# Tanzanian *Garcinia*Species

# 1.1 Introduction

Tanzania, like many other African countries, is endowed with tropical forests that are rich in natural resources, particularly plants. The country is divided into six major ecological zones, namely Lake Victoria Mosaic, Coastal Forest and Thickets, Afromontane Forest, Acacia-Savanna and Grasslands, Acacia - Commiphora Thornbush and Miombo forests/woodlands, while the floristic regions are known to be eight, T1-T8. Every zone/region has its characteristic flora/plants and some uniqueness in terms of medicinal value of plants (Stuart *et al.*, 1990). Our ethnobotanical survey and the literature report revealed that *Garcinia* plants grows at least in almost all ecological and floristic zones except T2, where there is no any *Garcinia* plant species being reported (Bampss *et al.*, 1978).

# 1.2 Tanzanian Floristic Regions

Tanzanian flora is within the Tropical East African Flora which comprises of about 21,650 vascular plant species. Tanzania alone has over 10,650 higher plant species, out of which about 2,500 species are indigenous whereas more than 1200 plant species are endemic. Currently, Tanzania has eight (8) floristic ecozones, T1-8 (Fig. 2), each zone being characterised by unique features of plant diversity, including the richest Eastern Arc Mountains as one of the biodiversity hot spots of Tanzania. It spreads and covers all parts of T3 and T6 floristic regions and is reported to contain about 2000 plant species with 25 – 30% being endemic to the forests and forest edges of the mountains (Burgess *et al.*, 2002).



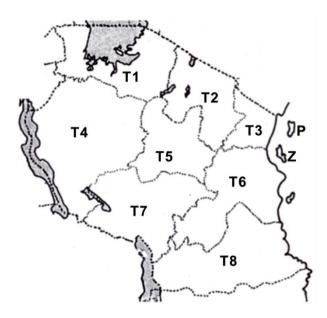


Fig. 2. Tanzanian Floristic Regions.

Each floristic zone covers a certain number of political regions in Tanzania as indicated in Table 1 below.

Table 1. Floristic zones and their corresponding political regions in Tanzania.

Zone	Regions
T1	Geita, Mwanza, Kagera, Mara, Simiyu and Shinyanga
T2	Arusha, Manyara
T3	Kilimanjaro, Tanga
T4	Kigoma, Rukwa, Tabora
T5	Dodoma, Singida
T6	Coastal, Dar es Salaam, Morogoro
T7	Iringa, Mbeya
T8	Lindi, Mtwara, Ruvuma
P	Pemba
Z	Zanzibar



# 1.3 Distributions of *Garcinia* Plant Species in Tanzania

The distribution of the Garcinia plants in Tanzania indicated these plants to grow in almost all eight (8) floristic zones. A total of 15 Garcinia plant species are known from different habitats ranging from the altitude of 400 to 2300 m high. Different studies have been done to establish potential biodiversity of Tanzanian forest potentials. A study to determine richness of vascular endemic plants of the Uluguru Mountains, in Morogoro region (T6), identified about 108 plant species to be endemic to the Uluguru Mountains. From this study, only one Garcinia species, namely G. bifasculata, was reported to be endemic to the Kimboza Forest Reserve (Temu and Andrew, 2008). In another study on the East and West Usambara mountains (T3), about 150 vascular plant species were reported to be endemic (Polhill, 1968) from which two Garcinia species, namely G. volkensii and G. buchanannii, are indigenous and four Garcinia species namely G. edulis, G. ferrea, G. mangostana and G. xanthochymus, are exotic (Bamps et al., 1978). In Zanzibar, only three Garcinia species have been cultivated including G. mangostana (at Kibweni and Kizimbani areas), G. xanthochymus (at Zanzibar fide) and G. indica (at Migombani and Mtoni areas). The complete list of Tanzanian Garcinia species include G. acutifolia N. Robson, G. bifasculata N. Robson, G. buchananii Bak., G. edulis Exell, G. ferrea Pierre, G. huillensis Welw. ex Oliv., G. indica DC., G. kingaensis Engl., G. livingstonei T. Anderson, G. mangostana L., G. pachyclada N. Robison, G. smeathmannii (Planch&Triana) Oliv., G. semseii Verdc, G. volkensis Engl. and G. xanthochymus (Roxb. T. Anders), (Table 2).



