Non-edible vegetable oils

Non-edible vegetable oils are plant-derived fats unsuitable for human consumption due to toxicity or unpleasant properties, acting as sustainable, renewable raw materials. Key examples include Castor, Neem, Karanj, Mahua, Jatropha, and Linseed oils, commonly utilized for biodiesel, biolubricants, soaps, coatings, and industrial lubricants.

Key Non-Edible Vegetable Oils & Sources:

- **Castor Oil (*Ricinus communis*):** Widely used in lubricants, paints, varnishes, and industrial soaps.
- **Jatropha Oil (*Jatropha curcas*):** Known for its potential as a high-quality, drought-resistant biodiesel feedstock.
- **Neem Oil (*Azadirachta indica*):**Used in pesticides and skincare products (medicinal, non-edible).
- **Karanja Oil (*Pongamia pinnata*):** Used for biodiesel and lubrication.
- **Mahua Oil (*Madhuca indica*):** Common in biodiesel production and soap manufacturing.
- **Linseed Oil (*Linum usitatissimum*):** Utilized in paints and coatings.

Common Uses of Non-Edible Vegetable Oils:

- **Biodiesel Production:** A major application due to high oil content in seeds.
- **Biolubricants:** Used in automotive and machinery sectors.
- **Industrial Applications:** Linoleum manufacturing, varnishes, specialized coatings, and soaps.
- **Pest Control:** Specifically Neem oil.

Non-edible vegetable oils resources

Non-edible vegetable oils are not suitable for human food due to the presence of some toxic components in the oils. The selection of non-edible vegetable oils as **feedstocks** for biodiesel production requires reviewing the existing works. Recent comprehensive reviews on biodiesel production from various feedstocks show the advantages of non-edible oils over edible oils. Production of biodiesel from non-edible oils feedstocks can overcome the problems of food verses fuel, environmental and economic issues related to edible vegetable oil. Moreover, Non-edible **biodiesel crops** are expected to use lands that are largely unproductive and those that are located in poverty-stricken areas and in degraded forests. They can also be planted on cultivators' field boundaries, fallow lands, and in public land such as along railways, roads and irrigation canals. Non-edible biodiesel development could become a major poverty alleviation program for the rural poor apart from providing energy security in general and to rural areas in particular and upgrading the rural non-farm sector. All of these issues have a great impact on the sustainability of biodiesel production. Non-edible feedstocks of biodiesel should be considered as **sustainable and alternative fuels**.

Non-edible oil plants are well adapted to arid, semi-arid conditions and require low fertility and moisture demand to grow. Moreover they are commonly propagated through seed or cuttings. Since these plants do not compete with food, seed cake after oil expelling may be used as fertilizer for soil enrichment. Several potential **tree borne oil seeds (TBOs)** and non-edible crop source have been identified as **suitable feedstock for biodiesel**.

Table shows the list of potential tree borne oil seeds (non-edible oils) for biodiesel production.

Non-edible vegetable source	**Distribution**	**Plant type**	**Plant part**	**Uses**
Azadirachta indica (neem)	Native to India, Burma, Bangladesh, Sri Lanka, Malaysia Pakistan and Cuba, growing in tropical and semitropical regions	Tree	Seed, kernel	Oil-illuminant, timber, firewood, **biodiesel**
Annona squamosa	Caribbean, Central America, Northern South America, Western South America, Southern South America, Pacific, Australasia, Indomalaya	Tree	Seed	Oil, **biodiesel**
Barringtonia racemosa Roxb. (L.) Spreng.	Widely spread in East Africa, Southeast Asia and the Pacific islands	Tree	Seed	Oil-illuminant used in lamps
Calophyllum inophyllum L.	Tropical regions of India, Malaysia, Indonesia, and the Philippines.	Tree	Seed, kernel	Oil used for burning, timber
Ceiba pentandra	Native to Mexico, Central America and the Caribbean, northern South America, and (as the variety *C. pentandra* var. *guineensis*) to tropical west Africa, Indonesia (Java)	Tree	Seed	Timber, oil
Cerbera odollam (sea mango)	Native to India and other parts of Southern Asia	Tree	Seed, kernel	Illuminant (release thick smoke)
Croton tiglium	China, Malabar, Ceylon, Amboina (of the Molucca islands), the Philippines and Java	Herbaceous perennial	Seed, kernel	**Biodiesel**, resin, oil
Crotalaria retusa L.	Native in Asia, Coastal Eastern and Africa	Herbaceous annual	Seed	Oil, **biodiesel**
Garcinia indica	Tropical rain forests of	Tree	Seed	**Biodiesel**,

