RESEARCH ARTICLE

Sacred Groves as the Source of Local Medicinal Plants and Sites of Biodiversity Conservation in North 24 Parganas, West Bengal

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Abstract

A Sacred Grove (SG) is any grove of trees, shrubs and even herbs of special religious importance to a particular culture. SGs are considered as distinct patches of vegetation (ranging in size from a small cluster of a few trees to a large forest stand spanning several hundred acres) which are venerated in the name of local deities or ancestral spirits, promoting conservation. Conservation of biodiversity in sacred groves is a consequence of the sacred physical space of the sacred grove which is communally shared as commons and used to observe crucial social ceremonies in indigenous societies. While documenting the sacred groves in the district of North 24 Parganas of West Bengal through a detailed field survey, plants of local medicinal importance were identified in these patches in which the local people traditionally conserved the medicinal plants since time immemorial. An extensive field survey to potential district areas and documentation of major flora, including their correct identification and their related Traditional Knowledge (TK) in each SG was done. More than 120 local medicinal plants were found and traditional knowledge associated with these plants was documented which included *Adhatoda vasica, Abroma agustum, Andrographis paniculata, Bacopa monnieri, Centella asiatica, Cocculus hirsutus, Gloriosa superba, Tinospora cordifolia* to name very few. Out of these purified aqueous extract of *Cocculus hirsutus* has also been reported in COVID-19 treatment in many research papers. Traditional knowledge associated with these plants found in the sacred groves is a hidden treasure from where further research, learning and dissemination of potential information can ensue. These SGs are examples of *in-situ* conservation traditionally by local people and gene pool for various medicinal plants.

Keywords: Sacred groves, traditional knowledge, local medicinal plants, biodiversity conservation, North 24 Parganas, West Bengal.

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Introduction

India has an ancient culture of conserving nature since Vedic period or earlier. The significance of forests and vegetation can be cited from texts of India's ancient culture like *Aranyakas*, which is also somewhat synonymous to knowledge acquisition. A chapter in *Ramayana* namely *Aranya Kanda* has been dedicated to forests. Similarly, *Vana Parva* in *Mahabharata* too has been dedicated to life in the forests. Buddha's enlightenment as per Buddhist texts also took place under the Bodhi tree, a peepal (*Ficus religiosa*) tree (Singh, 2017). These indeed signify the indispensable importance of forest life in human development. Forests have shrunk to less than 30%, as per the Forest Survey Report of 2021 total forest cover in India is about 21.71% (FSI Forest Survey of India, 2021)

A sacred grove is a collection of trees, shrubs and even herbs of special religious importance to a particular culture. These are remnants of virgin forests with rich diversity (Khan *et al*., 2008). Sacred groves are considered as distinct patches of vegetation (ranging in size from a small cluster of a few trees to a large forest stand spanning several hundred acres) that are consecrated in the name of local deities or ancestral spirits promoting conservation (Kandari*et al.,* 2014; Amirthalingam, 2016;). In India, around 13,270 sacred groves have been documented by Malhotra in 1998, which increased to more than 50,000 in 2001 (Malhotra, 2001). These patches of vegetation are conserved culturally and can range from few hectares (or less) to 500 hectares. These small patches of vegetation most often serve as a reservoir of plant species that otherwise disappeared owing to various anthropogenic activities like habitat destruction, urbanization, environmental degradation etc. Endangered and medicinally important plants may occur in such undisturbed patches of ancient forests.In the words of Dr. M.S. Swaminathan, "Unlike a botanical garden, where a wide range of trees and plants are collected and cultivated for the purpose of our education and enjoyment, the sacred groves are one method of expressing the gratitude of human beings to the trees which sustain and support life under a given agro-ecological condition". Sacred groves not only promote the conservation of plant species as a relic of past forests (Sukumaran *et al.,* 2008), their ecological significance is also immense as they provide shelter to a wide number of bird populations (Deb *et al.,* 1997; Caughlin *et al.,*2012) and various other organisms. Worshipping of deities in these relic forest patches restricts any type of disturbances in flora and fauna in such areas thereby effecting conservation (Khumbongmayum *et al.,* 2005). Various ethnic groups living close to nature practice unique traditional knowledge towards utilization of bioresources (Chanda *et al.,* 2013).

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District of North 24 Parganas is located between 23°15´N to 22°11´N latitude and 89°05´E to 88°20´E longitude. Situated in the southeastern part of the state of West Bengal, it shares its boundary with Nadia district in the north and north-west, Howrah, Kolkata and South 24 Parganas in the western part. District of North 24 Parganas shares a long international border with Bangladesh in the east and faces South 24 Parganas in the south. With its rich human population and ever-changing habitations, except the areas adjacent to Sundarban Biosphere Reserve situated at the district's southern extremes, constant population increase has caused tremendous habitat destruction for the wild but medicinally important local plants. In spite of this, considerable numbers of sacred groves were seen during the survey. The presence of various medicinal plants in most the sacred groves their use by the local people were also observed and documented. An extensive field survey found that sacred groves are the repository of local medicinal and threatened plants of the region, namely lower part of the Gangetic plain. Owing to the taboo associated with these particular places, various plants get conserved in such pockets, which is the most significant reason behind the local people's spontaneous *in-situ* conservation since time immemorial. Various local medicinal plants are thus conserved in these remnants of ancient forests. The aim of the present work was to search and locate the SGs, extensive survey of the locally available medicinal plants in these SGs, documentation and understanding threats associated with these conservation units. Work also aimed at a detailed survey to different areas of the district to find out reported and unreported SGs as well as document major flora and fauna, including their correct identification and their related Traditional Knowledge in each sacred grove.

Materials and Methods

Area of Survey for Sacred Groves

In West Bengal, most of the sacred groves are reported from South-western districts (Deb, 2007; Basu, 2009). Recently, Chakraborty *et al.,* (2016) studied on Sacred Groves (SG) and Sacred Trees (ST) along the eastern Bank of the River Hooghly of North 24 Parganas (Fig. 1) and enumerated total 129 SGs & STs, but without documentation of any major fauna, flora and related Indigenous and Traditional Knowledge (ITK). They also mentioned that among 129 SGs and Sacred Trees (STs), about 65% are well-maintained by the local people. Medicinal plants and herbs from these SGs needed to be documented more comprehensively for which the present work was undertaken and entrusted to the author by West Bengal Biodiversity Board, Government of West Bengal.

Methodology of Work

The formation of team members comprising local knowledgeable & elderly people, students, local herbal experts for floristic identification was done first for data collection and field visits. This was followed by an extensive survey of potential areas of the district comprising field survey, data collection and monitoring, and identification of existing sacred groves in the survey domain. This was followed by identifying the people with traditional knowledge in each sacred grove and visiting these sacred groves followed by documenting plants of medicinal importance and vigorous data collection. Taking photographs of medicinal plants and their identification was confirmed at CAL (Central National Herbarium) as well as through expert taxonomists.

After data collection, analysis of data in the laboratory was carried out. Analyzing status of availability of reported or collected herbs/plants in the area of their occurrence. Determination of the abundance of these plant specimens, whether threatened or most frequently available, was based on the occurrence and preservation of data in digitized form and reporting significant data from the research work (if any) through appropriate research communication. Finally, documentation and analysis of threats to such areas were also done.

Results and Discussion

North 24 Parganas district in the state of West Bengal is a large in terms of area as well as in terms of population. It borders Bangladesh towards east (Fig. 1). After the partition of India into East Pakistan (now Bangladesh) in 1947 it saw highest number population due to influx. It had naturally caused habitat destruction to great deal of natural flora and fauna. Important rivers traverse this region like Ichhamati, Kalindi, Raimangal, Dansa, Bidyadhari, and Hooghly. Apart from this the community development blocks (C.D. in Fig. 2) of Minakhan, Sandeshkhali have seen a change in the pattern of land use in the form of transformation of the cultivable lands into water bodies for pisciculture, prawn culture etc. More than 200 small to medium-sized sacred groves (SGs) were found encountered during the survey work out of which SGs with rich in plant populations have been reported here.

