 4–7x6–11 cm, entire-undulate, thin, green–purplish; venation reticulate divergent; base hastate; petiole slender, fistular, 1–2 cm. Fruit a capsule ovoid, dehiscent, pediculate, 5x3 mm, yellowish–white, persistent petals; seed 3 in each fruit, globose, brown, rugose, 2x1.5 mm, pedicilate; pedicel slender, glabrous, 4 cm.

Fl. & Fr.: August–October.

**Propagation by:** Seeds.

**Field notes:** Common in bundh, Sayar, Jore, ditches and stagnant water of water bodies.

**Growth-form:** Nymphaeids.

**Status:** Very Common.

**Distribution:** Tropical Asia.

**Specimens examined:** Sankra (Barabundh), MM-428; Khariduara (Sayar bundh), MM-446; Guniyara.
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(Barabundh), MM-542; Guniyara (Ruknibundh), MM-544; Mangalda (Burosayar), MM-546; Raghunathpur (Dhanar bundh), MM-548; Raghunathpur (Barikbundh), MM-549; Kharbar (Deshbundh), MM-552; Karangberiya (jore), MM–555; Ketankiyari (Jore), MM-556; Patharmura (Maidhara), MM-559; Kantadih (Mahatobundh), MM-560; Patharmura (Gobindasayar), MM-562; Kalidaha (Dewanbundh), MM-56

(Plate 5 & Fig. 11)

15. **Convolvulaceae** Juss.

Key to the genera

1. Leaves orbicular-subcordate; corolla subrotate

2. Stem decumbent, ribbed; flowers axillary

3. Stem floating /erect, cylindrical; flowers terminal

1. **Evolvulus** L.


A small prostrate, perennial herb. Roots adventitious from nodes, branched, brown, hard, 6 cm. Stem herbaceous, branched, filiform, glabrous, creeping 35 cm; internode always 5 mm. Leaves alternate, simple, orbicular-subcordate, 5-9x5-8 mm, entire, obtuse; petiole slender, 4 mm. Flowers axillary; corolla, subrotate, white, 3 mm. Fruit a capsule with persistent calyx, globose, 3x2 mm. hyaline; calyx 5, persistent, lenceolate, 3x2 mm, entire, acute, greenish; pedicel slender, pubescent, 5 mm; seeds 2 in each fruit, flat, ovate, 2x2 mm, black.

Fl. & Fr.: June–October.

Propagation by: Seeds.

Field notes: Rare in wetland, found on wetplaces near bundh.

Growth-form: Herbids.

Status: Rare.

Distribution: Native of west Indies. Introduced and now well distributed in India, Tropical Africa, Malagasy, America from Mexico to north Argentina.

Specimen examined: Adra (Sahebbundh), MM-453.
2. Ipomoea L.

Key to the species

1. Stem somewhat woody, erect shrubby plants ........................................ 2. I. fistulosa
1. Stem herbaceous, creeping or floating plants ........................................ 1. I. aquatica

1. Ipomoea aquatica


Vernacular name: Kalmilata, Kalmisak.

A perennial herb. Stem floating, herbaceous, branched, fistular, cylindrical, creeping, pubescent, 21-40 cm; internode 2.5-8 cm. Roots adventitious from lower nodes branched, cluster, reddish-brown, 3-9 cm. Leaves alternate, simple, lanceolate-sagittate or hastate, 4.5-7 x 4-2 cm, entire-undulate, acute, glabrous, base hastate, petiolate, exstipulate, reticulate, midrib prominent, or 3 main veined; petiole slender, glabrous, 3-4.3 cm. Flowers terminal; corolla campanulate, white, 4.5 cm.

Fl. & Fr.: November-April.

Propagation by: Seeds.

Field notes: Frequently grows in jore, sayar, bundh etc.

Growth-form: Ipomoeids.

Status: Very common.

Distribution: Old World tropics, and subtropics, naturalized in the New World.

Specimens examined: Ketankiyari (Jore), MM-251; Puruliya (Nibaransayar), MM-282; Adra (Saheb bundh), MM-317; Guniyara (Barabundh), MM-384; Baraurma (Kumari), MM-424.

(Fig. 12 & Plate 3g.)

2. Ipomoea fistulosa


Vernacular name: Berakalmi

Propagation by: Seeds and cutting of lateral shoot.
A perennial shrubby plant. Stem unbranched, fistular, somewhat woody, cylindrical, emergent, glabrous, 2m. Leaves alternate, simple, hastate, 11x9 cm, entire, acute, glabrous, venation reticulate, divergent, basecordate; petiole slender, 7 cm. Flower axillary tube 4.5 cm; sepals 5, subequal, ovate, obtuse; corolla 5, campanulate, pink; stamens villous; anther 6 mm.

Fl. & Fr.: December–May.

Field notes: Common in bundh, jore, sayar etc.

Growth-form: Ipomoeoids.

Status: Very Common.

Distribution: Native in S. America, naturalized in Africa and Asia including India.

Specimens examined: Chharra (Angarkhuri), MM-468; Chharra (Purunosayar), MM-469; Puruliya (Rajabundh), MM-474; Raghunathpur (Barikbundh), MM-472; Guniyara (Barabundh), MM–473; Barabazar (Gorsabundh), MM-478; Balarampur (Hanumatadom), MM-476; Banduan (Pokabundh), MM-479; Jhalda (Lihirbundh), MM–470; Tiyashi (Gayerbundh), MM-582.

(Plate 18)


A perennial, decumbent herb. Stem creeping, herbaceous, branched, solid, ribbed, glabrous-pubescent, purple red, slender, 55 cm; internode 2.9-3.5 cm; branching lateral, slender, erect. Roots adventitious from nodes, brown, 1 cm. Leaves alternate, simple, cordate-ovate, 1.3-2x.8-2.2 cm, crenate-undulate, obtuse, membranous, glabrous-pubescent, base cordate, petiolate, extipulate; venation reticulate, divergent; petiole slender, pubescent, 1.3-1.5 cm. Flowers axillary; corolla campanulate, yellow, 6.5 mm.

Fl. & Fr.: September-January.

Propagation by: Seeds.

Field notes: Rare in wetland, grows at the margin of water as well as wet places.

Growth-form: Ipomoeoids.

Status: Rare.
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**Distribution:** Old World tropics.

**Specimen examined:** Adra (Sahebbundh), MM-318.

16. **Solanaceae** Juss.

1. **Solanum** L.


**Vernacular name:** Gurkhi.

A marshy annual herb. Stem herbaceous, branched, solid, cylindrical, emergent, glabrous, 22 cm; internode 4.9-5.8 cm; branching lateral, slender, glabrous. Leaves alternate, simple, ovate, 2.8-6x 0.8-.2 cm, entire-serrate, acute, glabrous, reticulate; base caudate; petiole glabrous, 7 mm. Flower complete, bisexual, hypogynous, actinomorphic, pentameric; pedicel slender, glabrous, 4 mm; calyx-5, camparulate, persistent; corolla-5, rotate, 4 x 2 mm, entire, acute, white; stamen 5, isomeric, connate at base; filaments filiform, hyaline, 1 mm; anthers oblong, 2 mm, basifixed, 2-lobed, yellow; style filiform, hairy, hyaline, 3 mm; stigma capitate. Fruit berries with persistent calyx, globose, 5 x 5 mm.

**Fl. & Fr.:** August.

**Propagation by:** Seeds.

**Field notes:** Grows at the bank of sayar and wet places.

**Growth-form:** Herbids.

**Status:** Rare.

**Distribution:** This is a Pantropic species.

**Specimen examined:** Puruliya (Nibaransayar), MM–435.

17. **Scrophulariaceae** Juss.

Key to the genera

1. Stem somewhat woody and pubescent; flowers actinomorphic................4. Verbascum

1. Stem herbaceous and glabrous; flowers medianly zygomorphic:

2. Stem creeping.................................................................................................1. Bacopa

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**Results**
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2. Stem erect/submerged:
   3. Venation reticulate often 1-nerved..........................3. Lindernia
   3. Venation reticulate often 2-3 nerved .........................2. Limnophila

1. **Bacopa** Aublet. nom. cons


**Vernacular name:** Brambhi.

A perennial or annual herb. Stem herbaceous, branched, solid, with narrow lacunae, cylindrical, creeping, sometimes erect, glabrous to pubescent, 30 cm; branching lateral, stout. Roots adventitious from nodes, unbranched, 2.5-4 cm. Leaves, exstipulate. Flowers solitary, axillary, bisexual, pedicillate, complete, hypogynous, brown, 5 mm; pedicels brown, 4 mm; calyx 2, lanceolate, 3 mm; stamen 3, heteromeric; filaments filiform 7 mm; anthers bi-lobed, dorsifixed, introse, yellow, 2 mm; ovary globose, 2 mm, brown; style 4 mm; stigma capitate, 0.5 mm wide.

**Fl. & Fr.**: February-June.

**Propagation by:** Seeds and runner.

**Field notes:** Grows at the bank of bundh as well as other wet places.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** Tropics and subtropics of the world.

**Specimens examined:** Ketankiyari (Jore), MM-243; Adra (Sahebbundh), MM-320, MM-327; Joypur (Ranibundh), MM–378. (Fig. 13 & Plate 3d.)

2. **Limnophila** R. Br.

Key to the species
1. Stem solid; leaves petiolate ...................................................... 5. L. rugosa
1. Stem fistular; leaves sessile:
   2. Stem submerged ............................................................. 1. L. erecta
   2. Stem emergent:
      3. Leaves compound, pinnatisect:
         4. Aerial leaves in whorls of 3-5 and submerged leaves in
            whorls of 6-8 ......................................................... 2. L. heterophylla
      4. Aerial leaves in whorls of 3-4 and submerged leaves in whorls of
      6. .................................................................................. 6. L. sessiliflora
      3. Leaves simple, dissected:
         5. Leaves with 3 main veins .............................................. 3. L. indica
         5. Leaves with single prominent mid vein .......................... 4. L. repens

   Annual herb. Stem submerged, herbaceous, branched, fistular, cylindrical, glabrous, 22-30
   cm; branching lateral, slender; internodes 1.7-2 cm. Roots from nodes, branched, brown, 5 cm.
   Leaves opposite decussate, simple, lanceolate, 2.5-5 × 0.5-0.6 cm, entire, obtuse, glabrous,
   exstipulate, base caudate; venation reticulate, midrib prominent; sessile.
   Fl. & Fr.: Throughout the year.
   Propagation by: Seeds and cutting of lateral shoot.
   Field notes: Common in jore, bundh, Sayar, etc.
   Growth-form: Herbids.
   Status: Very common.
   Distribution: SE Asia.
   Specimens examined: Kalidaha (Jore), MM-258; Rampur (Barabundh), MM-268, MM-272; Adra
   (Sahebbundh), MM-323, MM-326; Raghunathpur (Barikbundh), MM-404; Patharmura
   (Gobindasayar), MM-442.

2. Limnophila heterophylla (Roxb.) Benth; Scroph. Ind. 25. 1835; Hook. f. in Hook f; Fl. Brit. India
   Columnnea heterophylla Roxb., Fl. Indica 3: 97. 1832.
A perennial or annual herb. Stem submerged/partially submerged, spongy, glabrous, herbaceous, branched, cylindrical, erect-decumbent, 13-30 cm; branching lateral, stout; internode 0.6-1.5 cm; aerial leaves in whorls of 3-5, lanceolate, 1.7-2.5x0.3-0.5 cm, subcrenate, serrate, acute, glabrous, sessile; venation reticulate; submerged leaves in whorls 6-8, compound, pinnate, 2-2.5 cm long; segments multifid, capillary. Flowers solitary, axillary, pedicilate, 7 mm; pedicel slender, 2 mm; calyx 5, campanulate, lobes connate at base, subequal, lanceolate, 7x1 mm, entire, acute; ovary globose, black, 2x2 mm; style slender, 2 mm; stigma capitate, 2 mm wide.

Fl. & Fr.: August–October.

Propagation by: Cutting of lateral shoot.

Field notes: This is a common wetland species of the district, grows abundantly.

Growth-form: Herbids.

Status: Very Common.

Distribution: Tropical Asia.

Specimens examined: Babiddi (Babirbundh), MM–311; Adra (Sahebbundh), MM–328; Raghunathpur (Dhanarbundh), MM–402; Khariduara (Sayarbundh), MM–445.


Annual or perennial herbs. Stem submerged, herbaceous, branched, fistular, cylindrical, pubescent, purple red, 9-15 cm; branching lateral, stout; internode 1.5-2 cm; aerial leaves opposite decussate, or whorled, simple, lanceolate, 15 x 2-3 mm, entire-dissected, acute, pubescent, extstipulate, reticulate, main veins 3; sessile. Fruits capsule, 4x4 mm, pedicillate, covered by sepals; pedicel slender, pubescent, 7 mm.

Fl. & Fr.: December.
**Survey of Wetlands in Puruliya District**

**Propagation by:** Cutting of lateral shoot.

**Field notes:** Rare in wetland, grows occasionally in marshy places near bundh.

**Growth-form:** Herbids.

**Status:** Rare.

**Distribution:** Tropical Africa, Asia, and Australia.

**Specimen examined:** Rampur (Barabundh), MM-271.

   
   Annual, herbs, erect, 36 cm. Stem herbaceous, branched, fistular, cylindrical, emergent, glabrous-hispid, decumbent, node narrow, 34x0.2-0.6 cm; branching lateral, stout; internode 2.2–6 cm long. Roots from nodes. Leaves opposite-decussate, simple, lanceolate, 2.1-4x 0.5-0.9 cm, crenate-serrate, acute, pubescent, base cuneate, extipulate; venation reticulate, midrib prominent. Fruits capsule, 3.5mm long.

**Fl. & Fr.:** October-February.

**Propagation by:** Seeds and cutting of lateral shoot.

**Field notes:** Common in Sayar, bundh etc.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** Tropical Asia.


**Vernacular name:** Kala–Karpur.

Annual herbs, erect, 20 cm. Stem herbaceous, branched, soft, solid, cylindrical, emergent, glabrous; branching lateral, stout; internode 2–4 cm. Leaves opposite decussate, simple, ovate or oblong–ovate, 2.9–4x1.2–2.4 cm, entire, serrate, acute, glabrous, caudate, petiolar, extipulate, reticulate, divergent, 3 main veins; petiole 3–5 mm.

**Fl. & Fr.:** Throughout the year.

**Propagation by:** Seeds and cutting of lateral shoot.

**Field notes:** Rare in wetland, found in river bank during dry seasons.

**Growth-form:** Herbids.
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Status: Rare.

Distribution: Tropical Asia.

Specimen examined: Baraurma (Kumari), MM–419.


Annual or perennial herb. Stem partly submerged, erect, herbaceous, unbranched, fistular, cylindrical, glabrous, soft, 27–43 cm; submerged leaves whorls of 6, compound; lobes divided pinnately into capillaries, flattened, 5–10 cm; aerial leaves in whorls of 3–4, lanceolate, 1.5–1.7x0.5–2 mm, acute, glabrous, venation reticulate; sessile. Flowers solitary, sessile, 1.5 mm. Fruit capsule, axillary, globose, flattened, green, rugose, 3 x 2 mm, without persistent calyx.

Fl. & Fr.: October.

Propagation by: Cutting of lateral shoot

Field notes: Grows on Sayar, bundh and wet places near sayar.

Growth-form: Herbids.

Status: Very Common.

Distribution: Tropical and E Asia

Specimens examined: Puruliya (Nibaransayar), MM–279; Adra (Sahebbundh), MM–325, MM–329; Mangalda (Burosayar), MM–388; Raghunathpur (Dhanarbundh), MM–396; Raghunathpur (Barikbundh), MM–403.

3. Lindernia All.

Key to the species

1. Leaves ovate; capsule with persistent calyx ............................................ 2. L. parviflora
1. Leaves oblong-lanceolate; capsule without persistent calyx.......................... 1. L. crustacea


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Results
A glabrous annual herb. Stem herbaceous, branched, cylindrical, glabrous, emergent with ascending branches, 4–7.5 cm. Leaves opposite, simple, suborbicular, 0.5–1.7 x 0.4–1.5 cm, entire, acute, glabrous, pinnately nerved, petiolate, petiole 1 cm, glabrous, cylindrical. Flowers axillary, bilabiate; sepals 5, campanulate; petals 5, bilabiate, tube cylindric; stamens 4, didynamous; carpel connate in a 2-celled ovary. 

Fl. & Fr.: August–September.

