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SURVEY OF NATURAL DYE YIELDING PLANTS IN VELLAMCODE PANCHAYATH, KANYAKUMARI DISTRICT, TAMILNADU, SOUTH INDIA

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ABSTRACT

India is known across the world for its rich biodiversity and its flora and fauna. Natural dyes are the way ahead for the textile industry and with the anticipated increase in demand in the upcoming decade it becomes essential that an extensive research is done to ensure that there are plans and guidelines in place to protect our biodiversity while maintaining the increase in demand. Natural dyes are derived from natural elements like plants, animals, minerals and microbial sources. Plants are considered to be the major source of natural dyes. In this current investigation, the number of dye yielding plants and the availability of natural dyes are recorded.

INTRODUCTION

Production of natural dyes by utilizing the correct combination of mordants and pH value can help derive multiple colors, and at the same time have minimalistic impact on the environment. Today natural dyes are a part of an untapped market and are utilized for dying all forms of fabrics like cotton, hemp, yarn, silk, etc (Kothari *et al.*, 2021).

Many of the plants used for dye extraction have recently been revealed antimicrobial activity (Joylani *et al.*, 2013). Some other sources of plant dyes rich in naphthoquinones such as lawsone from *Lawsonia inermis* L. (henna), juglone from walnut and lapachol from alkanet are reported to exhibit antibacterial and antifungal activity (Gerson, 1975; Wagner *et al.*, 1989).

Optimized natural dye powders of *Acacia catechu* (L.f.) Willd, *Rubia cordifolia* L. and *Rumex maritimus*, *Kerria lacca*, were obtained from commercially and they showed antimicrobial activities (Clinton, 1998; Rae and Agarwal, 1999).

Pomegranate fruit not only used as natural dye it also having traditional medicinal value (Al-Maiman and Ahnad,2002) is now supported by data obtained from modern science showing that the fruit contains anticarcinogenic (Adhami and Mukhtar, 2006) anti-microbial (Reddy *et al.*, 2007).

These colours are exhibited by various organic and inorganic molecules and their mixture is due to the absorption of light in the visible region of 400-800 nm (Chengaiah *et al;* 2010). Natural dyes are colourants which can be derived from plants, minerals and animals; capable to dye other substances such as textile material, leather, food, medicine etc. This technique of dyeing was practiced by ancient people before thousands of years (Geelani *et al.*, 2015; Prabhu and Bhute, 2012).

The different sources of natural colour have been found mentioned in Vedas and Bible (Ado *et al.*, 2014). Due to this huge amount of synthetic dye production, its non biodegradable effluent is now a major pollutant to environment (Geelani *et al.*, 2016; Aminoddin and Haji, 2010; Arun and Yogamoorthi, 2014).

Recently a ban on synthetic dye use has been imposed by European Economic Community, Germany, USA and India to protect the eco system from harmful, carcinogenic chemicals (Prabhu and Bhute, 2012). As a result natural dye started regaining interest in textile industries for its non toxic, environment friendly nature (Yusuf *et al.*, 2016).

India is a country with large, diverse ethnic societies and also rich in biodiversity. There are 45,000 species of wild plants out of which 9,500 species are reported as ethnobotanically important species (Kumaresan *et al.*, 2011). Colour depends on

the part of the plant and the shades may vary upon season and extraction protocols (Siva, 2007).

Herbal dyes require mordant that help to attach dye to the fiber. Mordant may be metallic salts of aluminium, iron, chromium or copper. Herbal dyes suit best with natural fiber of cotton, linen, wool, silk and jute (Wanyama *et al.,* 2010). Cotton dyeing needs complex process of pretreatment before it absorbs any dye (exception indigo). On the other hand wool or silk fibers absorb quite easily (Samanta and Agarwal, 2009).

With the advent of synthetic dyes competes with natural dyes and almost completely replaced the latter within a century (Maxia *et al.,* 2013). Productions of synthetic dyes make use of petrochemical source, and some of these dyes contain carcinogenic amines (Haji, 2011).