It was observed that stronger is the taboo is associated with the SGs, more it is protected by the communities living around such SGs. Taboo is thus one of the most important factor which safeguard these small units of preservation centres amid high population and anthropogenic activities in and around such SGs. Table 1gives a list of local medicinal plants found in different SGs (Table 2). More than 150 medicinal plants were identified from various SGs; among these 63 local medicinal plants have been shown here with their local names, family and uses due to their more uses by the local people. The work elucidated how sacred groves play a significant part in being the reservoir of local medicinal plants. A great variety of local medicinal plants naturally exist in such SGs thus acting as an area of *in-situ* conservation. Medicinal garden are created in various institutions as an agent of *ex-situ* conservation for learning and research; interestingly, SG can serve as an area for the conservation of naturally available medicinal plants (Figs. 3(a), 3(b) and 3(f)), learning and limited use for scientific research where taboo is comparatively low. Traditional use by the local people also observed as depicted in Figs. 3(c) and 3(d) where *Andrographis paniculata* (Kalmegh) handmade tablets are being used by the locals.

It was observed that the larger the area of SGs, the higher the number of plant species it harbours (Fig. 6a) viz. with the area shrinking the number of species decreases, an important finding which implies disappearance of plant species owing to habitat loss. Biodiversity in the SGs is thus directly proportional to the area of a sacred grove. The SGs' proximity to the main roads or avenues

of communication led to the shrinkage of such conservation units [Fig. 6(b)]. Highways and main roads cause increased frequency of vehicles, urban population, market; this may be deleterious for the taboos which protect the SGs against vulnerability.

SGs are natural sites of naturally available medicinal plants. Out of different medicinal plants surveyed *Acalypha indica, Andrographis paniculata, Oxalis corniculata, Eclipta prostrata, Scoparia dulcis, Vernonia. cinerea*were some plants which

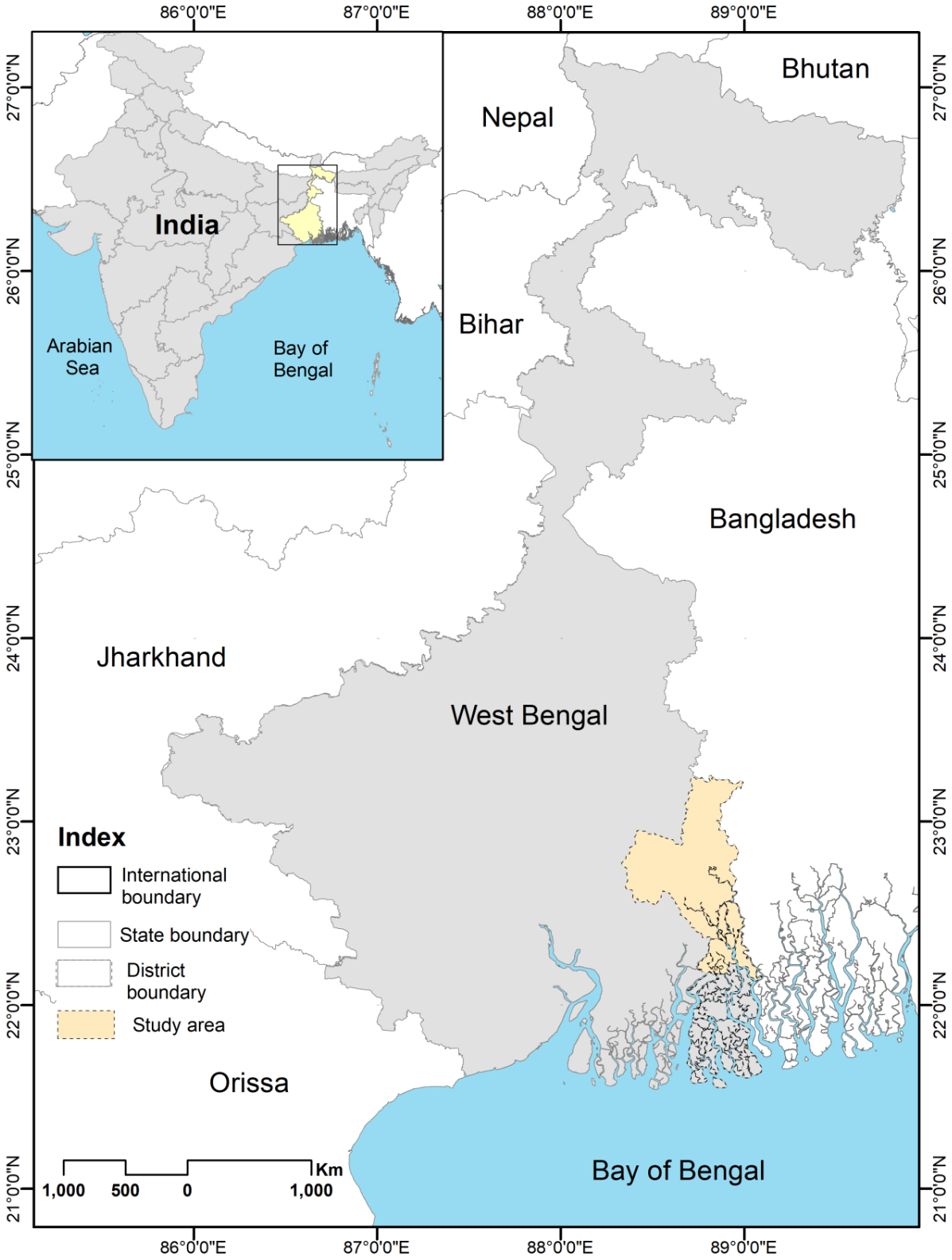
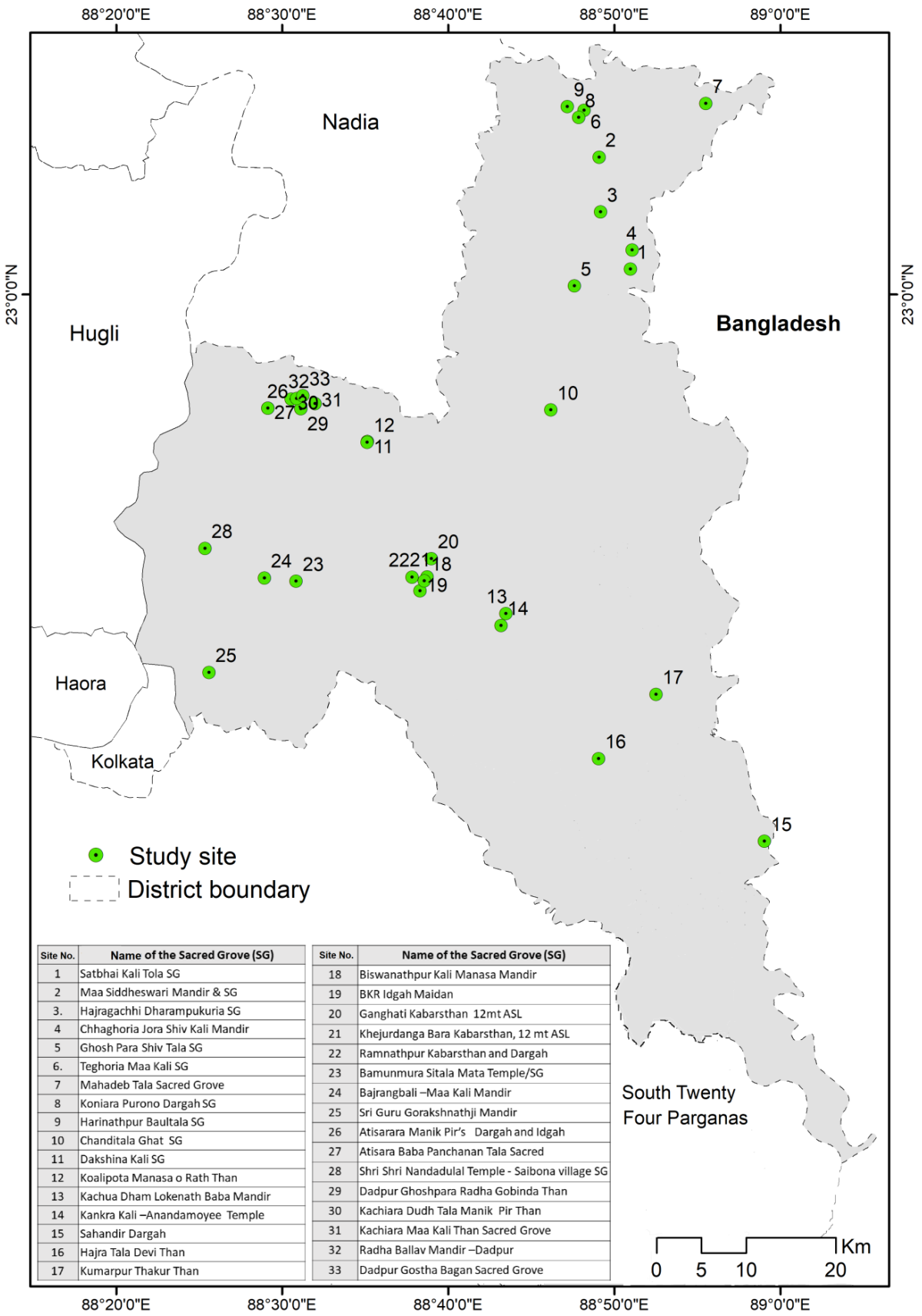


