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Flora of Nandan Kanan Sanctuary: Medicinal plants with their role in Health care

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Abstract

The present study reflects the major medicinal flora of Nandan Kanan Sanctuary, a small protected area along the Kanjia Lake, in the district of Cuttack, Odisha, India. The survey reveals that there were 61 plant species belonging to 40 different families highlighted the floral wealth of the sanctuary.The dominant floristic components were *Aerva lanata, Biophytum sensitivum, Christella dentate, Heliotropium indicum, Hyptis suaveolens, Terminalia arjuna, Terminalia bellirica, Pongamia pinnata, Cassia fistula, Polygonum barbatum, Lygodium flexuosum, Mimosa pudica, Leonotis nepetifolia* etc. The details of these plants in terms of local name, family, plant part(s) used, chemicals present and their use in health care such as malnutrition, communicable diseases, metabolic disorder and other miscellaneous effects has been listed. The implications of this study in terms of sustainable use by the local community, conservation, and education have been discussed.

Key-Words: Medicinal plant, Health care, Conservation, Sustainable use, Environmental education

Introduction

Biodiversity provides humankind enormous direct economic benefits, an array of indirect essential services through protected areas and plays a prominent role in modulating ecosystem functions and stability[1] The forests has been the source of invaluable medicinal plants since the time man realized the importance of preventive and curative properties of plants and started using those in human health care. Living close to nature, traditional societies have acquired unique knowledge about the use of wild flora and fauna, most of which are unknown to the people who live away from such natural ecosystem such as forests. The old traditional Indian system of medicines is one of the most ancient medicinal practices known to the word derives maximum formulations from plants and plant extracts that exist in the forests. The value and importance of this tradition knowledge is now being increasingly acknowledged all over the world. As such the pharmaceutical industries are trying to investigate and confirm the efficacy of many medicines and toxins used by traditional communities. Thus realizing the potentiality of wild species in health care, the inventory of plants occurring in any given area has been realized and often felt necessary[2].

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Even the protected areas do play a vital role in the sustainable use of biodiversity besides conservation. Under this back ground, the present study has been conceptualized to study the medicinal flora of a small protected area, the Nandan Kanan Sanctuary of Odisha. The specific objectives of the study are:
i) to find out the major medicinal flora of the sanctuary and ii) to know the plant parts , chemical constituents and their uses in traditional healthcare.

Methodology

Study Site

The Nandan Kanan Sanctuary, an unique, deciduous forest, covering about 437 ha with latitude of 20° 24' 25" N and longitude of 85° 49' 30" E is situated in Cuttack district of Odisha, India, 40 meters above MSL. Amidst the lush green Chandka forests and along the bank of Kanjia Lake stands Nandan Kanan, a beautiful park that got its name from "Nandan Van" meaning the "Garden of the God". It was established in the year 1960. The Botanical Garden established in the year 1963 spreading over 173 acres, is situated in the sylvan setting of the moist deciduous forest of the sprawling green Nandan Kanan Sanctuary standing between two wetlands (Plate-1). In the year 1979, the park together with the lake and the Botanical Garden were declared as a sanctuary[3].Though Nandan Kanan is famous for *White Tiger* & *Lion Safari*, different

species of mammals, birds, reptiles and other faunas also indicate its richness in faunal diversity that attracts large number of tourists and naturalists from India and abroad.

Collection of Information

The field studies were carried out during the years 2009 to 2011 in different seasons to collect major medicinal flora. The plant samples were collected from Nandan Kanan Sanctuary (Botanical garden and Zoological Park) and from the banks of the Kanjia Lake. The plants were identified by the authors following the flora books[4,5]. The medicinal uses of plants identified were ascertained through the survey of literature and interaction with local inhabitants, detail of which has been reflected in Tables 1-4. The information pertaining to bioactive compounds / active principles present in the plant parts were found out through literature survey, details of which have been listed. In Tables 1-4. For each plant species, its botanical name, local name(s), plant part(s), phytochemical(s) present along with medicinal uses have been described.