Propagation by: Seeds.

Field notes: common in Sayar, bundh, river bank and marshy places.

Growth form: Herbids.

Status: Common.

Distribution: Old World tropics.

Specimens examined: Rampur (Barabundh), MM-496; Karangberiya (Jore), MM-499.
Specimens examined: Mangalda (Burosayar), MM–394; Baraurma (Kumari), MM–421; Patharmura (Maidhara), MM–444.

4. Verbascum Thapus


Annual herb. Stem somewhat woody, emergent, branched, solid, cylindrical, densely pubescent 35 cm; branching, lateral, stout, woody; internode 0.5–1.2 cm. Leaves simple, alternate ovate, 13–15x5–6 mm, crenate–dentate, acute pubescent, exstipulate; venation reticulate, 3 main veined; sessile. Fruit oblong, ovoid, septicidal capsule, 8x4 mm, blackish brown, dehisce by 4 valves, pedicilate, covered with persistent sepals; pedicel stout, pubescent, 1.3–1.4 cm; sepals 5, connate at base; lobe lanceolate, entire, acute, 6x2 mm; seeds numerous, black, 25x25 mm.

Fl. & Fr.: May.

Propagation by: Seeds.

Field notes: Rare in wetland, found at river bank during dry seasons.

Growth form: Herbids.

Status: Rare.

Distribution: Throughout India, Sri Lanka, Afghanistan, Burma, China.

Specimen examined: Baraurma (Kumari), MM–420.


1. Utricularia L.

Key to the species

1. Flowering axis with vesicle ................................................................. 4. U. stellaris
2. Plants aquatic; stem submerged:
   3. Flowering axis with scale; corolla glabrous ................................. 2. U. australis
   3. Flowering axis without scale; corolla pubescent ........................... 1. U. aurea
2. Plants semiaquatic; stem not submerged ........................................ 3. U. bifida
Results


A perennial, submerged insectivorous herb. Stem filiform, branched, herbaceous, slender, submerged, glabrous, creeping, soft, blackish-brown, papillose, 8–12 cm; internodes blackish brown, slender, 0.5-1 cm. Leaves numerous, divided, filiform; secondary segments pinnate; pinna forked, 1.5-3 cm x 0.5 mm, serrate, acute, with minute bladder. Flowering axis slender, erect, emergent, glabrous, brownish without scale, 13 cm. Flower 6-7, black, 6 x 5 mm, pedicilate; pedicel–filiform, redish, glabrous, 1.4 cm; bracteoles–1, hyaline, 2x.5 mm, bracteate; corolla–2, reddish, lanceolate, 4x.2 mm, pubescent, connate at base, entire, acute; ovary–globose, 3x.3 mm, red; style filiform, 2 mm, red; stigma capitulate, 0.5 mm.

Fl. & Fr.: October–November.

Propagation by: Seeds and offset.

Field notes: Occasionally grows in bundh.

Growth–form: Utricularids.

Status: Rare.

Distribution: S and E Asia and Australia.

Specimen examined: Raghunathpur (Dhanarbundh), MM-397.

(Plate 2g.)


A perennial, submerged herbs. Stem submerged, herbaceous, flexible, branched, blackish, cylindrical, creeping, glabrous, 13-20 cm; internode 4-9 cm. Leaves numerous, forked pinnately divided, cappillary, 2.5-2.9 cm; trap oval/globose, 1-1.5x1 mm, hyaline–greenish. Flowering axis filiform, with scale, erect, emergent, blackish brown, terete, glabrous, 7 cm; Flowers 3-6, pedicilate; petals–2, glabrous brownish; pedicel filiform, terete, glabrous, 3 mm.

Fl. & Fr.: October.

Propagation by: Seeds.
**Field notes:** Found in bundh, Sayar etc.

**Growth-form:** Utricularids.

**Status:** Very common.

**Distribution:** Widely distributed in the old world (Europe, Africa, Asia, Australia) in temperate and tropical regions.

**Specimens examined:** Adra (Sahebbundh), MM–316, MM–319; Joypur (Ranibundh), MM–366; Mangalda (Burosayar), MM–389; Raghunathpur (Dhanarbundh), MM–398.

(Plate 31)


A marshy, semiaquatic, emergent, annual herb. Flowering axis filiform not twining, emergent, terete, glabrous, 11-14 cm. Flowers 4-5, pedicilate; abaxial petals 3, ovate, 2-5 x 0.3 mm, membranous, hyaline, entire, obtuse; adaxial petals 3, lanceolate, 3 x 1 mm, hyaline, entire, acute, curved; ovary globose, 1.5 x 1 mm, rugose, red; pedicel – filiform, slender, terete, glabrous, curved, 6 mm.

**Fl. & Fr.:** November-December.

**Propagation by:** Seeds.

**Field notes:** Rare in wetland, grown in marshy places near bundh.

**Growth-form:** Utricularids.

**Status:** Rare.

**Distribution:** India to Japan and Australia.

**Specimen examined:** Kalidaha (Dewanbundh), MM–494.


**Vernacular name:** Jhangi.

A submerged, insectivorous, perennial or annual herb. Stem herbaceous, filiform, terete, branched, flexible, glabrous, submerged, cylindrical, 15–26 cm; internode, 1–1.2 cm. Leaves very numerous, divided, filiform; secondary segments pinnate, pinnate forked, capillary, 2–2.5 cm, serrate, acute; bladder ovate, 2 x 1 mm, hyaline, entire, acute. Inflorescence with 5–7 flowers; flower yellow, 4 mm x 3 mm; pedicel 1–3 mm, blackish; axis
19. **Acanthaceae** Juss.

1. **Hygrophila** R. Br.

Key to the species

1. Stem erect, solid; capsule oblong or linear–oblong:
   2. Capsule 4-8 seeded; stem 4-gonous, hispid .........................3. *H. schulli*
   2. Capsule many seeded; stem cylindrical, glabrous puberulous …..2. *H. polysperma*

1. Stem emergent or submerged, fistular; capsule absent .....................1. *H. difformis*


An annual herb. Roots adventitious from lower node, branched, brown, 2-6 cm. Stem emergent, sometimes submerged, herbaceous, branched, fistular, decumbent, soft, pubescent, 13-25 cm; internode 2-8.7 cm; branching slender. Leaves submerged and emergent; submerged leaves opposite, simple, pinnately lobed, 3-5 x 0.1-0.2 cm, serrate, acute, soft, pubescent, emergent leaves simple, elliptic–ovate, 1.8-3.5 cm x 1-2 cm, serrate, acute, pubescent, caudate; petiole 4 mm, slender.

**Fl. & Fr.:** December-April.

**Propagation by:** Cuttings of lateral shoot.

**Field notes:** Frequently grows in bundh, Sayar, dry ponds etc.

**Growth form:** Herbids.

**Status:** Common.
Distribution: Probably endemic to the northern part of India Subcontinent, naturalized in the south.

Specimens examined: Rampur (Barabundh), MM-273; Mangalda (Burosayar), MM-393; Raghunathpur (Dhanarundh), MM-401.


A perennial herb. Roots adventitious from node, branched, brown, 2-5 cm. Stem decumbent, herbaceous, branched, solid, glabrous–puberulous, erect, cylindrical, brown, 14 cm; internode 2 cm. Leaves opposite, simple, oblong 1 x 0.4 cm, entire, acute, pubescent, base cuneate; hair white, acute, brown. Fruit capsule, narrow, oblong, 8 x 2 mm, glabrous, sessile; seed many, globose, 1 x 1 mm, flat, brown, margin pubescent; retinacula hard, slender, curved.

Fl. & Fr.: December.

Propagation by: Cutting of lateral shoot.

Field notes: Rare in wetlands, but grows in muddy wet places and bank of bundhs.

Growth-form: Herbids.

Status: Rare.

Distribution: India to Indochina, introduced established in some warmer parts of N America.

Specimen examined: Rampur (Barabundh), MM-269.


Vernacular name: Kulekhara, Kuyla-khara.
A perennial herb. Stem emergent, stout, 4-gonous, unbranched, hispid, 0.5-1 m. Leaves opposite, simple, linear-lanceolate, 5.5x1.3 cm, entire, acute, subsessile, pubescent. Flowers in axillary, whorl, bilabiate; bract oblong-lanceolate, foliaceous, 2-2.2 cm; bracteoles linear, lanceolate, 1.6 x 2 cm. Capsule linear-oblong, acute, 4-8 seeded, 6-8 mm.

**Fl. & Fr.:** December–February.

**Propagation by:** Seeds.

**Field notes:** Common at the margin of water and wet places.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** Throughout India and Sri Lanka.

**Specimens examined:** Rampur (Barabundh), MM-497; Ketankiyari (Jore), MM-498.

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**Vernacular name:** Bhui–okra.

A perennial herb. Stem herbaceous, creeping, solid, cylindrical, branched, pubescent, with centrally attached and appressed hairs, decumbent, 9 cm; internode 1–1.5 cm. Roots adventitious from nodes, branched, brown, 3–6 cm. Leaves–opposite superposed, simple, spatulate, 4.9x2-4 mm, serrate, acute, glabrous, reticulate, caudate; petiole–slender, 3 mm.

**Fl. & Fr.:** July–August.

**Propagation by:** Seeds and roots.

**Field notes:** Grows at the bank of bundh, wet places etc.

**Growth-form:** Herbids.

**Status:** Rare.
**Distribution:** Cosmopolitan in tropical to warm regions.

**Specimen examined:** Rampur (Barabundh), MM–277.

21. **Nyctaginaceae** Juss.

1. **Boerhavia** L.


   **Vernacular name:** Khapra–Sak.

   A diffuse, perennial herb. Stem somewhat woody, diffuse, branched, fistular, cylindrical, pubescent, younger parts tinged red, decumbent; internode 7–12 cm; branching stout. Leaves opposite superposed in unequal pair, simple, ovate, 1-2.3 x 0.8-0.4 cm, entire, acute, thickish, pubescent, cuneate, reticulate convergent; petiole 3–5 mm; stipule 2 mm. Flower actinomorphic, incomplete, haplochlamydous, hypogynous, bracteate; pedicel articulate; perianth–5, petaloid, pink; stamen 3, heteromorous; carpel–1. Fruit enclosed in truncate perianth base, 5–ribbed with small sticky gland, 4 mm.

   **Fl. & Fr.:** June–October.

   **Propagation by:** Seeds.

   **Field notes:** Rare in wetland, grows also in wet places.

   **Growth-form:** Herbids.

   **Status:** Rare.

   **Distribution:** Throughout India, Sri Lanka and the Malaya Peninsula; also found in China, Africa, America and the islands of the Pacific.

   **Specimen examined:** Adra (Sahebbundh), MM–451.

22. **Amaranthaceae** Juss.

Key to the genera

1. Stem erect, ribbed; leaves pubescent; stigma 2–fid ................................. 2. Gomphrena

1. Stem decumbent, cylindrical; leaves glabrous; stigma capitate .......... 1. **Alternanthera**

   1. **Alternanthera** Forsk.

   Key to the species

1. Stem solid; leaves sessile ................................................................. 2. **A. sessilis**
Results

1. Stem fistular; leaves petiolate …………………………………….………1.A.philoxeroides


A perennial herb. Roots adventitious from nodes, numerous, branched, cluster, blackish–brown, 2.5–3.5 cm. Stem decumbent, herbaceous, branched, flattened, fistular, forming mats, glabrous, cylindrical, creeping, 57 cm; internode, 3.5–8 cm; branching lateral, slender. Leaves opposite supperposed, simple, spathulate, 2–4.5x0.3-0.7 cm, undulate, acute, glabrous, petiolate, estipulate, reticulate, midrib prominent; base cuneate; petiole 2-3 mm.

FL.& Fr.: March-June.

Propagation by: Seeds.

Field notes: Common in sayar, bundh, and small waterbodies.

Growth-form: Herbids.

Status: Common.

Distribution: Native in S America, naturalized in N America, Asia and Australia.

Specimens examined: Puruliya (Nibaransayar), MM-281, MM-294; Babiddi (Sabibundh), MM-295; Joypur (Ranibundh), MM-375.

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**Vernacular name:** Chanchi.

Annual or perennial herbs. Roots adventitious from nodes, brown-white, 1-2.5 cm. Stem decumbent, sometimes erect, herbaceous, branched, solid, cylindrical, ribbed, glabrous or pubescent, 17 cm; internode 2-3.5 cm; branching lateral, stout. Leaves opposite superposed, simple, ovate, 17x6 mm, entire, obtuse, glabrous, sessile, extipulate, base cuneate, reticulate, midrib prominent. Fruit a capsule, cordate, 2x1.5 mm; seeds one in each fruit, elliptic, red, 0.5 mm.

F. & Fr.: August–October.

**Propagation by:** Seeds and runners.

**Field notes:** Abundantly grows in sayar, bundh etc throughout the district.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** This is a Pantropics species.

**Specimens examined:** Puruliya (Nibaransayar), MM–298; Adra (Sahebbundh), MM–336; Mangalda (Burosayar), MM–395.

2. *Gomphrena L.*


Annual herbs. Stem herbaceous, branched, solid, ribbed, emergent, glabrous, nodal thicker, 19 cm, internode 1.9–5.6 cm; branching lateral, stout. Leaves opposite, simple, lanceolate–spatulate, entire, acute, pubescent, reticulate, midrib prominent, cuneate; hair white, bristle–like; petiole pubescent, 3 cm. Flowers in terminal condensed, head white, sessile, bracteate; perianth 5, connate at base, lanceolate, 5x3 mm, acute, hard; ovary subglobose, red, 2x1 mm; style 1.5 mm; stigma 2 fids, feathery, 0.5 mm; bract 1, hyaline, lanceolate, 5 x 3 mm, entire, acute; bracteole 1, hyaline, soft, lanceolate, 7x3 mm.

F. & Fr.: October.

**Propagation by:** Seeds.

**Field notes:** Not very common, found at the margins of wetland.
Growth form: Herbids.

Status: Rare.

Distribution: Native of Tropical America, introduced in India, S. Africa, Australia, and Malaysia.

Specimen examined: Joypur (Ranibundh), MM–364.

23. Polygonaceae Juss.

1. Polygonum L.

Key to the species

1. Raceme lax, hanging ................................................. 1. P. hydropiper

1. Raceme compact, erect:

2. Leaves ovate, pubescent, petiole 1 cm ...................... 2. P. orientale

2. Leaves lanceolate, glabrous, petiole 0.4 cm .............. 3. P. pulchrum


Vernacular name: Pakurmul.

Annual herb. Root adventitious, cluster, branched, black, 3 cm. Stem herbaceous, emergent, fistular, cylindrical, glabrous, 30 cm; internode 4-4.2 cm. Leaves alternate, simple, ovate lanceolate, 4.5x1.5 cm, entire, acute, glabrous; petiole 1 cm; ochrea membranous, glabrous, 1.8x0.5 cm; inflorescence terminal raceme, slender, brown; axis hanging, pubescent, 2.2 cm; perianth-5, segment lanceolate, 5x3 mm, entire, obtuse, brown; ovary globose, 2x2 mm, brown; style 1 mm; stigma–2. fidi, 0.5 mm wide.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Found at the peripheral parts of wetlands.

Growth-form: Herbids.

Status: Rare.

Distribution: N Africa, temperate and tropical Eurasia, introduced in N America.

Specimen examined: Adra (Sahebbundh), MM– 450.


**Vernacular name:** Pani-marich.

A erect annual herb. Stem herbaceous, branched, fistular, longitudinally ribbed, emergent, pubescent, reddish, 29 cm; internode 2.5 cm; hair white, unbranched, 1.2 mm. Leaves alternate, simple, ovate, 5.5-10 x 1.3-2.3 cm, entire, acute, pubescent; venation reticulate; base caudate; petiole slender, pubescent, 1 cm; ochrea tubular, 1.5 x 0.5 cm, membranous, hairy. Flower in terminal raceme. axis 15 slender, erect, pubescent, 3-5 cm; perianth 4, unequal, 3 x 4 mm, serrate, hyaline, membranous, persistent with fruit. Fruits nutlet, 3-gonous, oblong, 3 x 1 mm.