Fig. 1: Area of work: North 24 Parganas district of West Bengal, India



Site No.	Name of the Sacred Grove (SG)
1	Satbhai Kali Tola SG
2	Maa Siddheswari Mandir & SG
3.	Hajragachhi Dharampukuria SG
4	Chhaghoria Jora Shiv Kali Mandir
5	Ghosh Para Shiv Tala SG
6.	Teghoria Maa Kali SG
7	Mahadeb Tala Sacred Grove
8	Koniara Purono Dargah SG
9	Harinathpur Baultala SG
10	Chanditala Ghat SG
11	Dakshina Kali SG
12	Koalipota Manasa o Rath Than
13	Kachua Dham Lokenath Baba Mandir
14	Kankra Kali –Anandamoyee Temple
15	Sahandir Dargah
16	Hajra Tala Devi Than
17	Kumarpur Thakur Than

Site No.	Name of the Sacred Grove (SG)
18	Biswanathpur Kali Manasa Mandir
19	BKR Idgah Maidan
20	Ganghati Kabarsthan 12mt ASL
21	Khejurdanga Bara Kabarsthan, 12 mt ASL
22	Ramnathpur Kabarsthan and Dargah
23	Bamunmura Sitala Mata Temple/SG
24	Bajrangbali –Maa Kali Mandir
25	Sri Guru Gorakshnathji Mandir
26	Atisarara Manik Pir's Dargah and Idgah
27	Atisara Baba Panchanan Tala Sacred
28	Shri Shri Nandadulal Temple - Saibona village SG
29	Dadpur Ghoshpara Radha Gobinda Than
30	Kachiara Dudh Tala Manik Pir Than
31	Kachiara Maa Kali Than Sacred Grove
32	Radha Ballav Mandir –Dadpur
33	Dadpur Gostha Bagan Sacred Grove

Fig. 2: Map of North 24 Parganas with the sacred groves

Table: 1 Name of Sacred Groves with GPS coordinates of each located in the respective Block/ GP

Sl No.	*Name of the Sacred Grove (SG)*	*Coordinate (Longitude followed by latitude)*	*Location*
1	Satbhai Kali Tola SG	88°50′59.65476′′E 23°1′31.222567′′N	Bongaon (Bongaon Gram)
2	Maa Siddheswari Mandir & SG	88°49′6.04776′′E 23°8′14.3973′′N	Bongaon (Ganrapota)
3.	Hajragachhi Dharampukuria SG	88°49′ 12.5317′′E 23°56′ 85.28′′N	Bongaon (Dharampukur)
4	Chhaghoria Jora Shiv Kali Mandir	88°51′5.95008′′ E 23°2′40.27956′′N	Bongaon (Chhaghoria)
5	Ghosh Para Shiv Tala SG	88°47′36.3289′′E 23°0′31.41936′′N	Bongaon (Kalupur)
6.	Teghoria Maa Kali SG	88°48′11.19628′′E 23°11′5.41176′′ N	Bagda (Beyara)
7	Mahadeb Tala Sacred Grove	88°55′30.259.5′′E 23°11′30.0757′′N	Bagda (Mama Bhagina)
8	Koniara Purono Dargah SG	88°47′51.46′′ E 23°10′ 39.881′′N	Bagda (Koniara-II)
9	Harinathpur Baultala SG	88°47′10.37′′E 23°11′19.762′′N	Bagda (Beyara)
10	Chanditala Ghat SG	88°46′37.926′′E 22°53′4.684′′N	Habra –I (Gobardanga Municipality)
11	Dakshina Kali SG	88°35′734′′E 22°51′985′′N	Habra – II (Bhurkunda)
12	Koalipota Manasa o Rath Than	88°35′768′′ E 22°51′653′′N	Habra – II (Bhurkunda)
13	Kachua Dham Lokenath Baba Mandir	88°43′421′′ E 22°40′822′′N	Swarupnagar (Swarupnagar GP)
14	Kankra Kali –Anandamoyee Temple	88°43′421′′E 22°40′056′′N	Swarupnagar (Swarupnagar GP)
15	Sahandir Dargah	88°59′01′′E 22°27′05′′N	Hingalganj (Sandeler Bill)
16	Hajra Tala Devi Than	88°49′471′′E 22°32′335′′N	Hasnabad (Bhebia)
17	Kumarpur Thakur Than	88°52′392′′ E 22°35′281′′N	Hasnabad (Makhalgachha)
18	Biswanathpur Kali Manasa Mandir	88°37′940′′ E 22°42′452′′N	Deganga (Nur Nagar GP)
19	BKR Idgah Maidan	88°38′18′′E 22°42′824′′N	Deganga (Nur Nagar GP)
20	Ganghati Kabarsthan 12mt ASL	88°38.627′E 22°43.658′N	Deganga (Nur Nagar)
21	Khejurdanga Bara Kabarsthan, 12 mt ASL	88°38.436′E 22°42.973′N	Deganga (Nur Nagar GP)
22	Ramnathpur Kabarsthan and Dargah	88°37′744′′E 22°42′60′′N	Deganga (Nur Nagar)

23	Bamunmura Sitala Mata Temple/SG	88°30´509´´ E 22°42´440´´ N	Barasat –II (Dadpur GP)
24	Bajrangbali –Maa Kali Mandir	88°28´56´´ E 22°42´565´´N	Barasat Municipality
25	Sri Guru Gorakshnathji Mandir Sree Sidhanath Kapilmuni Ashram	88°25´36´´E 22°37´14´´N	Rajarhat (Arjunpur)
26	Atisarara Manik Pir's Dargah and Idgah	88°29´812´´E 22°53´951´´N	Barrackpur – I (Shibdashpur GP)
27	Atisara Baba Panchanan Tala Sacred	88°29´894´´E 22°53´809´´N	Barrackpur – I (Shibdashpur GP)
28	Shri Shri Nandadulal Temple - Saibona village ManasaThan SG	88°4425.351´´E 22°44.748´´N	Barrackpur – I (Kowgachhi –I GP)
29	Dadpur Ghoshpara Radha Gobinda Than	88°31´044´´E 22°53´742´´N	Amdanga (Adhata)
30	Kachiara Dudh Tala Manik Pir Than	88°30´79´´E 22°53´429´´N	Amdanga (Adhata)
31	Kachiara Maa Kali Than Sacred Grove	88°31´82´´E 22°53´233´´N	Amdanga (Adhata)
32	Radha Ballav Mandir –Dadpur	88°30´943´´E 22°53´664´´N	Amdanga (Adhata)
33	Dadpur Gostha Bagan Sacred Grove	88°31´146´´ E 22°53´547 ´´N	Amdanga (Adhata)

Fig. 3 a-f:(a) Sacred grove a repository of plants; (b) *Tiliacora acuminata* (Menispermaceae) at the base of a SG; (c) *Andrographis paniculata* drying on the roof of houses; (d) Traditional method of making tablets of *A. paniculata*; (e) Invasive species: threat to sacred groves (f) Flowering *Mucuna pruriens* in a sacred grove