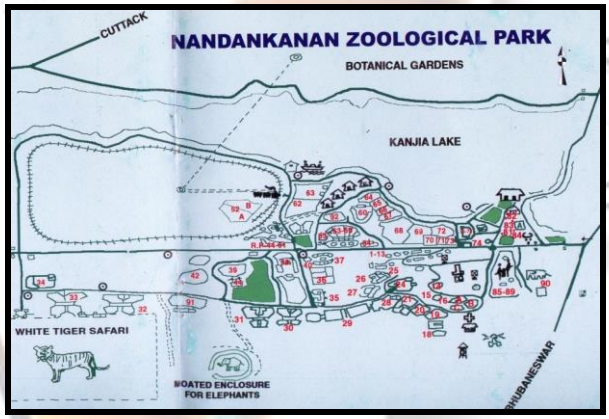

Plate 1 : Geographical location of Nandan Kanan Sanctuary

Results and Discussion

Identification of plant species / floral resources has always been realized for their sustainable use besides conservation. In the present study, 61 plant species belonging to 40 different families having some medicinal value(s) were identified (Table 1- 4). For each plant species, its botanical name, local name(s), plant part(s) in use, phytochemical(s) present along with medicinal value has been described. Among the plant species, trees were the dominant (34 %) followed by herbs (30 %) and climbers (23 %). Shrubs represented the lowest number of species (Fig: 1). Fabaceae was the dominant family followed by Apocyanaceae (Fig: 2) as far as the number of plant species are concerned. Some important medicinal plants such as *Peperomia pellucida*, *Saraca asoca* and *Evolvulus alsinoids* etc has been depicted in plate 2 and 3. Regarding the role of these plants in health care is concerned, 11 species quite useful for malnutrition have been recorded (Table-1) Fifteen plant species (Table-2.) are good against metabolic disorder such as gastrointestinal ailments, asthma, jaundice, diabetes etc.For example, fresh leaves of Gudmari (*Gymnema sylvestre*) are very effective for diabetes. Twenty four plant species were useful against Communicable diseases and microbial infections. (Table-3) and from these species, 5 were common to both Botanical garden (BG) and Nandan Kanan Zoological area (NZA) (Table-3). Twenty one plant species were useful against Non-Communicable diseases, 8 of these species were seen both in the Botanical Garden and Zoological Park. From the total plants species about 30 % have their leaves used against different diseases and infections. Leaf juice of *Leonotis nepetifolia* is used against Malaria. Leaves of *Paederia foetida* and *Pergularia daemia* are useful against diarrhea and lever disorder respectively. Leaf of *Lygodium flexuosum* is very effective against eczema. Roots and fruits from 15 % and 13 % of plant species are used for treatment of a variety of infections. Fruits powders of *Guazuma ulmifolia* (Fig -3) are good as antiseptic and for anticancer activity. Stems are of the least use. Active principle(s) and chemicals present in these plant part(s) include mostly alkaloids, phenolic compounds and glycosides, details of which have been presented in the Tables as well. Hyoscyamine present in *Datura stramonium* acts against dandruff. Scopotetin from *Evolvulus alsinoids* acts as a hair growth enhancer. Coumarin present in *Ageratum conyzoides* is active against fever and gastrointestinal aliments. As a whole; it seems the Nandan Kanan Sanctuary is a rich reservoir of plant species having high medicinal values. Besides conservation and sustainable economic use of this rich wealth by the local community, being a restricted area (sanctuary) there is a need to highlight the importance of these plants in health care as large number of tourists and nature lovers reaching several lakhs in a year do visit this sanctuary. Further these resources can be used[6] by the students, practioners and researchers who are interested or engaged in the development, evaluation and use of herbal medicines. Moreover, sanctuary along with its plant and animal resources provides an ideal situation for Environmental Education, both in formal and non formal sectors. As floral wealth is vanishing at a rapid rate due to climate change, habitat loss, invasion of exotic species and other factors[8], Sanctuaries and National Parks provide

ideal sites for conservation[9] as in the present case. It is interesting to note that recently, 72 herbaceous plant species[7] having some medicinal values has been recorded from an urban environment, the campus of Regional Institute of Education, Bhubaneswar, Odisha.

