



Ethnobotanical exploration of wild edible fruits of Balasore district in Odisha, India - An initiative for accelerating food security and biodiversity conservation

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Abstract

Wild edible plants play a crucial role in overcoming the problem of worldwide hunger and food insecurity. Wild edible fruit plants are loaded with nutrients, antioxidants and pharmacologically active compounds which not only meet the dietary requirements but also help in alleviating malnutrition and other diseases. Both natural and anthropogenic factors are responsible for depletion of wild plant resources and its habitat. Due to more consumption of commercially cultivated fruits available in the market, uses of wild edible fruits are often neglected. Besides supplementing nutritional requirements of human and livestock in rural and forest areas, they boost self-employment by generating alternative source of income in rural as well as tribal households, thereby promoting self-sustaining livelihoods and empowering communities. The present paper deals with 81 wild fruit plants belonging to 60 genera under 34 families consumed by the people of Balasore district of Odisha. The purpose of this scientific investigation is to educate the younger generation about the importance of wild edible fruits and exploring its potential for the welfare of humankind. There is an urgent need for awareness among public about the conservation of traditional knowledge related to usage of wild edible fruits for future generations.

Keywords: Wild edible fruits, ethnic uses, conservation, Balasore district, Odisha

1. Introduction

Hunger and food insecurity are global issues which needs immediate attention for addressing these problems. Wild edible food plants having multiple uses play a significant role in order to tackle these obstacles. Wild Edible Plants (WEPs) are those edible plant species which are neither cultivated nor domesticated but are available in the natural habitat [1]. Wild fruits play a vital role in human nutrition, as rich sources of carbohydrates, proteins, vitamins [retinol (A), thiamine (B1), niacin (B3), pyridoxine (B6), folic acid (B9), ascorbic acid (C) & E], minerals, dietary fiber with huge medicinal potential [2, 3, 4]. As compare to cultivated fruits, some wild fruits have been identified to have better nutritional value [5, 6]. They safeguard rural communities from food insecurity especially during food crisis, famine, chronic malnutrition and less agricultural production. However, wild edible fruits remain underutilized in spite of its wide occurrence and rich nutritional as well as medicinal properties. Lack of scientific inquiry, urbanization, forest degradation, limitations of its ethnic uses to specific communities and regions, dependency on exotic and cultivated plant species are the main reasons for its under exploitation.

Wild fruits often considered as 'famine or hunger food' have been recognized to have ability to meet household diet and income security [7, 8]. Wild fruits are generally consumed raw or processed, which help to meet the daily nutritional requirement of especially forest dwellers, tribal and rural people. Besides their edibility as fruits, they can be used as fodder, fibre, dye, gum, fuel, resin, drug, beverage, timber, flavouring, religious offerings etc. Some of them are also available in local markets of rural areas. But the popularity of wild fruits has been gradually declining due to lack of awareness among public about their nutritional,

economic and therapeutic potential. But many rural and tribal inhabitants still use them as supplement in their diet. Being inexpensive, high adaptability to diverse agro-climatic conditions, low maintenance and less investment it can be easily utilized for the benefit of humankind. With the emergence of modern agriculture and changes in lifestyles, traditional knowledge related to usage of wild edible plants by indigenous communities is diminishing day by day.

Several studies have been done related to botanical description, mode of use, flowering and fruiting seasons of wild edible fruit plants. But information on distribution, consumption and ethnomedicinal uses of wild edible fruit plants is scanty so far, the state of Odisha is concerned. Very less study has been conducted on the exploration, identification, documentation as well as various uses of wild edible fruit plants in Balasore district of Odisha. Therefore, the present study was undertaken to identify, document and to build up a scientific data base on underutilized wild edible fruit plants of selected areas of Balasore district of Odisha and to conserve those plants for the future generations.

2. Methodology

Description of Study Area

The ethnobotanical survey of wild edible fruit plants was conducted in the Balasore district of Odisha. It is located in north-east coastal section of the state of Odisha, between 21°3' to 21°59' N latitude and 86°20' to 87°29' E longitude with an average altitude of 19.08 m. This district covers a total area of 3634 km². The average temperature of the district is 43.1°C in summer while the average winter temperature is 10.6°C. The average annual rainfall is approximately 1,583 mm. Balasore district is surrounded by Purba and Paschim Medinipur district of West Bengal in

its northern side, Bay of Bengal in its east, Bhadrak district in its south and Mayurbhanj & Kendujhar districts lies on its western side [Fig.1].

Data Collection

An extensive field survey was conducted in five C.D. Blocks namely, Basta, Balasore, Nilgiri, Remuna and Bahanaga of Balasore district of Odisha during January 2018 to February 2020. Each area was visited a number of

times in different seasons. The first-hand information (growth forms, local name, mode of consumption, period of ripening, availability in local markets, ethnobotanical uses, storage methods, method of collection and processing) were recorded through interviews and discussion with the tribal medical practitioners and elder knowledgeable rural inhabitants in and around the study area. Data were also collected through readymade questionnaires in their local languages (Odia and Bengali).



