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Biodiversity on some Natural Dye Yielding Plants in Thanjavur District

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Abstract

In recent years, there has been an increasing tendency towards the natural dyes due to the increasing awareness of toxicity and serious health hazards of synthetic dyes. Natural dyes find use in the colouring of textiles, drugs, cosmetics, etc., owing to their non-toxic effects; they are also used for colouring various food products. The present paper is based on extensive survey. Collection of ethanobotanical information and Biodiversity of Natural dye yielding plants in Thanjavur district. It has also been known that the natural dyes are not harmful and eco-friendly. The study report 30 dye yielding plant species belong to 21 families. Along with their botanical name, common name, family, general description, season of flowering & fruiting, traditional uses, plant parts used, colour and application of dye used are mentioned in this paper. Apart from medicinal uses, it also describes preparation of dyeing stuff. Use mordant and specific dye utilization to serve various purposes, including several of the new dye resources. The use of Natural dye has diminished over generations due to dearth of documentation and in old civilization the ayurvedic medicine says natural dyes contain plenty of medicinal properties. Keeping these points in view the present study will be carried out to the biodiversity and selected dye yielding plant were applied in cotton cloth. These studies revealed that these economically important dye-yielding plants need to be conserved.

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Introduction:-

In the human civilization plants are used not only for the basic needs of life such as food, fiber, fuel, cloths and shelter but also as sources of natural dyes for dyeing cloths, design and painting. A spectrum of beautiful natural colours ranging from yellow to black exists in the above sources. 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 [1].

India has a rich bio-diversity and it is not only one of the world's twelve mega diversity countries but also one of the eight major centre's of origin and diversification of domesticated taxa, it has approximately 49,000 plant species of which about 17,500 are angiosperms. The purpose of the present investigation is to study the flora of Thanjavur district in general and to find out prospective species of plants which are the sources of natural in particular dyes. As stated earlier. The natural dyes do not pose any threat to health of users which is not the case with synthetic dyes. Moreover the natural dyes are commonly available and because of their availability at cheaper cost there are within the reach of common man. The ubiquitous green pigment chlorophyll helping to capture sun's energy and convert it to chemical energy, to the beautiful vibrant colors of the flowers and fruits to attract insects or animals either for pollination or for the purpose of seed dispersal [2].

The dyeing process was practiced during the Indus river valley civilization at Mohenjodaro and Harappa (3500 BC), former Egyptian, and China period [3]. Moldenke (I.C) reports that an orange or yellow impermanent dye is made from corolla-tubes of *Nyctanthes arbor-tristis* Linn. for Buddhist robes in Sri Lanka [4]. Ancient times in India, traditionally 'Holi' was played with flowers petals or with natural colors obtained from different plant parts [5]. Different plant parts like 'Seuli'; 'Palash' were widely used for these purposes. That time of 'Holi' festivals were safe too because the natural dyes was not harmful for the human body, but recent times a few cheaper chemical dyes are commonly used broadly in the market as alternative of natural dyes creates different hazards like skin allergic, respiratory, kidney and liver diseases.

Research has shown that the natural dyes are quite safe and environment friendly [6]. The aim of the present investigation was carried out in Biodiversity of 30 natural dye yielding plants in Thanjavur district as a source of natural dye used traditionally by the ethnic communities and also prompt them to conserve the natural dye yielding plants in the state.

Development of synthetic dyes replaced almost all forms of natural dyes with better quality materials as they are more stable. Natural dyes are still in use but mostly limited to food stuff.

1.1 Synthetic dyes

In spite of the novelty value of their brilliant hues, the early artificial basic dyes, because of their poor - fastness, were not popular and even by the end of that century, were not fully accepted as a substitute of natural dyes. The first quarter of the twentieth century also saw the development of the chemical dyes. Verguin produced Magenta in 1859. [7]. The dyers and printers had dyestuff suitable for all the fibres then in use like acid, basic, azo, direct and sulphur.

1.2 Natural dyes

Natural dyes comprise those colourants (dyes and pigments) that are obtained from animal or vegetable matter without chemical processing [8]. Natural dyes are mostly non substantive and must be applied on textiles by the help of mordants, usually a metallic salt, having an affinity for both the colouring matter and the fibre [9].

2. MATERIAL AND METHODS

Various plants of the district shall be collected for extracting dyes depending upon the specific part of the plant resource. The information was recorded during this study was through direct observation and discussion with tribal villagers. Each species is arranged alphabetically and is correct botanical name, Local name, Family, General description, phenology and dye- yielding plant parts [6].