Table 2. Garcinia plant species found in Tanzania.

	Name	Status	Habit	Habitat	Distribution	Region
1	G. acutifolia	Indigenous	Shrub, 2-3 m	Dry evergreen forest, 100 m	Pugu Forest Reserve Litipo Forest Reserve	T6, Coastal T8, Lindi
2	G. bifasciculata	Endemic	Shrub, 4-6 m	Swamp forest (area of limestone soil), 400 m	Kimboza Forest Reserve	T6, Morogoro
3	G. buchananii	Indigenous	Tree/shrub, 2-15 m	Evergreen riverine forest, 60-1800 m	Amani Nature Reserve	T3, Tanga
					Karagwe	T1, Bukoba
					Ukerewe	T1, Mwanza
					Mahali Mts, Kassangazi river-Mpanda	T4, Rukwa
					Karagwe	T1, Kagera
					Rondo plateau, Mchinjiri	T8, Lindi
				500-800 m	Kanga Forest Reserve	T6, Morogoro
4	G. edulis	Exotic			Amani Nature Reserve	T3, Tanga
5	G. ferrea	Exotic			Amani Nature Reserve	T3, Tanga
6	G. huillensis	Indigenous	Shrub, 2-8 m	Deciduous woodland,	Lugoda village	T7, Iringa
7	G. indica	Exotic		,	Zanzibar (at Migombani and Mtoni)	Zanzibar
8	G. kingaensis	Indigenous	Tree, 3-15 m	Evergreen forest, 1200-2300 m	Lugoda village	T7, Iringa
			111	1200 2300 III	Fonera Forest	T7, Mbeya
					Reserve Kanga Forest Reserve	T6, Morogoro
					Madenge Forest hill	T7, Iringa
9	G. livingstoneii	Indigenous	Shrub or small tree, 3-18 m	Woodland, thicket and grassland, 0-1650 m	Pugu Forest Reserve	T6, Coastal



	Name	Status	Habit	Habitat	Distribution	Region
					Kazimuzumbi village	
					Chalinze village	
10	G. mangostana	Exotic		300-400 m	Kimboza Forest Reserve Amani Nature Reserve Zanzibar (at	T6, Morogoro T3, Tanga Zanzibar
				Woodland and	Kibweni)	Zunzrour
11	G. pachyclada	Indigenous	Shrub, 2-5 m	shrubby grassland, 0-1500 m	Ufipa district, Kasanga village, near Ngolotwa	T4, Rukwa
12	G. semseii	Endemic	Tree, 3-15 m	Rain forest, 210-1800 m	Kimboza Forest Reserve	T6, Morogoro
					Kihansi	T7, Iringa
					Manyangu forest-Nguru MTS	T6, Morogoro
13	G. smeathmannii	Indigenous	Tree	Riverine forest, 1000-1600 m	Mukugwa-Kibondo	T4, Kigoma
					Mwalesi-Rungwe	T7, Mbeya
					Lupembe-Njombe	T7, Iringa
14	G. volkensii	Indigenous	Much-bran ched tree, 2-20 m	Evergreen forest, 960-2400 m	Amani Nature Reserve	T3, Tanga
			2 20 111	1520-1980 m	Ikwamba Forest	T6,
				1020 1900 III	reserve Kanga Forest	Morogoro T6,
				1300-2000 m	Reserve	Morogoro
				1600-1760 m	Mamboto Forest Reserve Uluguru South	T6, Morogoro T6,
					Forest	Morogoro
					Shagayu forest, Lushoto	T3, Tanga
					Barankata area, Moshi	T3, Kilimanjar o
15	G. xanthochymus	Exotic			Amani Nature Reserve	T3, Tanga
					Zanzibar	Zanzibar