Non-edible vegetable source	Distribution	Plant type	Plant part	Uses
	Western Ghats, Konkana, North Kanara, South Kanara, Bombay, Goa and Coorg			resin, oil
***Guizotia abyssinica* L.**	Cultivated in Ethiopia and India	Herbaceous annual	Seed	Commercial oil, **biodiesel**
Hevea brasiliensis	Grow in Nigeria, India, Brazil, Southeast Asia, West Africa	Tree	Seed	Surface coatings including paints, printing inks, rubber/plastic processing, pharmaceuticals, lubricants, cosmetics, chemical intermediates and diesel fuel substitute/extender
***Jatropha curcas* L.**	Indonesia, Thailand, Malaysia, Philipines, India, Pakistan, Nepal	Tree	Seed, kernel	Oil-illuminant (burns without soot), lubricant, **biodiesel**
Linum usitatissimum	Distributed to the region extending from the eastern Mediterranean to India, wider cultivation of this crop in Europe and its adapted to wide range in Canada and Argentina	Herbaceous annual	Seed	Oil for wall paint and floor oil, **biodiesel** resin, fiber, surface coating applications stains, linoleum.
Madhuca indica	India	Tree	Seed, kernel	**Biodiesel**
Melia azedarach	Distributed to India, southern China and Australia	Shrub/tree	Seed, kernel	**Biodiesel**
Michela chaampaca	Eastern Himalayas, Assam, Burma, China, Western Ghats and throughout India.	Tree	Seed	Oil, **biodiesel**
Mesua ferrea	Forest in NorthEast India, Karnataka, Kerala		Seed	Soaps, lubricants, illumination
Nicotiana tabacum	Greece, Turkey, Bulgaria,	Herb	Seed, kernel	Oil,

Non-edible vegetable source	Distribution	Plant type	Plant part	Uses
	Macedonia, India, England, Pakistan, Serbia, Brazil, Cuba, Columbia, East Africa, Ecuador, Fiji, Guatemala, Haiti, India, Iran, United States, Tanzania			ethnomedicinal
Pongamia pinnata	Native Western Ghats in India, northern Australia, Fiji and in some regions of Eastern Asia.	Tree	Seed, kernel	Oil-illuminant, timber, **biodiesel**, firewood
Putranjiva roxburghii	Distributed in India	Tree	Seed	Oil-burning, Kernel yield , seeds yield a fatty, oil used for burning an essential oil
Pongamia glabra	Naturally distributed in tropical and temperate Asia, from India to Japan to Thailand to Malesia to north and north-eastern Australia to some Pacific islands	Tree	Seed	Oil for diesel generator, firewood
Ricinus communis	Cuba, Brazil, China, India Italia, French and the countries of the former Sovien Union	Tree/shrub	Seed	Seed oil-fuel, Seeds yield castor oil, a fatty oil used as cathartic and also for lubrication and illumination
Sapindus mukorossi (soapnut)	Asia (India, Nepal, Bangladesh, Pakistan), America, Europe	Tree	Seed, kernel	Oil, **biodiesel**
Terminala catappa	Brazil	Tree	Seed	Timber, oil, **biodiesel**

Feedstocks of non-edible vegetable oils

Jatropha curcas L.

Jatropha curcas L. is a small tree or large shrub, up to 5–7 m tall, belonging to the Euphorbiaceae family. It is a drought-resistant plant capable of surviving in abandoned and fallowed agricultural lands. It is a tropical plant that is able to thrive in a number of climatic zones with rainfall of 250–1200 mm. The plant is native to Mexico, Central America, Africa, India, Brazil, Bolivia, Peru, Argentina and Paraguay. It is well adapted in arid and semi-arid conditions and has low fertility and moisture demand. It can also grow on moderately sodic and saline, degraded and eroded soils. The ideal density of plants per hectare is 2500. It produces seeds after 12 months and reaches its maximum productivity by 5 years and can live 30–50 years. Seed production ranges from 0.1 tha^{-1} yr^{-1} to more than 8 t ha^{-1} yr^{-1}depending on the soil conditions. Depending on variety, the decorticated seed of *Jatropha* contain 43–59% of oil.