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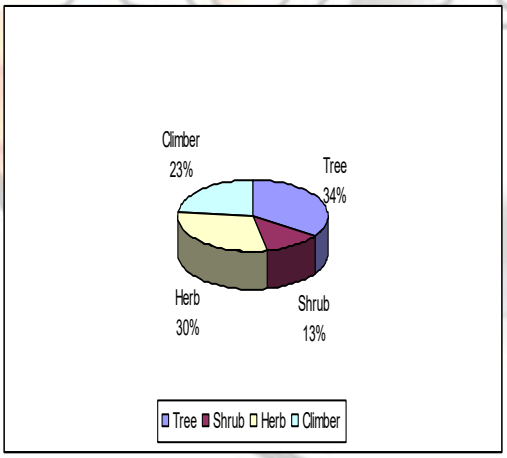

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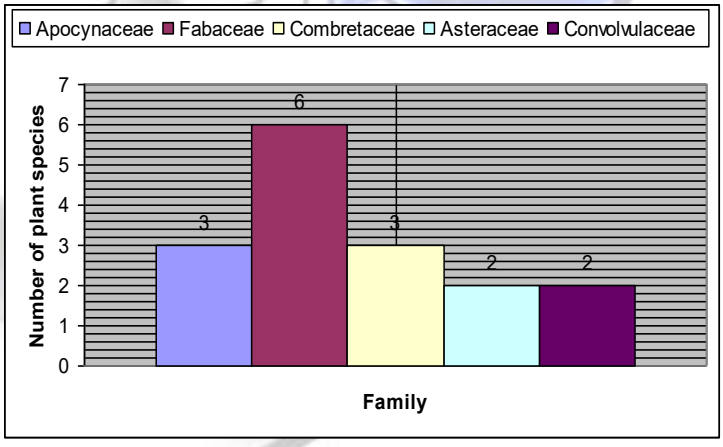

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Fig. 1: Floral Biodiversity of (major medicinal plants) Nandan Kanan Sanctuary

Fig. 2: Dominant families among the identified species

Table 1: Plants having Nutritional Values

Plant species	Local Name	Family	Plant parts	Bioactive compounds	Location	Uses
Asparagus racemosus (Willd.)	Satabari	Asparagaceae	Whole plant	Asparoside[13]	BG	Plant used in **Night blindness.**
Euphorbia hirta (L.)	Chitakutei	Euphorbiaceae	Root	Euphorbins, Rutin and Oxaltes[20]	BG, NKZ	Roots are used as nourishment for feeding mother when production of **milk comes down**
Evolvulus alsinoids (L.)	Krishna Onkranta	Convolvulaceae	Whole plant	Scopotetin , Scopolin[21]	BG	Whole plant juice with mustard oil is used as **Hair Growth Enhancer**
Heliotropium indicum (L.)	Hatisundha	Boraginaceae	Root	Pyrrolizidine alkaloids[22]	BG	Root with honey is taken as vitamin for **Iron Deficiency** by woman against anemia during pregnancy
Murraya Koenigii (L.)	Bhrusunga	Rutaceae	Leaf	Carbozole alkaloids[34]	BG, NKZ	Leaves are used as **Curry leaf**
Argyria nervosa (Burm.f.) Bojer.	Mundanoi	Convulvulaceae	Root	Caffeic acid[42]	BG	Roots are used in **Sexual Weakness**
Calamus latifolius Roxb.	Betakoli	Areaceae	Fruit	Different types of phenolic compounds[43]	NKZ	Fruits are eaten as good source of **Nutrients for Health**
Tinospora cardifolia (Thunb.) Miers.	Guluchi	Menispermaceae	Stem	Berberine[49]	NKZ	Stems are used as **Tonic** for good Health
Lagerstroemia parviflora Roxb.	Salora	Lythraceae	Flower	Different types of Glycosides[58]	BG NKZ	Flowers are source of good **Honey**
Xantolis tomentosa (Roxb.) Raf.	Kanta Baula	Sapotaceae	Fruit	Rich of Phenolic compounds[70]	BG	Wild edible fruits
Phonix sylvestris Roxb.	Khajuri	Areaceae	Fruit	Beta-amyrin[71]	NKZ	Fruits are edible and juice is used as **Tonic**

(NKZ – Nandan Kanan Zoological Park, BG- Botanical garden)