Fig 1: Location map of Balasore district of Odisha

Identification and collection of voucher specimens

The specimens of wild fruit plants were collected during field visit with the help of native people. The healthy fresh plants or flowering twigs were collected and their digital photographs were also taken. The collected specimens were then dried and preserved as voucher specimens using the techniques described by Jain and Rao^[9]. The plant species were identified in consultation with the regional floras^[10, 11, 12] and matching with authentic herbarium specimens housed in different Indian Herbaria. An effort was made to cross check the folklore claims. This study involved checking and rechecking of particular folklore claims by the different dwellers of the same community in different forest pockets. This had cleared many doubts regarding the use and identity of plant specimens. The herbarium specimens were deposited in the Department of Botany, K.K.S. Women's College Balasore, Odisha, India.

3. Results and Discussion

From the present study, a total of 81 wild edible fruit plants were documented which are being consumed by the people of Balasore district. The wild edible fruit plants reported during the survey have been enumerated in Table-1 with their botanical name arranged alphabetically along with the family to which they belong, local name, habit, edible parts, fruit types, fruiting period and their ethnobotanical uses. These 81 species belonged to 60 genera under 34 families. Out of the documented 81 plants, 76 are dicotyledons and remaining 5 are monocotyledons. In terms of habit, trees are represented by 48 species (59%), shrubs by 16 species (20%), liana or climbing shrub by 6 species (7%), climbers by 5 species (6%), herbs by 3 species (4%) and hydrophytes by 3 species (4%) [Fig.2]. Among the angiospermic families, Rutaceae (06 genera with 07 species) occupies the dominant position followed by Phyllanthaceae (04 genera

with 06 species) and Moraceae (03 genera with 06 species) [Fig.3]. The genus *Ziziphus* with 4 species is assessed as the dominant genus followed by *Solanum*, *Terminalia*, *Ficus* and *Capparis* with 3 species each [Fig.4]. Fruit type-wise distribution of wild edible fruit plants shows 69 (85 %) belongs to simple fruits followed by 7 (9%) multiple fruits and 5(6%) aggregate fruits [Fig.5]. Among simple fruit-bearing plants, 31 plants with berry-type of fruit was considered dominant, whereas syconus with 3 plant species is dominant among multiple fruits followed by etaerio of berries with 2 species among aggregate fruits [Fig.6]. Besides their edibility as fruits, most of the plants are exploited to a larger extent because of their multipurpose uses. Some of them are *Aegle marmelos*, *Borassus flabellifer*, *Pandanus fascicularis*, *Madhuca indica*, *Mangifera indica*, *Artocarpus heterophyllus*, *Tamarindus indica* etc. Commonly available wild fruits in the market include *Dillenia indica*, *Phyllanthus emblica*, *Aegle marmelos*, *Annona squamosa*, *Artocarpus heterophyllus*, *Borassus flabellifer*, *Spondias pinnata*, *Syzygium cumini*, *Mangifera indica* and *Ziziphus mauritiana*. Since most of the wild edible fruit plants are seasonal and perishable, therefore, preservative techniques like drying, fermenting, picking, freezing, canning etc. are employed for increasing their shelf life and for its long-term use. Wild fruit plant bears fruit in different seasons, thereby ensuring its availability throughout the year. Most of the wild fruit plants ripen during summer season providing water, fiber, antioxidants and nutrients in the hot weather. Despite the scorching sun and heat waves, people enjoy the summer season due to availability of delicious summer fruits which keeps our body cool and hydrated. Wild fruits available during summer include *Aegle marmelos*, *Madhuca indica*, *Mangifera indica*, *Phoenix sylvestris*, *Schleichera oleosa*, *Diospyros melanoxylon*, *Syzygium cumini* etc.

Table 1: Wild Edible Fruits of Balasore district of Odisha.

