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Documentation of Dye Yielding Plants in Ballari District, Karnataka

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Abstract:- The present research carried out survey on dye yielding plants of Ballari district, Karnataka from JAN-JULY (2023-24). Enumerated total 40 dye yielding plants belonging to 33 genera and 20 families, along with their vernacular name, habit, part used. Among plant families Fabaceae is dominant with 10 species followed by Combretaceae with 5 species and Asteraceae with 3 species emerged as three dominant families. The dye yielding plants were extracted by using various techniques. The study identified and extracted natural dyes from various plant sources.

Keywords:- *Natural Dyes, Floristic Diversity, Ballari District, Bio-Diversity Conservation.*

I. INTRODUCTION

In India there are more than 450 plants that can yield dyes. Dye-yielding plants, throughout human history, have been crucial for their ability to provide natural colorants that enrich textiles, artworks, cosmetics, and even medicinal preparations. These plants encompass a diverse array of species, each yielding unique pigments extracted from various parts such as roots, leaves, flowers, and barks. This study explores the botanical diversity, extraction methods of dye-yielding plants. Ancient cultures such as the Egyptians, Greeks, Romans, Chinese, and Indians utilized plant-based dyes extensively. For example, *Lawsonia inermis* as henna. *Terminalia chebula* flowers are used for producing yellow colour.

Dye-yielding plants derive their colouring properties from a diverse range of chemical compounds synthesized within their tissues. These compounds include flavonoids, anthocyanins, carotenoids, tannins, and alkaloids, among others. The colour produced vary widely depending on the plant species, its growth conditions, and the parts used for extraction. Natural dye plants and dyes produced by these plants have a very good demand in the national and international markets now a days use of such plants for dyeing our clothes is as old as our history (Dr.Nagaraj Parisara et al., 2016).

II. MATERIALS AND METHODS

- *Study Area:*

Ballari city is situated in the eastern part of Karnataka, the city covered over an area of 85.95 Km2 and is situated at an altitude of 485 M from the mean sea level. The coordinates of this city are 15˚ 09' North latitude to 76˚ 55' East longitude. The district has semi-arid to arid climate and hot summers with 600mm rainfall. Ballari vegetation consists of dry deciduous forests, scrublands, and grasslands.

III. EXTRACTION METHODS AND TECHNIQUES

The extraction of natural dyes from plants involves several techniques aimed at maximizing colour yield and stability. Traditionally, dyeing processes included methods such as boiling or soaking plant material in water or alcohol to release soluble pigments. Mordants, substances that facilitate the binding of dyes to fibers, were crucial in enhancing colour fastness and varying shades. Common mordants included alum, iron salts, and tannic acid, each influencing the final colour outcome. Modern extraction methods include advanced techniques such as solvent extraction, enzymatic extraction, and supercritical fluid extraction. These methods optimize the efficiency of pigment extraction while minimizing environmental impact and ensuring consistency in colour quality.

A variety of plant sources were explored for their dyeing potential. The colourful flowers, fruits, roots, leaves and barks of the trees were used for extracting the dyes (Nikita G.S. et al., 2017). The collected plant specimens were identified with the help of flora (https://powo.science.kew.org).

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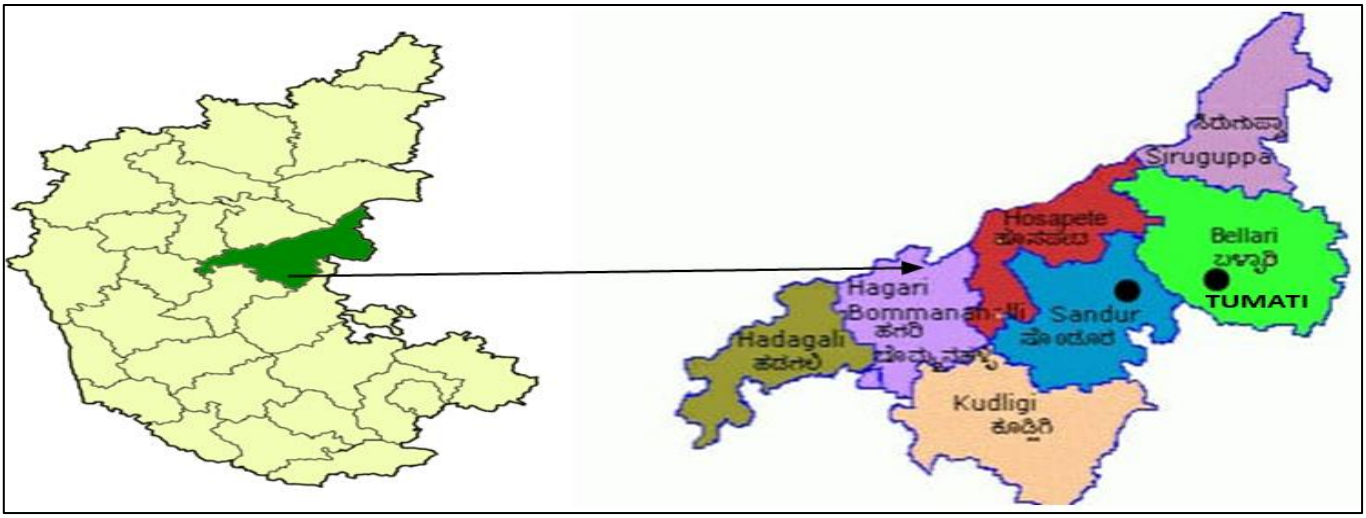