**Fl. & Fr.:** October.

**Propagation by:** Seeds.

**Field notes:** Common, found in margins of wetland where it is moist.

**Growth form:** Herbids.

**Status:** Common.

**Distribution:** India to Japan, southward to Australia.

**Specimens examined:** Adra (Sahebbundh), MM–354; Joypur (Ranibundh), MM–380; Baraurma (Kumari), MM–423.


Plant a decumbent, annual or perennial herb. Root adventitious, cluster, branched, blackish, 3-7 cm. Stem woody, decumbent, branched, fistular, cylindrical, glabrous, reddish, 38 cm; internode 2-2.5 cm; branching lateral, erect, stout. Leaves alternate, simple, lanceolate, 4.5-5 x 1-1.5 cm, entire, acute, glabrous base caudate; petiole slender, 4 mm; ochrea membranous, tubular, 1.4 x 0.5 cm, glabrous, pubescent, reddish; barb 4 mm.

**Fl. & Fr.:** August-May.

**Propagation by:** Cutting of lateral shoot.

**Field notes:** Grows on the bank of the wetland.

**Growth form:** Herbids.

**Status:** Common.

**Distribution:** Tropical old world, India.

**Specimens examined:** Barabazar (Gorsaibundh), MM–410; Baraurma (Kumari) MM–422.

24. **Piperaceae** Bercht. & J. Presl.
1. **Peperomia** Ruiz. & Pav.


**Vernacular name:** Luchi–Pata.

Plant perennial herb. Stem emergent, herbaceous, branched, fistular, cylindrical, slender, glabrous, 21-24 cm; internode 4.6 cm. Leaves alternate, simple, orbicular, 1.4-1.6 x 1-1.2 cm, entire, obtuse, membranous, glabrous, petiolate, exstipulate, reticulate, main veins 5; petiole filiform, 7 mm. Fruit minute, indehiscent, dry berry / nutlet, 1 x 1 mm; axis–filiform, 3.4–4.3 cm long.

**Fl. & Fr.:** October.

**Propagation by:** Cuttings of lateral shoots and seeds.

**Field notes:** Found at the margin of wetland.

**Growth-form:** Herbids.

**Status:** Rare.

**Distribution:** Common through out India, native of Tropical America, introduced and widely naturalized in tropics of the Old World.

**Specimen examined:** Puruliya (Nutanbundh), MM-356.

25. **Euphorbiaceae** Juss.

1. **Croton** L.


**Vernacular name:** Bhabari, jhamti.

A perennial herb. Stem woody, branched, solid, longitudinally ribbed, emergent, glabrous, 15 cm; internode 2.5 cm; branching lateral, stout. Leaves alternate, simple, lanceolate, 3.5-5.2 x 1-2 cm, serrate, acute, glabrous; venation reticulate, divergent midrib prominent, base caudate; petiole slender with gland, 2.2 cm long. Inflorescence androgynous raceme with male flowers upper and female flowers with the lower part; axis 13 cm, slender; male flowers numerous, filaments free, short, 1.5 mm; anthers round, 0.5 mm; stigma 3, bifid, persistent; pedicel slender, 2 mm. Fruit regma.
trilocular, 5x4 mm.

Fl. & Fr.: August–June.

Propagation by: Seeds.

Field notes: Grows at the periphery of wetland and marshy places.

Growth-form: Herbids.

Status: Very common.

Distribution: Pantropic, Native of S. Bolivia.

Specimens examined: Chharra (Angarkhuri), MM-431, MM-465; Jhalda (Lihirbundh), MM-467; Puncha (Ghoshalpukur), MM-579; Puncha (Khagerbundh), MM-580; Chharra (Puranosayar), MM-584.

26. Ceratophyllaceae S. F. Gray

1. Ceratophyllum L.

Key to the species

1. Stem fistular, leaves 3–4 times forked, teeth inconspicuous .............. 2. C. muricatum

1. Stem solid, leaves 1-time forked, teeth conspicuous .................. 1. C. demersum


Vernacular name: Jhangi.

A submerged, aquatic, annual or perennial herb. Stem herbaceous, submerged, branched, solid, flexible, cylindrical, creeping, bottle-brush appearance, spongy, glabrous, brown, 24 cm; internode 0.5 cm. Leaves whorls of 3–4, bright green, brittle, compound, one time forked; pinna in 19 pairs, aciculare, 1-1.5 cm; teeth conspicuous, acute; rachis filiform, 3-4 cm.

Fl. & Fr.: September–December.

Propagation by: Bulb.

Field notes: Not very common, found in deep wetlands.

Growth-form: Myriophyllids.

Status: Rare.

Distribution: Almost cosmopolitan.

Specimen examined: Babiddi (Babirbundh), MM-314.

A submerged, aquatic, perennial or annual herb. Roots adventitious from lower nodes, brown, branched, 4-7 cm. Stem herbaceous, branched, filiform, flexible, cylindrical, fistular, spongy, creeping, submerged, tip diffuse, 19-26 cm; internode 2-8.5 cm; branching lateral, filiform. Leaves whorls of 7-8, light green, flaccid, soft; compound, 3-4 times forked; pinna acicular, 2.5 cm x 0.5 mm, teeth inconspicuous, acute.

Fl. & Fr.: September-November.

Propagation by: Seeds.

Field notes: Abundantly grows in bundh, sayar etc in the district.

Growth form: Vittate.

Status: Common.

Distribution: Tropical and Warm regions.

Specimens examined: Joypur (Ranibundh), MM-363; Raghunathpur (Dhanarbundh), MM-399.

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1. Hydrocharitaceae Juss.

Key to the Genera

1. Plants emergent

2. Plants submerged:

3. Leaves petiolate

4. Leaves sessile

5. Stem stoloniferous; leaves entire

6. Stem elongate; leaves serrate:

7. Leaves band-shaped, margin and apex with unicellular spine

8. Leaves lanceolate, margin and apex without unicellular spine


Annual, scapigerous herbs, 40-43 cm in height. Stem herbaceous, branched, fistular, slender, emergent cylindrical, flaccid, glabrous; internode 2.5–4 cm; branching lateral, slender.
Leaves opposite decussate, cauline, lanceolate, 2.5 X 0.5 cm, entire-undulate, acute, pubescent, sessile, gradually attenuate at a blunt point at the tip; venation parallel, midrib distinct. Inflorescence with 5 flowers; flowers complete, bisexual, diplochlamydous, actinomorphic, hypogynous, trimerous, pedicilate; pedicel 4 mm; calyx 3, gamosepalous; corolla 3, linear, white, 4 mm; stamens 2, anisomerous; filaments filiform; anthers narrow, 2-celled; carpels 3, syncarpous; ovary swollen; style short; stigma 3.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Common in Jore, bundh, wet places and at the margin of waterbodies.

Growth-form: Natopotamids.

Status: Common.

Distribution: South and East Asia.

Specimens examined: Kalidaha (Jore), MM–257; Adra (Sahebbundh), MM–330, MM–332; Rampur (Barabundh), MM–456.


Vernacular name: Chingri–dal.

A submerged, leafy, annual or perennial herb. Roots unbranched, upto 13 cm. Stem elongate, herbaceous, branched, fistular, soft, horizontal, glabrous, slender, 11-27 cm. Leaves in whorls, cauline, simple, lanceolate, 1-1.3 X 0.2–0.4 cm, serrate, acute and terminating in a single spine-cell, sessile.

Fl. & Fr.: February–March.

Propagation by: Seeds.

Field notes: Frequently found in wetlands.

Growth-form: Parvopotamids.

Status: Very Common.
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Distribution: Old World, naturalized in America.

Specimens examined: Kalidaha (Jore), MM-265; Guniyara (Barabundh), MM-385; Barabazar (Gorsai bundh), MM-407; Damda (Ganakbundh), MM-413; Kantadih (Mahabundh), MM-425; Patharmura (Maidhara), MM-443; Ketankiari (Jore), MM-517; Rampur (Barabundh), MM-520; Puruliya (Nabaransayar), MM-513; Raghunathpur (Dhanarbundh), MM-530; Lalpur (Gaylabundh), MM-532; Chharra (Angarkhuri), MM-534; Kalidaha (Dewanbundh), MM-535; Babiddi (Babirbundh), MM-538.

(Plate 2a.)

3. Nechamandra Planchon


A submerged, annual or perennial herb. Stem herbaceous, elongate, branched, slender, cylindrical, submerged, floating, glabrous, 27 cm; internode contracted at apparently irregular intervals, 5.3-6.3 cm; branching irregular, lateral, slender. Leaves cauline, clustered, flat, band-shaped, 4-6 x 0.3-0.4 cm, serrate, margin and apex with unicellular spines, glabrous, sheathing, and somewhat amplexicaul at the base; venation parallel, sessile. Inflorescence axillary; flowers trimerous, bracteate, pedicilate; pedicel slender, spiny, reddish, 5 cm; bracts 2, membranous, hyaline.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Found in stagnant water of Jore, bundh etc.

Growth–form: Parvopotamids.

Status: Common.

Distribution: India, China and Vietnam, naturalized in Sudan.

Specimens examined: Kalidaha (Jore), MM-259, MM-260; Kantadih (Mahatobundh), MM-427; Rampur (Barabundh), MM-459.


**Vernacular name:** Parmi-Kalla, Jaljhinge.

A submerged, annual or perennial herb. Leaves radical, crowded, lanceolate–cordate, 11–15X3.5–4 cm, membranous, entire, acute; petiole–25 cm. Flower solitary, sessile within a tubular, trimerous; calyx–3, lanceolate, 15X4 mm, entire, acute, greenish; spathe membranous, truncate, 35x5 mm; corolla–3, alternate to calyx lobe, membranous, white, 2.5–1 cm; stamen–6, 2-seriate. Fruit oblong, 3.5 X 1 cm; pedicel–coiling, slender, 30 cm.

**Fl. & Fr.:** September–November.

**Propagation by:** Seeds.

**Field notes:** Not very common, grows at the margin as well as in deep water.

**Growth-form:** Otteliids.

**Status:** Rare.

**Distribution:** Tropical Asia and Australia, introduced in Europe and N America.

**Specimens examined:** Rampur (Barabundh), MM–457, MM–460.

(Fig. 14 & Plate 26)

5. **Vallisneria** L.


**Vernacular name:** Dal.

A submerged, tufted, stemless, stoloniferous, annual or perennial herb. Leaves long, linear, 13-30 X0.3–0.9 cm, entire, obtuse, glabrous, many parallel veins, sessile. Flowers dioecious; male flowers many, 2 mm, in an ovoid, peduncled spathe; female flower solitary, spiral, stamens 3; filament thickish, 3 mm; anthers didymous. Fruit linear, 2 mm.

**Fl. & Fr.:** March–April.

**Propagation by:** Seeds.

**Field notes:** Common in bundh, Sayar etc.

**Growth–form:** Vallisneriids.
Status: Very Common.

Distribution: Wide spread in the Old World, also found in Australia and Oceania.

Specimens examined: Sankra (Barabundh), MM-430; Patharmura (Gobinda Sayar), MM-440; Kalidaha (Jore), MM-518; Rampur (Barabundh), MM-521; Puruliya (Nibaran Sayar), MM-526; Raghunathpur (Barikbundh), MM-531; Mangalda (Burosayar), MM-533; Sankra (Benagora), MM-536; Khariduara (Sayerbundh), MM-537.

(Plate 1c.)

2. Pontederiaceae Kunth.

Key to the genera

1. Stem floating, stoloniferous; petiole spongy ........................................ 1. Eichhornia
2. Stem emergent, rhizomatous; petiole marsupium-like.............................. 2. Monochoria

1. Eichhornia Kunth nom. cons.


Vernacular name: Kachuripana.

A perennial or annual herb. Stem floating, stoloniferous, herbaceous, fistular, spongy, cylindrical, glabrous, blackish–brown, 15 cm. Roots adventitious, much branched, cluster, black, 4–15 cm; Root pocket, marsupinate, black, 5 mm. Leaves cauline, submerged or floating, emergent, differentiated into petiole and blade; blade ovate- orbicular, 2.3-3.1 x 2.5-4 cm, entire- undulate, round, pubescent, base rounded; venation parallel, multicostate, convergent; petiole–swollen at base, marsupium-like, pubescent, 4-4.3 x 3 cm.

Fl. & Fr.: November–December.

Propagation by: Offset.

Field notes: Common in wetlands, grows gregariously, found throughout the district.

Growth form: Eichhorniids.

Status: Very Common.

Distribution: A native of Tropical America, now pantropic.

Specimens examined: Puruliya (Rajabundh), MM–305; Puruliya (Nibaransayar), MM–307; Banduan (Pokabundh), MM–539; Babiddi (Babirbundh), MM–540.

(Plate 16)
2. **Monochoria** Presl.

Key to the species

1. Leaves ovate; pedicels 3 mm……………………………2. M. vaginalis.
2. Leaves hastate; pedicels 4 cm……………………….1.M. hastata.


A perennial herb, 11.6 cm in height. Stem rhizomatous, herbaceous, branched, cylindrical, emergent, fistular, glabrous. Leaves alternate, simple, hastate, 4.3 x 2.5 cm, entire, acute, glabrous; venation parallel. Inflorescence subumbellate, borne 3.7–4.2 cm below the leaves; flowers bisexual, incomplete, pediculate, subtended by spathe; pedicel 4 cm, filiform; spathe pouch or marsupium like, 4.3 x 2.2 cm, membranous; perianth petaloid, 8 x 4 mm, blue, hyaline; stamens 6; filaments 2 mm; anthers oblong, bilobed, 4 mm; ovary globose, 2 x 1 mm; style 9 mm; stigma capitate, 5 mm wide.

**Fl. & Fr.:** July–September.

**Propagation by:** Seeds.

**Field notes:** Not very common, remain scattered in the wetland of the district.

**Growth–form:** Sagittariids.

**Status:** Common.

**Distribution:** Tropical South and South East Asia.

**Specimens examined:** Puruliya (Nibaransayar), MM–564; Puruliya (Nutanbundh), MM–565.

(Plate 3e.)


An aquatic, annual or perennial herb. Stem herbaceous, rhizomatous, branched, emergent, cylindrical, fistular, up to 30 cm. Leaves alternate, simple, ovate, 4-5 x 5-1.5 cm, entire,
Survey of Wetlands in Puruliya District

Results

Commelinaceae R.Br.

Key to the genera

1. Stem fistular:
   - 2. Stem submerged on flowing water; leaf margin herbaceous
   - 2. Stem erect; leaf margin cartilaginous

1. Stem solid

1. Commelina L.

Key to the species

1. Stem puberulous; leaves ovate, glabrous–puberulous
2. Stem glabrous; leaves lanceolate, glabrous


Vernacular name: Kansira, Kanasak.

A decumbent, perennial or annual herb with adventitious roots from lower node. Stem herbaceous, cylindrical, emergent, solid, upper part tinged red, puberulous, branched; branching axillary, stout. Leaves alternate, simple, ovate, 42x25 mm, entire-undulate, acute, glabrous to puberulous, multicoastate parallel convergent; base cuneate; petiole puberulous, 3–5 mm; leaf sheath lax, puberulous, 10 mm; hair white, 3– 4 mm. Flower helicoid cymes enclosed in hooded spathe; calyx 3, membranous, subequal; corolla 3, clawed, one larger than the others, pink, 4 x 3 mm; androecium 3 with 3 alternating staminode; staminode white, 4 mm; filament filiform, violet,
hairy below, 3 mm; anthers sagittate, 2 lobed, 1.5 mm; ovary 3–chambered, swollen, hairy on wall, 2 mm; style filiform, violet, 3 mm; stigma capitate, 0.5 mm.

**Fl. & Fr.:** August–September.

**Propagation by:** Seeds.

**Field notes:** Common in Jore, bundh and wet places.

**Growth-form:** Herbids.

**Status:** Very Common.

**Distribution:** Old World tropics.

**Specimens examined:** Raghunathpur (Barikbundh), MM–493; Rampur (Barabundh), MM–490; Karangberiya (Sindripathar), MM–492; Puruliya (Nubaransayar), MM–529.


**Vernacular name:** Jata Kansira.

An erect or prostrate, annual or perennial herb. Stem herbaceous, branched, solid, cylindrical, flexible, glabrous, emergent, 18-20 cm; internode 2–7.5 cm; branching lateral, slender. Roots adventitious from nodes, branched, cluster, brown, 5–11 cm. Leaves alternate, simple, lanceolate, 3.9–4.9 x 0.9–1.3 cm, entire, acute, glabrous, parallel; sheath 1.3 cm x 0.8 cm.

**Fl. & Fr.:** March–September.

**Propagation by:** Seeds.

**Field notes:** Common in bundh, Sayar etc.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** Native of Java; Now widely distributed in India.