Sl. No.	Botanical name & Family	Local name	Habit	Edible part	Fruit type	Fruiting	Ethnobotanical uses
1	<i>Aegle marmelos</i> (L.) Correa [Rutaceae]	Bela	Tree	Fruit pulp, unripe fruit	Amphisarca	May-June	Fruit - aromatic edible pulp used in sherbat, squash; unripe fruit for diarrhoea, dysentery; rind of unripe fruit for yellow dye production. Leaf - offering to god. Trunk - gum, timber.
2	<i>Alangium salvifolium</i> (L.f.) Wangerin [Cornaceae]	Ankula	Tree	Fruit	Berry	June-July	Fruit - fleshy ripe fruits edible. Root - used as antidote for several poisons. Trunk - timber.
3	<i>Allophylus serratus</i> (Roxb.) Kurz. [Sapindaceae]	Khanda-koli	Shrub	Fruit	Berry	September- October	Fruit - ripe fruit edible, used against tapeworm infestation. Leaf - decoction used in piles, nose bleeding, elephantiasis, wounds. Trunk - timber.
4	<i>Ampelocissus latifolia</i> (Roxb.) Planch. [Vitaceae]	Bana-angur	Climber	Fruit	Berry	August- October	Fruit - blackish purple berries are sweet - sour in taste eaten by human and birds. Root - decoction is taken in chronic dysentery.
5	<i>Annona reticulata</i> L. [Annonaceae]	Atta, Ramphala	Tree	Fruit pulp	Aggregate fruit (Etaerio of berries)	December - February	Fruit - ripe fruit eaten as dessert. Leaf and seed - with insecticidal properties.
6	<i>Annona squamosa</i> L. [Annonaceae]	Neua, Sitaphala	Tree	Fruit pulp	Aggregate fruit (Etaerio of berries)	July- September	Fruit - ripe fruit pulp for the preparation of ice cream, sherbet, jelly, jam, syrup etc. Leaf - poultice of leaves with salt applied on boils and ulcers to induce suppuration; kills lice and prevents bedbugs & maggots.
7	<i>Antidesma acidum</i> Retz. [Phyllanthaceae]	Matha	Tree	Fruit	Drupe	September- December	Fruit - ripe fruits are slightly acidic and eaten as such. Leaf - cooked as vegetable.
8	<i>Antidesma buniis</i> (L.) Spreng. [Phyllanthaceae]	Anepu	Tree	Fruit	Drupe	July-August	Fruit - ripe fruit for preparing syrup and jam; preserve meat and fish. Leaf - extract given in indigestion.
9	<i>Artocarpus heterophyllus</i> Lam. [Moraceae]	Panasa	Tree	Fleshy pods, seed	Multiple fruit (Sorsosis)	June - July	Perianth - succulent perianth eaten raw, used in candy, ice cream & other desserts. Fruit - unripe fruit and seed used as vegetable. Trunk - timber. Leaf - fodder.
10	<i>Artocarpus lacucha</i> Buch.-Ham. [Moraceae]	Jeuta	Tree	Fruit pulp	Multiple fruit (Sorsosis)	May & October	Fruit - fruit pulp used in chutney, curry. Bark - substitute to betel nuts and its powder used for curing wounds and sores. Trunk - timber.
11	<i>Averrhoa carambola</i> L. [Oxalidaceae]	Karamanga	Tree	Fruit	Berry	October- November	Fruit - ripened fruit eaten fresh or used in squash and jelly preparation whereas sour ones are made into refreshing drinks, pickles, as substitute to tamarind. Leaf - crushed leaves applied externally against chicken pox, ring worm and scabies.
12	<i>Baccaurea ramiflora</i> Lour. [Phyllanthaceae]	Rajkoli	Tree	Fruit pulp	Capsule	May- July	Fruit - pulp for jam, jelly, wine. Bark - fresh bark juice used in constipation.
13	<i>Borassus flabellifer</i> L. [Arecaceae]	Tala	Tree	Fruit- mesocarp, endosperm, sap	Drupe	August- September	Fruit - mesocarp and endosperm of ripe fruits eaten raw or made into cake & sweet. Trunk - timber, sap as traditional