# 1.4 Basic Features of Selected *Garcinia* Plant Species

Plants from the genus *Garcinia* are usually evergreen trees or shrubs and dioecious and most of them grow in lowland rainforests or along riverines (Peres and Nagem, 1997). Most notably, they are trees or shrubs, secreting yellow latex when cut (Fig. 3) and generally glabrous. Leaves opposite or whorled, with latex canals; petiole bases usually strongly excavated. Inflorescences in axillary fascicles, rarely branched, or flowers solitary, axillary or terminal. Flowers bisexual and/or unisexual (plants usually dioecious or polygamous). Sepals 2-4(5), mostly imbricate; petals 2-4(-6), white, yellow, or red, decussate or imbricate, the pairs often of different sizes. Stamens free, variously fasciculate, or connate into a central mass, numerous in staminate flowers, fewer in bisexual flowers; anthers short. Ovary 2-12-locular, often absent from staminate flowers; ovule 1 per locule; styles short or lacking; stigmas expanded. Fruit a berry, mostly 1-locular, smooth to verrucose, leathery, ellipsoid to globose or ovoid, the mesocarp often juicy and sweet. Seeds 1-4; cotyledons minute.

(http://www.mobot.org/MOBOT/research/ven-guayana/clusiaceae/page6.shtml)

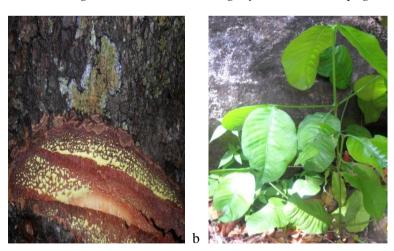


Fig. 3. (a) Stem bark of G. semseii showing yellow exudates and (b) G. semseii showing some leaves.

a



Fruits have been observed to have one to four seeds with fleshy, smooth or verrucose glabrous or puberulous berry (Bamps et al, 1978). Fruits of many *Garcinia* species are edible, particularly those of an African mangosteen (Figure 4) and are highly eaten by wild animals as well as by humans.





Fig. 4. Fruits of G. livingstoneii.

A survey conducted to locate the Tanzanian *Garcinia* species indicated that some of them are threatened for extinction due to habitat destruction. A good example is *G. acutifolia* formerly reported to grow in Pugu Forest, Coastal region, which was currently wiped out from this area (Bamps *et al.*, 1978). This survey, therefore, was able to locate and identify 15 *Garcinia* species growing in Tanzania as described in the following sub-sections.

# 1.4.1 Garcinia acutifolia N. Robson

The botanical description of *G. acutifolia* indicate that the plant is a shrub or small tree, 2-3 m. high, glabrous; branches slender, narrowly 4-winged. Leaves are opposite, petiolate; lamina, chartaceous, bright green, concolorous, ovate to lanceolate or elliptic, shortly and usually very acutely acuminate at the apex.



Male flowers with 2 antisepalous stamen-fascicles, each of 3 stamens, with filaments completely united and anthers sessile, oblong or elliptic, curved or straight, not septate.



Fig. 5. Aerial parts of G. acutifolia at Litipo Forest Reserve, Lindi, Tanzania.

This plant is mostly found among dry coastal forest species reported to grow in Mozambique and Tanzania and it is threatened by habitat loss. (Lovett and Clarke, 1998). In Mozambique, it grows between Muaguide and the Quissanga-Macomia crossroads, 2 3 km from Muaguide. In Tanzania, it is reported to grow in Pugu Forest Reserve, Coastal region at Kazimzumbwi area as well as at Litipo forest in Lindi region.

# 1.4.2 Garcinia bifasculata N. Robson

This plant is reported to grow at Kimboza Forest Reserve; it is a tree found to grow at an altitude of 390 m along the swamp forest on limestone outcrops. The voucher specimen as well as the photo was taken at the site. Neither flowers nor fruits were observed during the time of visit to the Kimboza forest reserve.





Fig. 6. Aerial parts of G. bifasculata at Kimboza Forest Reserve, Morogoro, Tanzania.