Preparation of plant powder [10]

One gram of flowers, leaves, roots and pedicel or any other plant parts were taken and made a fine powder, powder was added in 50ml of chemical (70%) solvent and the extract was shaken well for 30 minutes by free hand and wait for 24 hours. After the extracts were filtered was used for further analysis.

Extraction of Dye

The plant parts were cut into small pieces and put into distilled water and heated in a water bath for one hour and filter the extract. These extract were used for dyeing cotton fabric. All materials were thoroughly cleaned with distilled water and then after ground finely in the machine. Extraction was carried out throughout in aqueous media.

Mordant

Mordants are chemical additives that sometimes help a fiber accept a dye that it might otherwise reject. (The word mordant comes from the Latin "morders" which means "to bite"). Alum, Copper sulphate and Ferrous sulphate etc., is used as a Chemical Mordant.

There are three types of mordant: Metallic mordants: Metal salts of aluminium, chromium, iron, copper and tin are used. Tannins: Myrobalan and sumach are commonly used in the textile industry. Oil mordants: These are mainly used in dyeing turkey red colour from madder. The main function of the oil mordant is to form a complex with alum used as the main mordent.

Method of Fastness

The artificial light source method of determination of light fastness was used in this study. The specimens were exposed behind a glass and inserted into the light fastness testing machine. Exposure was carried out for 48hrs. Exposure was terminated after the contrast between the exposed and the unexposed portion of the specimen is equal to the grades on the grey scale, for assessing change in colour. Change in colour was assessed by comparing the tested fabric under a white light with standard as reference

Results and Discussion

The study report 30 dye yielding plant species belong to 20 families. Along with their botanical name, common name, family, general description, season of flowering & fruiting, traditional uses, plant parts used, colour and application of dye used shown in Table : 1.

Table: 1 Shows a Different Dye- Yielding Plants:

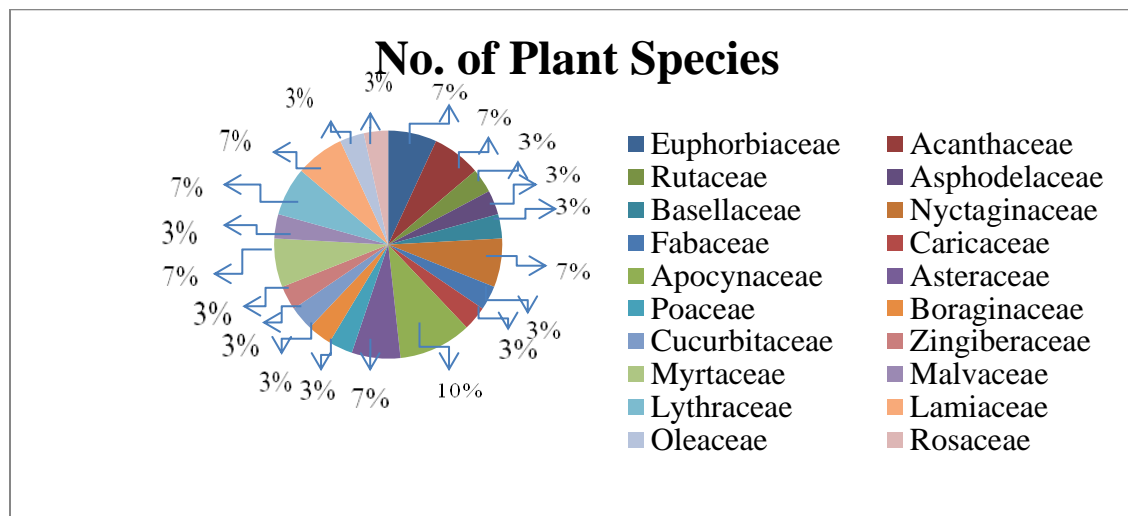
| S.No | Botanical Name | Common Name | Family & Parts Used | General Description | Season of Flowering & Fruiting | Traditional Uses |
|------|-----------------------------|---------------|-------------------------|---|--------------------------------|--|
| 1. | <i>Acalypha indica</i> | Indian Nettle | Euphorbiaceae Leaves | It is a Herbaceous Annual, It grows up to 60cm tall | Throughtout the year | anti-pyretic, anti-inflammatory, anti- cancer, anti- obesity |
| 2. | <i>Adhatoda vasica Nees</i> | Malabar Nut | Acanthaceae Leaves | Perennial, Evergreen Shrub, 1-3 feet (hgt) | Throughtout the year | Bronchitis, leprosy, blood disorder |
| 3. | <i>Aegle marmelos</i> | Beli Fruit | Rutaceae Fruit | Medium sized Deciduous tree, 12m(hgt) | May- June | To treat deafness, piles, laxative, good for heart & brain |
| 4. | <i>Aloe</i> | Aloea | Asphodelaceae | Perennial Succulent | July- Sep | Antioxidant, antibacterial, |