Table 2: Plants used to cure Metabolic Disorder / Non-Communicable Diseases

Plant species	Local Name	Family	Plant parts	Bioactive compounds	Location	Uses
Ageratum conyzoides (Linn.)	Pokusunga	Asteraceae	Leaf	Coumarin[11]	BG, NKZ	used to treat fever and **Gastrointestinal ailments**
Biophytum sensitivum (L.) DC.	Lokachana, Chhotalajakuli	Oxalidaceae	Whole plant	Isoorinetin[14]	BG	Whole plant is used as **Anti-tumor activity**
Cissampelos aprieara (L.)	Pitusing	Menispermaceae	Leaf	Tetrandrine[17]	BG	Leaves are used in **Asthma**
Hemidesmus indicus (L.) R.Br.	Anantmula	Asclepiadaceae	Root	Different types of Saponin[23]	BG	Roots are used in **Kidney problems**

Mucuna pruriens (L.) DC.	Baidanka	Fabaceae	Seed powder	L-Dopa[28]	BG	Seeds are used to cure **Parkinson diseases**
Peperomia pellucida (L.)HBK.	Ghusuripan	Piperaceae	Whole plant	Xanthone glycosides[30]	BG	Whole plant is used to cure **Abdominal pain**
Synedrella nodiflora (L.)	Badi Pokasunga	Asteraceae	Leaf	Sesquiterpene lactones[33]	NKZ, BG	Leaves are used to treat **Rheumatism**
Coccinia grandis (L.) J.Voigt.	Ban Kundri	Cucurbitaceae	Fruit	Beta- carotene[45]	NKZ	Fruits have Antihistaminic potential and good for **Diabetic patients**
Scindapsus officinalis (Roxb.) Schott.	Gajapipli	Araceae	Fruit	High contains of flavonoids[48]	BG	Fruits are used in **Diabetes**
Sesbania cannabina (Retz. Pers.)	Dhanicha	Fabaceae	Leaf	Different types of alkaloids[50]	BG	Leaves juice is taken in **Contraceptive problems**
Wrightia tinctoria Roxb.	Koruan	Apocynaceae	Leaf	A terpenoid : Wrighitial[53]	BG	Leaves are used against **Jaundice**
Guazuma ulmifolia Lam.	Debdaru	*Sterculiaceae*	Fruit	Rich of Polyphenolic acid[57]	BG	Fruits are used as **Antiseptic** and also used as **Anti-Cancer**
Morinda tinctoria Roxb.	Achhu	Rubaceae	Fruit	Different types of terpenoids[60]	NKZ	Fruits are used in **Relive Pain** in the gout
Syzygium cumini (L.) Skeels.	Jamukoli	Myrtaceae	Seed	Jabosine-3[66]	NKZ	Seed powder is good for **Diabetes**
Gymnema sylvestre Roxb.	Meshasringi, Gudmari	Asclepiadaceae	Leaf	Gymnemic acid[75]	BG	Fresh leaf is used to control **Diabetic**

(NKZ – Nandan Kanan Zoological Park, BG- Botanical garden)

Table 3: Plants acting against Microbial Infections / Communicable Diseases

Plant species	Local Name	Family	Plant parts	Bioactive compounds	Location	Uses
Aerva lanata (L.)	Paunsia Saga	Amaranthaceae	Whole plant	Beta- sitosterol[10]	NKZ,BG	Used against **Cholera.**
Argemone Mexicana (L.)	Agora, Bonai	Papaveraceae	Seed oil	Pancorione[12]	BG	Seed oil is used to cure **Skin diseases**
Christella dentate Forssk.	Kokkodi	Thelypteridaceae	Leaf	Different types of Saponin[16]	NKZ, BG	Leaves paste is applied for **Skin disease**
Datura stramonium (L.)	Duddura	Solanaceae	Leaf juice	Hyoscyamine[18]	BG	Leaves juice is applied as **Anti-dandruff**

