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Natural Dyes

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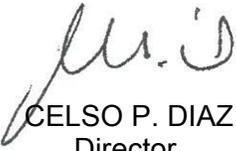
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Foreword

Natural dyes are very important articles of commerce. With the coming of synthetic products, dyes have become cheaper and more available. Despite this, the production of natural dyes should not be neglected.

In the Philippines, there are a large number of plants which yield dyes. These plant species are found growing throughout the country. Some of them are used to dye fabrics, food like jams, sweets and ice cream. They also give color to beverages and are used as food flavoring.

In this issue, some of the species are enumerated with their botanical descriptions and the color of dyes derived from the plant.



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ANNATO OR ACHUETE

1. Common name: achuete, annatto (English)

2. Local names: achuete (Bicol, Ilocos, Panay, Visayas, Zambales, Pilipino); atsuti (Ilocos, Pampanga); achote (Pangasinan); apatut (Nueva Vizcaya); asute (Bataan); janang, chanang (Sulu); sotis (Negros).

3. Scientific name: *Bixa orellana* (Linn.)

4. Family: Bixaceae

5. Botanical description

Annato is a small bushy tree 2 to 8 m high and 30 cm in diameter with stem color varying from green to red. Young twigs are covered with rust colored scales. Leaves are heart shaped and alternate. Fruits are dark red to green.

The seed pods vary in size, maybe round or elongated with pointed ends, dry to brown color. These burst open to reveal bright orange to yellowish red color. The inside of the pod is divided into valves that contain 10 to 50 seeds.

6. Distribution

Annato originated from tropical America. At present, it is abundantly distributed in the tropics and is common throughout the lowlands of the Philippines.

7. Uses

In Latin America, the tree is interplanted with pineapple, papaya and cowpeas. It is used as living fence and firewood. Leaves, barks and seeds have medicinal uses. The bark is also a source of fiber.

As dye: The coloring matter of the dried seed (bixin) is employed commercially for coloring butter, cheese and other food, condiments and in the preparation of leather and floor polishes. The bark is also a good source of dye.

8. Site requirements

The tree is found in backyards and open fields. It thrives in almost all types of soils but grows best in a moist deep loamy soil. It grows at an altitude below 800 m. It is capable of withstanding mild drought of less than 4 months.

9. Propagation

It is propagated by seeds. There are 26,000 seeds/liter and 34,700 seeds/kg. The germinative capacity of the seed is 80 to 100%.

10. Management

The area to be planted must be cleared and left open for 1 to 2 months before planting. Seedlings raised in the nursery should be spaced 10 cm x 25 cm apart and placed under light shade. These may be outplanted when they are 15 to 25 cm tall.

For direct seeding, the recommended spacing is 5 m x 5 m (with a population of 400 plants/ha). Plant 2 to 3 seeds per hole and cover with a thin layer or soil. Thin direct seeded plants when 4 months old. Cultivate the soil around the plants to a shallow depth. Prune out damaged or diseased limbs.

Little is known about pests and diseases affecting annatto. Powdery mildew has been observed infecting the plant.

Harvest the pods when they begin to show a tinge of red or when they begin to split. Cut with sharp scissors just above the first node of the bunch, and another crop will be produced in 12 months.

11. Phenology

Flowering occurs from August to December. The tree begins to bear fruits in 18 months. Full crop is attained in 3 to 4 years.

BANKORO

1. **Common name:** bankoro

2. **Local names:** bankoro (Visayas), bankudo (Tagalog); noni (Tahitians)

3. **Scientific name:** *Morinda citrifolia* L.

4. **Family:** Rubiaceae

5. Botanical description

An erect, smooth shrub or small tree that grows up to 15 ft with spreading branches. Leaves are quite large, ovate in form, shining green contrasting with creamy white long lateral veins. Fruit is fleshy and as big as a child's fist. When ripe, it looks pale yellowish and has soft pulp. Its odor and taste are unfavorable.

6. Distribution

Found throughout the Philippines. It is also found in India to Polynesia.