Synthetic materials and their products are more complex; it will take a long time for decomposing and return to nature hence causes environmental pollution (Lal *et al.,* 2011). Research has shown that most of the synthetic dyes cause health-related problems, as it decreases food intake capacity, growth and fertility rate, causes damage to liver, spleen, kidney, and heart; inflicts lesions on skin, eyes, lungs and bones (Sinha *et al.,* 2012).

Dye compounds from natural resources especially from plants are increasingly becoming important alternatives to synthetic dyes for use in the textile industry (Deo and Desai, 1999; Gokhale *et al.,* 2004; Samanta and Agarwal, 2009). Unlike synthetic dyes which have been found to be toxic and harmful to the environment, natural dyes are biodegradable, non-toxic and generally have higher compatibility with the environment when compared with their synthetic counterparts (Maria *et al.,* 2010).

They can provide a wide range of beautiful shades with acceptable levels of colour fatness (Ekrami *et al.,* 2011). Hence there is considerable research work being undertaken across the world on the application of natural dyes in the textile industry and the return to the use of natural dyes as important alternatives to synthetic dyes (Acguah and Oduro, 2012).

Reports from India alone highlight an abundance of dyeyielding plants from whose different parts extraction of colour components for textile application and commercialization is gaining prominence in that part of the world (Mayunga, 2007).

Plants have had a long history of use on the African continent, inspiring enormous research efforts to prospect for lead natural products for drug and foreign research groups (Mayunga, 2007).

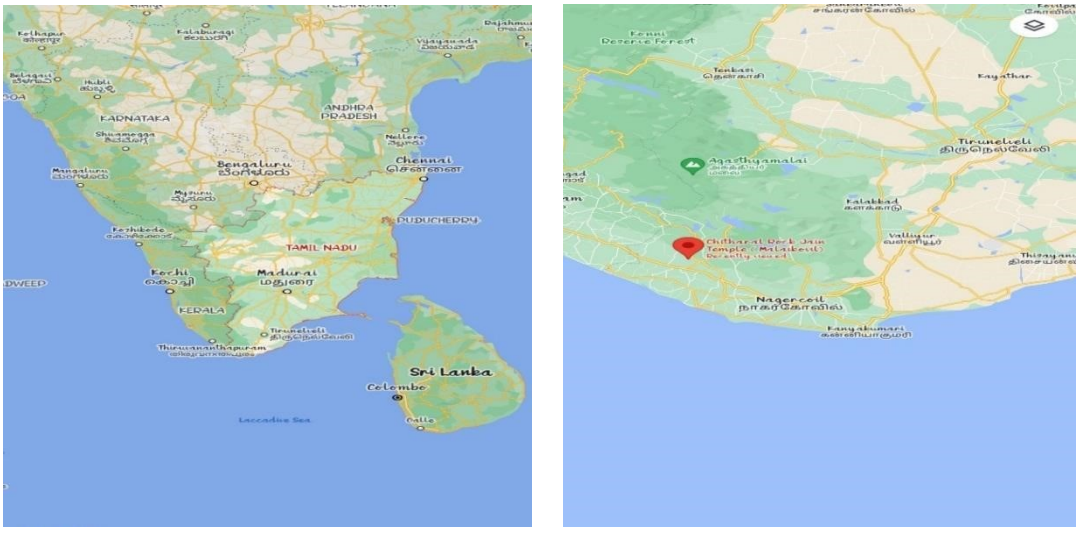
METHODOLOGY

Study Area

The study area Vellamcode Panchayath is situated in Vilavancode taluk, Kanyakumari district, Tamil Nadu, India. Vellamcode is a village in Melpuram Block in Kanniyakumari District of Tamil Nadu, India. It is located 33 km towards west from District head quarters Nagercoil, 5 km from Melpuram, 724 Km from Chennai. The latitude is 8.079625 and longitude is 77.5538635 are the geo-co-ordinate of Vellamcode. According to Census 2011 information, the location code or village code of Vellamcode village is 643107. Vilavancode is nearest town to Vellamcode village for all major economic activities (Plate 1).

