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DIVERSITY OF WILD EDIBLE FRUIT PLANTS OF ACHARYA JAGADISH CHANDRA BOSE INDIAN BOTANIC GARDEN, HOWRAH, WEST BENGAL, INDIA

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ABSTRACT

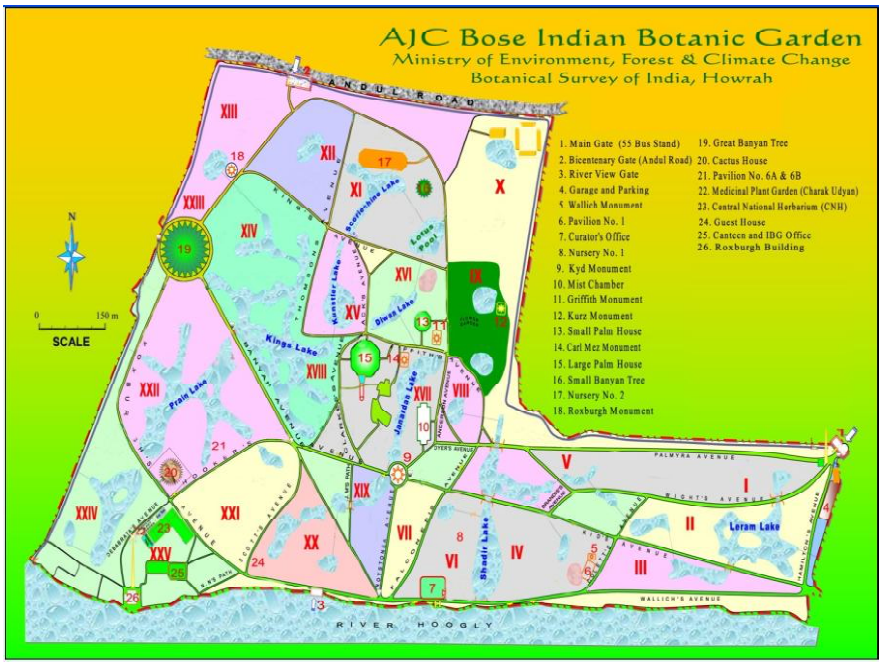
The present study was carried out at Acharya Jagdish Chandra Bose Indian Botanic Garden (AJCBIBG), Howrah, West Bengal, India to document the wild edible fruit plants with its economic importance that may have been introduced and naturalized in the premises of the garden. Survey of different divisions of the garden revealedthe presence of about 51 speciesof wild edible fruits plant belonging to 41 genera under 29 families. It was observed that out of the total species documented 65.38% species were native from Indian subcontinent, majority of the species were trees followed by shrub and liana. Moreover, among the documented families Moraceae was found to be most dominant family with 5 species followed by Rutaceae, Arecaceae etc. with 3 species. Enlisting the diversity of the wild edible fruits plant species would facilitate to investigate the nutraceutical and pharmaceutical values in near future.

Key words : Wild edible fruit, AJCBIBG, Moraceae, Indian subcontinent.

Introduction

Fruits play an important role in meeting the essential nutritional requirement of living beings specifically human beings but in today's era of globalization and commercialization the nutritional qualities of fruit are degrading because of extensive application of fertilizers and pesticides to obtain maximum production, therefore in the present scenario people are focusing on consuming wild edible fruits. The Wild edible plants (WEPs) refers to plant species that are harvested for food from their natural habitat rather than being domesticated or cultivated (Beluhan and Ranogajec, 2010; Pradhan *et al*., 2020). Wild edible fruits are the popular non -timber forest products and vital source of nutrition, medicine, and revenue for the tribal and rural people (Sardeshpande and Shackleton, 2019). More than 7000 species of wild edible plants have been used as food at some point throughout human history (Grivetti and Ogle, 2000). Among the WEPs, the edible fruit bearing species form one of the most important local survival strategies and its uses are well depicted in ancient literature such as Vedas, Puranas and Upanishads.