7. Uses

Tree : ornamental shade
Leaves : medicinal
Fruit juice : manufactured as health drink called noni
Use as dye : bark of roots is used for dyeing in Java

8. Site requirements

Growing along or near the seashore and rarely at high altitude.

9. Propagation: seeds

10. Management

Dried seeds are sown in seedboxes. Water regularly and when the seedlings reach to a height of 10 inches with at least 10 or more leaves, they may now be transplanted individually to pots or they may be planted on the ground with spacing of at least 10 m apart. Water the seedlings regularly and apply soap solution when attacked by aphids and mealy bugs.

11. Phenology

It bears flowers throughout the year.

BAYOK

1. **Common name:** bayok

2. **Scientific name:** *Pterospermum diversifolium* Blume

3. **Family:** Sterculiaceae

4. Botanical description

The tree grows from 4 to 10 m in height. Leaves are oblong, 15 to 25 cm in length, pointed at the apex; broad and heart shaped at the base. The upper surface is smooth, and the lower surface is pale and densely hairy. Flowers are white, and born singly or in pairs. Fruit is woody and oblong.

5. Distribution

Occurs from Cagayan to Camarines Provinces in Luzon, Mindoro, Palawan, Ticao, Masbate, Guimaras, Negros, Mindanao and Basilan. It is also found in Indo China, the Malay Peninsula, Sumatra, Borneo, Java and Moluccas.

6. Uses

Wood is used for jointing, flooring, furniture, cladding, tool handles, implements and manufacture of plywood. It is also used in ship and bridge building and construction of beams, joists and rafters. Wood is also suitable for matches and production of wood-wool board.

The pulp is suitable for making paper. The leaves and bark, rich in tannin, are used in traditional medicine, e.g. as poultice against itch and to treat wounds, and taken internally to treat dysentery. Bark is used to toughen fishing nets.

The bark of this tree is used for dyeing fish nets and cloth.

7. Site requirements

Scattered in primary forests or grows abundantly in secondary forest especially on river banks, often on alluvial soils. It grows in elevation up to 1400 m asl.

8. Propagation

There are about 19,500 dry seeds without wings per kg. Seeds can be stored for a maximum of two weeks, hence, these should be transported in the form of fruits. Seeds are sown in nursery beds provided with shade. Direct sowing or planting of wildlings has been done in case the development of seedlings is low.

9. Management

Seedlings are planted in the field at 3 x 1 or 3 x 2 m. The gap closes after three years and the first thinning is necessary after 5 years to prevent formation of too slender stems which tend to bend. Yield is 51-64 m³/ha at 8 years and 98 m³/ha at 13 years. Trees generally coppice or re-sprout after fire. The tree is fast growing and light demanding. Regeneration in natural forest is restricted to gaps and forest fringes.

10. Phenology

In Thailand, *P. diversifolium* flowers in February-April and fruits in March-May.

BIGNAY

1. **Common name:** bignay

2. **Local names:** bignay kalabaw (Tagalog); bugnay (Ilocos, Bontok, Ibanag, Bisaya); bugney, buglay (Bontok, Ifugao); bundey, vunnai (Ibanag); dokodoko, nutagtamanuk

(Bagobo); isip (Pampanga); oyhip (Sambali); bitaog, dalimdiman (Bukidnon); paginga, pagiruga (Ibanag)

3. Scientific name: *Antidesma bunius* (Linn.) Spreng.

4. Family: Euphorbiaceae

5. Botanical description

Bignay is an attractive, dioecious shrub or a small tree 4 to 10 m high. Leaves are small, dark green, shiny, alternate, pointed at the tip, rounded or pointed at the base. Flowers are small, green and odorous. Fruit is thin-skinned, spherical to ovoid, dark red when ripe, small, juicy, sour and well flavored. It contains a single flat seed. There are 20 to 25 or more fruits per cluster.