							drink (palm toddy) or preparation of palm-jaggery and sugar candy. Leaf - thatching and making decorative items; fibre.
14	<i>Bridelia retusa</i> (L.) A.Juss. [Phyllanthaceae]	Pani-kasi	Tree	Fruit	Drupe	September- January	Fruit - ripe fruit eaten raw by human and birds. Leaf - cattle feed. Trunk - timber.
15	<i>Buchanania lanzan</i> Spreng. [Anacardiaceae]	Chara-koli	Tree	Fruit kernel	Drupe	April-May	Fruit - ripe kernels eaten raw or taken roasted; as substitute for almonds, in flavouring sweet-meats, confectionery. Seed - oil is applied to glandular swellings of neck. Leaf - fodder; leaf powder applied to wounds. Trunk - timber.
16	<i>Calamus guruba</i> Buch.- Ham. ex Mart. [Arecaceae]	Kanta-beta	Liana, Climbing shrub	Fruit pulp	Berry	December	Fruit - mucilaginous fruit pulp eaten raw by human, ants and birds as well as preparation of pickles. Stem - furniture, handicraft items, mats, ropes, umbrella handles, basketry etc.
17	<i>Canthium parviflorum</i> Lam. [Rubiaceae]	Tuthudi	Shrub	Fruit	Drupe	November- December	Fruit - edible, used in curries. Leaf - control hookworm and tapeworm infestation.
18	<i>Capparis brevispina</i> Auct. non DC. [Capparaceae]	Nepheda	Liana, Climbing, Shrub	Fruit	Berry	April-June	Fruit - ripe fruit eaten raw; unripe fruit thinly sliced, salted, sun dried, fried and served with traditional snacks.
19	<i>Capparis sepiaria</i> L. [Capparaceae]	Kantikapali	Liana, Climbing, Shrub	Fruit	Berry	November - December	Fruit - ripe fleshy fruit edible. Leaf - cattle feed.
20	<i>Capparis zeylanica</i> L. [Capparaceae]	Asadhua	Liana, Climbing, Shrub	Fruit	Berry	September- October	Fruit - white pulp of ripe fruits are occasionally eaten; unripe fruits as vegetable, pickles. Leaf - fodder; poultice used against piles, boils and swellings.
21	<i>Carissa carandas</i> L. [Apocynaceae]	Karanda-koli, Anku-koli	Shrub	Fruit	Berry	July-October	Fruit - ripe fruit used in preparation of salads, puddings and jellies. Root - paste in stomach ache.
22	<i>Carissa spinarum</i> L. [Apocynaceae]	Anka-koli	Shrub	Fruit	Berry	October- December	Fruit - ripe fruit taste sweet and are eaten raw or as a cooked; preserve; they make good tarts, syrups and jellies. Root - possess purgative property; used in treating worm-infested wounds of domestic animals. Flower - fragrant and are used as hair decoration by women.
23	<i>Citrus maxima</i> Merr. [Rutaceae]	Batapi nimbu	Tree	Ripe and unripe fruit	Hesperidium	October- January	Fruit - pulp eaten raw; juice in salads, chutney; rind useful in vomiting, diarrhoea.
24	<i>Citrus medica</i> L. [Rutaceae]	Tabha, Bada-nimbu	Shrub	Ripe and unripe fruit	Hesperidium	October- December	Fruit - fruit pulp used for preparing chutney and pickles; fruit juice in squash; rind powder used for dysentery.
25	<i>Coccinia grandis</i> (L.) Voigt [Cucurbitaceae]	Bana-kunduri	Climber	Fruit, tender shoots	Berry	Year round	Fruit - ripe fruits eaten raw; fried and eaten with cooked rice; used to kill intestinal worms and to increase body strength. Shoot - tender shoots used as leafy vegetable.
26	<i>Cordia dichotoma</i> G. Forst. [Boraginaceae]	Guala-koli	Tree	Fruit	Drupe	July- September	Fruit - raw fruit eaten as vegetable and made into pickle; mucilaginous latex of fruit used as gum; taken to kill intestinal worms and as expectorant in treating respiratory ailments.

							Leaf - fodder. Trunk - timber.
27	<i>Dillenia aurea</i> Sm. [Dilleniaceae]	Chhota-oau	Tree	Fruit	Berry	May- July	Fruit - ripe fruits edible and used for seasoning.
28	<i>Dillenia indica</i> L. [Dilleniaceae]	Oau	Tree	Fleshy sepals	Amphisarca	September-February	Fruit - fleshy sepals used for flavouring curries; used to make chutney, pickles, jam, jelly. Leaves - fodder; dried leaves used for polishing ivory and horn and as a substitute to sand paper. Trunk - timber.
29	<i>Diospyros malabarica</i> (Desr.) Kostel. [Ebenaceae]	Mankada-kendu	Tree	Fruit	Berry	March-April	Fruit - ripe fruits edible; pulp used as glue for book binding and boat repairing; unripe fruits employed for conditioning leathers and dyeing clothes; fruit juice cures wounds and ulcers. Trunk - timber.
30	<i>Diospyros melanoxylon</i> Roxb. [Ebenaceae]	Kendu	Tree	Fruit	Berry	March-April	Fruit - ripe fruits edible. Leaf - wrapping bidis. Bark - decoction administered for dysentery and diarrhoea.
31	<i>Ficus auriculata</i> Lour. [Moraceae]	Raja-dimiri	Tree	Fruit	Multiple fruit (Syconus)	October-December	Fruit - ripe figs eaten raw.
32	<i>Ficus benghalensis</i> L. [Moraceae]	Bara	Tree	Fruit	Multiple fruit (Syconus)	Throughout the year	Fruit - ripe fruits eaten raw by human, birds & monkey. Leaf - fodder. Whole plant - considered sacred by Hindus. Trunk - timber. Bark - ropes, used in dysentery and diarrhoea.
33	<i>Ficus hispida</i> L.f. [Moraceae]	Dimiri	Tree	Fruit	Multiple fruit (Syconus)	Fruits are seen round the year	Fruit - ripe fruits occasionally eaten raw; young fruit cooked as vegetable. Leaf - fodder.
34	<i>Flacourtia indica</i> (Burm.f.) Merr. [Salicaceae]	Bhaincha-koli	Shrub	Fruit	Berry	March-May	Fruit - ripe fruits eaten fresh or pulp preserved as jams and jellies. Bark - tanning. Branches & leaves - fodder.
35	<i>Garcinia xanthochymus</i> Hook.f. [Clusiaceae]	Sitambu	Tree	Fruit	Berry	May	Fruit - pulp of fruit preserved in the form of jams, vinegar; used as substitute of tamarind; decoction of dried fruit used in bilious conditions; under-ripe fruit exudates -yellow in colour and is used for dyeing materials.
36	<i>Glycosmis pentaphylla</i> (Retz.) DC. [Rutaceae]	Chauladhua	Shrub	Fruit	Berry	November-April	Fruit - ripe berries are eaten raw. Leaf - used in fever, liver complaints and as vermifuge. Twigs - used as tooth brush.
37	<i>Grewia helicterifolia</i> Wall. [Malvaceae]	Kula	Shrub	Fruit	Drupe	October-January	Fruit - eaten raw, sherbet; cures diarrhoea and dysentery. Root - paste with water applied to wounds to hasten suppuration and as antiseptic in dressing.
38	<i>Grewia asiatica</i> L. [Malvaceae]	Pharsa-koli	Shrub	Fruit	Drupe	June-July	Fruit - ripe fruits used as dessert fruit, refreshing summer drink; preserved as pickles.
39	<i>Hibiscus sabdariffa</i> L. [Malvaceae]	Khatta-palanga, Toko-bhendi	Shrub	Fruit	Capsule	August-November	Fruit - ripe fruits eaten fresh or cooked; in preparation of jelly. Leaf - used as green vegetable. Stem - yield fibre.
40	<i>Lantana camara</i> L. [Verbenaceae]	Dahanimara	Shrub	Fruit	Drupe	Year round	Fruit - eaten raw. Leaf - crushed leaves applied in fresh cuts, ulcers and swellings.
41	<i>Lepisanthes rubiginosa</i> (Roxb.) Leenh. [Sapindaceae]	Nehenga-koli	Tree	Fruit	Berry	April-May	Fruit - edible. Tender shoots - used as vegetable.
42	<i>Limonia acidissima</i> L.	Kaitha	Tree	Pulp of ripe	Berry	November-	Fruit - pulp used for preparing