The Acharya Jagdish Chandra Bose Indian Botanic Garden, Shibpur, Howrah (Map 1) situated on the banks of river Hooghly (22.5587^0 N, 88.2911^0 E) spread across an area of 273 acres is among the oldest and best landscaped garden of the world (Hameed *et al*., 2016) harbours a rich resource of wild edible fruits which are conserved in different divisions of the garden. With 25 division and 24 interconnected lakes garden is a home to many wild edible fruit species such as *Aegle marmelos* (L.) Correa, *Annona squamosa* L, *Averrhoa carambola* L, *Flacourtia indica* (Burm.f.) Merr., *Manilkara hexandra* (Roxb.) Dubard and many more. The wild edible fruits are often considered underutilized fruit because of lack of knowledge among the common people as the knowledge are mainly confined to the rural or tribal people who inhibit close to forest (Kulsum *et al.*, 2023). Tribal communities are playing a pivotal role in the conservation of forests and sustainable utilization of forest



Map 1 : Study of Map

products (Kumar *et al.*, 2012). A large population of the world do not have enough food to meet the nutritional requirements and the other part of population may be having stable food but suffers from nutritional deficiency, this is where wild edible fruits can add additional nutrients in the diet (Mahapatra and Panda, 2009). Moreover, in times of scarcity such as famine where cultivated fruits are more prone to get affected, the wild edible fruits can act as food security for people as reported in Sudan in 1973 and 1984–1985 (Bell, 1995), Bihar, India (1965–1966), Bangladesh (1974–1975) (FAO, 1999) and during the recent war in Bosnia-Herzegovina (Redzic, 2007). The wild gene of wild edible fruits may act as gene pool for resistance against diseases. Further wild edible fruits also act in generating employment for tribal and rural people and add some extra income to their livelihood as traditional knowledge beholds one of the uses of natural resources from the forest and uses it for their livelihood needs (Kumar *et al.*, 2013). In view of the above facts a survey was undertaken to identify and document the wild edible fruits of AJCBIBG.

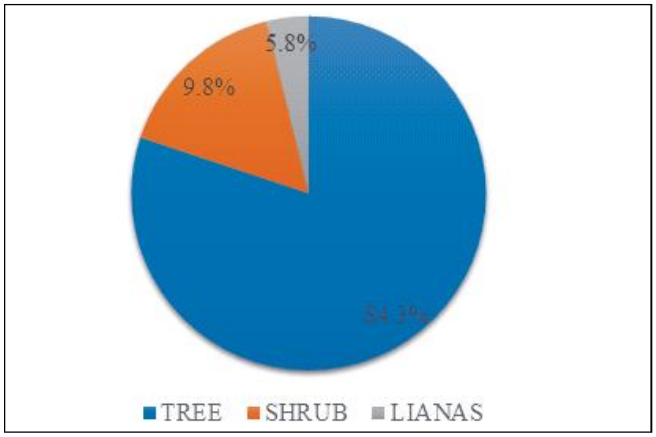
Materials and Methods

The enlisting of wild edible fruit plant species of AJCBIBG was performed by exhaustive field surveys of various divisions and the plant species were identified by consulting literatures and monographs (Haines, 1921-1925; Chowdhury and Pandey, 2007; Debnath *et al.*, 2014). Websites of the International Plant Index (IPNI) [http://www.ipni.org/], Plant of World Online (POWO) [https://powo.science.kew.org/] and Tropics [http://

Fig. 1 : a. *Aegle marmelos* **b.** *Alangium salviifolium* **c.** *Annona reticulata* **d.** *Annona squamosa* **e.** *Antidesma ghaesembilla* **f.** *Ardisia solanacea* **g.** *Artocarpus heterophyllus* **h.** *Atalantia monophylla*.

Fig. 2 : a. *Averrhoa carambola* **b.** *Borassus flabellifer* **c.** *Buchanania lanzan* **d.** *Careya arborea* **e.** *Cordia dichotoma* **f.** *Dillenia aurea* **g.** *Dillenia indica* **h.** *Dillenia pentagyna.*

www.tropicos.org/] were consulted for verifying the current status of a species. The identified plant species were summarized alphabetically in tabular form along with their botanical names, followed family, habit, common name, native range, flowering and fruiting time, edible parts and economic importance.