6. Distribution

It grows in Sri Lanka, southern India, eastern Himalaya, Burma (Myanmar), Indo China, southern China, Thailand, the Malesian region excluding Malaysian Peninsula and mot of Borneo (recorded in Banggi Island only) and Australia (Queensland). Possibly not native to the Philippines. Widely cultivated in Indonesia (mainly Java), Peninsular Malaysia, the Philippines and Indo China.

7. Economic uses

Tree : ornamental, reforestation and weed suppressing species.
Leaves : young leaves are eaten as salad, sometimes used as substitute for tomato or vinegar flavor fish and meat stew.
Leaves and bark : contains alkaloid and applied externally (though also reported as poisonous) e.g., to relieve fever and treat smallpox or body swellings.
Wood : temporary construction, poles, posts, fence posts, walking sticks and tool handles.
As dye : fruit is a source of blue dye.

8. Site requirements

Found in the understory of primary or secondary, lowland to montane rain forest, up to 1,800 m altitude. They grow on a wide variety of soils including alluvial flats, clayey soils, peaty soils, volcanic soils, podzols and limestone.

9. Propagation

Seeds, grafting or budding, stem cutting and marcotting. Depulped and fried fruits may be stored for 2 to 5 years in airtight containers. There are 28,000 dry seeds/kg. The seeds need one month after ripening and can then be sown under shade without pretreatment. Fresh seeds, however, need a pretreatment with sulfuric acid for 15 minutes followed by soaking in water for 4 hours. Seed viability of bignay is 3 to 30% germination. Germination takes 30 to 60 days.

10. Phenology

Bignay is known to flower from April to June. Generally, the main fruiting season is from July to August.

For more information please see: RISE Vol. 6 No. 6 November-December 1994.

KATMON

1. **Common name:** katmon

2. **Scientific name:** *Dillenia philippinensis* Rolfe

3. **Family:** Dilleniaceae

4. Botanical description

A tree reaching a height of 6 to 15 m. The leaves are leathery, shining, 12 to 25 cm long. The flowers are white, large, showy, and about 15 cm in diameter. The fruit which is rounded, is 5 to 6 cm in diameter. Fruit is fleshy, green and edible with a flavor somewhat similar to a green sour apple.

5. Distribution

Found throughout the Philippines.

6. Site requirements

Common in forests at low and medium altitudes.

7. Economic uses

A red dye is obtained from the bark.

8. **Propagation:** by seeds. No other available information.

LANGKA

1. **Common name:** langka or nangka (Jack fruit)

2. **Local names:** langka (Tagalog, Ilocos, Visayas, Bicol)

3. **Scientific name:** *Artocarpus heterophyllus* Lam.

4. Family: Moraceae

5. Botanical description

A small to medium-sized, evergreen tree that reaches 8 to 14 m high. It has a straight cylindrical, low branched trunk that measures 30 to 100 cm in diameter and a dense, irregular or spreading crown. Bark is thick, grayish and exudes a milky sap when injured. Leaves alternate, spirally arranged, stiff and leathery, dark green and shiny above and pale green beneath. Young leaves are pale yellowish green. Fruit is large, covered with short pyramidal spines. Pericarp and pulp around the seeds are the edible portions. Pulp is thick, rich yellow, sweet and aromatic when ripe. Seeds are numerous and vary in size.

6. Distribution

A native to the rain forests of the Western Ghats of India, and widely cultivated throughout the tropical lowlands of both hemispheres. It is an important fruit crop in India, Burma, Sri Lanka, Malaysia, Indonesia, Thailand, the Philippines and many other tropical countries. Introduced in the Philippines during pre-historic period. Widely distributed throughout the country both cultivated and wild.

7. Economic uses

- Tree : shade, agroforestry, intercropping, reforestation crop
- Fruit : immature fruit maybe used as vegetable, ripe fruit is made into sweets, preserves, flavoring for ice cream and ingredient for ginataan, salad and halo-halo. It may also be fermented and distilled for an alcoholic beverage.
- Seeds : very rich in starch, delicious either boiled or roasted.
- Rags : very rich in pectin and ideal for jelly making.
- Wood : tool handles, timber, furniture, building materials, musical instruments.
- Leaves : in India, leaves are stitched and used as plates and other containers. It is also used as fodder.
- Bark : yields a white latex used for caulking boats, cementing broken chinawares and trapping birds.
- As dye : a yellow dye, obtained by boiling mature wood or sawdust, is used for dyeing garments.