Fig. 4: (a) Grazing leading to habitat and species loss in SG; (b) Author collecting data at a site

were more frequent than other [Fig. 5(a)]. Plants of medicinal importance but which were not abundantly present were *Asparagus racemosus, Emblica officinalis, Terminalia bellirica, Cissus quadrangularis, Rauvolfia tetraphylla, Piper retrofactum, Cocculus hirsutus, Artemisia vulgaris, Gymnema sylvestre* etc [(Fig. 6(a)].Out of this *Emblica officinalis, Terminalia bellirica* are the plants of dry deciduous region may have been introduced by some people inside the boundary of SG. It clearly confirms the idea of conservation of medicinal and aromatic plants in the sacred groves through local beliefs (Kandari *et al.,* 2014)

SGs not only serve as a repository of plants but possess immense potentialities in natural method of germplasm preservation in the site of occurrence of flora as well as fauna of diverse types (Gadgil *et al.,* 1993). They serve as source of traditional knowledge for the people living adjacent to it as they observe these bio-resources in these SGs identify and

Table 2: Lists of medicinal plants reported from across all above sgs along with their uses

Sl. No.	*Scientific name*	*Local name*	*Habit*	*Family*	*Parts utilized*	*Uses*
1	*Abelmoschus moschatus* Medik.	Kasturi bhindi	Under shrub	Malvaceae	Seeds	Diuretic and demulcent, decoction used in nervous debility, hysteria (Asolkar *et al.,* 2010)
2	*Abroma agustum* (L.) L.f	Ulat kambol	Under shrub	Malvaceae	Leaves	Effective uterine tonic, regulate irregular menses and pain (Asolkar *et al.,* 2010)
3	*Abutilon indicum* (L.) Sweet.	Petari	Under shrub	Malvaceae	Roots and leaves	Febrifuge, anthelmintic, anti-inflamatory (Asolkar *et al.,* 2010)
4	*Acalypha indica* L.	Muktojhuri	Herb	Euphorbiaceae	Leaf	Paste applied in burns, leaf juice useful in rheumatism, arthritis, powdered leaf in maggot infested wounds (Asolkar *et al.,* 2010)
5	*Achyranthes aspera* L.	Apang	Herb	Amaranthaceae	Herb, leaf, roots	Cough, kidney stone, Leaf extract used in leprosy and eczema, tetanus, heated sap in cataracts, seeds in insect bites (Asolkar *et al.,* 2010)
6	*Acorus calamus* L.	Boch	Under shrubby grass	Araceae	Rhizome	Roots, rhizomes in cancer, chronic dyspepsia, diarrhea, flatulence, anthelmintic, roots for fever, cough and toothache (Asolkar *et al.,* 2010)
7	*Adhatoda vasica* Nees. *Syn. Justicia adhatoda*	Vasaka	Shrub	Acanthaceae	Leaves	Powerful digestive stimulant, hypertension, as an anti-fatigue, uremia, cough and cold, purifies blood (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
8	*Aegle marmelos* Correa ex Roxb.	Bel	Tree	Rutaceae	Leaves, fruit, root	Fruit- hypoglycaemic, spasmodic; root bark in hypochondriasis and melancholia, heart and stomach pain, night fever, convulsion, cramps constipation, diarrhoea, dysentery, cholera
9	*Aloe barbadensis* Mill.	Ghritakumari	Herb	Asphodelaceae	Leaf	Juice in digestive problems, stomach pain during menstruation, leaf extract in burn, insect, fish bites, skin ailments cosmetics (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
10	*Andrographis paniculata* (Burm.f.) Nees.	Kalmegh	Herb	Acanthaceae	Leaves, tender shoots	Leaf powder with mustard oil in itching, spleen complaints, diarrhoea, cholera (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
11	*Artemisia vulgaris* L.	Titepati	Shrub	Asteraceae	Leaves	Regulate gastrointestinal problems, skin irritation, antioxidant, anti-bacterial, anti fungal, anti malarial, hypolipidemic, antiplasmodic, analgesic (Ekiert *et al.,* 2020)
12	*Asparagus racemosus* Willd.	Shatavari, Satamuli	Climber	Asparagaceae	Roots	Tonic, diuretic, galatogaogue, immune-adjuvent Alok, *et al.,* 2013
13	*Averrohea carambola* L.	Kamranga	Tree	Oxalidaceae	Fruits	Fever, cough, gastr-enteritis, diarrhoea, ringworm, skin inflammations Muthu *et al.,* 2016
14	*Azadiracta indica* L.	Neem	Tree	Meliaceae	Leaves, bark, fruit, seed	Antibacterial, antifungal, antipyretic, hypoglycaemic, antigastric ulcer, anti-inflammation, Alzohairy *et al.,* 2016
15	*Bacopa monnieri* (L.) Pennell.	Brahmi	Herb	Plantaginaceae	Leaves and tender leaves	Reduce anxiety, enhances memory (Kumar *et al.,* 2016)
16	*Butea monosperma* L.	Palash	Tree	Fabaceae	Fruit, bark, leaves, seeds, roots	Used for parasitic infections, urinary diseases, and diabetes (Asolkar *et al.,* 2010)

17	*Bryophyllum pinnatum* (Lam) Pers.	Patharkuchi	Herb	Crassulaceae	Leaf	Leaf juice used in burns , control diabetes, with *A. marmelos* to control dysentery (Asolkar *et al.,* 2010)
18	*Boerhaavia diffusa* L.	Punarnava	Herb	Nyctaginaceae	Leaf, tender stems, roots	Leaf and stem ashes used to cure night blindness, restoration of virility in man, leaf extract in eye wounds, muscular pain, dropsy, diuretics, anti-inflammatory, oedema, ascites from cirrhosis (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
19	*Cajanus cajan* (L.) Millsp.	Arhar	Shrub	Fabaceae	Seeds, leaves, flowers	Seeds Hypoglycaemic, convulsant, colic, leprosy, roots with anti-fungal property (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
20	*Calotropis gigantean* (L.) Dryand.	Akand	Shrub	Apocynaceae	Roots, leaves	Roots -Balm, enema, anti cancerous, antispasmodic, used in lupus, leprosy, syphilis, leaf juice used in wounds, whole plant in small pox, ailments of spleen, dropsy, hydrocele, muscular pain, bronchitis, asthma etc, latex applied to teeth (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
21	*Capparis zeylanica* L.	Rohin fal	Climber	Capparaceae	Leaves, fruits	Pain, swelling, rheumatism, hemipegia, colic, sores, breast pain, dropsy, cholera (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
22	*Catharanthus roseus* (L.) G.Don	Nayantara	Herb	Apocynaceae	Plant, root, root bark	Anticancer activity particularly against Leukaemia, dried roots used in hypertension, cause cerebrovascular dilatation, leaves extract hypoglycaemic, menstrual disorders (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
23	*Centella asiatica* (L.) Urban	Thankuni	Herb	Apiaceae	Leaves, stem, whole plant	Antibacterial, ulceration of womb, eczema, elephantiasis, ascariasis, , leaf juice in cataract, diuretic, dysmenorrhea, galactogogue, anti-inflammatory (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
24	*Cheilocostus speciosus* (J.Koening.) Specht. *Syn. Costus speciosus*	Beng. Keu Sans. Kemuka	Under-shrub	Zingiberaceae	Rhizomes	Rhizome paste in dysentery and digestive trouble, , fever dropsy, cholera, buring sensation in urination, (Asolkar *et al.,* 2010
25	*Cissus quadrangularis* L.	Harjora	Climber	Vitaceae	Leaves, stem	Stem pulp useful in eye diseases, chronic ulcer, root diction useful in dysentery and digestive disorders, healing of bone fractures in human, thermogenic, laxative, dyspepsia (Prajapati *et al.,* 2004; Asolkar *et al.,* 2010)
26	*Clitoria ternatea* L.	Neelkanth, Aparajita	Climber	Fabaceae	Roots, leaves, seeds	Laxative, intellect promoting, diuretic, anthelmintic, aphrodisiac, bronchitis, pulmonary tuberculosis, ascites, ulcers, opthalmopathy Prajapati *et al.,* 2004)
27	*Coccinia grandis* (L.) Voigt.	Telakucha	Climber	Cucarbitaceae	Roots, Leaves, fruits	Roots are cooling, aphrodisiac, useful in burning uterine, sensation, leaves astringent diuretic, galactogogue, liver tonic, jaundice, anemia, (Prajapati *et al.,* 2004)
28	*Cocculus hirsutus* (l.) Diels.	Patalgaruda, Huyer in Beng.	Climber	Menispermaceae	Leaves, roots	Roots are bitter, thermogenic, digestive, carminative, diuretic, aphrodisiac, anodyne, antipyretic, cough bronchitis, gout, (Prajapati *et al.,* 2004), skin diseases, urinary diseases, Logesh *et al*., 2020) Phytochemicals show anti Covid 19 property (Rajan *et al.,* 2022)