Vellamcode panchayath has population of 12,715 of which 6,256 are males while 6,456 are females. Population of children with age of 0-6 is 1217 which 9.57% of total population of Vellamcode. The summers are much rainier than the winters in the study area. The summers are much rainier than the winters in the study area. The average temperature is 26.9 °C or 80.4 °F. Temperature is 27 °C. Rainfall is 11%. There will be 60% change of rain in the day time and 60% change in night. Highest temperature in and around the village will be 31 °C. Low temperature in and around the village will be 27 °C.

PLATE 1- STUDY AREA MAP



Documentation

A field survey was conducted from January 2022 to March 2022 (3 months), to record the natural dye yielding plants are growing in different parts of Vellamcode Panchayath. One visit was made at every week end. The identification of plant was done using taxonomic literatures (Gamble and Fischer, 1915; Mathew, 1983; Nair and Henry, 1983) and with the help of experts. All the voucher specimens were maintained in the herbarium of Department of Botany, S.T.Hindu College, Nagercoil.

RESULTS AND DISCUSSIONS

The present study is a first attempt to compile a list of dye yielding flowering plant resources in the study area. The present study revealed that the natural dye yielding plants of the study area. A total of 56 plant species under 34 families (table 1, 2 & 3). Among the 34 families, Fabaceae was the dominant family with 6 species followed by Caesalpinioideae, Moraceae with 4 species each, Rubiaceae with 3 species, Apocynaceae, Asteraceae, Combretaceae, Euphorbiaceae, Lamiaceae, Lythraceae, Nyctaginaceae, Rosaceae, Solanaceae with 2 species; Acanthaceae, Amaranthaceae, Anacardiaceae, Annonaceae, Arecaceae, Basellaceae, Bignoniaceae, Boranginaceae, Casuarinaceae, Liliaceae, Malvaceae, Meliaceae, Mimosaceae, Myrtaceae, Nymphaceae, Oleaceae, Phytoloccaceae, Rutaceae, Utricaceae, Verbinaceae, Zingiberaceae contain single species each (Table.3).

Based on the percentage composition, the family Fabaceae (10.7%), Caesalpinioideae, Moraceae (7.1%), Rubiaceae (5.3%), Apocynaceae, Asteraceae, Combretaceae, Euphorbiaceae, Lamiaceae, Lythraceae, Nyctaginaceae, Rosaceae, Solanaceae (3.5%), Acanthaceae, Amaranthaceae, Anacardiaceae, Annonaceae, Arecaceae, Basellaceae, Bignoniaceae, Boranginaceae, Casuarinaceae, Liliaceae, Malvaceae, Meliaceae, Mimosaceae, Myrtaceae, Nymphaceae, Oleaceae, Phytoloccaceae, Rutaceae, Utricaceae, Verbinaceae

and Zingiberaceae (1.7%) are distributed in the study area (Table 2).

Based on the mode of regeneration of identified natural dye yielding plants, 27 species are regenerated by seeds, followed by 18 species are by cutting, 4 species are by stem cutting, 3 species are by grafting, 3 species are by root cutting, 1 species are by rhizome. Among the collected plants, a part from the dye yielding properties, 54 plants are used as medicinal, 45 plants are grown as ornamental.