	[Rutaceae]			fruits		January	sherbet, chutney; used for curing diarrhoea and dysentery. Trunk - gum, timber.
43	<i>Luffa cylindrica</i> (L.) M. Roem. [Cucurbitaceae]	Tadari	Climber	Fruit	Pepo	July-September	Fruit - young fruit cooked as vegetable whereas dried fruit used as body scrubber.
44	<i>Madhuca indica</i> J.F. Gmel. [Sapotaceae]	Mahula	Tree	Mature fruit, flower	Berry	March-April	Fruit - mature fruit eaten raw or cooked. Flower - eaten raw or after frying or baking into cakes; preparation of alcohol, country wine, syrups, vinegar. Seed - oil is used for preparation of soaps, as emollient and applied to the affected part of the body against skin diseases, rheumatism, headache. Bark - used for tanning, dyeing and has medicinal uses for rheumatism, itches, tonsillitis and diabetes.
45	<i>Mangifera indica</i> L. [Anacardiaceae]	Amba	Tree	Mesocarp of fruit	Drupe	April-May	Fruit - ripe fruits taken raw; pulp in preparation of juice, squash, jams & jellies; unripe fruits used in preparation of pickles, chutney, amchur and culinary preparations. Seed - kernel powder used as anthelmintic and also used in bleeding piles.
46	<i>Manilkara hexandra</i> (Roxb.) Dubard [Sapotaceae]	Khira-koli	Tree	Fruit	Berry	March-June	Fruit - ripe fruits are eaten either fresh or dried. Leaf - used as cattle fodder. Trunk - timber, yields a gum. Bark - used for tanning purposes.
47	<i>Mimusops elengi</i> L. [Sapotaceae]	Baula	Tree	Mature fruit	Berry	April-May	Fruit - ripe fruits taken raw; cures urinary infection; pounded fruits helps in delivery during child birth. Bark - used for diarrhoea, dysentery and dental care. Trunk - timber. Twigs - toothbrush. Leaves and branches - fodder.
48	<i>Morinda pubescens</i> Sm. [Rubiaceae]	Achhu	Tree	Fruit	Multiple fruit (Syncarp)	November-April	Fruit - ripe fruits are edible; raw fruits used for preparing pickles. Trunk - timber. Leaves & tender shoot - fodder. Root bark - dye.
49	<i>Murraya koenigii</i> (L.) Spreng. [Rutaceae]	Bhursunga	Tree	Fruit	Berry	May-September	Fruit - ripe fruits are edible. Leaf - used as flavouring curries, chutneys; used for treatment of dysentery, diarrhoea, diabetes and to check vomiting.
50	<i>Nelumbo nucifera</i> Gaertn. [Nelumbonaceae]	Padma	Hydrophytes	Seeds, rhizome	Aggregate of Achenes	August-September	Seeds - eaten raw or roasted. Rhizome - consumed by boiling. Flower - ornamental, considered as 'sacred' by Hindus; decoction of flower is given in cholera, fever, diseases of the liver and palpitation of the heart. Plant - remediation of waste water.
51	<i>Nymphaea pubescens</i> Willd. [Nymphaeaceae]	Kain	Hydrophytes	Seeds, rhizome	Aggregate of nuts	October-January	Seed - may be popped, parched or ground into flour. Rhizome - consumed by boiling. Flower - ornamental.
52	<i>Opuntia stricta</i> (Haw.) Haw. [Cactaceae]	Nagapheni	Shrub	Fruit	Berry	January - September	Fruit - ripe fruits eaten raw by natives, birds, insects, lizards; industrial source of alcohol; baked fruit used in whooping cough, control spasmodic cough