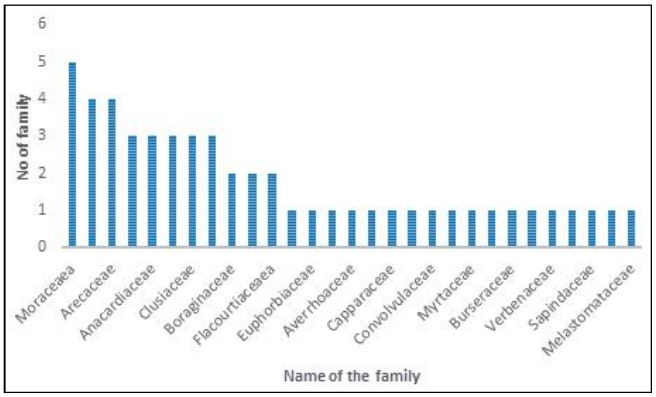


Graph 1 : Habit distribution of Wild Edible Fruits of AJCBIBG.

Fig. 3 : a. *Diospyros melanoxylon* **b.** *Diospyros sylvatica* **c.** *Ehretia aspera* **d.** *Ficus auriculata* **e.** *Ficus benghalensis* **f.** *Ficus hispida* **g.** *Flacourtia jangomas* **h.** *Garcinia xanthochymus.*

Results and Discussion

The survey work came out with a total of 51 species belonging to 41 genera under 29 families under wild edible fruits of AJCBIBG (Table 1). Among the listed plant species, 43 species were tree (84.3%), 5 were shrub (9.8%) and 3 were liana which comprise of 5.8% total



Graph 2 : Dominant Wild edible fruit plant families of AJCBIBG.

Table 1 : Diversity of wild edible fruit plant species of AJCBIBG.

S. no.	Botanical name	Family	Habit	Common name	Native Range	Flowering	Edible Part	Economic Importance
1.	*Aegle marmelos* (L.) Correa	Rutaceae	Tree	Bael (H), Bael tree (Eng.)	Indian Subcontinent	Fl. : Mar-Apr & Fr.: May-Jun	Fruit, leaf, root, bark and seed.	Fruits are used for medicinal purpose and timber are used for commercial -purpose.
2.	*Alangium salviifolium* (L.f.) Wangerin	Alangiaceae	Tree	Akola (H), Sage-leaf Alang (Eng.)	Indian Subcontinent	Fl. : Mar- Apr & Fr.: Jun-Jul	Fruit	Leaves are used as a poultice in rheumatism. Timber are used for construction.
3.	*Annona reticulata* L.	Annonaceae	Tree	Bullock's Heart (Eng).	Mexico	Fl.: Jun- Jul & Fr. : Dec-Feb	Fruit, leaf, root and seed.	Unripe fruits are used for medicinal purpose as anthelmintic and anti-dysenteric.
4.	*Annona squamosa* L.	Annonaceae	Tree	Sharifa (H), Custard Apple (Eng)	Mexico to Colombia	Fl.: Mar-May & Fr.: Jul-Sept	Fruit	Leaves are used for medicinal purpose. The fruits are used for making jelly, jam, sharbat etc.
5.	*Antidesma ghaesembilla* Gaertn.	Euphorbiaceae	Tree	Umtea (H), Black-Currant Tree (Eng).	Northern Australia to Subtropical Asia	Fl.: Apr-Jun & Fr.: Sep-Oct	Leaves and Fruits	Leaves are consumed as leafy-vegetables and timber are utilised for construction.
6.	*Ardisia solanacea* Roxb.	Myrsinaceae	Shrub	Rakatphar (H).	Indian Subcontinent to China and Malaysian peninsula	Fl.: Apr-May & Fr.: Oct-Jan	Flower, Fruit and leaves	Roots are used for medicinal purpose, leaves are eaten as salad and juice of fruit are consumed as drink for tribals.
7.	*Artocarpus heterophyllus* Lam.	Moraceae	Tree	Kathal (H), Jackfruit (Eng).	Southwest India	Fl.: Dec- Feb & Fr.: Jun-Jul	Bracts, Perianth and seed	Unripe fruits are consumed as vegetable and other culinary purpose. Timber is used for const-truction of doors and windows.
8.	*Atalantia monophylla* DC.	Rutaceae	Tree	Jangli Nimbu (H), Wild Lime (Eng).	India to Peninsula Malaysia.	Fl.: Oct-Dec & Fr.: Apr-May	Fruit	The essential oil obtained from fruit are used as anti-fungal and anti- bacterial purpose.
9.	*Averrhoa carambola* L.	Averrhoaceae	Tree	Kamarak (H), Star fruit (Eng).	Central & E. Jawa to Maluku	Fl.: Jun-Sep & Fr.: Oct-Nov	Fruit	Fruits are used in preparing various pickles, drinks, squash etc. Roots and leaf extract have medicinal importance.