The study revealed that, the different plant parts like leaves, flower, seed, bark, rhizome, nut, fruits, whole plants, peel are used by the local people of study area (Table 3). Based on the useful parts in 18 plants, dye are derived from flowers (*Albizia julibrissin, Alysicarpus vaginalis,Bouganivillea spectabilis, Caesalpinia pulcherrima, Catharanthus roseus, Celosia cristata, Clitoria ternatea, Combretum indicum, Hibiscus rosa-sinensis, Ixora coccinea, Mirabilis jalapa , Nerium oleander, Nyctanthes arbor- tristis, Nymphaea nouchali, Rosa chinensis, Sphagneticola trilobata, Tagetes erecta, Tecoma stans*); in 13 plants, leaves are used to prepare dye (*Duranta repens, Heliotropium indicum, Indigofera tinctoria, Justica adhatoda, Lawsonia inermis, Mangifera indica, Mimosa pudica, Murraya koenigii, Psidium guajava, Tamarindus indica,Tectona grandis, Terminalia catappa, Urtica dioica*); in 10 plants, dyes are derived from fruits (*Annona reticulata, Gardenia jasminoides, Mallotus philippensis, Morus alba, Phyllanthus emblica, Prunus avium, Punica granatum, Rivina humilis, Solanum lycopersicum, Solanum nigrum*); in 8 plants, bark are used to derive dyes (*Acacia mangium, Artocarpus heterophyllus, Azadirachta indica, Cassia fistula, Casuarina equisetifolia, Ficus religiosa, Morinda tinctoria, Senegalia catechu*); in 2 plants, whole plants are used to make dyes (*Aloe vera , Basella alba*); in 2 plants, seeds are used to produce dye (*Clerodendrum infortunatum, Senna tora*); in 1 plant, dried rhizome are used (*Curcuma longa*); in 1 plant, nuts are used to derive dyes *(Areca catechu*); in 1 plant dyes are derived from, peel or core (*Artocarpus altilis*) (Table. 3).Flowers were the dominant dye yielding parts in 23 sps and followed by leaves (19) fruits (11), roots (1), rhizome (1), peel (1) etc.

The family Fabaceae has the largest number of dye yielding taxa (6) followed by Caesalpinioideae, Moraceae with (4) species each, Rubiaceae with (3) species, Apocynaceae, Asteraceae, Combretaceae, Euphorbiaceae, Lamiaceae, Lythraceae, Nyctaginaceae, Rosaceae, Solanaceae with (2) species, Acanthaceae, Amaranthaceae, Anacardiaceae, Annonaceae, Arecaceae, Basellaceae, Bignoniaceae, Boranginaceae, Casuarinaceae, Liliaceae, Malvaceae, Meliaceae, Mimosaceae, Myrtaceae, Nymphaceae, Oleaceae, Phytoloccaceae, Rutaceae, Utricaceae, Verbinaceae, Zingiberaceae families are represented by a single taxon (Table.3). The plant parts used in extracting colour include peel (1), fruit (11), Leaves (19), root (1), flowers (23), bark (9) and the whole plant (1). The identified plants produced the different colours like Yellow (14), red (11), grey (2), black (9) and blue (5). There was *Hibiscus rosa-sinensis* L. with more than one plant part in use.

India is known to possess more than 450 taxa that yield herbal dyes. Among them 50 are considered as most important and they possess various medicinal properties (Siva, 2007). Genetic variations in dye content in *Bixa orellana* is also reported by Siva and Krishnamurthy (Siva and Krishnamurthy, 2005). Natural dye yielding plants and its ethnic knowledge from the tribals in Achanakmar-Amarkantak Biosphere reserve of Chhattisgarh was documented as an initial step to conserve ethnic knowledge (Tiwari and Ajay Bharat, 2008).

An extensive survey of dye yielding plants Garhwal Himalaya reported 46 plants of different families. The study is an aid to the availability, extraction of natural dyes from the selected plants and its application textile making (Sharma Antima *et al.*, 2012). Previous studies, from Maharashtra recorded are either for local regions or for specific taxa. Most of the reports are ambiguous or erroneous.

Patil and Shisode (2017) have documented 53 Angiosperm species as natural dye yielding sources in Khandesh region. Gokhale *et al*. (2004) reported 500 dye types from indigenous species from India. Among other considerable studies Siva (2007) reported 88 dye resources. Kar and Borthakur (2008) have reported 47 dye yielding plants from Assam.

Sutradhar *et al*. (2015) have made an attempt to document dye yielding plant resources from Tripura, which incorporates 39 species distributed under 35 genera and 26 families. The present findings record Fabaceae as a most dominant natural dye yielding family, which is in congruence with studies by Sutradhar *et al*. (2015).

Light fastness characteristics of dyes is influenced by the mordanting method and fibres used (Samanta and Agarwal, 2009). In addition, light fastness depends on the chemical structure of dye molecule and the nature of the dye-yielding plant (Siva, 2007).