29	*Cymbopogon citrates* (DC.) Stapf.	Eng. Lemon grass	Shrub	Poaceae	Leaves, rhizomes	Leaves chewed for sore gums, , elephantiasis, expectorant analgesic , antipyretic (Asolkar *et al.,* 2010)
30	*Cymbopogon nardus* (L.) Rendle.	Eng. Lemon grass	Shrub	Poaceae	Leaves, rhizomes	Antimicrobial, constituent for essential oils (Asolkar *et al.,* 2010), aromatic, anthelmintic, thermogenic, laxative, flatulence, gastric irritation, anaphrodisiac
31	*Datura stramonium* L.	Dhutura	Under shrub	Solanaceae	Leaves seeds, roots Fruit pericarp	Analgesic, asthma, whooping cough, muscle spasms, relaxes muscles in gastro-intestinal, bronchial and urinary tracts (Prajapati *et al*., 2004), CNS stimulant, respiratory decongestion, skin and tooth ailments (Sony *et al*., 2012)
32	*Desmodium gangeticum* (L.) DC.	Shalparni	Herb	Fabaceae	Leaves, roots	Thermogenic, nervine tonic, dysentery, fever, gout cough, asthma, cardiopathy (Prajapati *et al*., 2004; Asolkar *et al*., 2010)
33	*Ecbolium viride* (Forsk.) Alston.	Udujati Neel kanta	Under shrub	Acanthaceae	Leaves and roots	Against tumours, with cardiovascular effects (Asolkar *et al*., 2010), contains cardiac glycosides (Lalita *et al*., 2010)
34	*Eclipta prostrata* (L.) L.	Kesut	Herb	Asteraceae		Hair growth stimulant, skin diseases, used in gall bladder and liver ailments hepato-protective, myocardial depressant, hypotension (Asolkar *et al*., 2010; Timalsina *et al*., 2021)
35	*Emblica officinalis*	Amla, Beng. Amloki	Small tree, to shrub	Phyllanthaceae	Fruits, leaves	Common cold, fever, diuretic, laxative, liver tonic, cardio-protective, anti anemia, controls blood cholesterol, gastroprotective, antipyretic, Anticancer property (Baliga *et al*., 2011)
36	*Chromolaena odorata* (L.) R.M. King & H.Rob. Syn. *Eupatorium odoratum*	Ban matmatiya	Shrub	Asteraceae	Leaves	Crushed leaves stop bleeding, cuts and wounds (Asolkar *et al*., 2010), anti-hepatotoxic, hypoglycaemic, anti-microbial, anti- cancerous (Sirinthipaporn *et al*., 2017)
37	*Ayapana triplinervis* (M.Vahl.) R.M. King & H.Rob. *Syn. Eupatorium triplinerve* Vahl.	Ayapan	Herb	Asteraceae	Leaves	Effective against Zika virus infections, Haddad et al., 2019 Digestive, thermogenic, stimulant, expectorant and tonic, effective in gastropathy, dyspepsia, wounds, ulcers etc. (Prajapati *et al*., 2004),
38	*Evolvulus nummularius* (L.) L.	Bhui akra	Prostrate herb	Convolvulaceae	Leaves	Antibacterial, antioxidant (Pavithra *et al*., 2009)
39	*Justicia gendarussa* Burm. F.	Vataghni	Herb	Acanthaceae	Leaves	Anti-inflammatory, expectorant emenagogue, insecticidal, active against hepatic injury Prajapati *et al*., 2010; Yadav *et al*., 2017)
40	*Gymnema sylvestre* R.Br.	Gurmar	Climbing perennial	Apocynaceae	Whole plant , leaves	Supports healthy sugar, metabolism, with an anti diabetic digestive facilitator, maintain normal blood sugar levels, liver tonic, expectorant and uterine tonic (Kanetkar *et al*., 2007; Prajapati *et al*., 2010)
41	*Hemisdesmus indica* (L.) R.Br.	Sasaparilla	Climber	Asclepiadaceae	Roots, leaves, stem	Roots aromatic, anthelmintic, aphrodisiac, in bronchitis, carminative, in snake bites, scorpion sting, diabetes, skin diseases (Nandy, 2020; Prajapati *et al*., 2010)
42	*Hygrophilla auriculata* Schumach.	Kulekhara, Gokulkanta	Herb	Acanthaceae	Leaves	Hypoglycaemic, antidiabetic, demulcent, used in cancer, leaf juice in anemia, tonic aphrodisiac (Prajapati *et* al., 2010)

43	*Jatropha gossypifolia* L.	Lal verenda	Under shrub	Euphorbiaceae	Seeds	Seeds used as purgative, , oil relieves body pain, rheumatism, paralysis, skin diseases, (Asolkar *et al*., 2010) anti microbial, insecticidal, used in influenza, diarrhoea (Wu *et al*., 2019)
44	*Mentha spicata* L.	Pudina	Herb	Lamiaceae	Leaves and whole plant	Carminative, anti spasmodic, diuretic, antibacterial, antioxidant, effective in cold and flu, stomachache Snoussi *et al*., 2015
45	*Murraya koenigii*	Kari pata	Shrub	Rutaceae	Leaves	Carminative, used in the treatment of piles, dysentery, edema, inflammation and bruises. (Balakrishnan *et al*., 2020)
46	*Nyctanthes arbor-tristis* L.	Shiuli	Shrub to tree	Nyctanthes	Leaves, flowers, seeds	Anthelmintic, antibacterial, anodyne, sudorific (Prajapati *et al*., 2004), laxative, rheumatism, against skin ailments (Agrawal & Pal, 2013)
47	*Ocimum gratissimum* L.	Vriddhtulasi	Herb	Lamiaceae	Leaves, whole plant	Used in the treatment of sunstroke, headache, influenza, diaphoretic (Prajapati *et al*., 2004)
48	*Ocimum sanctum* L.	Holy basil	Herb	Lamiaceae	Leaves, whole plant	Positive effect on memory , cognitive function, antimicrobial, anxiolytic and anti-depressant (Cohen, 2014)
49	*Oxalis corniculata* L.	Amruli	Herb	Oxalidaceae	Leaves, whole plant	Remedy for convulsions in children, fractured bones, blood purifier, treatment of diarrhoea, dysentery, dizziness (Prajapati *et al*., 2004) antibacterial, antifungal and insecticidal (Rehman *et al*., 2015)
50	*Piper longum* L.	Pipul	Climber	Piperaceae	Leaves, fruits, roots	Spikes used in diarrhoea, indigestion, jaundice, asthma, whooping cough, piles, malarial fevers, chest congestion etc. (Prajapati *et al*., 2004)
51	*Paederia scandens* (Lour.) Merr.	Gandhal	Climber	Rubiaceae	Fresh leaves	Leaves possess antidysenteric property, decoction in urinary lithiasis, dysuria, rheumatism, also effective in cough and cold (Prajapati *et al*., 2004; Chanda *et al*., 2013)
52	*Rauwolfia serpentina* (L.) Benth ex Kurz.	Sarpagandha	Herb	Apocynaceae	Roots	Sedative, hypnotic, reduces blood pressure, stimulate CNS (Prajapati *et al*., 2004; Lobay *et al*., 2015)
53	*Rauvolfia tetraphyla* L.	Bar chandrika	Under-shrub	Apocynaceae	Root bark	Snake and other poisonous bite, antibacterial, anti-inflammatory (Rao et al., 2012)
54	*Ricinus communis* L.	Erondo	Shrub	Euphorbiaceae	Seeds, bark	Oil used as purgative, laxative, in abdominal disorders, arthritis, backache, period pain menstrual cramps, bark used to treat skin inflammations, rashes (Prajapati *et al*., 2004; Marwat *et al*., 2017)
55	*Saraca asoca* (Roxb.)Willd.	Ashoka	Tree	Fabaceae	Bark, leaves, flowers, seeds	Bark is anthelmintic, constipating, used in dyspepsia, colic, ulcers, menorrhea, syphilis, dried flowers in diabetes and haemorrhagic dysentery, uterine, genital disorders in women, increase hemoglobin, RBC (Prajapati *et al*., 2004; Gupta *et al*., 2014)
56	*Sida rhombifolia* L.	Atibala	Under shrub to herb	Malvaceae	Roots and leaves	Roots used as emollient, aphrodisiac, strengthen sexual vigour, in rheumatism, colic, emaciation (Prajapati *et al*., 2004)