Table 1 continued....

Table 1 continued....

10.	*Phanera vahlii* (Wight & Arn.) Benth. (=*Bauhinia vahlii* Wight & Arn.)	Fabaceae	Liana Climber (Eng).	Jallur, Maljan (H), Camel's Foot	Indian Subcontinent	Fl.: Apr-Jun & Fr.: Dec-Mar	Seeds, leaf and pods	Seeds are consumed as vegetable. Leaves are used
11.	*Borassus flabellifer* L.	Arecaceae	Tree	Palmyra Palm (Eng)	Indo-China, Jawa to Lesser Sunda Islands.	Fl.: Mar- May & Fr.: Aug-Sep	Fruit and leaves	All parts of the plant are useful especially its fruit. Leaves are used for thatching purpose.
12.	*Buchanania lanzan* Spreng.	Anacardiaceae	Tree	Chironji (H), Almondette Tree (Eng).	Indian Subcontinent to China (S.Yunnan) and Indo-China.	Fl.: Jan-Mar & Fr.: Apr-May	Fruit and seed	Leaves are used for medicinal purpose, seeds are used as flavouring agent in food. Timber are used for constructing doors or Window frames.
13.	*Calamus guruba* Buch.-Ham. ex Mart.	Arecaceae	Liana	Kanta beta (O)	NE. India to Bangladesh	Fl.: Mar-Apr & Fr.: Dec	Fruit pulp, seeds and tender shoots	Roots are used as expectorant and anaesthetic.
14.	*Capparis zeylanica* L.	Capparaceae	Shrub	Ardanda (H), Ceylon Caper (Eng).	SE. China to Tropical Asia	Fl.: Feb-Apr & Fr.: Apr-Jun	Fruit, seeds, root, shoot and leaves	Fruits are consumed as vegetable. Leaves are used for medicinal purpose for treating ailments such as boil etc.
15.	*Careya arborea* Roxb.	Lecythidaceae	Tree	Kumbhi (H), Slow-Match Tree (Eng)	Afghanistan to NW. Peninsula Malaysia	Fl.: Apr-May & Fr.: Jul-Aug	Fruit, seed, leaves and bark	Fruits are consumed and often used for treating ailments related to digestive disorders.
16.	*Cordia dichotoma* G.Forst.	Boraginaceae	Tree	Lasora (H), Large Sebesten (Eng)	Indian Subcontinent to Nansei-shoto and SW. Pacific	Fl.: Mar-Apr & Fr.: Jul-Sep	Fruit, leaves	Raw fruits are consumed as vegetable and for preparing pickles. Gum extracted from plant are used for medicinal purpose.
17.	*Dillenia aurea* Sm.	Dilleniaceae	Tree	Rai, Karmata (O)	E. India to Indo-China	FL.: Apr- May & Fr.: May-Jul	Fruit	Fruits are consumed and used as seasoning.
18.	*Dillenia indica* L.	Dilleniaceae	Tree	Chalta (H), Elephant apple (Eng)	India to China (S. Yunnan, S. Guangxi) and W. & Central Malesia	Fl.: May-Jun & Fr.: Sep-Feb	Fleshy sepal	Fleshy sepal of ripe fruits are used as flavouring and preservative agent in food

Table 1 continued....

Table 1 continued....