**Specimens examined:** Puruliya (Sahebbundh), MM–358; Puruliya (Rajabundh), MM–360; Mangalda (Burosayar), MM–391.


Key to the species

1. Blades of lower leaves ovate to oblong …………………………………………………2. *M. spirata*

1. Blades of lower leaves linear …………………………………………………1. *M. nudiflora*

Annual herb, suberect, emergent, slender. Leaves glabrous, linear-lanceolate, 10.9 x 1.1 cm; leaf sheath margin ciliate. Capsules 2–4 mm long, equally 3-celled; seeds 2 in each cell, brown, rugose.

**Fl. & Fr.:** October–November.

**Propagation by:** Seeds.

**Field notes:** Common in marshy wetlands.

**Growth-form:** Graminids.

**Status:** Common.

**Distribution:** Old World tropics naturalized in the West Indies.

**Specimens examined:** Adra (Sahebbundh), MM-352; Rampur (Barabundh), MM-522; Puruliya (Nibaransayar), MM-527.


Annual/perennial herbs. Stem emergent, herbaceous, branched, fistular, emergent, cylindrical, glabrous, 24 cm; internode 1.8–8.5 cm; branching lateral, slender. Leaves alternate, simple, linear, 2.5–5.5 x 0.3–0.4 cm, margin cartilaginous, acute, glabrous pubescent, parallel; sheath 6 x 4 mm, glabrous. Flower bracteate; lower bract hyaline, lanceolate, 3 x 2 mm; upper bract membranous, lanceolate, 2.5 x 2 mm, persistent. Fruit capsule, ovoid, large, 5 x 3 mm; valves–3, lanceolate, 3 x 2 mm, entir e, acute; pedicel slender, 5 mm, brown.

**Fl. & Fr.:** October.

**Propagation by:** Seeds.

**Field notes:** Common in Jore, bundh and wet places.

**Growth-form:** Graminids.

**Status:** Rare.

**Distribution:** Indomalaysia.

**Specimen examined:** Ketankiyari (Jore), MM–247.

3. **Tonningia** Neck. ex A. Juss.

An annual herb. Stem herbaceous; branched, submerged, on flow water, fistular, cylindrical, glabrous, terete, 29-37 cm; internode 1.5-5.5 cm; branching lateral, slender. Roots adventitious from lower node, cluster, branched, 2-4 cm. Leaves alternate, simple, linear lanceolate, 2-5 x 0.2-0.4 cm, margin entire, acute, glabrous; sheath inflated, glabrous, 8x8 mm. Fruit capsule, globose, small 1 x 1 mm; pedicel slender, glabrous, 9 mm.

**Fl. & Fr.:** October–November.

**Propagation by:** Seeds.

**Field notes:** Found in stagnant water of jore, bundh etc.

**Growth-form:** Graminids.

**Status:** Common

**Distribution:** South and South East Asia and Australia.

**Specimens examined:** Kalidaha(Jore), MM–255; Kalidaha(Dewanbundh), MM–263.

4. **Juncaceae Juss.**


A perennial herb. Stem herbaceous, terete, emergent, filiform, unbranched, fistular, glabrous, 36 cm; internode 1-6 cm. Leaves alternate, basal and on stem, linear, 2-3.5 x 2 cm, terete, entire, acute, glabrous; sheath scarious, 1.3 x 0.2 cm. Perianth 6 in two whorls, outer segments hard, oblong, 4 x 1 mm, obtuse, pubescent, hyaline, inner segments membranous, oblong, 3 x 1 mm, entire, obtuse, stamens 2; filament filiform, hyaline, 3 mm; anther capitate; ovary oblong, 2 x 1 mm, yellowish; style 4 mm; stigma suboblong.

**Fl. & Fr.:** October.
Typha L.


**Vernacular name:** Kam, Hoogla.

A marshy, perennial herb; aerial shoot erect, cylindrical, emergent, spongy, 4-6 feet in height. Leaves erect, spongy, linear, 1 mx1.5 cm, entire, acute, semicylindric above the sheath; sheath decumbent. Inflorescence stalk 1–2.5 m long, longer than the subtending leaves; female flower in the proximal part and male flowers in distal part. Fruits one seeded indehiscent subtended by persistent hairy calys.

**Fl. & Fr.:** May-June.

**Propagation by:** Seeds and rhizome.

**Field notes:** Common, grows gregariously in bundh and at the margin of jore.

**Growth-form:** Graminids.

**Status:** Very common.

**Distribution:** Warm and tropical regions of the World.

**Specimens examined:** Raghunathpur (Barikbundh), MM-471; Balarampur (Hanumatadam), MM–475; Kalidaha (Jore), MM-480; Ketankiyari (Jore), MM–481; Baraurma (Kumaridam), MM–477; Karangberiya (Sindripathar), MM–482.

(Plate 27 & Plate 37)

### Araceae Juss.

1. **Colocasia L.**


**Vernacular name:** Kachu.

A perennial herb, emergent. Leaves with stout petiole, sheathing below; lamina sagittate, 24 x 17 cm, entire, acute; venation reticulate, divergent; base cordate. Inflorescence shorter than the petiole, 31 cm; spathe lanceolate, 24 x 2 cm, membranous, white; female flower on the lower, 2-3 cm; male flower 3-4 cm; sterile-2 cm; appendix glabrous, slender, solid, 16-19 cm.

**Fl. & Fr.:** October.

**Propagation by:** Seeds and rhizome.

**Field notes:** Frequently found in Bundh, Sayar and wet places.

**Growth-form:** Herbids.

**Status:** Common.

**Distribution:** Native in tropical Asia, widely naturalized in the tropics.

**Specimens examined:** Puruliya (Nabaransayar), MM-438; Banduan (Pokabundh), MM-515.

7. **Lemnaceae** S.F. Gray


A floating, aquatic, perennial herb. Roots soft, clustered, branched, white, 2 cm. Frond floating on water surface; leaflets-3, ovate; suborbicular, 6 x 5 mm, entire, obtuse, upper side green but lower side red.

**Fl. & Fr.:** October-December.

**Propagation by:** Seeds.

**Field notes:** Found on sayar, bundh and stagnant water courses.

**Growth-form:** Lemnids.

**Status:** Common.

**Distribution:** Tropical and subtropical South America, introduced in India.

**Specimens examined:** Puruliya (Nabaransayar), MM-284; Puruliya (Nutanbundh), MM-357.

8. **Alismataceae** Vent.

1. **Sagittaria** L.

Key to species
1. Leaves rising above the surface of water; petiole stout, pubescent.  
2. Sagittaria sagittifolia

1. Leaves floating; petiole filiform, glabrous.


A scapigerous annual herb. Rhizome ovate, 1 x 6 cm, entire, acute, black. Leaves cauline, long petioled, simple, sagittate, 1.7–2.9 x 1-2.1 cm, entire, obtuse, floating, membranous, glabrous, base sagittate; petiole flexible, floating, filiform, terete, glabrous, blackish brown, 15-27.5 cm.

Fl. & Fr.: June-September.

Propagation by: Seeds.

Field notes: Common in bundh and wet places.

Growth–form: Sagittariids.

Status: Rare.

Distribution: Old World tropics but absent from Australia and Oceania.

Specimens examined: Babiddi (Sabirbundh), MM-304; Babiddi (Babirbundh), MM-313.


Vernacular name: Muya – muya.

A scapigerous perennial herb. Leaves rising above the surface of water, cauline, floating, simple, sagittate, 6.5 X 7.5 cm, entire, obtuse, glabrous-pubescent, parallel, multicostate, divergent, base hastate; petiole erect, long, floating, spongy, stout, pubescent, 16 cm.

Fl. & Fr.: June-September.

Propagation by: Seeds.

Field notes: Not very common, grows at the margin of wetlands.

Growth–form: Sagittariids.

Status: Rare.

Distribution: India; Europe, throughout Asia to Japan, eastwards to Java and adjacent areas.

Specimen examined: Babiddi (Sabirbundh), MM–315.
9. Aponogetonaceae Hill.

1. Aponogeton Thunb.

Key to the species

1. Leaves linear, sessile................................................................. 1. A. appendiculatus

1. Leaves lanceolate or obovate, petiolate:

2. Leaves undulate, midrib wide with 4 parallel veins........... 2. A. undulatus

2. Leaves entire, midrib wide with 3 parallel veins................. 3. A. natans


A perennial herb, scapigerous, aquatic. Leaves submerged, simple, linear, 3.5-11 x 0.2-0.5 cm, undulate, cuneate, glabrous, with 2-4 parallel veins; sessile. Inflorescence axis 53 cm long, fistular, greenish, articulated; spathe 9 x 0.5 cm, brownish, marsupinate.

Fl. & Fr.: June-October.

Propagation by: Seeds.

Field notes: Occasional, grows at the margin of wetlands.

Growth–form: Vallisneriids.

Status: Rare.

Distribution: Endemic to S India, India.

Specimens examined: Adra (Sahebbundh), MM–333; MM–324.


A perennial herb, aquatic, submerged. Leaves simple, lanceolate, 3-4.5 x 0.6-1.1 cm, entire, cuneate, glabrous, with 3-parallel veins, midrib wide, base cuneate, petiolate; petiole slender, 7-11 cm long.

Fl. & Fr.: Throughout the year.

Propagation by: Seeds.

Field notes: Rare in this district, found in bundh, wet places etc.

Growth–form: Vallisneriids.

Status: Rare.

Distribution: Endemic to India and Sri Lanka.

Specimen examined: Adra (Sahebbundh), MM–334.

(Plate 1g.)

An aquatic, perennial herb. Stem herbaceous, unbranched, emergent, fistular, cylindrical, suberect, glabrous, whitish, 28 cm. Leaves radical, simple, obovate, 10-10.5 x 4-4.2 cm, undulate, cuneate, glabrous, midrib wide with 4 parallel veins, cuneate, petiolate; petiole 17.5 cm; blade elongate, marcescent, 5 X 0.5 cm. Inflorescence spike, axis 22 cm; flower incomplete, bisexual, haplochlamydous, actinomorphic, hypogynous, trimerous, pedicilate, bracteate; perianth 3, petal-like, pinkish, 4 mm; stamen-6, epiphyllous; filament filiform, white, 2 mm; anther oblong, basifixed, 2-chambered, 2 mm; carpel-3-4, syncarpous.

Fl. & Fr.: October.

Propagation by: Seeds.

Field notes: Not very common, grows in Jore and adjacent marshy places.

Growth-form: Vallisneriids.

Status: Rare.

Distribution: South East Asia.

Specimen examined: Ketankiyari (Jore), MM-240.

(Fig. 15)

10. **Potamogetonaceae** Dum.

1. **Potamogeton** L.

Key to the species

1. Leaves all submerged; margin serrate, wavy; apex acute .................. 1. *P. crispus*

1. Leaves floating above; margin entire, not wavy; apex obtuse ........... 2. *P. nodosus*


Vernacular name: Kalaypata.

A perennial herb, aquatic, submerged. Stem herbaceous, branched, solid, cylindrical, flattened, glabrous, reddish, 15 cm; branches lateral, slender. Leaves submerged, alternate, simple, lanceolate, 7-10 x 1.2-2.4 cm, serrate, wavy, acute, glabrous; venation parallel; midrib prominent,
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base cuneate; petiole 2-4 cm; stipule thin, reddish, 2-5 cm. Fruits drupelets, globose, usually connate at base, 2mm; peduncle rigid, erect, emergent, 10 cm long.

Fl. & Fr.: October.

**Propagation by:** Stolon.

**Field notes:** Rare in this district, occasionally grows in bundh.

**Growth-form:** Batrachids.

**Status:** Common.

**Distribution:** Temperate to tropical Europe, Africa, Asia, Australia and North America.

**Specimens examined:** Rampur (Barabundh), MM-458; Ketankiyari (Jore), MM-516; Kalidaha (Jore), MM-519.

( Fig. 16 & Plate 22)


**Vernacular name:** Kalaypata.

A perennial herb. Stolon rhizometous, robust, creeping, yellowish–white, 5.2 cm. Stem herbaceous, branched, terete, cylindrical, glabrous, nodes swollen, 16 cm; internode 2-2.5 cm, fistular. Leaves alternate, upper leaves floating but lower leaves submerged, simple, lanceolate, 6-9x 1.5-3 cm, entire, not wavy, obtuse, pubescent, many parallel veined, base cuneate, petiolate, leaves sometime floating; floating leaves dark green to reddish brown; petiole 5-6.5 cm, tinged red, slender.

Fl. & Fr.: Throughout the year.

**Propagation by:** Stolon.

**Field notes:** Common in bundh, jore, river etc.

**Growth–form:** Natopotamids.

**Status:** Very common.

**Distribution:** Warm and tropical regions of the World.

**Specimens examined:** Adra (Sahebbundh), MM-335, MM-344; Barabazar (Gorsaibundh), MM-408; Damda (Ganakbundh), MM-414; Chharra (Angarkhuri), MM–432.

( Plate 3i .)

11. **Najadaceae** Juss.

1. **Najas L.**

Key to the species
1. stem glabrous, appearing feather like above ………………………….3. N. minor
1. stem pubescent, not feather like above:
   2. Teeth minute ……………………………………………………1. N. graminea
   2. Teeth broad ……………………………………………………2. N. malesiana
   **Vernacular name:** Chingri-dal.
   A perennial or annual herb, aquatic, submerged, appearing feather like above. Stem herbaceous, unbranched, solid, cylindrical, slender, pubescent, 14 cm; internode 1.9 cm. Leaves whorled, simple, acicular; leaf blade 1.6–1.9 x 2 mm, serrulate with unicellular teeth, visible to the unaided eye, minute acute; leaf sheath hyaline, 1.5 mm; auricle hyaline, 2 mm.
   **Fl. & Fr.:** August–November.
   **Propagation by:** Seeds.
   **Growth–form:** Parvopotamids.
   **Field notes:** Not very common. Found in bundh.
   **Status:** Uncommon.
   **Distribution:** Warm and tropical Europe, Africa, Asia and Australia, naturalized in North America.
   **Specimens examined:** Adra (Sahebbundh), MM–337; Puruliya (Nibaransayar), MM–528.
   **Vernacular name:** Chingri-dal.
   Plant annual herb, aquatic, submerged, 11 cm. Stem herbaceous, branched, filiform, solid cylindrical, creeping, without spine, pubescent; branching lateral, slender. Leaves whorled, simple, linear, 21–23 x 1 mm, serrulate, acute, pubescent, 3–10 spines on each side, spine upward, broad, prominent, pointed, leaf sheath hyaline, spiny, 2 mm.
   **Fl. & Fr.:** October–December.
   **Propagation by:** Seeds.
   **Field notes:** Rare in Jore, bundh etc.
   **Growth–form:** Parvopotamids.
   **Status:** Rare.
   **Distribution:** Tropical Asia and Australia.
Specimen examined: Kalidaha (Jore), MM–256.


**Vernacular name:** Chingri-dal.

An annual herb, aquatic, submerged. Stem herbaceous, slender, without spines, branched, solid, cylindrical, glabrous, feathery towards the apex, 27-30 cm; internode 3.5-5.5 cm; branches lateral, slender. Leaves whorled, 2-4 in each node, simple, acicular; leaf blade 2 cm, serrulate, acute, spine on each side; spine upward, prominent; leaf sheath hyaline, lacerate, 3–5 mm.

**Fl. & Fr.:** October-February.

**Propagation by:** Seeds.

**Field notes:** Found in Sayar, Bundh etc.

**Growth-form:** Parvopotamids.

**Status:** Common.

**Distribution:** Temperate and Warm areas of Europe, North Africa, Asia and N America.

Specimens examined: Puruliya (Nabarang Sayar), MM–278; Joypur (Ranibundh), MM–376.


**Vernacular name:** Guri.

A annual herb, emergent. Roots clustered, branched, white. Leaves linear, 45 x 2 mm, entire, attenuate towards the apex, thin. Head terminal, globose, 3 mm, white; receptacle, slender, glabrous, 8 cm; involucral bract linear oblong, 3x2 mm, obtuse, hyaline; female flower many; petals-3, one large, lanceolate, 4 x 2 mm, entire, acute, hyaline; 2-petals small, lanceolate, connate at base, 3 mm, entire, acute, hyaline; ovary globose, brown, 1 mm; style filiform, 0.5 mm; stigma–3, oblong, 1 mm wide.