| | | | | | | |
|-----|--------------------------------|-----------------|---|--|--|---|
| | <i>barbadensis</i> | | Whole Plant | 30-61 cm (hgt) Plant, | | antibiotic, antiseptic |
| 5. | <i>Barleria cristata</i> | December Flower | Acanthaceae Flower | It grows as a Shrub, 60-100cm (hgt) | December | Diuretic, blood purifier |
| 6. | <i>Basella alba</i> | Inkberry | Basellaceae Fruit | 10m (hgt), Perennial, Climbing herb | Flower – May- Sep, Fruits ripen- July- Oct | Good herbal remedy for rheumatic pain |
| 7. | <i>Bougainvillea glabra</i> | Paper Flower | Nyctaginaceae Flower | Perennial, Climbing Shrub, 30 feet(hgt) | Throughout the year | It used to cure diarrhea, Cough, flower is used |
| 8. | <i>Caesalpinia pulcherima</i> | Caesalpinia | Fabaceae Flower | Tree, 5m tall | Throughout the year | Ulcers, inflammation, fevers, tumors, antimicrobial agent |
| 9. | <i>Carica papaya</i> | Papaya | Caricaceae Leaves, Fruit | Tree like Herb, 2-10m tall | Throughout the year | Blood pressure, dyspepsia |
| 10. | <i>Catharanthus roseus</i> | Graveyard | Apocynaceae Flower | Perennial, Sub Shrub | Jul- Sep | Relieving muscle pain, Diuretic |
| 11. | <i>Chrysanthemum indicum</i> | Chrysanthemum | Asteraceae Flower | Perennial Herb, It grows up to 0.6m | Flower – Aug- Sep | Inflammation of throat, itchiness of the skin and hypertension |
| 12. | <i>Chrysopogon zizanioides</i> | Bunch Grass | Poaceae Fruit | 2- 5m(hgt), It is a Perennial bunch Grass | Rainy Season | Blood purifier, skin disorder |
| 13. | <i>Clitoria ternatea</i> | Butterfly Pea | Fabaceae Flower | Perennial twining herb, 3cm | July-Dec | Antistress, Anxiolytic, antidepressant, anticonvulsant |
| 14. | <i>Coccinia grandis</i> | Ivy Gourd | Cucurbitaceae Fruit | It is a Dioecious, Perennial, Herbaceous vine, 9-28m long | Flower – Aug- Sep | Reduce blood pressure, anti-pyretic, anti-inflammatory, antiulcer, antidiabetic, |
| 15. | <i>Cordia sebestena</i> | Scarlet Cordia | Boraginaceae Leaves | It is a Small to Moderate Sized deciduous tree, Stem Bark is grayish brown | Throughout the year | Gastrointestinal disorders, antibacterial, |
| 16. | <i>Curcuma longa</i> | Turmeric | Zingiberaceae Rhizomes (underground stem) | Perennial Herb, 1m(hgt) | Flowering July- Nov | Rhizomes are used as condiment; also used as stomachic, tonic, blood purifier, antiseptic |
| 17. | <i>Eclipta prostrata</i> | False Daisy | Asteraceae Whole Plant | Annual Herb, 75cm (hgt) | Flower- August | Leaf extract is used powerful liver tonic and especially good for the hair and skin |