TABLE 1: SURVEY OF NATURAL DYE YIELDING PLANTS IN THE STUDY AREA.

S.NO	NAME OF PLANTS	FAMILY	COMMON NAMES	HABIT
1.	*Acacia mangium* Willd.	Fabaceae	Black wattle	Tree
2.	*Albizia julibrissin* Durazz.,	Fabaceae	Silktree mimosa	Tree
3.	*Aloe vera* (L.)	Liliaceae	Aloe	Herb
4.	*Alysicarpus vaginalis* (L.) DC	Fabaceae	Alyce clover	Herb
5.	*Annona reticulata* L.	Annonaceae	Sugar apple	Tree
6.	*Areca catechu* L.	Arecaceae	Betel-nut palm	Tree
7.	*Artocarpus altilis* (Parkinson)Fosberg	Moraceae	Bread fruit	Tree
8.	*Artocarpus heterophyllus* Lam.	Moraceae	Jack fruit	Tree
9.	*Azadirachta indica* A.Juss	Meliaceae	Neem	Tree
10.	*Basella alba* L.	Basellaceae	Malabar spinach	Herb
11.	*Bougainvillea spectabilis* Willd.	Nyctaginaceae	Paper poo	Shrub
12.	*Caesalpinia pulcherrima* (L.)	Caesalpinioideae	Peacock flower	Shrub
13.	*Cassia fistula* L.	Caesalpinioideae	Golden shower tree	Tree
14.	*Casuarina equisetifolia* L.	Casuarinaceae	Beach casuarina,Chavukku	Tree
15.	*Catharanthus roseus* (L.)	Apocynaceae	Bright eyes, Old maid	Herb
16.	*Celosia cristata* (L.)	Amaranthaceae	Cockscomb	Herb
17.	*Clerodendrum infortunatum* L.	Lamiaceae	Hill glory bower	Shrub
18.	*Clitoria ternatea* L.	Fabaceae	Bluebell vine, Blue pea	Herb
19.	*Combretum indicum* (L.)	Combretaceae	Rangoon creeper	Shrub
20.	*Curcuma longa* L.	Zingiberaceae	Turmeric	Herb
21.	*Duranta repens* L.	Verbenaceae	Golden dewdrop	Shrub
22.	*Ficus religiosa* L.	Moraceae	Arasa maram	Tree

23.	*Gardenia jasminoides* J.Elis	Rubiaceae	Cape jasmine	Shrub
24.	*Heliotropium indicum* L.	Boranginaceae	Indian turnsole	Herb
25.	*Hibiscus rosa-sinensis* L.	Malvaceae	Chembaruthi	Shrub
26.	*Indigofera tinctoria* L.	Fabaceae	True indigo	Herb
27.	*Ixora coccinea* L.	Rubiaceae	Scarlet Jungle Flame	Shrub
28.	*Justica adhatoda* L.	Acanthaceae	Malabar nut	Shrub
29.	*Lawsonia inermis* L.	Lythraceae	Henna Tree	Tree
30.	*Mallotus philippensis* (Lam)Muell.Arg	Euphorbiaceae	Kamala tree	Tree
31.	*Mangifera indica* L.	Anacardiaceae	Mango	Tree
32.	*Mimosa pudica* L.	Mimosaceae	Sensitive plant	Herb

S.NO	NAME OF PLANTS	FAMILY	COMMON NAMES	HABIT
33.	*Mirabilis jalapa* L.	Nyctaginaceae	Four o'clock	Herb
34.	*Morinda tinctoria* Roxb.	Rubiaceae	Indian mulberry	Tree
35.	*Morus alba* L.	Moraceae	White mulberry	Tree
36.	*Murraya koenigii* (L.)	Rutaceae	Curry leaf	Shrub
37.	*Nerium oleander* L.	Apocynaceae	Nerium	Shrub
38.	*Nyctanthes arbor-tristis* L.	Oleaceae	Night blooming jasmine	Shrub
39.	*Nymphaea nouchali* Burm.F.	Nymphaeaceae	Blue lotus	Herb(aquatic)
40.	*Phyllanthus emblica* L.	Euphorbiaceae	Indian gooseberry	Shrub
41.	*Prunus avium* L.	Rosaceae	Sweet jerry	Tree
42.	*Psidium guajava* L.	Myrtaceae	Guava	Tree
43.	*Punica granatum* L.	Lythraceae	Pomegranate	Shrub
44.	*Rivina humilis* L.	Phytoloccaceae	Blood berry	Herb
45.	*Rosa chinensis* Jacq.	Rosaceae	China rose	Shrub
46.	*Senegalia catechu* (L.f)	Caesalpinioideae	Cutch tree	Tree
47.	*Senna tora* (L.)	Caesalpinioideae	Sicklepod,Sickle Senna	Herb