### 1.4.3 Garcinia buchananii Bak

It is a small evergreen tree with leaves being oblong or elliptic. The leaves and bark exude yellow sticky latex when cut. Lateral veins are evidently fixed on both surfaces. Flowers are greenish-yellow and observed in solitary or in small clusters. The fruits are edible as they are fleshy, spherical and yellow when ripe.



Fig. 7. Aerial parts and fruit of G. buchanannii.



This plant is widely distributed, ranging from Sudan southwards through Eastern Africa to Angola, Mozambique and Zimbabwe. In Tanzania, this plant is reported from Amani Nature Reserve, Ukerewe, Kanga Forest Reserve (Morogoro), Gombe Forest Reserve (at Kakombe valley-Kigoma), Mwihana Forest Reserve (West Udzungwa-Iringa) and in Karagwe (Kagera region).

### 1.4.4 Garcinia edulis Exell

This is a small tree, 5-6 m tall, with a straight and dark brown trunk, producing yellow latex when cut. Leaves are opposite, stiff, 7-12 cm long and 3-5 cm wide. Flowers are whitish and small, produced in axillary groups of 1-15 at branch nodes (Fig. 8). Fruits are round, about 3 cm in diameter, with a thin orange to reddish peel with an aromatic sweet sour taste. Seeds are in 1 or 2. It is commonly known as 'the lemon drop mangosteen'. The plant is propagated by seeds that germinate easily with flowering and fruiting takes about 3 years.



Fig. 8. Aerial parts and flowers of G. edulis at Amani Nature Reserve, Muheza, Tanzania.

The plant is very attractive; sometimes it is used as an ornamental tree. The earlier classification of this plant placed it in the genus *Rhedia* and hence it was



called *Rhedia edulis*. In Tanzania, it is cultivated at Amani Nature Reserve near Sigi River, in Muheza district, Tanga region.

### 1.4.5 Garcinia ferrea Pierre

The common name for *G. ferrea* is Pursat mangosteen with a synonym to *Garcinia benthamii* Pierre. This plant grows up to 5-6 m high and in Tanzania is known to grow at Amani nature reserve, Muheza district, Tanga region.



Fig. 9. Aerial parts and fruits of G. ferrea at Amani Nature Reserve, Muheza, Tanzania.

### 1.4.6 Garcinia huillensis Welw. ex Oliv

The reported common names for this plant are Granite garcinia (English), Granite mangosteen (English) and Mutunduru (Shona) (Drummond, 1981). It is a small evergreen tree growing up to 4-5 m high. The leaves are oblong or elliptic, thick and leathery, exuding yellow sticky latex when broken. The veins are lateral and conspicuously etched on both surfaces. Flowers are solitary or in small clusters, axillary, greenish-yellow and short-lived with the flowering time



being September to November. Fruits are always fleshy, spherical, yellow when ripe and are edible.



Fig. 10. Aerial parts of G. huillensis at Igomaa village, Mufindi, Tanzania.

The habitat of this plant is on granite kopjes, rocky outcrops and in riverine fringes with an altitude of about 900-1800 m. Its distribution ranges from Sudan southwards through eastern Africa to Angola, Mozambique and Zimbabwe (Smith & Allen, 2004). In Tanzania, *G. huillensis* is reported to grow from Lugoda (Iringa), Geita (24 km South of Geita Gold Mines) and Gombe Forest Reserve along Kakombe valley in Kigoma region.

### 1.4.7 Garcinia indica DC

This plant is commonly known as 'kokum' in most parts of India. It is a tree with a dense canopy of green leaves being indigenous to India. Leaves are elliptic, oblong or oblong-lanceolate about 6-8 cm long and 3-4 cm broad. The flowers are fleshy, dark pink, solitary or in spreading cluster and the flowering period is November to February. The fruit is brownish or brownish-gray, marbled with yellow, and is crowned by the 4-parted, stalkless stigma. There are from 6 to 8 seeds, and the pulp is juicy, white, and delicious in taste and odor. The fruiting season is between April and May.





Fig. 11. Aerial parts and Fruits of G. indica.