8. Site requirements

It thrives best in moist tropical climates below an elevation of 1,000 m in areas with well distributed rainfall. In the Philippines, it grows well on all climatic types although a warm wet surrounding is best. The tree grows well on almost any type of soil, but for best performance, it prefers a deep, well drained, sandy or clay loam soils. While the soil moisture must be kept always at high level, the tree cannot tolerate water stagnation and poor drainage.

9. Propagation

Jackfruit is commonly propagated sexually and asexually by marcotting, inarching, budding and grafting. Seeds should be obtained from an outstanding mother tree. A fruit may contain 100 to 500 seeds. Large and heavy seeds are preferred to insure higher germination percentage and healthy seedlings. Seeds are sown immediately upon extraction because it loses viability upon exposure. Fresh seeds germinate in 22 days while month old seeds germinate in 45 days. Soaking seeds in 25 ppm NAA for 24 hours prior to sowing is recommended.

10. Management

The seedlings have a long tap root system very sensitive to injury. For this reason, it is advisable to sow seeds in individual containers or planted directly in the field. In India where it is used as shade tree in coffee plantations, seeds are sown directly in the field. Three seeds are planted at the center of the hole horizontally or with their embryos pointing downward to allow early germination. On the average, seeds germinate in about 18 days. Later, the 2 weaker seedlings are removed leaving healthy and straight one to develop. For containerized seedlings, clay loam soil mixed with compost or other source of organic matter is used as planting medium. For more rapid growth, they may be fertilized with a small amount of nitrogen containing fertilizer. Although they can tolerate full exposure to sunlight, these should be placed in partially shaded area.

For medium to large scale planting, the soil should be plowed and harrowed several times until the desired soil kilt is attained. To minimize injury to the seedlings, these should be planted in the field one year or younger. Care should be observed in order not to injure the roots and disturb the soil in which the roots are growing. Plants are carefully set in prepared holes which are later filled up with top soil mixed with compost. Leaves should be pruned in halves and likewise, the extra shoots to reduce transpiration. This may be done while the seedlings are in the nursery or before the plants are set in the holes. In the orchard, spacing is 8 to 10 m or more following the square or triangular system of planting. Planting is done best at the onset of the rainy season to avoid watering problem. Irrigation should be practiced during the first to second year particularly during the dry months. Mulching the trees may be sufficient to conserve moisture in the soil to last until the next rainy season.

About 100 to 150 g ammonium sulfate is applied per plant 1 month after planting, and an equal amount 6 months later or towards the end of the rainy season. When the trees start fruiting, 0.5 to 1.0 kg complete fertilizer may be applied per tree at the start of the rainy season and an equal amount towards the end of the rainy season. A full grown tree (15 to 20 years or older) requires 2 to 3 kg of complete fertilizer per application. In the Philippines, inflorescence rot (*Rhizopus migricans*), pink disease (*Corticium salmonicolor*) and rhizoctonia thread blight (*Rhizoctonia koleroga*) are common diseases and controlled by removing and burning the diseased parts and spraying with

Eupravit or Bordeaux mixture at recommended dosages. Seedlings start to bear fruits 6 to 8 years after planting. Grafts bear fruits in 4 to 5 years.

11. Phenology

In general, flowering occurs throughout the year. In India, as well as in the Philippines, the tree is injured at intervals on the bark of the trunk and branches with a bolo to induce profuse fruiting.

MALUNGAI

1. Common name: malungai

2. Local names: arungai (Pangasinan); balungai (Visayas); dooi (Pampanga, Visayas); kalamungai (Panay, Visayas); kalungai (Pampanga, Tagalog, Bicol); komkompilan; marungai (Ilocos, Ifugao); horse radish tree (English).