19.	*Dillenia pentagyna* Roxb.	Dilleniaceae	Tree	Kallai (H)	Indian Subcontinent to China (Yunnan) and S. Sulawesi	Fl.: Mar-Apr & Fr.: May-Jun	Buds and fruits	Fibre obtained from bark are used in making ropes. Timber obtained are used for construction.
20.	*Diospyros melanoxylon* Roxb.	Ebenaceae	Tree	Tendu (H), Coromandel Ebony Persimmon (Eng)	India, Sri Lanka	Fl.: Apr-May & Fr.: Mar-Apr	Fruits and leaves	Leaves are used in preparing country cigarettes (bidi). Ripe fruits are edible and consumed by tribal people.
21.	*Diospyros sylvatica* Roxb.	Ebenaceae	Tree	Madhur Kalicha (O)	S. India, Sri Lanka	Fl.: Apr-Jul & Fr.: Sep-Mar	Fruit	The wood is used in carpentary, the root and stem bark have anti-termitic properties.
22.	*Ehretia aspera* Willd. (=*Ehretia laevis* Roxb.)	Boraginaceae	Tree	Chamror(H)	Pakistan to Hainan and Peninsula Malaysia	Fl.: Jan-Mar & Fr.: Apr-May	Fruit, leaves and inner bark	Wood obtained from plant are used for making agriculture implements.
23	*Erycibe paniculata* Roxb.	Convolvulaceae	Liana	Joda Koli (O)	India, Sri Lanka, Assam to Bangladesh	Fl.: May-Jun & Fr.: Jun	Ripe fruits	Bark is used in treating various ailments such as cholera and dysentery.
24	*Erythroxylum monogynum* Roxb.	Erythroxylaceae	Shrub	Red Cedar (Eng)	India to Myanmar, Sri Lanka.	Fl.: May-Sept & Fr.: Aug-Dec	Fruit and leaves	Dried leaves are cooked and consumed. Crude oil obtained from wood are used as timber preservative.
25	*Eugenia roxburghii* DC. (=*Eugenia rothii* Panigrahi)	Myrtaceae	Tree	Sagadabatua, Anachana (O)	Indian Subcontinent to Indo-China	Fl.: Mar-Jun & Fr.: Jul-Nov	Fruit	Ripe fruits are used for preparing jellies and tarts and timber is used in preparing tool handles etc.
26	*Ficus auriculata* Lour.	Moraceae	Tree	Timla (H)	NE. Pakistan to S. China and Peninsula Malaysia	Fl & Fr.: Oct- Dec	Leaves and fruit	Ripe fruit are consumed as vegetable and fruit.
27	*Ficus benghalensis* L.	Moraceae	Tree	Bar, Bat (H), Banyan tree (Eng).	Indian Subcontinent, Andaman Islands	Fl. & Fr.: Throughout the year	Leaves and fruit	Leaves are used for fodder. Coarse rope is prepared from bark and aerial root.

Table 1 continued....

Table 1 continued....