Pongamia pinnata L. (Karanja)

Pongamia pinnata (L.) Pierre (karanja or honge), an arboreal legume is a medium sized evergreen tree belonging to the family (Legumnosae; Pappilonaceae), more specifically the Millettieae tribe, which grows in Indian subcontinent and south-east Asia and has been successfully introduced to humid tropical regions of the world as well as parts of Australia, New Zealand, China and the USA. A single tree is said to yield 9–90 kg seeds, indicating a yield potential of 900–9000 kg seed/ha (assuming 100 trees/ha). It is one of the few nitrogen fixing trees (NFTS) that produce seeds with a significant oil content. The plant is fast growing, drought resistant, moderately frost hardy and highly tolerant of salinity. It can be regenerated through direct sowing, transplanting and root or shoot cutting. Its maturity comes after 4–7 years. Historically, this plant has been used in Indian and neighboring regions as a source of traditional medicines, animal fodder, green manure, timber, water-paint binder, pesticide, fish poison and fuel. Recently, *Pongamia pinnata* has been recognized as a viable source of oil for the burgeoning biofuel industry. The tree may be planted with a spacing of 3×3 m^2. The seed oil content ranges between 30 and 40 wt%. The oil is reddish brown and rich in unsaponifiable matter and oleic acid .

Croton megalocarpus

Croton megalocarpus is a member of the Euphorbiaceae family. It is a dominant upper canopy forest tree with heights ranging from 15 to 40 m. It can grow between the altitudes of 1200 m and 2450 m respectively. *Croton megalocarpus* is a tree indigenous to East Africa and the seeds have oil content 40–45% oil . A tree of *Croton megalocarpus* produces up to 50 kg of seeds and a hectare produces 5–10 t of seeds per year.

Moringa oleifera

Moringa oleifera is a member of the Moringaceae family, grows throughout most of the tropics, it is drought-tolerant and can survive in harsh, poor and infertile land. *Moringa oleifera* is indigenous to northwest India, Africa, Arabia, Southeast Asia and South America. However, it

had distributed in the Philippines, Cambodia and Central and North America nowadays. *Moringa oleifera* oil is containing high in oleic acid which is around 70% of the total fatty acid profile. The plant starts bearing Pods 6–8 months after planting and reaches an average of 3 t of seed per hectare per year. The seed contains on average 40% oil by weight .

Aleurites moluccana

Aleurites moluccana is another member of the Euphorbiaceae family. It is generically known as the candle nut tree and Hawaiian tree. It thrives in wet or dry subtropical and tropical forest zones. *Aleurites moluccana* grows optimally between the altitudes of 0 and 1200 m; a temperature of 18–28 °C, a rainfall of 650–4300 mm and a soil pH of 5–8. The tree produces spherical fruits, 5 cm or more in diameter, with a thick, rough, and hard nut shell making up to 64–68% of fruit, and the nut shell is difficult to separate from its oil-rich kernel. In plantations, nut yields are estimated at 5–20 tha^{-1} yr^{-1}, each tree producing 30–80 kg of nuts. Oil production varies from 15% to 20% of nut weight. The oil is rich in polyunsaturated oils: linolenic, oleic and various linoleic acids.

Pachira glabra

Pachira glabra belongs to the Malvaceae family, in the Bombacaceae subfamily. It is also known as French peanut, Guinea peanut or money. The tree is originally a Brazilian native tree, now grown throughout the tropics and subtropics. It produces green fruits which upon reaching maturity, split open releasing seeds. Trees begin to fruit at about 4–5 years, producing fruits containing 10–25 rounded seeds of average 2.5 cm diameter, with 40–50% oil content.

Ricinus communis L. (Castor)

Ricinus communis belongs to the Eurphorbiaceae family and also called castor beans. It is non-edible oilseed crop that is easily grown and resistant to drought. The tree is grown in many countries such as United States, India, China, Central Africa, Brazil and Australia with different cultivation cultures. Its oil is viscous, slightly odor, pale yellow, non-volatile and non-drying oil with a bland taste and is sometimes used as a purgative. On the average, the seeds contain about 46–55% oil.

Calophyllum inophyllum L.