3. Scientific name: *Moringa oleifera* Lamk.

4. Family: Moringaceae

5. Botanical description

A small tree reaching a height of about 10 and 30 cm in diameter. Leaves are 26 to 50 cm long, bipinnate, triangular in outline and somewhat crowded towards the twig ends.

Leaflets are 3 to 9 cm and dark green when mature. Flowers are yellowish white. Fruit is 20 cm long, three-angled and pointed. The seeds are winged on the three angles.

6. Distribution

Malungai is planted throughout the Philippines in settled areas.

7. Uses

Tree is used as fencing materials and support of black pepper vines. Young leaves, flowers and young pods are eaten as vegetables. Roots are used for seasoning. The bark exudes a reddish gum which is used for tanning.

As dye: The wood is a source of blue dye.

8. Site requirements

The tree grows best under humid, tropical conditions. It grows from low to medium altitudes and easily adapts to various soil types. A well-drained soil is a must to prevent plants from rotting.

9. Propagation: seeds and cuttings

10. Management

Cutting is recommended as the most practical method of planting. Mature branches are cut 2 m long and buried about 30 cm deep. Direct seeding is also recommended for the seeds to germinate easily without much care. Spacing is 2 x 2 or 2 x 3 m. Young shoots could be harvested after one year. No pests and diseases have been found to attack the tree.

11. Phenology

It flowers in February in Mt. Makiling, September in Zamboanga and Rizal and October in Mindoro.

MANGO

1. Common name: mango

2. Scientific name: *Mangifera indica* Linn.

3. Family: Anacardiaceae

4. Botanical description

A large, widely and densely crowned evergreen tree reaching a height of 33 m and a diameter of 2 m. Leaves are oblong to oblong lanceolate. Flowers are 3 to 4 mm with long, pink, red, orange, green or yellow petals. The bark exudes a milky latex when injured.

Fruit descriptions are as follows:

“Carabao” variety size: medium to large, about 240 g, shape oblong, skin smooth, yellow and thin, flesh yellow, very tender and melting; flavor very delicate, aromatic and spicy, fiber medium coarse but short and confined almost entirely to the edge of the seed. Eating quality excellent.

“Pico” variety size: medium to large, about 230 grams, shape oblong more distinctly flattened than the “carabao”, skin smooth light orange yellow thick and tough; flesh rich orange yellow, tender, richer and sweeter than the “carabao” but not melting and lacks the spicy delicate aroma that

distinguishes the “carabao” mango, fiber fine and short, confined almost entirely to the edge of the seed. Eating quality good.

5. Distribution

Mango is believed to have originated from the Indo Pakistani and the Malay Peninsula or Indo-China. It is grown extensively in Egypt, India, Pakistan, Sri Lanka, Bangladesh, Kenya, Tanzania, Nigeria, South Africa, Australia, Burma, Thailand, Malaysia, Indonesia, Vietnam, China, Israel, Mexico, Cuba and the West Indies. Central and Southern Luzon, Central and Western Visayas, and the Ilocos provinces are the main mango production areas in the Philippines.

6. Uses

Wood : furnitures, doors, Mindoro casings, floors, plywood, turnery and boxes.

Leaves: eaten as vegetable and fodder for animals; also used to treat chicken pox.

Fruit : fruits are eaten fresh, dried, frozen, or canned and are made into pickles, juice, puree, nectars, scoops, jam, vinegar, wine, brandy, and ice cream flavoring. Tannins and astringents can be extracted from the green fruits. The fibers of the seedhusk make soft, fine pliable brushes. The kernel can be fed to pigs or, after soaking in water to remove astringents, ground into flour and used like wheat flour. Peelings of the fruit contains high quality pectin.

As dye : They yield a yellow textile dye (a xanthene derivative). In India, the yellow coloring in the leaves, bark and fruit is a dye called “peori dye”.