**Fl. & Fr.:** January–April.

**Propagation by:** Seeds.

**Field notes:** Rare in bundh, jore etc, grows on wet places.

**Growth-form:** Graminids.

**Status:** Common.
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**Distribution:** From Sri Lanka through India to Bangladesh and Myanmar.

**Specimens examined:** Kalidaha (Dewanbundh), MM–462, Kalidaha (Jore), MM–463; Rampur (Barabundh), MM–523.

(Plate 3c.)


Key to the genera

1. Stem leafless ................................................................. 2. *Eleocharis*

1. Stem leafy at base .......................................................... 3. *Fimbristylis*

2. Leaves pubescent ........................................................... 4. *Fuirena*

2. Leaves glabrous:


3. Glumes distichous:

4. Style 2–fid; rachilla deciduous ....................................... 5. *Kyllinga*

4. Style 3–fid; rachilla persistent ....................................... 1. *Cyperus*

1. *Cyperus* L.

Key to the species

1. Style linear–lanceolate ................................................... 4. *C. platystylis*

1. Style linear:

2. Spikelet spicate; nut ellipsoid–ovoid .............................. 3. *C. iria*

2. Spikelet digitate or clustered; nut not ellipsoid-ovoid:

3. Glume orbicular .............................................................. 1. *C. difformis*

3. Glume keel like .............................................................. 2. *C. haspan*


Annual herb. Culm tufted, herbaceous, branched, emergent, triangular, glabrous, spongy, 28 cm. Root fibrous, branched, brown, 7 cm. Leaves alternate, simple, shorter than the culm; leaf sheath membranous, glabrous, yellowish to brown, 7.5x0.4 cm; blade folded, 11x.4 cm, entire, acute,
glabrous, spikelet clustered, aggregated into spherical heads, sessile, linear, 3 x 0.5 mm; rachila straight, slender, 8 mm; glume orbicular, 2 x 1 mm, entire, acute, hyaline.

Fl. & Fr.: May - September.

Propagation by: Seeds and tuber.

Field notes: Rare, grows in wetland banks.

Growth-form: Graminids.

Status: Rare.

Distribution: Warm and tropical Old World, naturalized in America.

Specimen examined: Baraurma (Kumaridam), MM – 417.


A perennial emergent herb. Roots fibrous, clustered, branched, brown, 2–6 cm. Culm slender, weak, tufted, herbaceous, triangular, flacid, glabrous, 21 cm. Leaves alternate, simple, shorter than the culm; leaf sheath bladeless below, glabrous, brown, 5 cm x 4 mm; blade flat, 7–11 cm x 4 mm, entire, acute, glabrous, spikelet digitately arranged in clusters of 8–10; glume distichous, ovate, slightly keeled, 1.5 x 0.5 mm, entire, acute, reddish brown; ovary globose, hyaline, 0.5 x 0.5 mm; style filiform, glabrous, 2 mm; stigma 3 x 0.5 mm wide.

Fl. & Fr.: September-February.

Propagation by: Seeds and tuber.

Field notes: Rare in the district, occasionally grows at the margin of bundh.

Growth-form: Graminids.

Status: Rare.

Distribution: Tropical and Subtropical regions of the World.

Specimen examined: Kalidaha (Dewanbundh), MM-486.


An annual or perennial herb. Rhizome globose, hard, blackish brown, 1 x 1 cm. Roots fibrous, branched, 1.5-3 cm. Culm solitary, triangular, herbaceous, emergent fistular, glaucous, glab
rrous, 36 cm. Leaves simple; leaf sheath membranous, glabrous, purple, 5 cm x 0.4 cm; blade flat, 9x0.4 cm, flaccid, entire, acute; venation parallel / spikelet erect, linear–oblanceolate, 7–10 mm; glume distichous, obovate–suborbicular, 2 x 2 mm, entire, obtuse, middle dark brown and side hyaline. Nut ellipsoid-ovoid, 2 x 1 mm, entire, acute, 3–sided, shining, dark brown.

**Fl. & Fr.**: August–October.

**Propagation by**: Seeds and tuber.

**Field notes**: Rare in wetland, but found on wet and marshy places of this district.

**Growth-form**: Graminids.

**Status**: Rare.

**Distribution**: Warm and tropical Eurasia and Australia, naturalized in America.

**Specimen examined**: Kalidaha (Dewanbundh), MM–484.


A perennial herb. Root fibrous, clustered, branched, blackish, 2-4 cm. Culm 2 together, scabrous along the angle towards the tip, herbaceous, emergent, triangular, greenish, 20 cm. Leaves alternate, simple; leaf sheath laminaless below, keeled, brownish, 2-4 x 0.4 cm; lamina linear, flat, gradually acuminate, 5–11.5 cm x 2 mm, entire, acute; venation parallel. Spikes compound, depressed to corymbose with very numerous spikelets; glume distichous, boat-shaped, 4 x 3 mm, serrate, acute; ovary globose, base narrow, brown, 2 x 2 mm; style filiform, glabrous, brown, 1.5 mm; stigma 3-cleft, 1 mm wide.

**Fl. & Fr.**: October.

**Propagation by**: Seeds and tuber.

**Field notes**: Rare in wetland, grows on wet places, grass fields etc.

**Growth-form**: Graminids.

**Status**: Rare.

**Distribution**: Tropical Asia and Australia.

**Specimen examined**: Joypur (Ranibundh), MM–370.


Key to the species

1. Glume ovate-lanceolate; style glabrous ……………………………1. *E. atrapurpurea*

1. Glume spathulate; style pubescent ………………………………2. *E. retroflexa*

An annual herb. Roots fibrous, clustered, branched, brown, 2-5 cm. Culm herbaceous, fistular, emergent, cylindrical, spongy, glabrous, 3 x 3 cm, with longitudinal ridges and furrows. Inflorescence brush like, 4-6 cm; glume ovate-lanceolate, 6 x 3 mm, entire, acute, nerveless, side hyaline; stamens–2; anthers oblong, brown, 2 mm; ovary oblong, 3 x 1.5 mm, brown; style glabrous, 2 mm; stigma bifid, 3 mm wide.

**Fl. & Fr.:** August.

**Propagation by:** Rhizome.

**Field notes:** Found at the margin of bundh, jore etc.

**Growth-form:** Graminids.

**Status:** Common.

**Distribution:** Pantropics and subtropics extending to Europe and USA.

**Specimens examined:** Babiddi (Babirbundh), MM–308; Rampur (Barabundh), MM–524.

(Fig. 17)


An annual herb. Root fibrous, clustered, branched, filiform, whitish–brown, 2-6 cm. Culm tufted, filiform, herbaceous, emergent, curved, cylindrical, fistular, glabrous, flexuous, 29 cm. Spikelet ovoid to broadly lanceolate, 4 mm; glume spatulate, 2x2 mm, entire, acute, nerveless, hyaline; ovary oblong, 1x1 mm, base narrow, brown; style–2, base connate; depressed, conical, pubescent, 2 mm; stigma 2, capitate.

**Fl. & Fr.:** August.

**Propagation by:** Rhizome.

**Field notes:** Not very common, grows at the margin of bundh.

**Growth–form:** Graminids.

**Status:** Rare.

**Distribution:** Tropics of the Old World.

**Specimen examined:** Babiddi (Babirbundh), MM–309.

(Fig. 18)

3. **Fimbristylis** Vahl.
Key to the Species

1. Style 3–sided; stigma 3–fid ...........................................1. F. miliacea
1. Style ciliated; stigma 2–fid .........................................2. F. polytrichoides


Annual herbs, emergent. Root fibrous, clustered, branched, brown, 6 cm. Culm arising from the axis of bladed leaves, tufted, herbaceous, triangular, fistular, emergent, spongy, glabrous, 32 cm. Leaves basal with 6.5–12 cm, sheath; ligule absent; blade narrow, 1.5 cm x 4 mm, entire, acute, glabrous, spikelet ovoid, 3 mm; glume 2, boat shaped, 1.5 x 1 mm, rounded, membranous, rustly, brown; ovary globose, base narrow, 1 x 1 mm, brown; style filiform 3–sided brown, 2 mm; stigma 3 fid, minutely feathery, brown, 2 mm.

Fl. & Fr.: October.

Propagation by: Seeds and tuber.

Field notes: Common at the periphery of bundh, sayar etc.

Growth–form: Graminids.

Status: Common.

Distribution: Old World tropics and North Australia.

Specimens examined: Adra (Sahebbundh), MM–348; Joypur (Ranibundh), MM–368; Patharmura (Gobindasayar), MM–441.


Vernacular name: Talnaru.

Annual herbs. Stem densely tufted, glabrous, trigonous, emergent, straight, 6.8–25.2 cm. Leaves filiform. Spikelets solitary, 0.5 mm long, brown, many flowered; ovary–oblong 1.5 mm long; style ciliated; stigma–bifid.
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Fl. & Fr.: July–September.

Propagation by: Seeds and tuber.

Field notes: Rare in wetlands, found on wet places around wetlands.

Growth–form: Graminids.

Status: Rare.

Distribution: Old World tropics.

Specimen examined: Ketankiyari (Jore), MM–241.


*An annual herb. Roots fibrous, clustered, brown, 2-3 cm. Culms slender, tufted, herbaceous, branched, cylindrical, emergent, pubescent, 18 cm. Leaf sheath membranous, pubescent, 5 cm x 2 mm; Lamina flat, 2.5–5.5 x 0.5 cm, flaccid. Inflorescence of 3 terminal clusters of spikelets; cluster globose, 6x4 mm; glume obovate, 2x2 mm excluding a pubescent awn; awn strong, hairy, acute, 2 mm. Nuts 4, 3–angled, obovoid–ellipsoid, 1x1 mm, wrinkled, brown.*

Fl. & Fr.: December.

Propagation by: Seeds.

Field notes: Not very common, occasionally found on wet places around wetlands.

Growth–form: Graminids.

Status: Rare.

Distribution: Old World tropics and subtropics.

Specimen examined: Rampur (Barabundh), MM–270.

(Fig. 19)

5.*Kyllinga* Rottb.

A perennial herb. Rhizome stoloniferous, creeping, elongated, blackish brown, 7-9 cm. Root fibrous, blackish, 4.7 cm. Culm solitary, or in a single row, filiform, emergent, 8-18 cm. Leaf sheath membranous, lower laminaless, 4.5 cm x 2 mm, glabrous, brown-purple; lamina narrow, 2–4 cm x 0.2 cm, entire, acute. Inflorescence a single head; head globose; 5 x 5 mm; glumes distichous; glume–I, ovate, 2 x 1 mm, entire, acute, hyaline, 3-nerved; glume–II lanceolate, 2 x 0.5 mm, entire, acute, hyaline, many veined; glume–III lanceolate, 3 x 2 mm, acute, brown; glume–IV, ovate, 2.5 mm x 2 mm, entire, acute, brown.

Fl. & Fr.: August–October.

Propagation by: Rhizome.

Field notes: Common in Jore, Sayar and Wet places.

Growth–form: Graminids.

Status: Common.

Distribution: Warm and tropical regions of the whole World.

Specimens examined: Kalidaha (Jore), MM–254; Puruliya (Nibaransayar), MM–436.

6. Schoenoplectus Palla

Key to the species

1. Spikelet few–many; nuts black, acute ................................. 1. S. articulatus

1. Spikelet solitary; nuts brown, apiculate .............................. 2. S. grossus


An annual or perennial herb. Stem densely tufted, 20-30 cm, cylindrical, emergent, spongy. Leaves strap shaped. Spikelet few–many, below the middle, 6–15 mm, brown, ovoid, acute, sessile; glume membranous, spirally arranged, persistent, ovate, acute, margin hyaline; 4–4.8 x 3.6–4 mm. Nut elliptic–ovoid, black, acute, 1.4 mm.

Fl. & Fr.: February–March.

Propagation by: Seeds and tuber.

Field notes: Grows in marshy water bodies, stem tufted, spikelets below at the middle of the stem.

Growth–form: Graminids.

Status: Common.

Distribution: Mediterranean through Africa to Asia and Australia.
Specimens examined: Kalidaha (Dewanbundh), MM–488; Rampur (Barabundh), MM–525. 
(Fig. 20 & plate 1b.)


A perennial herb. Stem triangular, spongy, tufted, emergent, 12 cm. Leaves few, radical, as long as the stem, keel–shaped, serrulate, acuminate, spongy, 1.6 cm–2 cm; sheath long, open. Spikelets in solitary umbel; glume elliptic, spirally arranged, 1.6 –3.2 mm, concave, mucronate. Nut elliptic, obovoid, trigonous, smooth, apiculate, brown, 1.3–1.8 mm. 

Fl. & Fr.: February–March. 

Propagation by: Seeds and tuber. 

Field notes: Grows in Swampy area of jore, bundh etc. 

Growth–form: Graminids. 

Status: Common. 

Distribution: Tropical S E Asia. 

Specimens examined: Kalidaha (Dewanbundh), MM–489; Kalidaha (Jore), MM–491.


Key to the genera

1. Stem solid .................................................................2. Cynodon
1. Stem fistular:
   2. Stem with longitudinal ridges and furrows ......................4. Hygrorhiza
   2. Stem without longitudinal ridges and furrows:
   3. Caryopses laterally flattened, ovate ........................5. Leersia
   3. Caryopses not laterally flattened, narrowly oblong ..........7. Oryza
      4. Stem creeping or decumbent:
         5. Lamina linear, glabrous .................................1. Brachiaria
      4. Stem emergent:
         6. Spikelet 1-flowered .................................10. Sporobolus
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7. Ovary oblong, brown .................................9. Paspalum
7. Ovary globose, hyaline:
   8. Upper glume with 7-9 nerves.....8. Panicum
   8. Upper glume with 4-nerves.......3. Echinochloa

1. Brachiaria (Trin.) Griseb.
   An annual herb. Roots adventitious from lower node, 8-10 mm. Stem herbaceous, branched, fistular, cylindrical, glabrous, spongy, decumbent; branching lateral, slender, 54 cm; internode 3-6.5 cm. Leaves alternate, simple; leaf sheath, membranous, glabrous, 7.5-9 cm; ligule, membranous, hairy, hyaline, 2 mm; lamina linear, 9-12 cm, 0.4-0.6 cm, entire-undulate, acute, glabrous; venation parallel. Raceme 2-2.8 cm; rachis 3-angled, hairy; spikelet borne on 2 rows; lower glume membranous, 1.5 mm; upper glume ovate, 2 mm x 1.5 mm, entire, acute, hard, 2-nerved, brown; lemma ovate, 1.5 x 1.5 mm, entire, acute; palea 2 x 2 mm, hard, entire, acute, many nerved, hairy.
Fl. & Fr.: October.
Propagation by: Seeds.
Field notes: Rare, found on bundh and Wet places.
Growth-form: Graminids.
Status: Rare.
Distribution: Mediterranean eastwards to India.
Specimens examined: Adra (Sahebbundh), MM–345, MM–347.

2. Cynodon Pers.
Vernacular name: Dub-ghas.
A perennial herb. Roots adventitious from nodes, branched clustered, brown, 4 cm. Stem herbaceous, branched, creeping, slender, solid, cylindrical, glabrous, decumbent, 35 cm; branching lateral, slender; internode 1-2.5 cm. Leaves alternate, simple; leaf sheath glabrous, 2 cm; lamina narrow, 20x1 mm, entire, acute, glabrous; venation parallel.

Fl. & Fr.: July–September.

Propagation by: Rhizome and seeds.

Field notes: Common in wet places and margins of wetlands.

Growth–form: Graminids.

Status: Very Common.

Distribution: This is a pantropic species.

Specimens examined: Puruliya (Nibaransayar), MM–287; Chharra (Angarkhuri), MM-514; Baghmundi (Ranibundh), MM-577; Baghmundi (Kamalabundh), MM-578.


An annual herb. Stem herbaceous, branched, fistular, cylindrical, emergent, glabrous, 50 cm; branching lateral, slender; internode 12.3 cm. Leaves alternate, simple; leaf sheath glabrous, 7x0.4 cm; ligule absent; lamina linear, 17x0.3 cm, entire, acute, glabrous; venation parallel. Raceme several rows; rachis 10 cm; rachilla pubescent; upper glume ovate-lanceolate, 2 x 2 mm, entire, acuminate, hispid, 4-nerved; lemma ovate, 2x2 mm, entire, acuminate, brown, hard, 2 nerved; seed ovate, 2mx2mm, entire, hard, greenish.

Fl. & Fr.: August.

Propagation by: Seeds.

Field notes: Grows as an emergent grass.