28	*Ficus hispida* L.f.	Moraceae	Tree	Daduri, Dagurin (H)	S. China to Tropical Asia and N. Australia	Fl.: Jan-Feb & Fr.: Nov-Jul	Leaves and fruit	Leaves are consumed as fodder. Fibre obtained from bark are used for making ropes.
29	*Ficus racemosa* L.	Moraceae	Tree	Gular (H), Clustered Fig (Eng).	Pakistan to N. Queensland	Fl.: Mar- Jun & Fr.: Mar-Jul	Leaves and fruit	Leaves are used for fodder purpose. Milky latex obtained from bark are used for treatment of piles.
30	*Flacourtia indica* (Burm.f.) Merr.	Flacourtiaceae	Tree	Madagascar Plum (Eng)	Ethiopia to S. Africa, SE. China to Tropical Asia	Fl.: Dec-Mar & Fr.: Mar-May	Fruits, branches and leaves	Fruits are used in preparation of Jams and jellies. Leaves are used as fodder.
31	*Flacourtia jangomas* (Lour.) Raeusch.	Flacourtiaceae	Tree	Paniaonla (H)	Nepal to China (S. Yunnan, W. Guangxi) and N. Myanmar	Fl.: June & Fr.: Oct-Jan	Fruits, leaves and young shoots	Fruits are used in preparation of Jams and jellies. Leaves and bark are used for bleeding gums.
32	*Garcinia cowa* Roxb. ex Choisy	Clusiaceae	Tree	Cowa (H), Cowa Mangosteen (Eng)	India, Central Himalaya to China (W. & S. Yunnan) and Malaya	Fl.: Mar-Apr & Fr.: May-Jun	Fruits and leaves	Fruits are used in preparation of Jams and preservatives. Bark is used for dyeing clothes.
33.	*Garcinia xanthochymus* Hook.f. ex T.Anderson	Clusiaceae	Tree	Tamal (H)	Indian Subcontinent to China (Yunnan, SW. Guangxi) and Indo-China	Fl.: Apr-May & Fr.: May	Fruits	Fruits are used in preparation of Jams and preservatives.
34.	*Gardenia latifolia* Aiton	Rubiaceae	Tree	Ban-Pindalu (H)	India to Bangladesh	Fl.: Mar-Apr & Fr.: Jan-Jun	Fruits	Wood obtained from plants are used for making furniture, combs and other articles.
35.	*Garuga pinnata* Roxb.	Burseraceae	Tree	Kaikar (H)	India to China (E. Sichuan, S. & SE. Yunnan, SW. Guangxi) and Indo-China	Fl.: Feb-Apr & Fr.: Jun-Aug	Fruits, leaves and shoots	The extract of stem and roots are used for medicinal purpose.
36	*Grewia subinaequalis* Wall.	Tiliaceae	Tree	Phalsa (H)	Mascarenes, S. Iran to Queensland.	Fl.: Apr-May & Fr.: Jun-Jul	Fruits	Leaf is used in treating pustular eruptions. Fibre from bark is used in making ropes.

Table 1 continued....

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37	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Tree	Jhingan, Mohin (H), Wodier (Eng)	Indian Subcontinent to China	Fl.: Mar-Apr & Fr.: Apr-Jun	Fruits	Leaves are used in treating elephantiasis. Wood is used for construction purpose.
38	*Lantana camara* L.	Verbenaceae	Shrub	Indian Ash Tree (Eng)	Mexico to Tropical America	Fl. & Fr.: All through the year	Fruits	Leaf paste is used as ointment against ulcers, cuts and wounds.
39	*Leea indica* (Burm.f.) Merr.	Leeaceae	Shrub	Kukur-jihwa (H)	Laccadive Islands, W. & S. India, Sri Lanka	Fl.: Jul- Nov & Fr.: Aug-Dec	Fruits, shoot and leaves	Root is used in diarrhoea, colic, dysentery and as sudorific. Tender shoots are consumed as vegetable.
40	*Lepisanthes tetraphylla* (Vahl) Radlk.	Sapindaceae	Tree	Kurpa (H)	S. China to Tropical Asia	Fl.: Apr-May & Fr.: Apr-Jun	Fruit	The wood is occasionally used for house building, furniture and carving.
41	*Litsea glutinosa* (Lour.) C.B.Rob.	Lauraceae	Tree	Indian Laurel (Eng)	Tropical & Subtropical Asia	Fl.: Jun-Jul & Fr.: Sep-Nov	Fruit	Leaves and roots are used for medicinal purpose. Bark powder is used for making incense stick.
42	*Madhuca longifolia* var. *latifolia* (Roxb.) A.Chev.	Sapotaceae	Tree	Mahua (H), Butter Tree (Eng)	India to Bangladesh	Fl.: Jan-Feb & Fr.: Mar-Apr	Flowers and Fruit	Fruits have a lot of medicinal properties. Fruit pulp is used for preparing fermented drink. Floers are used as fodder for cattles.
43	*Mammea suriga* (Buch.-Ham. ex Roxb.) Kosterm.	Clusiaceae	Tree	Nagakesara (H)	W. India	Fl.: Apr- May & Fr.: Jul-Aug	Fruit	Flowers are consumed in perfume industry.
44	*Mangifera indica* L	Anacardiaceae	Tree	Am (H), Mango (Eng)	Assam to China (S. Yunnan)	Fl. Jan-Mar & Fr.: Apr-May	Fruit	Fruits are used for culinary purpose. Kernel powder are used as anthelmintic and against piles.
45	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae	Tree	Khirni (H)	India to China (S. Guangxi) and Peninsula Malaysia (Johor)	Fl.: Nov-Jan & Fr.: Mar-Jun	Fruit and leaves	Leaves are used as fodder for cattle. Timber is used for preparing agriculture implements. Bark yield gum which are used for tanning purpose.
46	*Memecylon umbellatum* Burm.f.	Melastomata-ceae	Tree	Iron Wood Tree (Eng.)	S. India to W. Malesia	Fl.: Mar-Jun & Fr.: Aug-Sep	Fruit	Leaves are used in treating leucorrhoea and gonorrhoea. Wood is used for construction purpose.