Calophyllum inophyllum L. commonly known as polanga or honne, is a non-edible oilseed belongs to the Clusiaceae family. It is a large and medium sized, evergreen sub-maritime tree which grows best in deep soil or on exposed sea sands. The rainfall requirement is 750–5000 mm/yr. This plant has multiple origins including East Africa, India, South-East Asia and Australia. The tree supports a dense canopy of glossy, elliptical, shiny and tough leaves, fragrant white flowers, and large round nuts. Its size typically ranges between 8 and 20 m (25–65 ft) tall at maturity, sometimes reaching up to 35 m (115 ft). The growth rate of the tree is 1 m (3.3 ft) in height per year on good sites. Its leaves are heavy and glossy, 10–20 cm (4–8 in.) long and 6–9 cm (2.4–3.6 in.) wide, light green when young and dark green when older. Fruits are spherical drupes and arranged in clusters. The fruit is at first pinkish-green later turning bright green and when ripe, it turns dark gray-brown and wrinkled. The tree yields 100–200 fruits/kg.

In each fruit, one large brown seed 2–4 cm (0.8–1.6 in.) in diameter is found. The single, large seed is surrounded by a shell (endocarp) and a thin, 3–5 mm layer of pulp. Oil yield per unit land area has been reported at 2000 kg/ha. The oil is tinted green, thick, and woodsy or nutty smelling. The seed oil has very high oil content (65–75%).

Sterculia feotida L.

Sterculia feotida L. plant belongs to sterculiaceae family with 2000 type of species and classified as non-drying oils. It is a wild plant and well adapted to tropical and subtropical area (30°North Latitude–35°South Latitude), although more humid environmental conditions are shown to result in a better crop performance. The plant has an average life span of more than 100 years. *Sterculia feotida* L. is a large, straight, deciduous tree growing up to 40 m in height and 3 m in girth, with the branches arranged in whorls and spreading horizontally, the diameter of trees is 100–120 cm. The ideal planting pitch has been found to be 3×3 m^2. The fruit is large, woody, red, nearly smooth and about 10 cm long. It contains from 10 to 15 seeds each, which are black and about 2 cm long. *Sterculia feotida* L. gives a yield of about 200–350 kg/tree/yr of seed and the kernel seeds oil content of 50–60%.

Madhuca indica L.

M*adhuca indica* is mainly found in India. It belongs to the Sapotaceae family and grows quickly to approximately 20 m in height, possesses evergreen or semi-evergreen foliage, and is adapted to arid environments. *Madhuca indica* is one of the forest based tree-borne non-edible oils with large production potential of about 60 million tons per annum in India. The *Madhuca indica* tree starts producing seeds after 10 years and continues up to 60 years. The kernel constitutes about 70% of the seed and contains 50% oil. Each tree yields about 20–40 kg of seed per year depending upon the maturity and size of the tree and the total oil yield per ha is 2.7 t per year. Its seed contains about 35–40% of *Madhuca indica*.

Sapium sebiferum (Linn.) Roxb (Chinese tallow)

Sapium sebiferum (Linn.) *Roxb* (Chinese tallow tree) is also commonly referred to as Stillingia tree. It belongs to the Euphorbiaceae family. The tree grows rapidly and can reach maturity within approximately 3–4 years. It can generate economic yields in its productive life span of which ranges between 70 and 100 years. The tree can be grown on marginal land is adapted to alkaline, saline, droughty, and acidic soils. The tree is native to eastern Asia (China, Japan and India) and grows well in the southern coastal United States to prevent soil erosion. The tree produces 4–10 t of seed every year. The seeds contain 45–60% oil. Historically, the tree has been used in soap and candles making, herbal medicine and to prevent soil erosion. Currently, It has been considered useful in the production of biodiesel because it is the third most productive vegetable oil producing crop in the world, after algae and oil palm.

Aleutites fordii (Tung)

Aleutites fordii tree is spread widely in western China, Argentina, Paraguay, Africa, India and United States. It is also commonly referred to as Tung tree. The tree usually bears fruit within 2–4 years and reaches maximum productivity at around 10–12 years of age. The productivity

of Tung oil mainly varies from 300 to 450 kg/ha. The oil content of fruit is between 14–20%, the kernel 53–60% and the seed 30–40%. Tung oil has been used in different industrial applications such as ceramic, paint, paper and cloth production. However, recently Tung oil (*Aleutites fordii*) has been regarded as a promising non-edible source of biodiesel production.