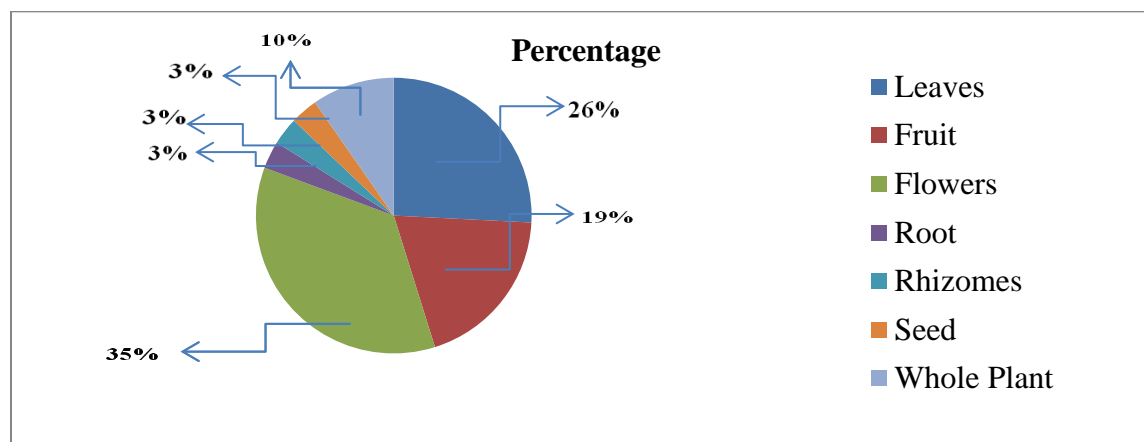
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|-----|---------------------------------|--------------------------------|----------------------------|---|---|---|
| 18. | <i>Eucalyptus globules</i> | Eucalyptus | Myrtaceae Young leaves | Tall Evergreen Tree,150-180 feet(hgt) | Jan- Aug | It used to cure cough, astringent. |
| 19. | <i>Hemidesmus indicus</i> | Nannari | Apocynaceae Whole Plant | Prostrate (or) Semi- erect Shrub, Roots are woody & Aromatic | Rainy Season | Astringent, diuretic, anti- pyretic, skin diseases, asthma,urinary diseases |
| 20. | <i>Hibiscus rosa-sinensis</i> | Hibiscus | Malvaceae Flower | Perinnial Shrub,2.5m (feet),Annual | Throughtout the year | To treat of excessive and painful menstruation, cystitis, coughs |
| 21. | <i>Jatropha curcas</i> | Angular Leaved | Euphorbiaceae Seed | Large Shrub or Small tree,Perennial 5m tall | Rainy Season | It is used to treat eczema, scabies, ringworm, gonorrhea, dysentery, diarrhea |
| 22. | <i>Lawsonia innermis</i> | Henna | Lythraceae Leaves | Branched Shrub, 7m(hgt), Annual plant | Flowering April Fruiting- December | Leaf is used for jaundice,astringent,diuretic, wounds,ulcers,leprosy & anemia |
| 23. | <i>Mentha arvensis</i> | Mint | Lamiaceae Leaves | Perennial Herb, 20- 80cm | Winter Season | It is used to rheumatic pains, arthritis and remedy for inflamed joints |
| 24. | <i>Mirabilis jalapa</i> | Mirabilis | Nyctaginaceae Flower | Herb, 2m(hgt), Perennial | Summer | Diuretic, purgative, wound healing, reduce inflammation |
| 25. | <i>Nerium oleander</i> | Nerium | Apocynaceae Flower | Small tree(or) Shrub, 2-6m(hgt), Perennial | Flower- June-Sep | It is used to cure asthma, epilepsy, cancer, painful menstrual periods, leprosy |
| 26. | <i>Nyctanthes arbor-tristis</i> | Night- Flowering Jasmine | Oleaceae Flower | Small sized tree,10m(hgt) | Sep-Dec | Fever, enlargement of the spleen, malaria, blood dysentery, cough and gastritis |
| 27. | <i>Punica granatum</i> | Pomegranate | Lythraceae Friut | Annual Shrub, 3- 4.5m in (hgt) | Throughtout the year | To treat sore throats, cough, urinary infections, skin disorder, arthritis |
| 28. | <i>Rosa hybrid</i> | Rose | Rosaceae Flower | Shrub, Perennial Flowering Plant, 118.50 cm(hgt) | Flower – Summer | It is used to cure stomach problems and are being investigated for controlling cancer growth |
| 29. | <i>Syzygium cumini</i> | Black Plum | Myrtaceae Fruit | Large Evergreen Tree, 30m in (hgt) | Flower- Mar- April; Fruit ripens in Jun- Aug | Relieve stomach pain, carminative, anti-scorbutic and diuretic |
| 30. | <i>Tectona grandis</i> | Teak Wood | Lamiaceae Leaves | Large Deciduous Tree | July-Jan | Leaves are used in skin diseases,bronchitis, paste applied to cure ringworm |

Total 30 Species belongs to 20 Families have been recorded in the present work Apocynaceae is found to be dominant with 3 Species followed by Euphorbiaceae, Acanthaceae, Nyctaginaceae, Asteraceae, Myrtaceae, Lythraceae, Lamiaceae having 2 Species each and rest of the families having one species each (Fig: 1).