57	*Scoparia dulcis* L.	Jastimodhu	Shrun	Scophulariaceae	Whole plant	Antioxidant, antidiabetic, anti-inflammatory, sore throat, cough, erythmea, boils, measles, (Prajapati *et al*., 2004; Mishra *et al*., 2013)
58	*Terminalia arjuna* (Roxb.) Wight & Arn	Arjuna	Tree	Combretaceae	Bark, leaves	Bark is astringent, cooling aphrodisiac, antidysenteric, expectorant, aurinary astringent, anemia, cirrhosis of liver, hypertension hypolipidemic, cardiovascular (Prajapati *et al*., 2004; Dwivedi, 2014)
59	*Terminalia bellirica* (Gaertn.) Roxb.	Bahera	Tree	Combretaceae	Fruits, barks	Bark is mildly diuretic, anti-anemic, leaucoderma, anti-inflammatory, antioxidant, anthelmintic, ophthalmic, antipyretic, antiemetic, (Prajapati *et al*., 2004; Jayesh *et al*., 2019)
60	*Tinospora cordifolia* (Thunb.) Miers	Guduchi	Climber	Menispermaceae	Root Stem, whole plant	Anti diabetic, anti allergic, anti, periodic, enhancing liver function, anti oxidant, anti arthritic, digestive, rejuvenating (Prajapati *et al*, 2004; Saha *et al*., 2012)
61	*Vernonia cinerea* (L.) Less.	Sahadevi	Herb	Asteraceae	Roots, whole plant	Anthelmintic, diuretic, sudorific, roots useful in diarrhoea, stomachache, seeds useful in roundwormsskin diseases, leprosy (Prajapati *et al*., 2004)
62	*Vitex negundo* L.	Nishinda		Verbenaceae	Leaves, seeds, roots	Effective in regulating cell cycle, menstruation, polycystic ovary disease, (Gill *et al*., 2018) anti-oxidant, anti tumor, anti –microbial, insecticidal, lowers cataract, osteoporosis (Zheng *et al*., 2015) carminative, expectorant, emmenagogue, diuretic, antipyretic (Prajapati *et al*., 2004)
63	*Wedelia chinensis* (Osbeck) Merr. *Syn. Wedelia calendulacea*	Pitabringaraj	Perennial herb	Asteraceae	Leaves	Anthelmintic, anti-inflammatory, cardiotonic, diuretic, febrifuge, used in dyspepsia, aphrodisiac, antibaceterial (Prajapati *et al*., 2004; Darah *et al*., 2013)

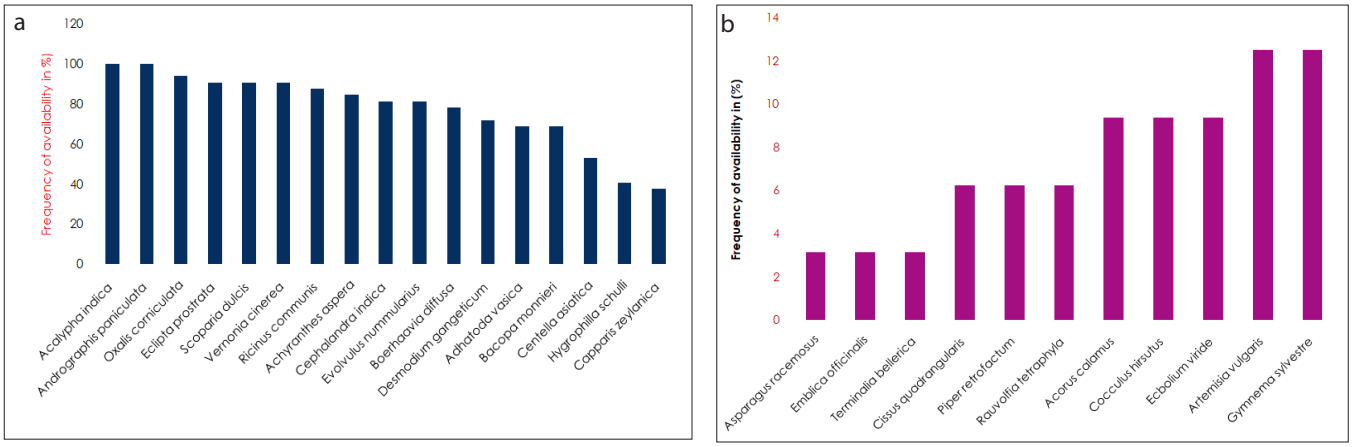


Fig. 5: (a) Percent frequency of availability of some relatively abundant and scarcely available medicinal plants (b) from surveyed sacred groves

know usages through age old traditional knowledge of relevant herbs and other plants available in such natural laboratory. It was observed during survey knowledge of medicinal plants though started to decay due to various modern techniques and allopathic medicines; in recent years there has been a tremendous impetus on the use and knowledge of traditional medicine owing to the expensive and enormous side effects of modern allopathic drugs. Medicinal plants, their use and correct identification, are immediately required not only for health care but can be also of great economic value (Kala, 2009).

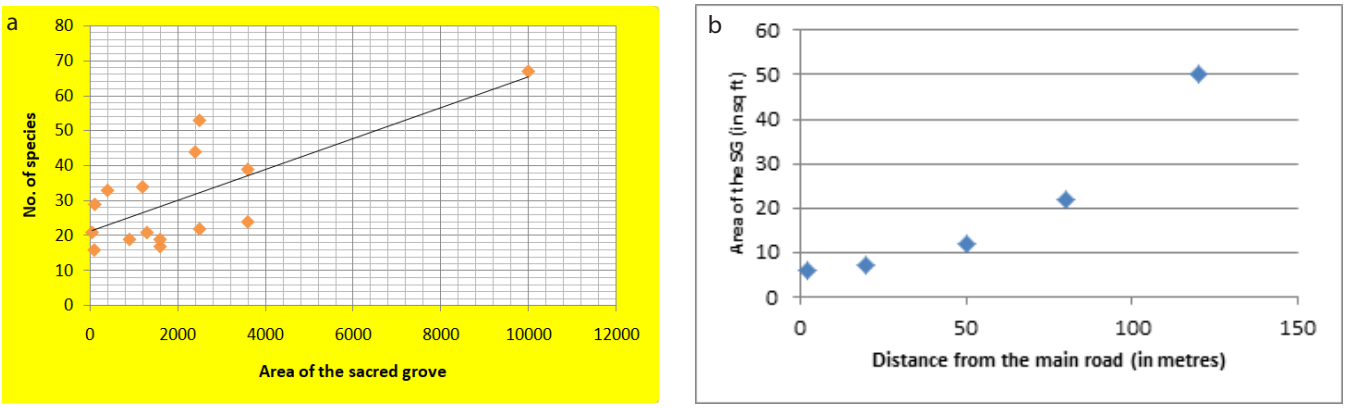


Fig. 6: (a) Correlation between the numbers of plant species versus area of a sacred grove (b) Area of sacred groves versus distance from roads and urban habitation

It will be futile to end the discussion without enumerating the causes of the vulnerability of SGs, some of which are - population pressure, urbanization, indiscriminate grazing by domestic animals, putting less emphasis on the popular taboos protecting the SGs, invasive species like *Mikania scandens* [Fig. 3(e) and 3(f)] *Parthenium hysterophorus* etc and other anthropogenic activities. Anthropogenic activities of diverse kinds nowadays are the most prominent cause of extinction of ecologically and economically importance species (Choudhury and Khan, 2010).

Conclusion

Traditional knowledge regarding medicinal plants and these sacred groves can transact and prosper in complementary way towards regulated utilization and conservation. These are treated as abode of deities by the local people. They may draw their livelihoods from nearby resources and value nature for the significant services nature provides them.