							and to increase secretion of bile. Stem - yield fibre and mucilage of commercial importance.
53	<i>Pandanus fascicularis</i> Lam. [Pandanaceae]	Kia	Shrub	Fruit pulp and seeds	Multiple fruit (Syncarp of drupes)	October-November	Fruit - fruit pulp and seeds are eaten. Flower - kewra oil, kewra attar, kewda water are the perfumery and flavouring products; kewra oil used to treat headaches, earache and rheumatic pains; offering to god. Leaf - fibre.
54	<i>Phanera vahlii</i> (Wight & Arn.) Benth. [Syn- <i>Bauhinia vahlii</i> Wight & Arn.] [Fabaceae]	Siali-lata	Climber	Seeds	Legume	December - March	Seed - eaten after boiling, roasting or cooked as vegetable; used against broken health and maintain health vigour. Leaf - used for making plates and cups; as fodder. Bark - fibre and tanning material.
55	<i>Phoenix acaulis</i> Roxb. [Arecaceae]	Bhuin-khajuri	Tree	Ripe fruit, tender peduncles	Drupe	May-June	Fruit - ripe fruit and tender peduncles are eaten raw. Leaf - used for thatching and for making mats, brooms and ropes; as fodder.
56	<i>Phoenix sylvestris</i> (L.) Roxb. [Arecaceae]	Khajuri	Tree	Ripe fruit, sap	Drupe	April-June	Fruit - ripe fruits are eaten raw; used in preparation of juice, jelly and sweet items. Sap - used to make jaggery, sugar whereas fresh unfermented sap is used as refreshing drink. Leaf - used for thatching; making mats, fans, baskets, bags, brooms and fishing nets.
57	<i>Phyllanthus acidus</i> (L.) Skeels [Phyllanthaceae]	Nara-koli	Tree	Fruit	Drupe	June-October	Fruit - ripe fruits are eaten raw with salt; used in preparation of jelly and as preservative.
58	<i>Phyllanthus emblica</i> L. [Phyllanthaceae]	Aenla, Amla	Tree	Fruit	Drupe	November-January	Fruit - ripe fruits eaten raw; used in preparation of pickles, jelly; one of the components of 'Triphala' used against constipation; used for preparation of shampoo, hair dyes; dried fruit used in the treatment of anaemia, jaundice, dyspepsia, diabetes, haemorrhage, asthma and bronchitis.
59	<i>Physalis minima</i> L. [Solanaceae]	Tipai, Paja	Herb	Fruit	Berry	August-November	Fruit - ripe fruits are eaten raw and cooked. Leaf - leaf juice mixed with mustard oil used as a remedy for ear-ache.
60	<i>Pithecellobium dulce</i> (Roxb.) Benth [Fabaceae]	Bilati-kayan	Tree	Fruit pulp	Lomentum	December-February	Fruit - ripe fruit pulp is edible. Bark - used against fevers.
61	<i>Psidium guajava</i> L. [Myrtaceae]	Pijudi	Tree	Fruit	Berry	November-January	Fruit - ripe fruit eaten raw; preparation of juice, jam, jelly. Leaf - fodder. Stem - firewood, charcoal, handicrafts, poles, tool handles.
62	<i>Schleichera oleosa</i> (Lour.) Oken [Sapindaceae]	Kusuma, Pagada-koli	Tree	Ripe fruit, seed	Drupe	April-May	Fruit - ripe fruits edible, also pickled. Seed - eaten raw or roasted; seed oil used for cooking and treating ulcers, itching, acne, intestinal parasites and promote hair growth. Trunk - firewood, timber, charcoal.
63	<i>Semecarpus anacardium</i> L.f. [Anacardiaceae]	Bhalia	Tree	Fruits and seed	Drupe	May - July	Fruit - fleshy ripe peduncles edible; possess counter irritant and aphrodisiac properties. Seed - kernel edible after roasting.