Fig 1 Location Map of Study Area

IV. RESULT AND DISCUSSION

The current research recorded total 40 dye yielding plants belonging to 33 genera and 20 families. Among 20 families the dominant top three families are Fabaceae (25%) with 10 species followed by Combretaceae (12.5%) with 5 species and Asteraceae (7.5%) with 3 species in fig 2.An evaluation of the 40 dye yielding species revealed that 27 species fell under Least concern category (67.5%), while 10 species were not applicable to the red list category (25%), followed by 1 species which fell under Data deficient category (2.5%), 1 species were listed as Endangered category (2.5%) and 1 species were listed as Vulnerable category (2.5%) in figure 3. Habit of plants shows most of them are 20 trees (50%), 13 shrubs (32.5%) and 7 herbs (17.5%) in fig 4. In terms of the Life forms the majority of dye yielding plants are 34 perennials (85%), followed by 5 annuals (12.5%) and 1 biennial (2.5%) in fig 5. Total 40 plant species were tabulated including botanical names vernacular name, IUCN status, habit, life forms, part used and dye in the table. Dyes extracted from the various plant parts are weak in nature and their permanency varies from plant to plant and traditional techniques of preparation. Use of multiple plants parts in a particular ratio may increase the longevity of dye. Sometimes special techniques viz. heat and cold treatment may increase dye stability. The selection of plants also depends on the colour choice, product type and purpose. (Sutradhar et al., 2015).

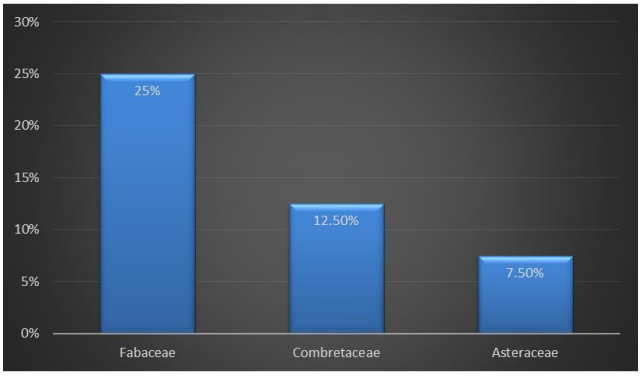

Fig 2 Top Three Families of Dye Yielding Plants

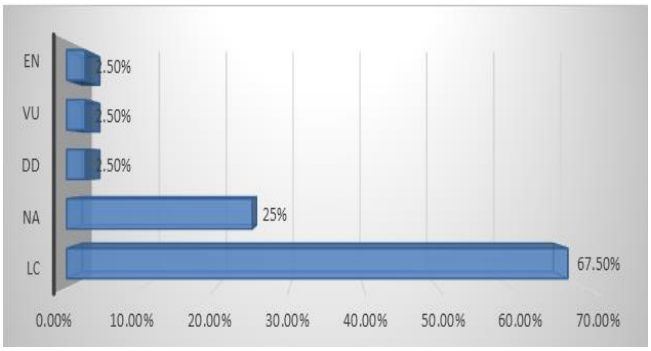

Fig 3 IUCN Status of Dye Yielding Plants.