Azadirachta indica (Neem)

Azadirachta indica (Neem) tree belongs to the Meliaceae family. It is a multipurpose and an evergreen tree, 12–18 m tall, which can grow in almost all kinds of soil including clay, saline, alkaline, dry, stony, shallow soils and even on solid having high calcareous soil. It is native to India, Pakistan, Sri Lanka, Burma, Malaya, Indonesia, Japan, and the tropical regions of Australia. It thrives well in arid and semi-arid climate with maximum shade temperature as high as 49 °C and the rainfall is as low as 250 mm. It can be raised by directly sowing its seed or by transplanting nursery-raised seedlings in monsoon rains. It reaches maximum productivity after 15 years and has a life span of 150–200 years. Planting is usually done at a density of 400 plants per hectare. The productivity of Neem oil mainly varies from 2 to 4 t/ha/yr and a mature Neem tree produces 30–50 kg fruit. The seed of the fruit contains 20–30 wt% oil and kernels contain 40–50% of an acrid green to brown colored oil.

Hevea brasiliensis (Rubber seed)

Hevea brasiliensis tree, commonly referred to Rubber tree, belongs to the family Euphorbiaceae. This rubber tree originates from the Amazon rain forest (Brazil). The tree is the primary source of natural rubber and produces 99% of world's natural rubber. Moreover, the tree's sap-like extract (known as latex) can be collected and used in various applications. It is distributed mainly in Indonesia, Malaysia, Liberia, India, Sri lanka, Sarawak, and Thailand. Growing up to 34 m in height, the tree requires heavy rainfall and produces seeds weighing from 2 to 4 g that do not currently have any major industrial applications. On an average, a healthy tree can give about 500 g of useful seeds during a normal year and this works out to an estimated availability of 150 kg of seeds per hectare. The seed contains an oily endosperm. Generally 37% by weight of the seed is shell and the rest is kernel. Rubber seed oil is a non-edible vegetable oil, which contain 50–60 wt% oil and kernel contain 40–50 wt% of brown color oil. The oil is high in unsaturated constituents such as linoleic (39.6 wt%), oleic (24.6 wt%), and linolenic (16.3 wt%) acids. Other fatty acids found in rubber seed oil include saturated species such as palmitic (10.2 wt%) and stearic (8.7 wt%) acids.

Rice bran

Rice bran is the cuticle between the paddy husk and the rice grain and is obtained as a by-product in the production of refined white rice from brown rice and is common in countries such as China and India. The bran is highly nutritious due to the presence of lipids, protein, minerals and vitamins. It is extracted from white rice bran by which the composition of rice bran varies with the rice type, climatic conditions and rice processing methods. The oil content in rice bran varies from 12% to 25%. The high FFA content of rice bran oil makes it unsuitable for eating purposes. The estimated potential yield of crude rice bran oil is about 8 million metric tons if all rice bran produced in the world were to be harnessed for oil extraction. Rice bran oil

is an underutilized non-edible vegetable oil, which is available in large quantities in rice cultivating countries, and very little research has been done to utilize this oil as a replacement for mineral diesel.

Nicotiana tabacum (Tobacco)

Nicotiana tabacum, commonly referred to tobacco, is a by-product that contains significant amount of oil (35–49% by weight) with an estimated annual yield of 15,000 t per year. It can be cultivated in more than 100 countries worldwide such as Macedonia, Turkey, South Serbia and widespread in North and South America etc. The tree is commonly grown for the collection of leaves. The oil extracted from tobacco seed is non-edible with physical, chemical and thermal properties that compare favorably with other vegetable oils and have the potentiality to be considered as a new feedstock for biodiesel production.

Thevettia peruviana (yellow oleander)

Thevettia peruviana is an evergreen perennial shrub native in tropical America, especially Mexico, Brazil and West Indies, and has naturalized in tropical regions of the globe. The tree belongs to Apocynaceae family and is commonly known by various names such as yellow oleander (Nerium), gum bush, bush milk, exile tree in India, cabalonga in Puerto Rico, ahanain Guyana, olomi ojo by Yorubas in Nigeria. Its height can reach up to 4.5–6 m with deep green linear sword-shaped leaves and funnel shaped (yellow, white or pinkish yellow colored) flowers. Thevettia plants produce annually more than 400–800 fruits depending on the rainfall and plant age. The plant has annual seed yield of 52.5 t/ha and about 1750 L of oil can be obtained from a hectare of waste land. It has high oil content which is around 67% in its kernel.

Sapindus mukorossi (Soapnut)

Sapindus mukorossi (Soapnut) is generally found in tropical and subtropical climate areas and various parts of the world including Asia (the outer Himalaya of Uttar, Pradesh, Uttaranchal, Himachal Pradesh, Jammu, Kashmir), America and Europe. The plant grows very well in deep loamy soils and leached soils. Therefore, cultivation of soapnut in such soil avoids potential soil erosion. The seed is enclosed in a black, smooth and hard globose endocarp. Soapnut seeds contain 23% oil of which 92% is triglycerides. The oil from soapnut has been considered as promising non-edible oil having significant potential for biodiesel production. This is because it is the third most productive vegetable oil producing crop in the world, after algae and oil palm.