48.	*Solanum lycopersicum* L.	Solanaceae	Tomato	Herb
49.	*Solanum nigrum* L.	Solanaceae	Black nightshade	Shrub
50.	*Sphagneticola trilobata* (L.)	Asteraceae	Yellow Creeping Daisy	Herb
51.	*Tagetes erecta* L.	Asteraceae	African marigold	Herb
52.	*Tamarindus indica* L.	Fabaceae	Tamarind	Tree
53.	*Tecoma stans* (L.)	Bignoniaceae	Trumpet bush	Shrub
54.	*Tectona grandis* L.F	Lamiaceae	Teak	Tree
55.	*Terminalia catappa* L.	Combretaceae	India almond	Tree
56.	*Urtica dioica* L.	Utricaceae	Stinging nettle	Herb

TABLE 2: DOMINANT FAMILIES OF IDENTIFIED NATURAL DYE YIELDING PLANTS IN THE STUDY AREA.

S.NO	FAMILY	NUMBER OF PLANTS	% OF COMPOSITION
1.	Acanthaceae	1	1.7
2.	Amaranthaceae	1	1.7
3.	Anacardiaceae	1	1.7
4.	Annonaceae	1	1.7
5.	Apocynaceae	2	3.5
6.	Arecaceae	1	1.7
7.	Asteraceae	2	3.5
8.	Basellaceae	1	1.7
9.	Bignoniaceae	1	1.7
10.	Boranginaceae	1	1.7
11.	Caesalpinioideae	4	7.1
12.	Casuarinaceae	1	1.7
13.	Combretaceae	2	3.5
14.	Euphorbiaceae	2	3.5

15.	Fabaceae	6	10.7
16.	Lamiaceae	2	3.5
17.	Liliaceae	1	1.7
18.	Lythraceae	2	3.5
19.	Malvaceae	1	1.7
20.	Meliaceae	1	1.7
21.	Mimosaceae	1	1.7
22.	Moraceae	4	7.1
23.	Myrtaceae	1	1.7
24.	Nyctaginaceae	2	3.5
25.	Nymphaceaceae	1	1.7
26.	Oleaceae	1	1.7
27.	Phytoloccaceae	1	1.7
28.	Rosaceae	2	3.5
29.	Rubiaceae	3	5.3
30.	Rutaceae	1	1.7
31.	Solanaceae	2	3.5
32.	Utricaceae	1	1.7
33.	Verbenaceae	1	1.7
34.	Zigiberaceae	1	1.7

TABLE 3: PLANT SPECIES AND THEIR PART USED TO PRODUCE COLOR SHADES

S.NO	NAME OF PLANTS	PARTS USED	COLOR
1.	*Acacia mangium* Willd.	Bark	Methyl orange
2.	*Albizia julibrissin* Durazz.,	Flower or Leaves	Lime Green
3.	*Aloe vera* (L.)	leaves	Golden yellow
4.	*Alysicarpus vaginalis* (L.) DC	Flower	Red
5.	*Annona reticulata* L.	Fruits and shoots	Bluish black