Growth–form: Graminids.

Status: Rare.

Distribution: Warm and tropical, Asia, Africa and America.

Specimens examined: Puruliya (Nibaransayar), MM–286, MM–293.

4. Hygrorhiza Nees
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   A perennial herb. Roots adventitious, branched, blackish–brown, spongy, 3.5–12 cm. Stem creeping, herbaceous, fistular, floating, longitudinal ridges and furrows, decumbent, glabrous, brown,32 cm; branching stout;internode 3 cm. Leaves alternate, simple; sheath open,strongly inflated,partly emergent,membranous,2 cm;ligule truncate,6 mm;lamina lanceolate,5–7 x 1.2-1.6 cm, entire, acute,membranous,glabrous,midrib prominent; venation parallel.

   **Fl.& Fr.**: October-December.

   **Propagation by**: Seeds.

   **Field notes**: Not very common, found in bundh and marshy places.

   **Growth–form**: Graminids.

   **Status**: Rare.

   **Distribution**: South and South east Asia.

   **Specimen examined**: Adra(Sahebbundh),MM–346.

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5. **Leersia**


   A perennial herb. Root adventitious from lower node, branched,white,2 cm. Stem stoloniferous , nodes swollen, fistular, emergent, cylindrical, 37-40 cm; internode 4.2–11 cm. Leaves alternate, simple; lamina linear–lanceolate,5–11x0.3-0.5 cm, entire, acute; venation parallel; ligule membranous, 2 mm; leafsheath 5 cm x 2 mm, greenish; panicle with flexuous branches,7.5 cm. Spikelet I-flowered, flattened laterally, whitish, 3 mm; pedicel slender, 1 mm. Caryopsis laterally flattened, ovate, 4 x 2 mm, entire, acute.

   **Fl.& Fr.**: October.

   **Propagation by**: Seeds.

   **Field notes**: Common in peripheral parts of wetlands.

   **Growth–form**: Graminids.

   **Status**: Common.
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**Distribution:** This is a Pantropic species.

**Specimens examined:** Adra(Sahebbundh), MM–350, MM–355; Raghunathpur(Dhanarbundh), MM–400; Puruliya(Nibaransayar), MM–510.

6. **Oplismenus** Beauv.

1. **Oplismenus compositus** P. Beauv., Ess. Agrost. 54. 168. 1812; Prain, Bengal Pl. 2: 1173. 1903.

   A diffuse, annual herb. Roots adventitious, clustered, brown, 7–8 cm. Stem herbaceous, branched, slender, cylindrical, creeping, decumbent, glabrous, 11 cm; branches erect, slender, ascending, leafy, 11-20 cm; internodes 1–3.5 cm. Leaves alternate, simple; leaf sheath truncate, pubescent, membranous, 12 x 2 mm; ligule absent; blade ovate–lanceolate, 29 x 0.8 cm, undulate, acute, pubescent; venation parallel; hair unbranched, white, pointed; glume–I ovate, 2 x 2 mm, hyaline; awn, 10 mm; glume–II ovate, 2 x 2 mm, hyaline, awn 6 mm; glume–III lanceolate, 3 x 2 mm, entire; awn 3 mm; glume–IV lanceolate, 2 x 1.5 mm, entire, acute, hyaline.

**Fl. & Fr.:** October.

**Propagation by:** Seeds.

**Field notes:** Rare, but grows on wet places at the margin of wetlands.

**Growth–form:** Graminids.

**Status:** Rare in wetlands.

**Distribution:** India and in all tropical countries.

**Specimen examined:** Adra(Sahebbundh), MM–341.

7. **Oryza** L.


**Vernacular name:** Dhan.

An annual herb. Stem herbaceous, emergent, fistular, glabrous, branched. Leaves alternate, simple, sheath truncate, greenish, 13 cm, lamina linear, 17 x 0.8 cm, entire, acute, glabrous; venation parallel. Fruit caryopsis, narrowly oblong, 7 x 4 mm, pubescent, acute, compressed, awned, covered with adnate to glume and palea; awn lateral, strongly compressed, pubescent, 4.5 cm; hair unbranched, pointed, whitish.

**Fl. & Fr.:** October.

**Propagation by:** Seeds.

**Field notes:** Occasionally remain scattered in wetlands.

**Growth–form:** Graminids.

**Status:** Rare.

**Distribution:** Cultivated in warm to tropical regions of the World.
Specimen examined: Joypur (Ranibundh), MM–371.

8. **Panicum** L.

Key to the species

1. Stem spongy at the base; lower glume nerveless 
   1. *Panicum paludosum*

1. Stem not spongy; lower glume 3-nerved 
   2. *P. repens*


**Vernacular name:** Borati.

A perennial herb. Stem herbaceous, spongy at the base branched, fistular, cylindrical, emergent, glaucous, 47 cm; branching lateral, slender; internode, 4-11.5 cm. Leaves alternate, simple; sheath glabrous, membranous, 6 x 0.4 cm; lamina flat, 9.5 x 0.4-0.6 cm, entire, acute, glabrous; venation parallel. Spikelet narrowly lanceolate, ellipsoid, 4 mm; upper glume with 7 nerves; lower glume subequal, lanceolate 4 x 2 mm, pubescent, acute, nerveless; androecium-6; anther oblong, yellow, 3 mm.

**Fl. & Fr.:** October.

**Propagation by:** Rhizomes and seeds.

**Field notes:** Common, found along the periphery of bundh as an emergent species.

**Growth–form:** Graminids.

**Status:** Common.

**Distribution:** Tropical Asia and Australia.

Specimens examined: Adra (Sahebbundh), MM–331, MM–343; Puruliya (Nutanbundh), MM–359; Damda (Ganakbundh), MM–415.


**Vernacular name:** Baranda.

A perennial herb. Stem herbaceous, not spongy, branched, fistular, cylindrical, emergent, glaucous, 30 cm; node reddish; branches lateral, slender; internode 11-13.5 cm. Leaves alternate,
simple, sheath glabrous but hairy along the free margin, membranous, glaucous, 7 x 0.8 cm; lamina linear, 8-16 cm x 0.8 cm, entire, acute, glabrous. Lower glume oblong, hyaline with 3 nerved, 4x1 mm; upper glume hyaline with 9-nerved; lemma hyaline, 2x1 mm; androecium 3; filament hyaline, 5 mm; anther sagittate, basifixted, blackish brown, 1.5 mm.

Fl. & Fr.: August–October.

Propagation by: Rhizome and seeds.

Field notes: Frequently found as emergent in the water of bundh, sayar etc.

Growth–form: Graminid.

Status: Common.

Distribution: Tropical and Subtropical regions of both hemispheres, probably originating in Asia.


9. Paspalum L.


A perennial herb. Rhizome flattened, brown, 2–3.4 cm. Stem herbaceous, branched, fistular, cylindrical, emergent, glaucous, glabrous, 34-50 cm; branching slender; internode 1.5-2.5 cm. Leaves alternate, simple; leaf sheath flattened, glabrous; lamina acute, glabrous, venation–parallel. Racemes 2, axis 8.5–10.5 cm; lower glume ovate, 2.5 x 2 mm, entire, acute, hyaline; lemma ovate–oblong, 2 x 2 mm, entire, acute; ovary oblong, brown, 1.5 mm; style–2, slender, brown, 1 mm; stigma–2, fimbriate, black, 1.5 mm.

Fl. & Fr.: August–October.

Propagation by: Rhizome.

Field notes: Common, grows on sayar, bundh and marshy places.

Growth–form: Graminids.

Status: Common.

Distribution: Pantropics but probably native to the New World.

Specimens examined: Puruliya (Nibaransayar), MM–291, MM–292; Puruliya (Rajabundh), MM–361; Joypur (Ranibundh), MM–373.

10. Sporobolus R. Br.

A perennial herb. Roots fibrous, branched, clustered, brown, 2.5–4 cm. Stem herbaceous, branched, emergent, slender, cylindrical, glabrous. Leaves alternate, narrow; sheath truncate, membranous, glabrous, 6.5 cm; lamina narrow, 8–13 cm x 2 mm, acute. Spikelet–1 flowered, minute; glume-I, ovate, lanceolate, 1.5 mm x 0.5 mm, entire, acute, 1 veined, hyaline; glume II 1.5 mm x 0.5 mm, hyaline; glume III - lanceolate, 2 x 1.5 mm.

**Fl. & Fr.**: June–October.

**Propagation by**: Rhizome and seeds.

**Field notes**: Grows mainly in the margin of bundh.

**Growth–form**: Graminids.

**Status**: Common.

**Distribution**: This is a Pantropic species.

**Specimens examined**: Joypur (Ranibundh), MM–369; Puruliya (Nibaransayar), MM–507.

11. **Vetiveria** Bory-de-St. Vincent


**Vernacular name**: Bena ghash, Kash.

A perennial herb. Culm herbaceous, glaucous, fistular, cylindrical, emergent, 23 cm. Leaf sheath flattened, glabrous, 11.5 cm; ligule aciliate, membranous; lamina narrow, 3 x 1 mm, entire, acute, folded. Inflorescence panicle, 15–18 cm; spikelets in pairs, sessile spikelets oblong, 4 x 1 mm, longitudinal ridges and furrows, entire, obtuse, pubescent, greenish brown; spikelet oblong, 3 x 1 mm; pedicel slender, pubescent, 3 mm. Lower floret sterile; lower
glume convex, 4 x 2 mm, entire, acute, spiny, reddish-greenish; upper glume 3 x 2 mm; lemma membranous, 3 x 1 mm, white.

**Fl. & Fr.:** October.

**Propagation by:** Rhizome and seeds.

**Field notes:** Rare, found at the margin of a few wetlands.

**Growth–form:** Graminids.

**Status:** Rare.

**Distribution:** Tropical Asia to Africa.

**Specimen examined:** Adra (Sahebbundh), MM–448.

(Plate 3h.)

PTERIDOPHYTA

Key to the Families

1. Plant free floating; floating leaves sessile.................................. Salviniaceae
2. Plant bottom rooted; floating leaves with petioles:
   2. Plants floating or emergent; corm absent; leaves with 4 terminal leaflets; sporocarps present.......................... Marsileaceae
   2. Plants submerged; corm present; leaves simple, awl shaped; sporocarps absent..........................................Isoetaceae

**1. Marsileaceae** Mirab.


**Vernacular name:** Susunisak.

Aquatic or subaquatic, annual or perennial, herb. Rhizome slender, creeping, blackish brown, 35 cm. Roots fibrous from nodes, branched, clustered, blackish brown, 9 cm. Leaves single from the node; petioles slender, erect, cylindrical, glabrous, flexuous, submerged or emergent, 8-
26cm; leaflet 4, floating, emergent, obovate, 4-2.5 cm x 3-2.1 cm, base narrow, entire, obtuse, glabrous, vein anastomosing.

**Propagation by:** Rhizome and sporocarp.

**Field note:** Common in bundh, jore, and wet embankments of wetlands.

**Growth-form:** Marsileids.

**Status:** Common.

**Distribution:** Throughout India, Java, Philippines.

**Specimen-examined:** Adra (Sahebbundh), MM-351; Bara Urma (Kumari), MM-416; Kantadih (Mahatobundh), MM-426.

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2. **Isoetaceae** J. Roux.


**Vernacular name:** Banarasun.

A small perennial, submerged, herbaceous plant. Corm clustered, white, 1 cm x 0.5 cm; bearing fibrous root on the lower part and leaves on the upper part. Roots fibrous, branched, lateral, clustered, blackish brown, 2-2.5 cm. Leaves densely crowded, rosette, linear, tapering, 14-30 cm x 0.2 cm; leafbase broad, spoon shaped, 4 mm wide; leaf tip straight or recurved, acute.

**Propagation by:** Corm

**Field note:** Not very common, grows on bundh, jore, marshy places and other water bodies.

**Growth-form:** Isoetids.

**Status:** Common.

**Distribution:** India (Tamil Nadu, Kerala, Karnataka, Maha Rastra, Gujrat, Madhya Pradesh, Uttar Pradesh, Bihar, Orissa, and West Bengal).

**Specimen examined:** Kalidaha (Dewanbundh), MM-483; Kalidaha (Jore), MM-485; Ketankiyari (Jore), MM-487.

(Plate 2e.)

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3. **Salviniaceae** Polhillrm


**Vernacular name:** Pana.
Annual, aquatic herb. Stem slender, bearing leaves on upper side; conceptacle bear branches and much branched feathery root fibre. Leaves simple, small, midrib distinct, horizontal, flat.

**Propagation by:** Sporocarp.

**Field note:** Free floating on the surface of water.

**Growth-form:** Salviniids.

**Status:** Common.

**Distribution:** Throughout India, Warm regions of Europe and S. E. Asia.

**Specimen examined:** Puruliya (Nibaran Sayar), MM-572; Puruliya (Nutan bundh), MM-573.

**ALGAE**

1. **Characeae R.D. Wood.**

1. **Chara fibrosa** Ag. ex Buz. in Subramanian, Monog. Ind. Charophyta 89, 2002. **Chara benthamii** Braun. in Agharkar & Kundu, Charophyta of Bengal 14, 1937.

   Submerged, annual, anchored to substratum with multicellular rhizoid, thalloid, bearing nodes and internode, node give rise to whorl of unicellular spine; spine unequal in size. Basal node bear globule and two bracteoles, subtends elliptic nucule with 5 spirally twisted tube cell and terminal 5-celled corona.

   **Field note:** Rare

   **Growth-form:** Parvopotamids.

   **Status:** Rare.

   **Distribution:** India, Singapore, China, Japan, Philippine Islands, N. America, Australia, New Zealand.

   **Specimen examined:** Adra (Sahebbundh), MM-349.

   (Plate 30)
15. The author, while consulting district library, Puruliya.
17. *Nelumbo nucifera* along with grasses at Dhanarbundh.
18. *Nymphoides hydrophylla* along with *Ipomoea carnea* ssp. *fistulosa* at Deshundh.

19. A view of Ranibundh (Baghmundi) used for domestic purposes
20. Water of Ketankiyari Jore descending downwards in a stepwise manner.
21. *Nymphaea pubescens* along with *Limnophila heterophylla* at Babirbundh.
22. *Potamogeton crispus* along with grasses at Ketankiyari Jore.
23. *Ipomoea carnea* ssp. *fistulosa* encroaching upon water at Ketankiyari Jore.
Grasses dominating the vegetation of Mahatobundh.

25. A view of Nutanbundh located at Puruliya.
26. *Ottelia alismoides* at Rampur Barabundh.

27. *Typha domingensis* dominating the wetland flora of Barikbundh.
28. Sahebbundh, a perennial fresh water wetland with luxuriant growth of aquatic macrophytes.

29. *Nelumbo nucifera* (padma) along with associated hydrophytes in Nibaran Sayar.
30. *Chara fibrosa* is one of the primary producer in aquatic ecosystem of Adra Sahebbundh.
31. *Utricularia australis* along with *Potamogeton nodosus* in Adra Sahebbundh.
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Results

PLATE-1

1a. Typha domingensis Pers. 1b. Schoenoplectus articulates (L.) Palla
1c. Vallisneria spiralis L. 1d. Heliotropium strigosum Willd. 1e. Potamogeton crispus
1f. Limnophila sessiliflora (Vahl) Bl. 1g. Aponogeton natans (L.) Engler et
Krause 1h. Limnophila sessiliflora (Vahl) Bl. 1i. Ammannia baccifera L.
PLATE-3

3a. Utricularia stelaris L.f.,
3b. Drosera Indica L., 3c. Eriocaulon quinqueangular L., 3d. Bacopa monniariis (L.) Pennell,
3e. Monochoria hastate (L.) Solm.,
3f. Ficulina ciliaris (L.) Rox.,
3g. Ipomoea aquatic Forsk.,
3h. Vatispera zizanioidis (L.) Nash
4.2.2. STUDY OF FORM CATEGORIES OF MACROPHYTES

4.2.2.1. Growth-form categories:

Categories of Growth-form, Life-form and Ecphase were determined for each of the 118 recorded species (Table 31) and on the basis of these findings the wetlands were grouped under five basic categories and 21 sub-types of Growth-form. The category helophyte (hyperhydate) with seven subcategories was found to be the most dominant one being successively followed by ephydate, rosulate and acropleustophyta with five, three and three subcategories respectively. Vittate and mesopleustophyta have two and one categories of growth-form respectively. These macrophytes manifested seven Life-form and four ecophase categories.