Need for documentation of these pockets of conservation and the traditional knowledge associated with the plants is the foremost need of the hour. Identification and documentation of potential SGs as given in Table 1 with precise coordinates can lead to further visit, can act as a source of important plants for scientific research and conservation.

Due to anthropogenic activities sacred groves are shrinking and in near future may be obliterated if not sensitized at competent levels of society and government authorities. Developmental activities in the urban and semi-urban areas have led to enormous habitat destruction for avifaunal population and various plant populations have been decimated which may lead to their disappearance in the near future. Therefore, the establishment of priority while using bioresources has to be maintained as a strategy towards conservation. Spontaneous linking of age traditional culture and beliefs with the remnant of forest patches which remains as SGs has huge potential for conservation of associated flora and fauna.

Sacred groves generally originate from the primary forests eroded daily due to human habitation with the expansion of the cultivable land and ultimately protected as remnants of those forests on the grounds of religious belief since long back. Therefore, time has come to document and protect sacred groves for the betterment of biodiversity conservation. Conservation of biodiversity in sacred groves is a result of the sacred area of the sacred grove which is communally shared and used to observe important social ceremonies in indigenous societies.

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Authors' Contributions

The research was designed by D. S. Mahanty (DSM), field visit, data collection done by DSM, data analysed by DSM and Dr. S. Mazumder (SM). Manuscript prepared by DSM and SM prepared maps.

Conflict of Interest

None.

References

Agrawal J, Pal A. *Nyctanthes arbor-tristis* Linn--a critical ethnopharmacological review. J Ethnopharmacol. 2013 Apr 19;146(3):645-58. doi: 10.1016/j.jep.2013.01.024. Epub 2013 Jan 30. PMID: 23376280.

Alok S, Jain SK, Verma A, Kumar M, Mahor A, Sabharwal M. Plant profile, phytochemistry and pharmacology of *Asparagus racemosus* (Shatavari): A review. Asian Pac J Trop Dis. 2013 Jun;3(3):242–51. doi: 10.1016/S2222-1808(13)60049-3. PMCID: PMC4027291.

Alzohairy MA. Therapeutics Role of *Azadirachta indica* (Neem) and Their Active Constituents in Diseases Prevention and Treatment. Evid Based Complement Alternat Med. 2016;2016:7382506. doi:

10.1155/2016/7382506. Epub 2016 Mar 1. PMID: 27034694; PMCID: PMC4791507.

Amirthalingam, M. (2016) Sacred Groves of India – An Overview, International Journal of *Current Research in Biosciences and Plant Biology* ISSN: 2349-8080 (Online) Volume 3 Number 4

Balakrishnan R, Vijayraja D, Jo SH, Ganesan P, Su-Kim I, Choi DK. Medicinal Profile, Phytochemistry, and Pharmacological Activities of *Murraya koenigii* and its Primary Bioactive Compounds. Antioxidants (Basel). 2020 Jan 24;9(2):101. doi: 10.3390/antiox9020101. PMID: 31991665; PMCID: PMC7070712.

Baliga MS, Dsouza JJ. Amla (*Emblica officinalis* Gaertn), a wonder berry in the treatment and prevention of cancer. Eur J Cancer Prev. 2011 May;20(3):225-39. doi: 10.1097/CEJ.0b013e32834473f4. PMID: 21317655.

https://www.sciencedirect.com/science/article/abs/pii/S0921344910000443

Basu, R., 2009. Biodiversity and Ethnobotany of Sacred Groves in Bankura District, West Bengal, *Indian Forester,* 135 (6), pp: 765–778.

Chakraborti, U., Biswas, O., Das, A., K., Roy, S., Das, P., and Mitra, B., 2016. Studies on sacred groves and sacred trees along the eastern bank of river Hooghly of north 24 Parganas, West Bengal, *Indian Forester,* 142 (2), pp: 156– 166

Chanda S, Sarethy I,De B, Sungh K. *Paederia foetida* — a promising ethno-medicinal tribal plant of northeastern India. Journal of Forest Research 2013 December DOI: 10.1007/s11676-013-0369-2

Choudhury, B. and Khan, M.L. (2010) 'Conservation and management of endangered plant species: a case study from Northeast India', Bioremediation, biodiversity and bioavailability, 4(1), 47-53.

Cohen MM. Tulsi - Ocimum sanctum: A herb for all reasons. J Ayurveda Integr Med. 2014 Oct-Dec;5(4):251-9. doi: 10.4103/0975-9476.146554. PMID: 25624701; PMCID: PMC4296439.

http://www.cpreecenvis.nic.in/Database/SacredGrovesinWestBengal_912.aspx

Deb, Debal, K Deuti and K C Malhotra 1997. "Sacred grove relics as bird refugia." *Current Science* (Bangalore) 73: 815-817

Deb, D., in: A model of community forest management. Sacred Groves of West Bengal. 8: 1-45. (ed. Dr. Oliver) Springate-Baginski, Overseas Development Group, University of East Anglia, Norwich, U.K. 2007.

Darah I, Lim SH, Nithianantham K. Effects of Methanol Extract of *Wedelia chinensis* Osbeck (Asteraceae) Leaves against Pathogenic Bacteria with Emphasise on Bacillus cereus. Indian J Pharm Sci. 2013 Sep;75(5):533-9. PMID: 24403653; PMCID: PMC3877514.

Dwivedi S, Chopra D. Revisiting *Terminalia arjuna* - An Ancient Cardiovascular Drug. J Tradit Complement Med. 2014 Oct;4(4):224-31. doi: 10.4103/2225-4110.139103. PMID: 25379463; PMCID: PMC4220499.

Ekiert H, Pajor J, Klin P, Rzepiela A, Ślesak H, Szopa A. Significance of *Artemisia Vulgaris* L. (Common Mugwort) in the History of Medicine and Its Possible Contemporary Applications Substantiated by Phytochemical and Pharmacological Studies. Molecules. 2020 Sep 25;25(19):4415. doi: 10.3390/molecules25194415. PMID: 32992959; PMCID: PMC7583039.

https://fsi.nic.in/forest-report-2021-details

Gadgil, Madhav, F. Berkes and Carl Folke 1993. "Indigenous Knowledge for biodiversity conservation." *Ambio* XII (2-3): 266-270.

Ganga Rao B, Umamaheswara Rao P, Sambasiva Rao E, Mallikarjuna Rao T, Praneeth D VS. Evaluation of in-vitro antibacterial activity and anti-inflammatory activity for different extracts of *Rauvolfia tetraphylla* L. root bark. Asian Pac J Trop Biomed. 2012 Oct;2(10):818-21. doi: 10.1016/S2221-1691(12)60235-4. PMID: 23569853; PMCID: PMC3609229.

Gill BS, Mehra R, Navgeet, Kumar S. Vitex negundo and its medicinal value. Mol Biol Rep. 2018 Dec;45(6):2925-2934. doi: 10.1007/s11033-018-4421-3. Epub 2018 Oct 11. PMID: 30311123.

Gupta M, Sasmal S, Mukherjee A. Therapeutic Effects of Acetone Extract of *Saraca asoca* Seeds on Rats with Adjuvant-Induced Arthritis via Attenuating Inflammatory Responses. ISRN Rheumatol. 2014 Mar 4; 2014:959687. doi: 10.1155/2014/959687. PMID: 24729890; PMCID: PMC3960775.

Haddad JG, Picard M, Bénard S, Desvignes C, Desprès P, Diotel N, El Kalamouni C. *Ayapana triplinervis* Essential Oil and Its Main Component Thymohydroquinone Dimethyl Ether Inhibit Zika Virus at Doses Devoid of Toxicity in Zebrafish. Molecules. 2019 Sep 23;24(19):3447. doi: 10.3390/molecules24193447. PMID: 31547527; PMCID: PMC6804133.

Jayesh K, Helen LR, Vysakh A, Binil E, Latha MS. Protective Role of *Terminalia bellirica* (Gaertn.) Roxb Fruits Against CCl_4 Induced Oxidative Stress and Liver Injury in Rodent Model. Indian J Clin Biochem. 2019 Apr;34(2):155-163. doi: 10.1007/s12291-017-0732-8. Epub 2018 Feb 7. PMID: 31092988; PMCID: PMC6486919.

Kala, C.P. (2009) 'Medicinal plants conservation and enterprise development', Med plants, 1(2), 79-95.