Table 1 continued....

Table 1 continued....

47	*Miliusa tomentosa* (Roxb.) Finet & Gagnep.	Annonaceae	Tree	Kirua (H)	Indian Subcontinent	Fl.: May-Jun & Fr.: Jun-Jul	Fruit	Leaves are used as fodder. Tree yields gum.
48	*Miliusa velutina* (DC.) Hook.f. & Thomson	Annonaceae	Tree	Dom-sal (H)	Himalaya to Indo-China	Fl.: May-Jun & Fr.: Jun-Jul	Fruit	Leaves are used for fodder purpose. Wood is use for preparing furnitures and agriculture tools.
49	*Mimusops elengi* L.	Sapotaceae	Tree	Maulsari (H), Indian Medaller (Eng)	S. India to Vanuatu	Fl.: Feb-Mar & Fr.: Apr-May	Fruit	Extract of flowers are used against heart diseases, leucorrhoea, menorrhagia and act as antidiuretic in polyuria and antitoxin.
50	*Bergera koenigii* L [=*Murraya koenigii* (L.) Spreng.]	Rutaceae	Tree	Mithaneem (H),. Curry Leaf Tree (Eng)	Indian Subcontinent to China (S. Yunnan, Guangdong) and Peninsula Malaysia (Langkawi), S. Hainan.	Fl.: Feb-Apr & Fr.: May-Sep	Leaves and fruit	Leaves are consumed as flavouring agent in curries, chutney and other food products. The extract of roots is used against kidney diseases.
51	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Tree	Khajur (H), Indian date palm (Eng.)	Indian Subcontinent to W. Myanmar	Fl.: Feb- Mar & Fr.: Apr-Jun	Fruit	Fruits are considered to have vital vitamins and minerals which has got lot of health benefits

Fig. 4 : a. *Gardenia latifolia* **b.** *Garuga pinnata* **c.** *Lannea coromandelica* **d.** *Lepisanthes tetraphylla* **e.** *Mangifera indica* **f.** *Manilkara hexandra* **g.** *Memecylon unbellatum* **h.** *Mimusops elengi.*

recorded taxa (Graph 1). It was further observed that out of 41 genera, the genera *Ficus* came out as a dominant genus with 4 species followed by *Dillenia* with 3 species and *Flacourtia*, *Diospyros*, *Annona*, *Garcinia* and *Miliusa* with 2 species. Moreover, out of 29 families, the dominant family was Moraceae represented by 5 species followed Rutaceae, Arecaceae, Clusiaceae, Dilleniaceae, Anacardiaceae and Sapotaceae havingeach of 3 species; Flacourtiaceae, Ebenaceae, Boraginaceae each represented by 2 species and the rest of the families were comprised by only one species each (Graph 2). Further, it was found that 34 species out of the total 51 species enlisted were native to Indian subcontinent and 17 were extended their distribution beyond to the Indian subcontinent.

Conclusion

The present work enlisted 51 Wild edible fruits plant of AJCBIBG, out of these most of the species have economic as well as medicinal importance. Besides, the

study also revealed that there are majority of the species were native to Indian subcontinent. The dominant families that came out from the study were Moraceae, Annonaceae, Arecaceae, Rutaceae, Anacardiaceae, Dilleniaceae, Clusiaceae and Sapotaceae. The habit of wild edible fruits was abundantly tree followed by shrub and lianas, respectively. Further phytochemical and nutraceutical studies of these edible species may provide better nutritional source for future.

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