64	<i>Shorea robusta</i> Roth [Dipterocarpaceae]	Sal	Tree	Seed	Samaroid	December- January	Seed - boiled seeds are eaten with salt, roasted or grounded into flour. Leaf - dried leaves used in the preparation of plates and cups. Trunk - resin, timber.
65	<i>Solanum nigrum</i> L. [Solanaceae]	Bahuphala, Nunununia	Herb	Fruit	Berry	August - October	Fruit - ripe fruits eaten. Leaf - used to cure stomach aches, chest pain, mouth ulcer and for deworming.
66	<i>Solanum torvum</i> Sw. [Solanaceae]	Dengabheji	Shrub	Fruit	Berry	August- November	Fruit - young fruits fried with ghee or oil is eaten as a vegetable.
67	<i>Solanum virginianum</i> L. [Solanaceae]	Bheji-baigana	Herb	Fruit	Berry	All year round	Fruit - consumed raw or cooked; used for diabetes, sore throats and rheumatism.
68	<i>Spondias pinnata</i> (L.f.) Kurz. [Anacardiaceae]	Salama, Ambada	Tree	Fruit	Drupe	August- September	Fruit - ripe fruits eaten raw whereas unripe fruit used for preparation of pickles, chutney. Leaf - flavouring. Bark - paste used against dysentery, diarrhoea, biliousness, arthritis. Trunk - timber.
69	<i>Sterculia foetida</i> L. [Malvaceae]	Baksa-badam	Tree	Fruit kernels	Aggregate of follicles	October- January	Seed - edible after roasting and taste like chestnuts. Bark - treatment of dropsy and rheumatism and it also yields fibre. Seed oil - biofuel. Trunk - gum, timber.
70	<i>Streblus asper</i> Lour. [Moraceae]	Sahada	Tree	Fruit	Berry	April-May	Fruit - ripe fruit eaten raw. Twigs - used as tooth brush, cures pyorrhoea.
71	<i>Syzygium cumini</i> (L.) Skeels [Myrtaceae]	Jammu-koli	Tree	Fruit	Drupe	May-July	Fruit - ripe fruits with salt eaten. Seeds - used for diabetes. Bark - decoction used as gargle to strengthen gums, treat mouth ulcers, dysentery, bronchitis, asthma etc. Trunk - timber. Leaf - fodder.
72	<i>Tamarindus indica</i> L. [Fabaceae]	Tentuli	Tree	Fruit pulp, tender, leaves	Lomentum	January- April	Fruit - fruit pulp is edible; pickles, chutney and curry. Leaf - tender leaves used as vegetable; decoction used for throat infection, cough, fever and intestinal worms. Trunk - timber.
73	<i>Terminalia bellirica</i> (Gaertn.) Roxb. [Combretaceae]	Bahada	Tree	Seeds	Drupe	November- February	Fruit - fleshy part of the seed is edible; fruits are useful in curing asthma and bronchitis.
74	<i>Terminalia catappa</i> L. [Combretaceae]	Deshi-badam, Jangli-badam	Tree	Seed	Drupe	July- September	Fruit - seed kernel of fruit eaten raw or roasted. Trunk - gum, dye, timber; tanning. Leaf - applied to rheumatic joints.
75	<i>Terminalia chebula</i> Retz. [Combretaceae]	Kasaphala, Harida	Tree	Fruit	Drupe	November- March	Fruit - edible, preserves as pickle; constituent of 'Triphala' which is used for kidney and liver dysfunctions; tanning leather; dyeing. Trunk - timber.
76	<i>Toddalia asiatica</i> (L.) Lam. [Rutaceae]	Tunda-poda	Climber	Fruit, root	Berry	September- December	Fruit - ripe fruit used as substitute of chilly. Root - used for malarial and intermittent fevers, dyspepsia, diarrhoea and bronchitis.
77	<i>Trapa natans</i> var. <i>bispinosa</i> (Roxb.) Makino [Lythraceae]	Pani-phala	Hydrophytes	Fruit kernels	Drupe	October- December	Fruit - soft kernels inside the fruits is eaten fresh, boiled, roasted or fried.
78	<i>Ziziphus mauritiana</i> Lam.	Bara-koli	Shrub	Fruit	Drupe	December- February	Fruit - ripe fruits eaten raw, pickled or used in beverages.

	[Rhamnaceae]						Trunk - timber, firewood. Leaf - fodder. Bark - decoction used for diarrhoea, dysentery and gingivitis.
79	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn. [Rhamnaceae]	Jangli bara-koli	Shrub	Fruit	Drupe	November - December	Fruit - ripe fruits are eaten fresh, pickled, dried or made into confectionery. Leaf - fodder; used to treat scabies and other skin diseases. Stem - fuel wood.
80	<i>Ziziphus oenoplia</i> (L.) Mill. [Rhamnaceae]	Kana-koli, Kantai-koli	Liana, Climbing shrub	Fruit	Drupe	October-January	Fruit - ripe fruits eaten raw. Bark - powder used healing wounds, stomach ache. Stem - fuel wood.
81	<i>Ziziphus rugosa</i> Lam. [Rhamnaceae]	Tina-koli	Liana/Climbing shrub	Fruit	Drupe	April-June	Fruit - ripe fruits eaten fresh or pickled. Leaf - fodder. Bark - poultice applied to swollen gums and to toothaches. Stem - firewood.