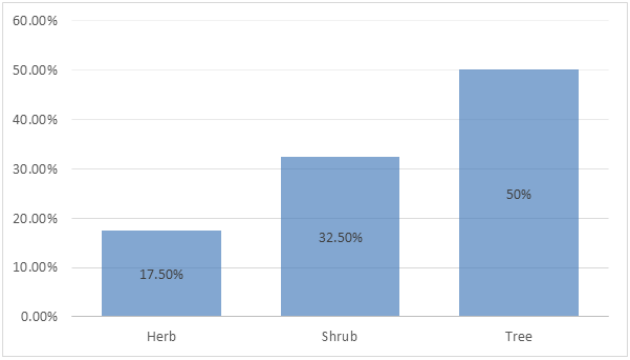

Fig 4 Habit of Dye Yielding Plants

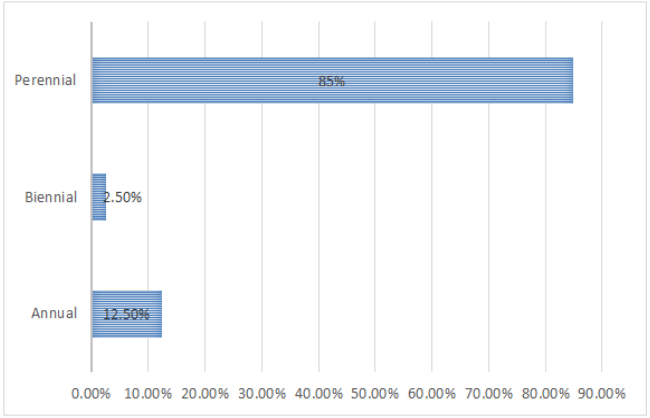

Fig 5 Life Forms of Dye Yielding Plants

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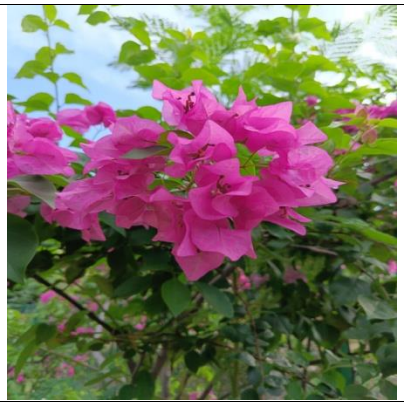
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Fig 6 A-*Annona squamosa* L. B-*Azadirachta indica* A.Juss. C-*Bougainvillea glabra* Choisy D-*Caesalpinia pulcherrima* (L.)Sw. E-*Cassia fistula* L. F-*Clitoria ternatea* L. G-*Delonix regia* (Bojer ex Hook.) Raf. H-*Euphorbia tirucalli* L. I-*Helianthus annuus* L.

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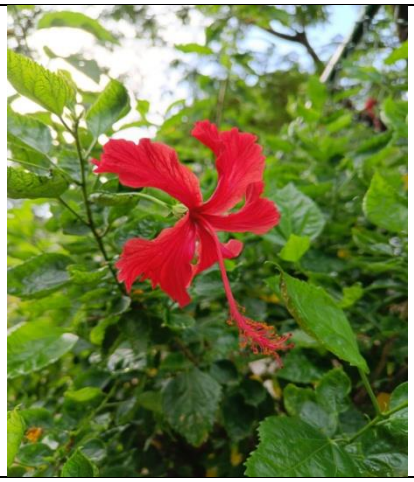
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Fig 7 J-*Hibiscus rosa-sinensis* L. K-*Ixora coccinea* L. L- *Mangifera indica* L. M-*Nerium oleander* L. N-*Ocimum tenuiflorum* L. O-*Punica granatum* L P-*Tecoma stans* (L.) Juss. ex Kunth Q-*Terminalia catappa* L. R- *Vachellia nilotica* (L.)P.J.H.Hurter and Mabb.

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Table 1 Dye Yielding Plants of Ballari District