Kandari, L.S., Bisht V.K., Bhardwaj,M., Thakur, A.K. Conservation and management of sacred groves, myths and beliefs of tribal communities: a case study from north-India, . Environmental Systems Research 2014, 3:16

Kanetkar P, Singhal R, Kamat M. *Gymnema sylvestre*: A Memoir. J Clin Biochem Nutr. 2007 Sep;41(2):77-81. doi: 10.3164/jcbn.2007010. PMID: 18193099; PMCID: PMC2170951.

Khan, M.L., Khumbongmayum, A.D., Tripathi, R.S., (2008). The sacred groves and their significance in conserving biodiversity: An overview, International Journal of Ecology and Environmental Sciences, 34(3), 277- 291.

Khumbongmayum, A.D.; Khan, M.L.; Tripathi, R.S. (2005) 'Sacred groves of Manipur, northeast India: biodiversity value, status and strategies for their conservation', Biodiversity & Conservation, 14(7), 1541-1582.

Kumar, J., Gond, P., Dabas, R., Tripathi, J.S., Byadgi, P.S., Tewari, P., Kumar, S., Rao, R.K., (2016). 'Medicinal Importance of *Bacopa monnieri* (L.) Pennell' Indian Journal of Agricultural and Allied Sciences

Lalitha KG, Sethuraman MG. Anti-inflammatory activity of roots of *Ecbolium viride* (Forsk) Merrill. J Ethnopharmacol. 2010 Mar 2;128(1):248-50. doi: 10.1016/j.jep.2009.12.030. Epub 2010 Jan 4. PMID: 20045456.

Lobay D. *Rauwolfia* in the Treatment of Hypertension. Integr Med (Encinitas). 2015 Jun;14(3):40-6. PMID: 26770146; PMCID: PMC4566472.

Logesh R, Das N, Adhikari-Devkota A, Devkota HP. *Cocculus hirsutus* (L.) W.Theob. (Menispermaceae): A Review on Traditional Uses, Phytochemistry and Pharmacological Activities. Medicines (Basel). 2020 Nov 10;7(11):69. doi: 10.3390/medicines7110069. PMID: 33182572; PMCID: PMC7696458.

Malhotra, K.C., 1998. Anthropological dimensions of sacred groves in India: An overview. In: Conserving the Sacred for Biodiversity Management (Eds.: Ramakrishnan, P.S., Saxena, K.G., Chandrashekara, U.M.) Oxford and IBH Publishing Co., New Delhi. pp.423-438.

Malhotra, K. C., Stanley, S., Hemam, N.S. and Das, K. (2001). Biodiversity conservation and ethics: Sacred groves and pools, In: Fujiki, N., & Macer, R.J., (eds.), Bioethics in Asia, Proceedings of the UNESCO Asian. Bioethics Conference, 338-345.

Marwat SK, Rehman F, Khan EA, Baloch MS, Sadiq M, Ullah I, Javaria S, Shaheen S. Review - *Ricinus cmmunis* - Ethnomedicinal uses and pharmacological activities. Pak J Pharm Sci. 2017 Sep;30(5):1815-1827. PMID: 29084706.

Mishra MR, Mishra A, Pradhan DK, Panda AK, Behera RK, Jha S. Antidiabetic and Antioxidant Activity of *Scoparia dulcis* Linn. Indian J Pharm Sci. 2013 Sep;75(5):610-4. PMID: 24403665; PMCID: PMC3877526.

Muthu N, Lee SY, Phua KK, Bhore SJ. Nutritional, Medicinal and Toxicological Attributes of Star-Fruits (*Averrhoa carambola* L.): A Review. Bioinformation. 2016 Dec 22;12(12):420-424. doi: 10.6026/97320630012420. PMID: 28405126; PMCID: PMC5357571.

Nandy S, Mukherjee A, Pandey DK, Ray P, Dey A. Indian Sarsaparilla (*Hemidesmus indicus*): Recent progress in research on ethnobotany, phytochemistry and pharmacology. J Ethnopharmacol. 2020 May 23;254:112609. doi: 10.1016/j.jep.2020.112609. Epub 2020 Jan 30. PMID: 32007632.

Pavithra PS, Sreevidya N, Verma RS. Antibacterial and antioxidant activity of methanol extract of *Evolvulus nummularius*. Indian J Pharmacol. 2009 Oct;41(5):233-6. doi: 10.4103/0253-7613.58514. PMID: 20177496; PMCID: PMC2812784.

Rajan M, Prabhakaran S, Prusty JS, Chauhan N, Gupta P, Kumar A. Phytochemicals of *Cocculus hirsutus* deciphered SARS-CoV-2 inhibition by targeting main proteases in molecular docking, simulation, and pharmacological analyses. J Biomol Struct Dyn. 2022 Sep 13:1-15. doi: 10.1080/07391102.2022.2121758. Epub ahead of print. PMID: 36099182.

Rehman A, Rehman A, Ahmad I. Antibacterial, Antifungal, and Insecticidal Potentials of *Oxalis corniculata* and Its Isolated Compounds. Int J Anal

Chem. 2015;2015:842468. doi: 10.1155/2015/842468. Epub 2015 Mar 19. PMID: 25873973; PMCID: PMC4383515.

Saha S, Ghosh S. *Tinospora cordifolia*: One plant, many roles. Anc Sci Life. 2012 Apr;31(4):151-9. doi: 10.4103/0257-7941.107344. PMID: 23661861; PMCID: PMC3644751.

Singh A.K., Bodhi Tree , Springer Link. 2017 January, DOI: 10.1007/978-94-024-0852-2_75

Sirinthipaporn A, Jiraungkoorskul W. Wound Healing Property Review of Siam Weed, *Chromolaena odorata*. Pharmacogn Rev. 2017 Jan-Jun;11(21):35-38. doi: 10.4103/phrev.phrev_53_16. PMID: 28503052; PMCID: PMC5414454.

Snoussi M, Noumi E, Trabelsi N, Flamini G, Papetti A, De Feo V. *Mentha spicata* Essential Oil: Chemical Composition, Antioxidant and Antibacterial Activities against Planktonic and Biofilm Cultures of Vibrio spp. Strains. Molecules. 2015 Aug 7;20(8):14402-24. doi: 10.3390/molecules200814402. PMID: 26262604; PMCID: PMC6332415.

Soni P, Siddiqui AA, Dwivedi J, Soni V. Pharmacological properties of *Datura stramonium* L. as a potential medicinal tree: an overview. Asian Pac J Trop Biomed. 2012 Dec;2(12):1002-8. doi: 10.1016/S2221-1691(13)60014-3. PMID: 23593583; PMCID: PMC3621465.

Sukumaran, S.; Jeeva, S.; Raj, A.D.S.; Kannan, D. (2008) 'Floristic diversity, conservation status and economic value of miniature sacred groves in Kanyakumari district, Tamil Nadu, Southern Peninsular India', Turkish Journal of Botany, 32(3), 185-199.

Timalsina D, Devkota HP. *Eclipta prostrata* (L.) L. (Asteraceae): Ethnomedicinal Uses, Chemical Constituents, and Biological Activities. Biomolecules. 2021 Nov 22;11(11):1738. doi: 10.3390/biom11111738. PMID: 34827736; PMCID: PMC8615741.

Wu Q, Patocka J, Nepovimova E, Kuca K. *Jatropha gossypiifolia* L. and its biologically active metabolites: A mini review. J Ethnopharmacol. 2019 Apr 24;234:197-203. doi: 10.1016/j.jep.2019.01.022. Epub 2019 Jan 26. PMID: 30695706.

Yadav D, Reshi MS, Uthra C, Shrivastava S, Srivastava N, Narayana SKK, Shukla S. Botanical and Chemical Fingerprinting of Medicinal Roots of *Justicia gendarussa* Burm f. Pharmacognosy Res. 2017 Apr-Jun;9(2):208-214. doi: 10.4103/0974-8490.204643. PMID: 28539747; PMCID: PMC5424564.

Zheng CJ, Li HQ, Ren SC, Xu CL, Rahman K, Qin LP, Sun YH. Phytochemical and Pharmacological Profile of *Vitex negundo*. Phytother Res. 2015 May;29(5):633-47. doi: 10.1002/ptr.5303. Epub 2015 Jan 30. PMID: 25641408.