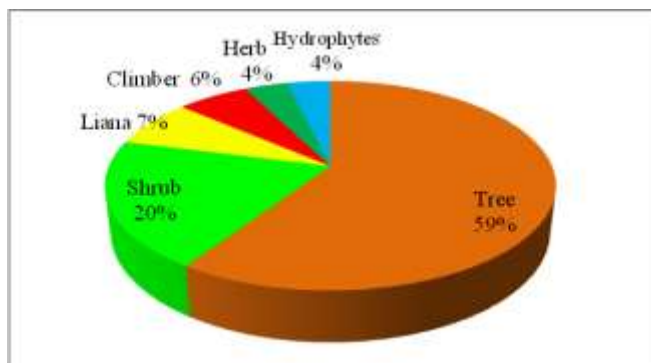


Fig. 2: Habit-wise distribution of wild edible fruit plants (in %) in the study area

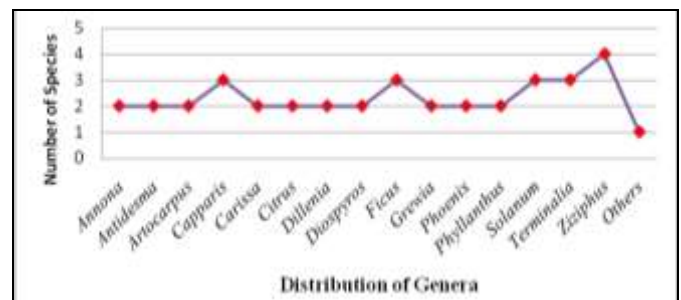


Fig. 4: Genus-wise distribution of wild edible fruit plants in the study area

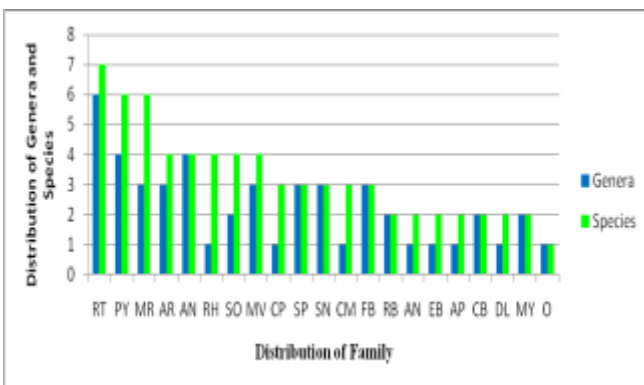


Fig.3: Family-wise distribution of wild edible fruit plant's genera and species in the study sites

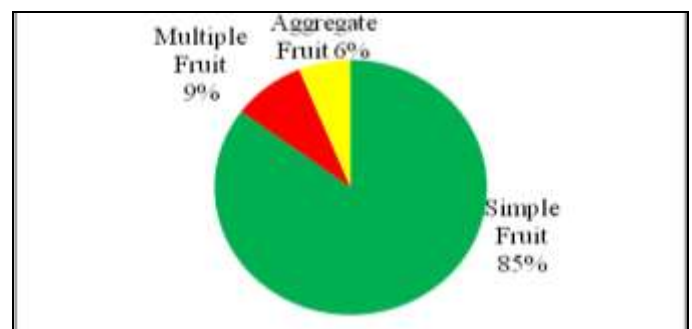


Fig.5: Fruit type-wise distribution of wild edible fruit plants (in %) in study area

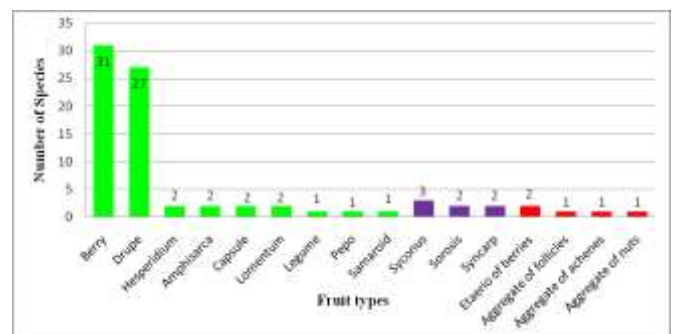


Fig.6: Fruit type-wise distribution of wild edible fruit plants in study area

[Note: Rutaceae- RT, Phyllanthaceae- PY, Moraceae-MR, Arecaceae-AR, Anacardiaceae-AN, Rhamnaceae-RH, Solanaceae-SO, Malvaceae-MV, Capparaceae-CP, Sapotaceae-SP, Sapindaceae-SN, Combretaceae-CM, Fabaceae-FB, Rubiaceae-RB, Annonaceae-AN, Ebenaceae-EB, Apocynaceae-AP, Cucurbitaceae-CB, Dilleniaceae-DL, Myrtaceae-MY, Others-O]

4. Conclusion

Although Balasore district is blessed with rich diversity of wild edible fruits, however, the basic information related to its edibility, nutrient composition and therapeutic properties of these wild fruits are unexplored. Necessary steps should be taken by the local administration as well as the local inhabitants in order to prevent the extinction of these valuable wild edible plants in their natural habitat, which are facing severe genetic erosion. Therefore, immediate measures should be taken to identify, document and promote the use of rich wild fruit resources for germplasm conservation and food security. Moreover, domestication of wild plants for commercial uses and dissemination of knowledge related to their nutritional and therapeutic potential can be studied for bioprospecting. Inclusion of wild fruits in agro-forestry, horticultural and reforestation programmes can explore its potential for commercial purposes.

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