SL.No	Name of the species	Family	Vernacular name	IUCN	Habit	Life forms	Part used	Dye
1	*Achyranthes aspera* L.	Amaranthaceae	Uttarani	NA	H	A	Entire plant	Auxillary
2	*Allium cepa* L.	Amaryllidaceae	Ullaagedde	NA	H	B	skin of bulb	Yellow to orange
3	*Annona squamosa* L.	Annonaceae	Sitaphala	LC	T	P	Fruit	Greenish-yellow
4	*Azadirachta indica* A.Juss.	Meliaceae	Turakabevu	LC	T	P	Bark	Brown
5	*Butea monosperma* (Lam.)Kuntze	Fabaceae	Brahmavrksha	LC	T	P	Flowers	Red, Orange
6	*Bauhinia purpurea* L.	Fabaceae	Kanchuvaala	LC	T	P	Bark	Brown
7	*Bougainvillea glabra* Choisy	Nyctaginaceae	Kaagadada hoo	LC	S	P	Flowers	Red-purple
8	*Caesalpinia pulcherrima* (L.)Sw.	Fabaceae	Ratnagandhi	LC	S	P	Flowers	Red
9	*Carthamus tinctorius* L.	Asteraceae	Kusube	NA	H	A	Flowers	Yellow, red
10	*Cassia fistula* L.	Fabaceae	Aaragu	LC	T	P	Bark/fruit	Dark brown
11	*Clitoria ternatea* L.	Fabaceae	Shankha pushpa	NA	S	P	Flowers	Blue
12	*Dalbergia sissoo* Roxb. ex DC.	Fabaceae	Indian rosewood	LC	T	P	Bark	Dark brown
13	*Delonix regia* (Bojer ex Hook.) Raf.	Fabaceae	Kattikaayi mara	LC	T	P	Flowers	Red
14	*Euphorbia tirucalli* L.	Euphorbiaceae	Bontakalli	LC	T	P	Wood	Auxillary
15	*Helianthus annuus* L.	Asteraceae	Suryamukhi	LC	H	A	Flowers	Yellow
16	*Hibiscus rosa-sinensis* L.	Malvaceae	Dasavala	NA	S	P	Flowers	Black
17	*Ixora coccinea* L.	Rubiaceae	Jungle geranium	NA	S	P	Flowers	Yellow
18	*Jatropha curcas* L.	Euphorbiaceae	Kananeranda	LC	S	P	Bark/leaves	Blue
19	*Lawsonia inermis* L.	Lythraceae	Madarangi	LC	S	P	Leaves	Red
20	*Magnolia champaca* (L.) Baill. ex Pierre	Magnoliaceae	Sampige	LC	T	P	Flowers	Yellow
21	*Mangifera indica* L.	Anacardiaceae	Maavu	DD	T	P	Bark/leaves	Yellow
22	*Nerium oleander* L.	Apocynaceae	Kaner	LC	S	P	Root/bark	Grey
23	*Nyctanthes arbor-tristis* L.	Oleaceae	Parijata	LC	S	P	Flower stalk	Yellow
24	*Ocimum tenuiflorum* L.	Lamiaceae	Tulasi	NA	H	P	Leaves	Green
25	*Phyllanthus emblica* L.	Phyllanthaceae	Betta nelli	LC	T	P	Fruit/bark	Brown
26	*Phyllanthus reticulatus* Poir.	Phyllanthaceae	Karihuli	LC	S	P	Fruits	Reddish purple
27	*Psidium guajava* L.	Myrtaceae	Seebe	LC	S	P	Bark	Brown
28	*Punica granatum* L.	Lythraceae	Daalimbe	LC	S	P	Flower/fruit	Yellow
29	*Senna tora* (L.) Roxb.	Fabaceae	Chagate	NA	H	A	Seeds	Brown
30	*Senegalia catechu* (L.f).P.J.H.Hurter and Mabb.	Fabaceae	Kaachu	LC	T	P	Bark/wood	Brown
31	*Syzygium cumini* (L.) Skeels.	Myrtaceae	Neredu	LC	T	P	Fruits	Grey

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32	*Tagetes erecta* L.	Asteraceae	Chendu mallige	NA	H	A	Flowers	Yellow
33	*Tecoma stans* (L.) Juss. ex Kunth	Bignoniaceae	Koranechellar	LC	S	P	Flowers	Yellow
34	*Tectona grandis* L.f.	Lamiaceae	Tegu	EN	T	P	Young leaves	Yellow
35	*Terminalia arjuna* (Roxb. ex DC.) Wight and Arn	Combretaceae	Torematti	NA	T	P	Bark,woodash	Brown,auxillary
36	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Taarekaayi	LC	T	P	Wood	Auxillary
37	*Terminalia catappa* L.	Combretaceae	Kaadubaadaami	LC	T	P	Bark	Brown
38	*Terminalia chebula* Retz.	Combretaceae	Harade	LC	T	P	Root/bark	Black
39	*Terminalia pallida* Brandis	Combretaceae	White gallnut	VU	T	P	Fruit	Brown,black
40	*Vachellia nilotica* (L.)P.J.H.Hurter and Mabb.	Fabaceae	Karijaali	LC	T	P	Fruit rind	Reddish brown

Note: IUCN status- LC = Least concern, NA = Not applicable, VU = Vulnerable, DD = Data Defecient; **Habit-** H = Herb, S = Shrub, T = Tree; **Life Forms-** P = Perennials, A = Annuals, B = Biennals.

V. ACKNOWLEDGMENT

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VI. CONCLUSION

Dye-yielding plants represent a rich and enduring resource that has shaped human culture, industry, and art throughout history. From ancient civilizations to modern innovations, these plants have provided natural colorants that not only beautify textiles, artworks, cosmetics, and medicinal preparations. The future of dye-yielding plants promises continued innovation and integration into diverse sectors such as fashion, cosmetics, and healthcare. Advances in biotechnology, agricultural practices, and dyeing techniques will further enhance the efficiency and accessibility of natural dyes, ensuring their viability in a rapidly changing world.

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