Only one species per growth-form category could be seen in case of *Marsilea minuta*, *Trapanatans var. bispinosa*, *Ludwigia adscendens*, *Aeschynomene indica*, *Nelumbo nucifera*, *Ottelia alismoides*, *Spirodela intermedia*, *Salvinia natans*, *Eichhornea crassipes*, *Potamogeton crispus*, *Ceratophyllum muricatum*, *Ceratophyllum demersum*, and *Isoetes coromandeliana* belonging to Marsileids, Trapids, Decodontids, Aeschynomenids, Nelumbids, Otteliid, Lemnids, Salvinids, Eichhorniids, Batrachids, Vittate, Myriophyllids, and Isoetids respectively.

The categories Nymphaeids and Natopotamids, include two species each. On the other hand, Utricularids, Ipomeids, Sagittariids and Vallisneriids include four species each. To the category Parvopotamids belong six species. Type Herbids and Graminids include forty nine and thirty species respectively. On the basis of species strength, Herbids and Graminids, occupy first (49 species), second (30 species) positions respectively. Herbids is the most dominant Growth-form among other growth-forms of the macrophytes.

4.2.2.2. Life-form Categories:

So far Life-form categories are concerned Pelochthophytes (50 out of 118 species) is the most dominant type in the wetland studied. Ochthohydrophytes, Pleustophytes, Euhydatophytes, Acrohydatophytes, Tenagophytes and Hydrochthophytes cover 21, 16, 10, 10, 7 and 4 species respectively.

4.2.2.3. Ecophase or Ecoperiods or Ecocycles:

As regards ecophases, Terrestrial ecophase is the most dominant one represented by 44 species. Hydrophase and Littoral ecophases cover 34 and 22 species respectively. Limosal ecophase is represented by 18 species only.
### Table 31: Form analysis of Macrophytes associated with wetlands in Puruliya District

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the plant</th>
<th>Family</th>
<th>Growth-form category</th>
<th>Life-form category</th>
<th>Ecophase Category</th>
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### Table 31: Form analysis of Macrophytes associated with wetlands in Puruliya District

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the plant</th>
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<th>Life-form category</th>
<th>Ecophase Category</th>
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### Table 31: Form analysis of Macrophytes associated with wetlands in Puruliya District (Contd.)

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<td>Potamogetonaceae</td>
<td>B.ii.b.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>95</td>
<td>Phyla nodiflora</td>
<td>Verbenaceae</td>
<td>B.b.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>96</td>
<td>Sagittaria guayanensis</td>
<td>Alismataceae</td>
<td>B.i.f.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>97</td>
<td>Sagittaria sagittifolia</td>
<td>Alismataceae</td>
<td>B.i.f.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>98</td>
<td>Schoenoplectus articulatus</td>
<td>Cyperaceae</td>
<td>B.i.a.</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>99</td>
<td>Schoenoplectus grossus</td>
<td>Cyperaceae</td>
<td>B.i.a.</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>Solanum nigrum</td>
<td>Solanaceae</td>
<td>B.b.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>101</td>
<td>Spilanthes acmella</td>
<td>Asteraceae</td>
<td>B.b.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>102</td>
<td>Spirodela intermedia</td>
<td>Lemnaceae</td>
<td>A.i.a.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>103</td>
<td>Sporobolus diander</td>
<td>Poaceae</td>
<td>B.i.a.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>104</td>
<td>Tonningia axillaries</td>
<td>Commelinaceae</td>
<td>B.i.a.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>105</td>
<td>Trapa natans var bispinosa</td>
<td>Trapaceae</td>
<td>B.ii.e.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>106</td>
<td>Turnera ulmifolia</td>
<td>Turneraceae</td>
<td>B.b.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>107</td>
<td>Typha domingensis</td>
<td>Typhaceae</td>
<td>B.i.a.</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>108</td>
<td>Utricularia aurea</td>
<td>Lentibulariaceae</td>
<td>A.ii.a.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>109</td>
<td>Utricularia australis</td>
<td>Lentibulariaceae</td>
<td>A.ii.a.</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table 31: Form analysis of Macrophytes associated with wetlands in Puruliya District (Contd.)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the plant</th>
<th>Family</th>
<th>Growth-form category</th>
<th>Life-form category</th>
<th>Ecophase Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td><em>Utricularia bifida</em></td>
<td>Lentibulariaceae</td>
<td>A.ii.a.</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>111</td>
<td><em>Utricularia stellaris</em></td>
<td>Lentibulariaceae</td>
<td>A.ii.a.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>112</td>
<td><em>Vallisneria spiralis</em></td>
<td>Hydrocharitaceae</td>
<td>B.iii.2.a.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>113</td>
<td><em>Verbascum chinense</em></td>
<td>Scrophulariaceae</td>
<td>B.i.b.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>114</td>
<td><em>Vetiveria zizanioides</em></td>
<td>Poaceae</td>
<td>B.i.a.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>115</td>
<td><em>Chara fibrosa</em></td>
<td>Characeae</td>
<td>B.iii.1.a.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>116</td>
<td><em>Isoetes coromandeliana</em></td>
<td>Isoetaceae</td>
<td>B.iii.2.c.</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>117</td>
<td><em>Marsilea minuta</em></td>
<td>Marsileaceae</td>
<td>B.ii.c.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>118</td>
<td><em>Salvinia natans</em></td>
<td>Salviniaceae</td>
<td>A.1.b.</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Legends of codes**

**Growth-form**

- A. Pleustophytes
- ii. Ephydates
- i. Acropleustophyta
- a. Nymphaeids
- a. Lemnids
- b. Natopotamids
- b. Salviiniids
- c. Marsileids
- c. Eichhorniids
- d. Batrachids
- ii. Mesopleustophyta
- e. Trapidids
- a. Utricularids
- iii. Hyphydates
- B. Rhizophytes
- 1. Vittate
- i. Hyperhydates
- a. Parvopotamids
- a. Graminids
- b. Myriophyllids
- b. Herbids
- 2. Rosulate
- c. Ipomeids
- a. Vallisneriids
- d. Decodontids
- b. Otteliids
- e. Aeschynomenids
- c. Isoetids
- f. Sagittariids
- g. Nelumbids
Survey of Wetlands in Puruliya District

Life-form
1. Pleustophytes
2. Euhydatophytes
3. Aerohydatophytes
4. Tenagophytes
5. Octothrophytes
6. Hydrochthophytes
7. Pelochthophytes

Ecophase
1. Hydrophase
2. Littoral ecophase
3. Limosal ecophase
4. Terrestrial ecophase

4.2.3. UTILITARIAN PERSPECTIVES OF MACROPHYTES:
The benevolent aspects of a total of 31 species out of 118 species of macrophytes recorded from
38 wetlands in the district (Table 30).

As many as 11 species were found to have medicinal uses against diseases of different
types (Table 30). Of these Cynodon dactylon, Bacopa monnieri, Centella asiatica, Hygrophila
schulli, Ludwigia adscendens, L. perennis, Nymphoides hydrophylla, Mikania micrantha are
medicinally important species. Both Centella asiatica and Commelina bengalensis are useful in
prevention of leprosy.

Leaves of Bacopa monnieri, Boerhavia diffusa, Centella asiatica, Colocasia esculenta,
Commelina benghalensis, Hygrophila schulli, Ipomoea aquatic, Potamogeton crispus L.,
Potamogeton nodosus, Marsilea minuta are cooked as vegetables. Stem, pedicels and flowers of
Nymphaea pubescens are cooked as vegetable. Seeds of Nelumbo nucifera and Nymphaea
pubescens are edible. Edible fruits are obtainable from Trapa natans. Fruits of solanum nigrum
are cooked as vegetable. Leaves of Najas graminea, Najas malesiana, Najas minor and
Vallisneria spiralis are used extensively as poultry feed. Leaf-crushings of Eclipta prostrata are
used in treatment of anthrax disease of domestic birds. Potamogeton crispus is a very useful
species for any wetland since it is a source of food for some water-fowls and ducks and provides
shelter and shade to fishes.

The leaves of Typha domingensis are woven into mats. The stem of Aeschynomene
indica gives ‘sola’ which is used in making articles for decoration, ornaments of Gods and
Goddesses, mask. The tender shoots of Cynodon dactylon, Hydrilla verticillata and flowers of
Nelumbo nucifera and Nymphaea pubescens are offered in worships and are used in ceremonies
and festivals. Leaves of Nelumbo nucifera are useful for making plates and those of Typha
domingensis (Cat grass) for thatching huts and fencing. Stems of Ipomoea carnea ssp. fistulosa
are also useful in fencing and together with the dry leaves of *Typha domingensis* it serves as household fuel.

Thus, all the species recorded in this work are very useful which, if used in sustainable manner, can prove beneficial to the poor people associated directly with wetlands.

### Table 32: Utilitarian perspectives of macrophytes as recorded from primary sources.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the plant</th>
<th>Local name</th>
<th>Family</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Aeschynomene indica</em></td>
<td>Sola</td>
<td>Fabaceae</td>
<td>Stem-pith is used to obtain sola for use in articles for decoration, ornaments of Gods and Goddesses, mask etleaves are c..</td>
</tr>
<tr>
<td>2</td>
<td><em>Bacopa monnieri</em></td>
<td>Brambhi</td>
<td>Scrophulariaceae</td>
<td>Leaves are fried and eaten.Juice obtained from crushing of leaves are used in conjunctivitis.</td>
</tr>
<tr>
<td>3</td>
<td><em>Boerhavia diffusa</em></td>
<td>Khapra-sak</td>
<td>Nyctaginaceae</td>
<td>Leaves are used as vegetables.</td>
</tr>
<tr>
<td>4</td>
<td><em>Centella asiatica</em></td>
<td>Thankuni</td>
<td>Apiaceae</td>
<td>Leaves are used as vegetables. Crushing of leaves are used in dysentery.It is preventive of leprosy.</td>
</tr>
<tr>
<td>5</td>
<td><em>Colocasia esculenta</em></td>
<td>Kachu</td>
<td>Araceae</td>
<td>Young leaves are used as vegetables.</td>
</tr>
<tr>
<td>6</td>
<td><em>Commelina benghalensis.</em></td>
<td>Kansira,K aasak</td>
<td>Commelinacea e</td>
<td>Young shoot and leaves are used as vegetables.It is preventive of leprosy.</td>
</tr>
<tr>
<td>7</td>
<td><em>Croton bonplandianum</em></td>
<td>Jhamti, Bhabari</td>
<td>Euphorbiaceae</td>
<td>Latex is used in external injury.</td>
</tr>
<tr>
<td>8</td>
<td><em>Cynodon dactylon</em></td>
<td>Dub-ghas</td>
<td>Poaceae</td>
<td>Leaf crushings are used in external injury. Shoot tips are used in worship and prayer.</td>
</tr>
<tr>
<td>9</td>
<td><em>Eclipta prostrata</em></td>
<td>Kesuti, Lao-keshra</td>
<td>Asteraceae</td>
<td>Crushing of leaves are used in anthrax of domestic birds..</td>
</tr>
<tr>
<td>10</td>
<td><em>Hydrilla verticillata</em></td>
<td>Chingridal</td>
<td>Hydrocharitaceae</td>
<td>Shoots are used in worship and prayer during sasthi puja.</td>
</tr>
<tr>
<td>11</td>
<td><em>Hygrophila schulii</em></td>
<td>Kulekhara, Kuyla-khaara</td>
<td>Acanhaceae</td>
<td>Leaves are used as vegetable and taken as soup to reduce high blood pressure.</td>
</tr>
<tr>
<td>12</td>
<td><em>Ipomoea aquatica</em></td>
<td>Kalmilata, Kalmisak</td>
<td>Convolvulacea e</td>
<td>Leaves are used in vegetables.</td>
</tr>
<tr>
<td>13</td>
<td><em>Ipomoea carnea ssp. fistulosa</em></td>
<td>Berakalimi</td>
<td>Convolvulacea e</td>
<td>Stem are used as stick, in fencing and as fuel.</td>
</tr>
<tr>
<td>14</td>
<td><em>Ludwigia adscendens</em></td>
<td>Keshradam</td>
<td>Onagraceae</td>
<td>Decoction of the plant is taken orally in general weakness usuaily in pregnant women</td>
</tr>
<tr>
<td>15</td>
<td><em>Ludwigia perennis</em></td>
<td>Banlanga</td>
<td>Onagraceae</td>
<td>Decoction of the plant orally</td>
</tr>
</tbody>
</table>
### Table 32: Utilitarian perspectives of macrophytes as recorded from primary sources.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the plant</th>
<th>Local name</th>
<th>Family</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Mikania micrantha</td>
<td>Rabanlata</td>
<td>Asteraceae</td>
<td>Leaves used as antiseptic in external injury.</td>
</tr>
<tr>
<td>17</td>
<td>Najas graminea</td>
<td>Chingridal</td>
<td>Najadaceae</td>
<td>Leaves are used as poultry feed.</td>
</tr>
<tr>
<td>18</td>
<td>Najas malesiana</td>
<td>Chingridal</td>
<td>Najadaceae</td>
<td>Leaves are used as poultry feed.</td>
</tr>
<tr>
<td>19</td>
<td>Najas minor</td>
<td>Chingridal</td>
<td>Najadaceae</td>
<td>Leaves are used as poultry feed.</td>
</tr>
<tr>
<td>20</td>
<td>Nelumbo nucifera</td>
<td>Padma</td>
<td>Nelumbonaceae</td>
<td>Root and seeds are eaten. Flowers offered to God. Leaves are used as plates.</td>
</tr>
<tr>
<td>21</td>
<td>Nymphaea pubescens</td>
<td>Saluk</td>
<td>Nymphaeaceae</td>
<td>Seeds are edible. Flowers offered to God.</td>
</tr>
<tr>
<td>22</td>
<td>Nymphoides hydrophylla</td>
<td>Panhar</td>
<td>Menyanthaceae</td>
<td>Rhizome paste is given with white sandal wood dust in leucorrhoea.</td>
</tr>
<tr>
<td>23</td>
<td>Oryza sativa</td>
<td>Dhan</td>
<td>Poaceae</td>
<td>2-4 gm roots are chewed with a betel leaf in dysentery. Straw and rice are used in Saharai festival.</td>
</tr>
<tr>
<td>24</td>
<td>Potamogeton crispus</td>
<td>Kalaypata</td>
<td>Potamogetonaceae</td>
<td>Leaves are used as vegetables.</td>
</tr>
<tr>
<td>25</td>
<td>Potamogeton nodosus</td>
<td>Kalaypata</td>
<td>Potamogetonaceae</td>
<td>Leaves are used as vegetables.</td>
</tr>
<tr>
<td>26</td>
<td>Solanum nigrum</td>
<td>Ghurki</td>
<td>Solanaceae</td>
<td>Fruits are used as vegetables, in cold and cough; fruits are used to trap rats in cage.</td>
</tr>
<tr>
<td>27</td>
<td>Typha domingensis</td>
<td>Kam, Hoogla</td>
<td>Typhaceae</td>
<td>Leaves are used in making mats, as fuel, for thatching huts and fencing.</td>
</tr>
<tr>
<td>28</td>
<td>Trapa natans var bispinosa</td>
<td>Paiphal</td>
<td>Trapaceae</td>
<td>Fruits are edible.</td>
</tr>
<tr>
<td>29</td>
<td>Vallisneria spiralis</td>
<td>Dal</td>
<td>Hydrocharitaceae</td>
<td>Leaves are used as poultry feed.</td>
</tr>
<tr>
<td>30</td>
<td>Vetiveria zizanioides</td>
<td>Benaghas,</td>
<td>Poaceae</td>
<td>Roots are used in worship and prayer.</td>
</tr>
<tr>
<td>31</td>
<td>Marsilea minuta</td>
<td>Susunisak</td>
<td>Marsileaceae</td>
<td>Young twig are used as vegetables.</td>
</tr>
</tbody>
</table>

##### 4.3. Resolution of Remedial Measures to Restore Wetlands and Optimize Their Use

The wetlands in Puruliya district have been facing with certain problems challenging their existence an accurate surveyance and mitigation of which is envisaged. During field surveys
undertaken at frequent intervals certain problems faced by the wetlands could be identified, the remedial measures for each of which are suggested in the following (Table 33).