7. Site requirements

Distinct wet and dry season, at least 5 months dry period; elevations below 600 m (although mangoes are known to thrive in the Cavite highlands); well-drained, deep loamy soil and pH range of 6 to 8; latitudinal range is from 30 degrees north to 30 degrees south latitude.

8. Propagation

Mango may be propagated both sexually (seed) and asexually (vegetative). The latter is preferred since trees grown from seeds: (1) take a longer time to bear fruit, (2) grow excessively large and (3) are difficult to manage. Cleft grafting is most successful and popular under local conditions. Extracted seeds from ripe fruit easily lose their viability and should be sown immediately in nursery beds about 10 cm apart and 1.3 cm deep. Seeds will germinate 1-4 weeks after sowing.

9. Management

Seedlings are usually transplanted in nursery rows when the second or third leaf has turned dark green. Seedlings are very sensitive to shock at this stage

and should be handled with care. Spacing is 30 to 60 cm apart to facilitate watering, grafting and other activities. When the stems are of pencil size or larger, they may be grafted. Young mango stocks may also be grown in containers measuring 15 to 30 cm in diameter and 20 to 25 deep and filled with sowing medium (consisting of one third sand, one third soil and one third compost). Watering should be done regularly and fertilized with soluble fertilizer after the first 2 months. Shade should be provided at the start and hardening may be started after the 2nd flush of leaves turns dark green. Stocks will reach graftable size when the stem diameter is 1 cm or when seedlings are 6 to 7 months. Watering of the stock should be done regularly. If successful, next growth in the scion will begin 2 to 3 weeks.

Transplanting should be done during the rainy season. Spacing is 14 x 14 m. During the first dry season, the trees should be watered frequently.

Fertilization: The following is a general fertilization guide for mango.

Age of tree	Rate/Grade	Method/time of application
Seedlings	200-300 gm/tree of 14-14-14 or 12-24-12	Apply 3 inches below roots and 5 inches to side of seedlings at planting
Young trees	300-500 gm/tree of 14-14-14 or 12-24-12 plus 200-300 gm/tree of urea (45-0-0)	Mix and apply in two equal doses in 4 to 5 holes around tree; 1 st at start of rainy season; 2 nd before end of rainy season.
Bearing trees	1.5-2.5 kg/tree of 14-14-14 or 12-24-12	Apply in 2 equal doses in 6 holes around tree; 1 st at start of rainy season; 2 nd in September or October.

Pest and Diseases

Mango hoppers (*Idioscopus clypealis* Leth., *Chunroceros niveosparsis* Leth., *Typhlocyba nigrobilineata* Mel. Homoptera)

Control: Spray with any of the following insecticides: Sevin, Hytox, Diazinon 20 EC, Malathion, Gusathion or EPN 30. Mango twig borer (*Niphonodea albata* Newm. and *N. capito* Pasc.)

Coleoptera Control: Cut off affected shoots and twigs and burn or spray with any of the following insecticides: Malathion, Sevin, Diazinon or EPN 300. Fruit flies (*Dacus dorsalis* Henl, *D. cucurbitae* Coz.) Diptera.

Control:

- a) Bait sprays such as Dipterex, Sevin or Malathion mixed with Protein Hydrolsate. The proportion is 10 tbsp of the toxicant to 15 tbsp. Protein Hydrolsate in 5 gallons of water.
- b) Wrapping or bagging. Individual fruit is wrapped with newspaper.
- c) Sanitation: Collect fallen fruit and dispose them into a deep pit or spray with Malathion.

10. Phenology

Flowering occurs in mid dry season. January to March induced trees are harvested in 110 to 120 days. September to November induced trees are harvested in 135 days. Full bloom occurs 4 to 4 weeks after spraying. Mango can bear anytime of the year in areas with no distinct dry season.