Fig:1 Family Wise presentation of natural dye yielding plants



In terms of plant parts utilized for dye extraction it was found that mostly Flowers has been utilized for dye extraction constituting 35% of total plant recorded followed by leaves 26% per cent, fruits constituting 19% per cent, Whole plants were 10% and followed by Each Root, Rhizome and seed were 3% per cent.(Fig.2). According to Chandramouli 1995¹¹ Many natural dyestuff and stains were obtained mainly from plants and dominated as sources of natural dyes, producing different colours like red, yellow, blue, black, brown and a combination of these (Table 1). Almost all parts of the plants like root, bark, leaf, fruit, wood, seed, flower, etc. produce dyes. It is interesting to note that over 2000 pigments are synthesized by various parts of plants, of which only about 150 have been commercially exploited. Nearly 450 taxa are known to yield dyes in India alone

Fig: 2 Plant parts wise (%) Presentation of Natural Dye Yielding Plants

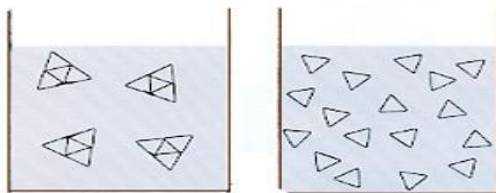
Thus it was observed from the present study that different dye yielding plants have important role in the social and cultural life of the local tribes. However it is matter of concern that the local tribes are fast losing their great heritage and knowledge about dye plants their uses and the method of extraction. Now a day the old person of local tribes have knowledge about such plants and their young generations are not keen to know and concern their knowledge. There is a need of serious attempts to document the traditional knowledge of tribes of this region about dye- yielding plants and their different extraction methods.

Pigments

- A dye is a colorant that goes into solution or dissolves
- Pigment particles remain clustered together in suspension.
- We associate plants with beautiful colors, yet most plant pigments do not make good dyes.
- Most plant pigments are chemically instable – when removed from the environment of the plant cell they are quickly degraded or washed away. (Fig: 3)

Dyes

- Dye particles break apart into single molecules.
- Dyes have a chemical affinity for fiber but pigments do not.
- Dyes must be chemically stable (many oxidize when exposed to air)
- Dyes must adhere to the fibers or they will be washed out. It is easier to dye animal fibers than plant fibers. (Fig: 4).

Fig:3 Pigment Particles Fig: 4 Dye Particles

Conclusion

It is quite clear from the present study Biosphere reserve is a storehouse of floral biodiversity and economically important plants particularly dye yielding plants. Preliminary study has been made about the assessment of biodiversity of dye yielding plants is needed to documental knowledge of current status of this region.

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Conflicts of Interest

All authors declare that there are no conflicts of interest.

Reference:

1. Chengaiah, B., Rao, K. M., Kumar, K. M., Alagusundaram, M. and Chetty, C. M., 2010. Medicinal importance of natural dyes are view.. *International Journal of Pharm Tech Research*, 2, (1): 144-154.
2. Das, P.K., Mondal, A.K. and Mondal (Parui), S.2011. Antibacterial activity of some selected dye yielding plants in Eastern India. *Afr. J. Plant science*, 5(9): 510-520.
3. Siva, R. 2007. Status of natural dyes and dye-yielding plants in India. *Curr. Sci.*, 92(7): 916-924.
4. Panigrahi, G. and Murti, S.K. Flora Bilaspur district, M. P .1999.*Bot. Sur. of India*, 1-2, India, Kolkata.
5. Dubey, A.2007. Splash the colours of holi, naturally!. *Sci. Rep.*, 44 (3): 9-13.
6. Mahanta D and Tiwari SC,2005. Natural Dye yielding plants and indigenous knowledge on dye preparation in Arunachal Pradesh, North East India, *Curr.Sci* 88,1474- 1480.
7. Shenai, V.A. and Saraf N.M..1991. Principles and Practise of Dyeing, Mumbai, *Sevak publications*, 7, 1 2,.
8. Gulrajani, M.L. and Gupta, D.1992. Natural Dyes and Application to Textiles. Department of Textile Technology, *Indian Institute of Technology*, 7.

9. Bechtold, Thomas, A. Turcanu, Erika Ganglberger, and Susanne Geissler2003. "Natural dyes in modern textile dyehouses—how to combine experiences of two centuries to meet the demands of the future?." *Journal of Cleaner Production* 11,5 : 499-509.
10. Krishnamurthy, T., 1993. *Minor Forest Products of India*, Oxford and IBH, New Delhi, pp. 340–364.
11. Chandramouli, K. V.,1995. *Sources of Natural Dyes in India – A Compendium with Regional Names*, PPST Foundation, Chennai.