Dipteracanthus prostrates (Poir.) Nees.	Nakachana	Acanthaceae	Root	Lignin glycosides[19]	BG, NKZ	Root paste used in **Syphilis.**
Hyptis suaveolens (L.)Poit.	Gondri	Lamiaceae	Leaf	Different alkaloids and reach of phenolic compounds[24]	NKZ, BG	Leaves are used to cure diarrhea and **Itching problems**
Ichnocarpus frutescens (L.) W.T.Aiton.	Dudhilata	Apocynaceae	Root	Pentacyclic triterpenoide[25]	BG	Roots help to cure **Scabies**
Leonotis nepetiifolia (L.) R.Br.	Kantasia	Lamiaceae	Leaf	Leonurine[26]	NKZ	Leaves are used to treat **Malaria**
Paederia foetida (L.) Mant.	Pasaruni	Rubiaceae	Leaf juice	Iridoid glycosides[29]	BG	Leaves are used to cure **Diarrhea**
Sida acuta Burm.f.	Bariari, Kulposh	Malvaceae	Whole plant	Indoloquinoline alkaloids[32]	NKZ	Whole plant is used in usually Elephantiasis and **Dandruff**
Lygodium flexuosum (L.) Sw.	Mahajaala, Indrajaal	Lygodiaceae	Leaf	Lygodinolide[36]	BG	Leaf paste is applied to cure **Eczema**
Xanthium strumarium (L.)	Kothu, Ban Gokhra	Asteraceae	Seed	Carboxyatractyloside[41]	BG	Seeds are used as **Anti-helmintic**
Lippia javanica (Burm.f.) Spreng.	Naguari	Verbenaceae	Whole plant	Different types of terpenoids[51]	NKZ	Whole plant is used as **Mosquito repellent**
Ventilago denticulate Willd.	Chadaikuli	Rhamanaceae	Stem bark	Anthocyanin and phenolic compounds[52]	BG	Bark is used in **Dysentery** and stomach pain
Alastonia scholaris (L.)	Chatyana	Apocynaceae	Leaf	Different types of alkaloids[54]	NKZ, BG	Leaves are applied in **Skin infections**
Cassia fistula (L.)	Sonari	Caselpinaceae	Leaf	Rich of Tannin and Saponin[55]	NKZ, BG	Leaves paste is used in **Skin infections**
Pongamia pinnata (L.) Pierre.	Karanja	Fabaceae	Seed	Oleic acid[62]	NKZ	Seed oil is used as **Insecticidal** and also used in **Skin infections**
Suregada multiflora (A.Juss.),Baill.	Khakra	Euphorbiaceae	Root	Diterpenoids[65]	NKZ	Roots are used in **Skin Infection**

Terminalia arjuna (Roxb. ex DC.) Wight & Am.	Arjuna	Combretaceae	Bark	Rich of Triterpenoids[67]	NKZ	Bark paste is applied in **Skin Infection**
Terminalia bellirica Roxb.	Bahada	Combretaceae	Bark	Bellericosides[68]	BG	Bark is Useful in **Leucoderma**
Terminalia chebula Retz.	Harida	Combretaceae	Fruit and bark	Rich of Phenolic compounds[69]	BG	Fruits powder is used to cure **Typhoid**
Pterocarpus marsupium Roxb.	Piasla	Fabaceae	Bark	Different types of phenolic compounds[72]	NKZ	Bark is used to cure **Elephantiasis**
Spathodea campanulata Beauv.	Turi	Bignoniaceae	Leaf	n-hexandecanoic acid[73]	NKZ	**Anti-microbial** activity and used in **Skin Infections**
Azadirachita indica (L.) Adelb.	Nemo	Meliaceae	Leaf	Limonoids, Azadirachtin[74]	BG and NKZ	Fresh leaf juice is used to treat different types of **Skin infections**

(NKZ – Nandan Kanan Zoological Park, BG- Botanical garden)