4.3.1. Surveillance of wetlands for restoration:

(i) Certain species could be selected preliminarily for mitigating wetland pollution, especially from heavy metals, and removal of excess macro and micro-nutrients (minerals) viz. *Schoenoplectus articulatus, Typha domingensis, Ceratophyllum demersum, C. muricat, Monochoria hastata, M. vaginalis, Nymphoides hydrophylla, Ludwigia adscendens, L. perennis, Nymphaea pubescens, Utricularia aurata, U. australis, U. stellaris, Panicum repens, Cyperus sp, Potamogeton crispus, P. nodosus, Nelumbo nucifera, Eichhornea crassipes, Ipomoea aquatica, Vetiveria zizanioides* etc. However, their role as hyper accumulators of heavy metals under the existing environmental and more precisely edaphic and climatic conditions need to be experimentally checked. Sustainability of their functions may be ensured by their judicious removal at intervals for subduing eutrophication.

(ii) Irrigation by extraction of water from wetlands must be regulated, As many as 21 wetlands necessitate desiltation.

(iii) Conservation of soils in the fringe areas by planting of soil binding herbaceous species and wind checking trees is suggested in case of 21 wetlands. The tree species may be selected from those once used under social forestry schemes for the respective areas. Soil conservation in the vicinity of wetlands must be emphasized to reduce the input of eroded soil into them by revegetation with efficient soil binding herbs or by undertaking scheme of aorestation/social forestry.

(iv) Raising of gardens around wetland to promote aesthetic value is suggested for three wetlands.

(v) Washing of automobiles needs to be prohibited in 13 wetlands and burning of deadbodies in the bank of 5 wetlands.

(vi) Input of urban sewage and dumping of other obnoxious wastes must be controlled immediately in case of 5 wetlands.

(vii) Banning of unhygienic domestic use of 16 wetlands is felt necessary.

(viii) Often eutrophicated wetlands need to be restored by removal of their excess nutrient load. Such a need can be fulfilled by judicious removal of macrophytes for use as a resource without hampering the wetland biodiversity. Such a management operation is felt necessary in case of Adra Sahebbundh, Dhanarbundh and Hanumata dam. Immediate removal of garbage is suggested in case of Sahebbundh.
(ix) Further raising of buildings on encroached parts of wetland need to be checked further in case of 6 wetlands (Angarkhuri, Barikbundh, Lihirbundh, Nutanbundh [Plate 25] Pokabundh and Rajabundh) [Plate 26].

(x) The wetland Nibaran Sayar is so greatly impoverished in its macrophytes content that it is certain to lose its wetland characteristics unless there is introduction and encouragement of macrophyte establishment.

4.3.2. Development from sustainable use of wetlands:

After thoroughly studying the 38 wetlands of Puruliya district the present author feels that certain developmental programmes may be launched based on sustainable use of their resources other than water (Table 34). Suggestions for sustainable development based on wetlands are enumerated in the following:

(i). Integrated scientific programmes for pisciculture and duckery for 24 wetlands (wetland nos- 2,5,6 8,9,12,13,14,17,18,20,21,22,23,24,25,26,27,31,32,33,34,36,38).

(ii). Floriculture (Nelumbo nucifera, Nymphaea pubescens, Nymphaea nouchali etc.) at least in 9 wetlands (wetland nos-3, 10,11,15,19,26,28,35,37).

(iii). Cottage industry (mats/sola, art and craft etc) for 6 wetlands (wetland nos-4,18,20,22,24,38).

(iv). Establishment of Co-operatives and Societies for employment generation through scientific pisciculture and other activities at least in case of 5 wetlands (wetland nos-3,7,15,19,29).

(v). Promotion of tourism for 5 wetlands (wetland nos-1,18,20,24,35).

(vi). Initiation of Vermicomposting of organic matter removed from wetlands during management practices in case of wetland nos-19,35.

(vii). Establishment of biogas plant and dry anaerobic composting with the organic matter removed during management in case of 2 wetlands (wetland nos-1,35).

Table 33: An inventory of wetlands and the restorative strategies suggested for them.

<table>
<thead>
<tr>
<th>Serial No</th>
<th>Name of the Wetlands</th>
<th>Suggestions for restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adra Sahebbundh</td>
<td>Rejuvenation (nutrient impoverishment) through judicious removal of plant resource e.g. for food, fodder, medicine etc; physico-chemical amendments, if necessary for revival of life sustainability raising of gardens around wetlands to promote aesthetic value and general awareness.</td>
</tr>
</tbody>
</table>
Table 33: An inventory of wetlands and the restorative strategies suggested for them (Contd.)

<table>
<thead>
<tr>
<th>Serial No</th>
<th>Name of the Wetlands</th>
<th>Suggestions for restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Angarkhuri</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands; Excavation for desiltation; removal of formation of building adjoining the wetlands.</td>
</tr>
<tr>
<td>3</td>
<td>Babirbundh (Sabir bundh)</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; prohibition of washing of automobiles; regulation of irrigation, if necessary, from wetlands; Excavation for desiltation.</td>
</tr>
<tr>
<td>4</td>
<td>Barikbundh</td>
<td>Removal of formation of building adjoining the wetlands; regulation of irrigation, if necessary, from wetlands; prohibition of washing of automobiles; Excavation for desiltation.</td>
</tr>
<tr>
<td>5</td>
<td>Benabundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; Excavation for desiltation.</td>
</tr>
<tr>
<td>6</td>
<td>Benagora</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; Excavation for desiltation.</td>
</tr>
<tr>
<td>7</td>
<td>Burosayar</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetland must be regulated, if necessary, from wetlands; Excavation for desiltation.</td>
</tr>
<tr>
<td>8</td>
<td>Deshbundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>9</td>
<td>Dewanbundh</td>
<td>Removal of burning of deadbody to the bank of the wetlands; regulation of irrigation, if necessary, from wetlands; Excavation for desiltation.</td>
</tr>
<tr>
<td>10</td>
<td>Dhanarbundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; rejuvenation (nutrient impoverishment) through judicious removal of plant resource e.g. for food, fodder, medicine etc; regulation of irrigation, if necessary, from wetlands.</td>
</tr>
<tr>
<td>11</td>
<td>Ganakbundh</td>
<td>Prohibition of washing of automobiles; physico-chemical amendments, if necessary for revival of life sustainability; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
</tbody>
</table>
Table 33: An inventory of wetlands and the restorative strategies suggested for them (Contd.)

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<th>Serial No</th>
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<th>Suggestions for restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Gayerbundh</td>
<td>Irrigation from wetlands must be regulated, if necessary, from wetlands; Excavation for desiltation.</td>
</tr>
<tr>
<td>13</td>
<td>Gaylabundh</td>
<td>Excavation for desiltation.</td>
</tr>
<tr>
<td>14</td>
<td>Ghoshalpukur</td>
<td>Excavation for desiltation; prohibition of washing of automobiles.</td>
</tr>
<tr>
<td>15</td>
<td>Gobindasayar</td>
<td>Raising of gardens around wetlands to promote aesthetic value and general awareness.</td>
</tr>
<tr>
<td>16</td>
<td>Gorsaibundh/Namobundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; Excavation for desiltation; prohibition of washing of automobiles</td>
</tr>
<tr>
<td>17</td>
<td>Guniyara Barabundh</td>
<td>Irrigation from wetlands must be regulated, if necessary, from wetlands; conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry.</td>
</tr>
<tr>
<td>18</td>
<td>Hanumata dam</td>
<td>Rejuvenation (nutrient impoverishment) through judicious removal of plant resource e.g. for food, fodder, medicine etc; prohibition of washing of automobiles; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>19</td>
<td>Joypur Ranibundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; Prohibition of washing of automobiles; irrigation from wetlands must be regulated, if necessary, from wetlands; physico-chemical amendments, if necessary, for revival of life sustainability; removal of burning of dead body to the bank of the wetlands.</td>
</tr>
<tr>
<td>20</td>
<td>Kalidaha (jore)</td>
<td>Removal of burning of dead body to the bank of the wetlands; Excavation for desiltation; prohibition of washing of automobiles; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>21</td>
<td>Kamalabundh</td>
<td>Excavation for desiltation.</td>
</tr>
<tr>
<td>22</td>
<td>Ketankiyari (Jore)</td>
<td>Removal of burning of dead body to the bank of the wetlands; physico-chemical amendments, if necessary, for revival of life sustainability; irrigation from wetlands must be regulated, if necessary, from wetlands; prohibition of washing of automobiles.</td>
</tr>
<tr>
<td>23</td>
<td>Khagerbundh</td>
<td>Prohibition of washing of automobiles; Excavation for desiltation.</td>
</tr>
<tr>
<td>24</td>
<td>Kumari dam</td>
<td>Prohibition of washing of automobiles; physico-chemical amendments, if necessary, for revival of life sustainability; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>25</td>
<td>Lihirbundh</td>
<td>Prohibition of polluted water from the entire city; Excavation for desiltation.</td>
</tr>
</tbody>
</table>
Table 33: An inventory of wetlands and the restorative strategies suggested for them (Contd.)

<table>
<thead>
<tr>
<th>Serial No</th>
<th>Name of the Wetlands</th>
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</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Mahatobundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands; physico-chemical amendments, if necessary for revival of life sustainability.</td>
</tr>
<tr>
<td>27</td>
<td>Maidhara</td>
<td>Excavation for desiltation; conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry.</td>
</tr>
<tr>
<td>28</td>
<td>Nutanbundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands; prohibition of polluted water from the city; prohibition of washing of automobiles; removal of formation of building adjoining the wetlands.</td>
</tr>
<tr>
<td>29</td>
<td>Pokabundh</td>
<td>Removal of formation of building adjoining the wetlands; Excavation for desiltation; prohibition of polluted water from the entire city.</td>
</tr>
<tr>
<td>30</td>
<td>Puranosayar</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>31</td>
<td>Rajabundh</td>
<td>Prohibition of polluted water from the city; removal of formation of building adjoining the wetlands; conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; Excavation for desiltation.</td>
</tr>
<tr>
<td>32</td>
<td>Rampur Barabundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; regulation of irrigation, if necessary, from wetlands; Excavation for desiltation.</td>
</tr>
<tr>
<td>33</td>
<td>Ranibundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry.</td>
</tr>
<tr>
<td>34</td>
<td>Ruknibundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation/social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>35</td>
<td>Sahebbundh/Nibaransayar</td>
<td>Encouragement of macrophytes growth for promotion of primary productivity and eventual energy input; raising of gardens around wetlands to promote aesthetic value and general awareness; physico-chemical amendments, if necessary for revival of life sustainability; removal of garbage, to protect from pollution of</td>
</tr>
</tbody>
</table>
### Table 33: An inventory of wetlands and the restorative strategies suggested for them (Contd.)

<table>
<thead>
<tr>
<th>Serial No</th>
<th>Name of the Wetlands</th>
<th>Suggestions for restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Sankra Barabundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation /social forestry; regulation of irrigation , if necessary, from the wetland.</td>
</tr>
<tr>
<td>37</td>
<td>Sayar bundh</td>
<td>Conservation of soil in the vicinity of wetlands is often envisaged through revegetation planting of efficient soil binding herbs and by aforestation /social forestry; irrigation from wetlands must be regulated, if necessary, from wetlands.</td>
</tr>
<tr>
<td>38</td>
<td>Sindripathar</td>
<td>Removal of burning of dead body to the bank of the wetlands; prohibition of washing of automobiles; physico-chemical amendments, if necessary for revival of life sustainability; irrigation from wetlands must be regulated, if necessary, from wetlands; Excavation for desiltation.</td>
</tr>
</tbody>
</table>

### Table 34: An inventory of wetlands and the strategies suggested for sustainable development based on them.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the Wetland</th>
<th>Suggestions for sustainable development by utilization of wetland resources.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adra Sahebbundh</td>
<td>Establishment of biogas plant and dry anaerobic composition with the organic matter removed during management; Promotion of tourism; Banning of unhygienic domestic use</td>
</tr>
<tr>
<td>2</td>
<td>Angarkhuri</td>
<td>Scientific pisciculture and duckery sustaining optimum Biodiversity have been suggested for the wetland.</td>
</tr>
<tr>
<td>3</td>
<td>Babir bundh/Sabir bundh</td>
<td>Floriculture; Creation of co-operatives for pisciculture and other activities to be sustained.</td>
</tr>
<tr>
<td>4</td>
<td>Barikbundh</td>
<td>Cottage industry (mats/sola, art and craft etc).</td>
</tr>
<tr>
<td>5</td>
<td>Benabundh</td>
<td>Duckery and pisciculture.</td>
</tr>
<tr>
<td>6</td>
<td>Benagora</td>
<td>Duckery and pisciculture.</td>
</tr>
<tr>
<td>7</td>
<td>Burosayar</td>
<td>Creation of co-operatives for pisciculture and other activities to be sustained; Banning of unhygienic domestic use.</td>
</tr>
<tr>
<td>8</td>
<td>Desh bundh</td>
<td>Scientific pisciculture and duckery sustaining optimum Biodiversity have been suggested for the wetland.</td>
</tr>
<tr>
<td>9</td>
<td>Dewanbundh</td>
<td>Duckery and pisciculture.</td>
</tr>
<tr>
<td>10</td>
<td>Dhanar bundh</td>
<td>Floriculture; Banning of unhygienic domestic use.</td>
</tr>
<tr>
<td>11</td>
<td>Ganakbundh</td>
<td>Floriculture; Banning of unhygienic domestic use.</td>
</tr>
<tr>
<td>12</td>
<td>Gayerbundh</td>
<td>Duckery and Pisciculture; Banning of unhygienic domestic use.</td>
</tr>
<tr>
<td>13</td>
<td>Gaylabundh</td>
<td>Duckery and pisciculture; Banning of unhygienic domestic use.</td>
</tr>
<tr>
<td>14</td>
<td>Ghoshalpukur</td>
<td>Scientific pisciculture and duckery sustaining optimum biodiversity have been suggested.</td>
</tr>
<tr>
<td>15</td>
<td>Gobindasayar</td>
<td>Creation of co-operatives for pisciculture and other activities; Floriculture.</td>
</tr>
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### Survey of Wetlands in Puruliya District

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<td>Gorsaibundh/ Namobundh</td>
<td>Banning of unhygienic domestic use.</td>
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<td>17</td>
<td>Guniyara Barabundh</td>
<td>Banning of unhygienic domestic use; Duckery and Pisciculture.</td>
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<td>Hanumata dam</td>
<td>Cottage industry (mats/sola, art and craft etc); Duckery and Pisciculture; Promotion of tourism.</td>
</tr>
<tr>
<td>19</td>
<td>Joypur Ranibundh</td>
<td>Creation of co-operatives for pisciculture and other activities; Vermiculture of organic matter removed from wetlands during management; Floriculture.</td>
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<tr>
<td>20</td>
<td>Kalidaha (Jore)</td>
<td>Cottage industry (mats/sola, art and craft etc); Duckery and Pisciculture; Promotion of tourism.</td>
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<td>Kamalabundh</td>
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<td>Cottage industry (mats/sola, art and craft etc); Duckery and Pisciculture.</td>
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<td>23</td>
<td>Khagerbundh</td>
<td>Scientific pisciculture and duckery sustaining optimum Biodiversity have been suggested.</td>
</tr>
<tr>
<td>24</td>
<td>Kumaridam</td>
<td>Cottage industry (mats/sola, art and craft etc); Duckery and Pisciculture; Promotion of tourism.</td>
</tr>
<tr>
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<td>Lihirbundh</td>
<td>Duckery and Pisciculture.</td>
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<td>Puranosayar</td>
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<td>Rajabundh</td>
<td>Duckery and Pisciculture.</td>
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<tr>
<td>32</td>
<td>Rampur Barabundh</td>
<td>Banning of unhygienic domestic use. Duckery and Pisciculture.</td>
</tr>
<tr>
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<td>Ranibundh</td>
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<td>34</td>
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</tr>
<tr>
<td>35</td>
<td>Sahebbundh/Nibaransayar</td>
<td>Promotion of tourism; Floriculture; Vermiculture of organic matter removed from wetlands during management; Establishment of biogas plant and dry anaerobic composition with the organic matter removed during management.</td>
</tr>
<tr>
<td>36</td>
<td>Sankra Barabundh</td>
<td>Banning of unhygienic domestic use; Duckery and Pisciculture.</td>
</tr>
<tr>
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<td>Sayarbundh</td>
<td>Floriculture; Banning of unhygienic domestic use.</td>
</tr>
<tr>
<td>38</td>
<td>Sindripathar</td>
<td>Cottage industry (mats/sola, art and craft etc); Duckery and Pisciculture.</td>
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