6.	*Areca catechu* L.	Nuts	Brown
7.	*Artocarpus altilis* (Parkinson)Fosberg	Peel and Core	Methyl blue
8.	*Artocarpus heterophyllus* Lam.	Bark	Yellow
9.	*Azadirachta indica* A.Juss	Bark	Pale green
10.	*Basella alba* L.	Whole plant	Deep purple
11.	*Bougainvillea spectabilis* Willd.	Flower	Yellow
12.	*Caesalpinia pulcherrima* (L.)	Flowers	Pale violet
13.	*Cassia fistula* L.	Bark, Flower, Fruit	Brown,Black,Yellow
14.	*Casuarina equisetifolia* L.	Bark	Light reddish brown
15.	*Catharanthus roseus* (L.)	Flower	Purple violet
16.	*Celosia cristata* (L.)	Flower	Red
17.	*Clerodendrum infortunatum* L.	Seed, Flower	Red, Black
18.	*Clitoria ternatea* L.	Flower	Deep blue
19.	*Combretum indicum* (L.)	Flower	Red
20.	*Curcuma longa* L.	Dried Rhizome	Yellow
21.	*Duranta repens* L.	Fruit, Flowers	Light blue
22.	*Ficus religiosa* L.	Bark, Leaves	Red pinkish
23.	*Gardenia jasminoides* J.Elis	Fruit	Yellow
24.	*Heliotropium indicum* L.	Leaves	Black
25.	*Hibiscus rosa-sinensis* L.	Flower, Leaves	Red,Blue,Purple
26.	*Indigofera tinctoria* L.	Leaves (or) Flower	Deep blue to indigo
27.	*Ixora coccinea* L.	Flower	Violet
28.	*Justica adhatoda* L.	Leaves	Yellow
29.	*Lawsonia inermis* L.	Leaves	Red, Bluish black
30.	*Mallotus philippensis* (Lam)Muell.Arg	Fruits	Red
31.	*Mangifera indica* L.	Leaves	Yellow, Brown
32.	*Mimosa pudica* L.	Leaves, Flower	Pink, Green
33.	*Mirabilis jalapa* L.	Flowers	Pink, Red
34.	*Morinda tinctoria* Roxb.	Bark	Bright orange-Red
35.	*Morus alba* L.	Fruit, Leaves, Bark	Brown-green/Green
36.	*Murraya koenigii* (L.)	Leaves, Seed	Black

37.	*Nerium oleander* L.	Flower	Green
38.	*Nyctanthes arbor-tristis* L.	Flower	Brown
39.	*Nymphaea nouchali* Burm.F.	Flower	White
40.	*Phyllanthus emblica* L.	Fruit	Black
41.	*Prunus avium* L.	Fruit and leaves	Grey, Green
42.	*Psidium guajava* L.	Leaves	Yellowish
43.	*Punica granatum* L.	Fruit	Red
44.	*Rivina humilis* L.	Berries	Red
45.	*Rosa chinensis* Jacq.	Flower	Red
46.	*Senegalia catechu* (L.f)	Leaves	Reddish brown
47.	*Senna tora* (L.)	Seeds	Yellow
48.	*Solanum lycopersicum* L.	Fruit	Yellow
49.	*Solanum nigrum* L.	Fruit	Brown-Black
50.	*Sphagneticola trilobata* (L.)	Flower	Pale yellow
51.	*Tagetes erecta* L.	Flower	Yellow
52.	*Tamarindus indica* L.	Leaves	Grey, Brown
53.	*Tecoma stans* (L.)	Flower	Yellow
54.	*Tectona grandis* L.F	Leaves, Bark	Yellow, Green
55.	*Terminalia catappa* L.	Leaves	Brown, Black
56.	*Urtica dioica* L.	Leaves	Yellowish green to olive green.

CONCLUSION

Moreover recently plant dyes regain their importance on account of their non-problematic and eco-friendly nature as compared to synthetic dyes. Some of the synthetic dyes are found to be associated with hazards affecting human life creating skin diseases and pulmonary problems. The environmentalists therefore, started searching the substitute of synthetic items which has lead to the use of more and more natural dyes. Nowadays fortunately, there is increasing awareness among people towards natural products. The awareness of global environmental problems has revived the interest in natural dyes. Currently, a large number of dye plants are assessed on the basis of their suitability for cultivation, yield, and dyeing quality.

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