Table 4: Plants having miscellaneous effect on Health

Plant species	Local Name	Family	Plant parts	Bioactive compounds	Location	Uses
Boerhavia diffusa (L.)	Pueuni saga	Nyctaginaceae	Root	Liiroseddrin[15]	BG, NKZ	diuretic and expectorant
Mimosa pudica (L.)	Lajakuli	Mimosaceae	Whole plant	Tubulin[27]	NKZ, BG	Plant decoction with milk is taken to treat **Bleeding in Piles**
Pergularia daemia Forssk.	Utrali	Asclepiadaceae	Leaf	2-acetylphenol[31]	NKZ	Leaves are useful in **Liver disorder**
Costus speciosus (J.Konig.) Sm.	Keu Kand	*Zingiberaceae.*	Rhizome	Glutathione[35]	BG	Rhizomes are used as paste on **Inflammation parts of body**
Monstear deliciosa Liebm.	Ceriman	Araceae	Whole plant	Different types of Oxalate[37]	BG	Whole plant parts are used in different types of **Inflammation**
Polygonum barbatum (L.)	Paniakheu	Polygonaceae	Leaf	Sitosterone[38]	NKZ, BG	Leaf paste is used as **Anti- inflammation**

Sida cordifolia (L.)	Bisiripi	Malvaceae	Leaf	Different types of glycosides[39]	BG	Leaves are used in **Nasal congestion - aching**
Triumfetta neglecta Wight.	Nichardia	Tiliaceae	Root	Different types of phenolic compounds[40]	BG	Roots are used as **Cooling agent**
Butea suprava Roxb.	Naipalaso	Caesalpinaceae	Leaf	Stigmasterol[44]	NKZ	Leaves are used as **Aphrodisiac**
Entada rheedii Spreng.	Gila, Hanuman Lata	Fabaceae	Seed	Rheediinosides[46]	BG	Seeds are used in **Inflammation**
Passiflora foetida (L.)	Gandha tamala	Passifloraceae	Leaf	High level of Saponin[47]	NKZ	Leaves are used to reduce **Sleeping problems**
Dillenia indica (L.)	Oau	Dilleniaceae	Stem bark	Betulinaldehyde [56]	BG	Bark is used as **Cooling agent**
Mimusops elengi (L.)	Baula	Sapotaceae	Fruit	Taraxerol[59]	NKZ, BG	Fruits are edible and used as **purgative**
Saraca asoca (Roxb.), De.wild.	Asoka	Casealpinaceae	Flower	3-4-dihydroxy-benzaldehyde, Catechin[63]	BG	Flowers are used in **painful menses**
Strychnos nux-vomica (L).	Kochila	Loganiaceae	Seed	Strychnine[64]	NKZ, BG	Seeds are used to **reduce swelling**
Narangi crenulata Roxb.	Benta	Rutaceae	Bark	Different types of phenolic compounds[61]	BG	Bark is useful in vitiated conditions of **Pitta**

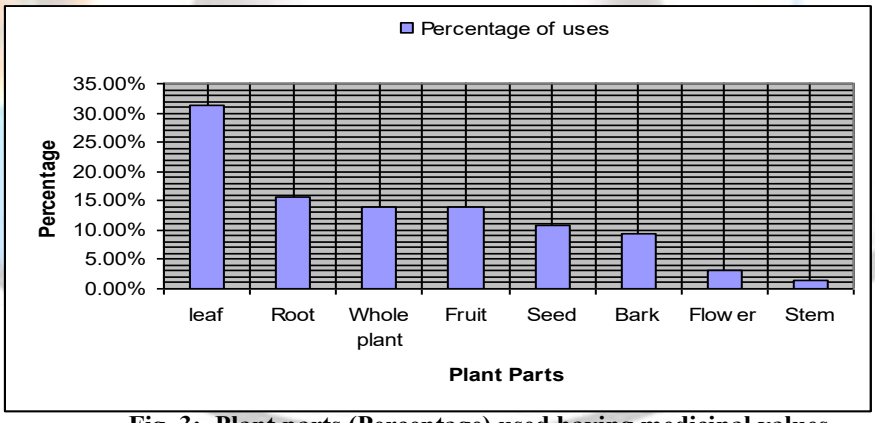

Fig. 3: Plant parts (Percentage) used having medicinal values

Plate 2 : a.)-Leaves of *Peperomia pellucida*, b.)- Flowers and leaves of *Lippia javanica*, c.)- Flowers of *Saraca asoca*, d.)- Fruit pods of *Mucna pruriens*

Plate 3 : e.)- Flowers of *Cassia fistula*, f.)- Flowers of *Evolvulus alsinoids*, g.)- Fruits of *Terminalia bellirica*