Cerbera odollam (Sea mango)

Cerbera odollam (Sea mango) also sometimes called *Cerbera manghas* L., is a tree belonging to the poisonous Apocynaceae family. *Cerbera odollam* grows well in coastal salt swamps and creeks in south India and along riverbanks in southern and central Vietnam, Cambodia, Sri Lanka, Myanmar, Madagascar and Malaysia. The *Cerbera odollam* tree grows to a height of 6–15 m and has dark green fleshy lanceolate leaves. The large white flowers have a delicate perfume, reminiscent of jasmine. The fruit, when still green, looks like a small mango, with a green fibrous shell enclosing an ovoid kernel measuring approximately 2 cm×1.5 cm and consisting of two cross-matching white fleshy halves. On exposure to air, the white kernel turns

violet, then dark gray, and ultimately brown or black. The oil content from *Cerbera odollam* seeds is 54%. The fatty acid composition of cerbera odollam oil is mainly oleic (48.1%), followed by palmitic (30.3%), linoleic (17.8%) and stearic (3.8%).

Other feedstocks

Guizotia abyssinica belongs to the Compositae family. It is an annual herbaceous plant cultivated in Ethiopia and India in rotation with cereals and pulses. The plant grows to a height of 0.5–1.5 m and reaches the maturity within 110–120 days. The crop is widely adapted to all types of soil and is commonly grown in India on poor and acidic soils or on hilly slopes that are low in fertility. It requires moderate rainfall and grows in temperate and tropical areas. Yield is reported to be 200–300 kg/ha, although they can reach 500–600 kg/ha with good management. The seeds are shinning black in appearance and are very light in weight as 1000 seeds weigh 3–5 g. The seed contains about 30% oil with 25% oleic and 55% linoleic acid in fatty acid composition.

Argemone mexicana *L.* (Common name: Mexican prickly poppy) belongs to the Papaveraceae family. It is a species of poppy found in Mexico and now widely naturalized in the United States, India and Ethiopia. It has been used by the Natives of the western US and parts of Mexico. The plant prefers light (sandy) soils, requires well-drained soil and can grow in nutritionally poor soil. The seeds contain 22–36% of a pale yellow non-edible oil, called argemone oil or katkar oil, which contains toxic alkaloids the sanguinarine and dihydrosanguinarine. The main fatty acids present in *Argemone mexicana* L. seed oil are myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid and arachidic acid. The non-edible oil from this tree has been found most suitable for biodiesel purpose.

Putranjiva roxburghii (Lucky bean tree) tree belongs to the family Euphorbiacae of order Geranials, which was identified by Roxburgh and accordingly the plant is called as *P. roxburghii*. The tree can reach to a height up to 18 m and a girth of 2 m. Putranjiva oil is yellow in color, highly pungent, volatile and rich in oleic acid. The seeds contain 41–42% of oil.

Melia azedarach (syringe tree) belongs to the family Meliaceae. It is a deciduous tree that grows between 7 and 12 m in height. It is native to India, southern China, and Australia. The oil content of dried syringe berries is around 10 wt% .

Michelia champaca belongs to Magnoliaceae plant family, which is found in Eastern Himalayas, Assam, Burma, China, Western Ghats and throughout India. It is a tall handsome evergreen tree with straight stem and smooth brown bark. Its seeds yielded 45% of oil.

Garcinia indica belongs to Guttiferae plant family, which is found in the tropical rain forests of Western Ghats, Konkana, North Kanara, South Kanara, Bombay, Goa and Coorg. *Garcinia indica* seeds yielded 45.5% of oil.

Eruca sativa L. is widespread in South Asia and it is known as taramira. It can be considered as a non-edible biodiesel feedstock. *Eruca sativa* L. has a yield of 1106 kg oil/ha and the oil yield is 30%.

Hibiscus sabdariffa L. (Roselle) tree belongs to the family Malvaceae. It is also known worldwide by many different common names such as jamaica sorrel, and, in Thai, as krachiap daeng. It is widely cultivated in tropical regions including the northern, south-eastern, central parts of Thailand and China. The seeds contain 18% oil.