NARRA

1. Common name: narra

2. Scientific name: *Pterocarpus indicus* (Willd.)

4. Family: Fabaceae

4. Botanical description

A large tree which grows up to 40 m high and a diameter of 120 cm. Bole is short, buttress is large, trunk fluted or deformed. Crown is wide spreading. Nearly deciduous for a short time during dry season. Leaves alternate, simple and shiny. Flowers numerous, bright yellow and fragrant. Fruit is flat, dry, very shortly beaked, containing 0 to 5 seeds.

5. Distribution

Grows throughout the Philippines. It also grows in India, Indo-China, Borneo, Celebes, New Guinea and the Caroline Islands.

6. Economic uses

The tree is planted as ornamental and shade tree. The wood is best known for furniture.

As dye: The wood is a good source of red dye.

7. Site requirements

Thrives best in moist, sandy loam or clay loam soils along gullies and streambanks. It grows in elevations as high as 1,300 m and grows in any of

the four climatic types of the Philippines. Adapted to temperatures of 22°C to 32°C and an average of annual precipitation of 2,366.

8. Propagation: Seeds, grafting, budding, marcotting and layering.

9. Phenology

Narra blooms as early as March to as late as September every year but the principal flowering season is from July to September. The fruits mature from July to January.

For more information, please refer to: Compilation of RISE issues Vol. 1 No. 1-10, 1989; RISE Vol. 7 No. 1, January – February 1995.

SIBUKAU

1. Common name: sibukau

2. Scientific name: *Caesalpinia sappan* L.

3. Family: Caesalpiaceae

4. Botanical description

It is a small tree, 3 to 5 m high. The leaves are compound and up to 50 cm long. The flowers are yellow. Pod is oblong, about 7 cm long, and 3.3 to 4 cm wide, hard and shining.

5. Distribution

Abundant throughout the Philippines. It occurs also in India, Malaya and Java.

6. Site requirements

Grows at low and medium altitudes in dry thickets and *parang*.

7. Economic uses

Sibukau is chiefly used as a dyewood, being very popular among the Filipinos for coloring the native fabrics. The coloring matter of sappan wood is brazilin.

8. Propagation: seed

No other information is available.

TEAK

1. Common name: teak

2. Local names: yati (Ilocos, Zamboanga, Sulu); ajate, dati, jate, djate (Sulu, Zamboanga); hadlajate (Agusan); dalanong (Panay); dalandon, kalayati; sagunyate (Visayas).

3. Scientific name: *Tectona grandis* Linn. F.

4. Family: Verbenaceae

5. Botanical description

A medium sized tree [25 to 30 m in height and approximately 1 m in diameter at breast height (dbh)]. However, under favorable site condition, it may grow up to a height of 50 m with a dbh of 2 m. It is a deciduous tree. Leaves are simple, ovate to round. Flowers are small but numerous and white. Fruits are round, hard and about 1 cm in diameter which turns brown when mature. A fruit contains 1 to 4 seeds.

6. Distribution

The species is well distributed in Asia, Southeast Asia, West Africa and to some extent in Central America, East Africa, and Oceania. It is a native of India and Indonesia. In the Philippines, it is mostly grown in many of the country's reforestation projects. Extensive plantations could be observed in the Ilocos Region, Nueva Vizcaya, Nueva Ecija, Cebu and in Los Baños, Laguna.

7. Economic uses

Wood : construction of bridges, wharves, railway carriages, ship decks, wood carvings, and general carpentry.

Leaves : leaves and nut have pharmaceutical value.

Nut oil : hairgrower

As dye : the root and bark is used in Celebes for a yellow stone brown coloring matter. The young leaves are used for dyeing in several parts of West Indies.

8. Site requirements

It grows well in lowland areas with elevation of not more than 800 m. It thrives well on deep, well drained soil, preferably calcareous soil (soil containing sufficient calcium carbonate). It should not be planted on dry, rocky slope or heavy clays.

Rainfall is from 1,000 to 2,000 mm annually. Tolerates dry spells of 4 to 6 months. Temperature ranges from 18°C to 30°C.

9. Propagation: seeds and cuttings

For more information, please see: Compilation of RISE Issues Vol. 1 Nos. 1-10, 1989.

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