The habitat of *G. indica* is always forest lands, riversides and wastelands. The plant prefers evergreen forests, but sometimes they also thrive in areas with relatively low rainfall. In Tanzania, it is repoted to grow in Zanzibar at Migombani and Mtoni areas.

# 1.4.8 Garcinia kingaensis Engl

This plant is always found in the understorey of evergreen forest and forested ravines at an altitude range of 1350-2100 m. It is a small to medium-sized tree with main branches, it appears horizontal while the lateral branches are grooved and angular. When cut it gives yellow sap. Leaves are opposite, narrowly elliptic to oblong and they are dull bluish to grey-green. Flowers are in clusters on short spur-branchlets along the stems. Fruits are spherical and yellow to orange and they are edible. The flowering time is between September and October.





Fig. 12. G. kingaensis showing flowers, at Lugoda village, Mufindi, Tanzania.

In Tanzania, it is reported to grow at Lugoda (Iringa), Songea (Luwiru-Kiteza Forest Reserve), Fonera Forest Reserve (Mbeya), Kanga Forest Reserve (Morogoro-Turiani), Madenge Forest (Iringa) and Mwanihana Forest Reserve (West Udzungwa mountains-Iringa. The wood is hard and used for firewood, poles, tool handles, spoons, stools and milk pots while the sap gives yellow dye. As known for other *Garcinia* plants, fruits are edible.

# 1.4.9 Garcinia livingstoneii T. Anders

It is an evergreen, small tree of up to 20 m high usually with dense rounded crown. Leaves are always in whorls of three, while flowers are in crowned fascicles of 5-15 and they attract insects due to their sweet nectar. Fruits are yellow or orange in colour while their shapes are always ovoid and they are edible.





Fig. 13. Branchlets and Fruits of African Mangosteen at Kazimzumbwi, Kisarawe, Tanzania.

It grows in a wide range of tropical Africa from from Côte d'Ivoire east to Somalia, and south to South Africa being commonly known as African mangosteen to its esteemed fruits. The distribution of the plant in Tanzania is high as it is reported to grow in Chalinze area, Pugu Forest Reserve and kisarawe at Kazimzumbwi village and it is called Mutumbi or Mpekechu (in Swahili).

# 1.4.10 Garcinia mangostana L.

It is a small tree of 7-8 m high with dense heavy branched crown. The leaves are leathery. The petioles are short and thick. The flowers are 5 centimeters in diameter, 4-parted, bisexual, and borne singly or in pairs at the ends of the branchlets. The seeds are large, flattened- and embedded in snowy-white or pinkish delicious pulp. The mangosteen fruit is the size of a small apple, purple colored, with a hard rind. Inside there are typically five to seven seeds surrounded by a sweet, juicy cover (or aril). Dried fruits are well known for their medicinal uses.





Fig. 14. Aerial parts and fruits of G. mangostana at Amani Nature Reserve, Tanzania.

Although this plant is known to be native to South East Asia, it is cultivated in almost all tropical countries. It is a true mangosteen due to its valuable fruits. In Tanzania, *G. mangostana* is cultivated at Amani Nature Reserve, Muheza district, Tanga region.

# 1.4.11 Garcinia pachyclada N. Robson

This appears as a shrub or small tree of about 5 metres high having thick branches with a grayish or corky bark. The bark secrets yellow and sticky latex when cut. Leaves are observed to be in whorls of three. Flowers are observed to be unisexual and clustered in axils or above the leaf-scars on mostly leafleded branches.

*G. pachyclada* differs from *G. livingstonei* by its Uapaca-like habit (ascending branches), its thicker rough branches; its leaves are thickened, undulate margins, and its large flowers on short pedicels. It is a plant of plateau



woodland rather than riverine forest. In Tanzania, this plant is reported to grow in Sumbawanga (Rukwa) at Kasanga area-Ngolotwa.

### 1.4.12 Garcinia semseii Verdc

This is a tree that grows to the height of about 15 mters, having slightly wrinkled branchlets and rough nodes. The leaves are opposite and they become reddish brown when dry. The plant always contains two flowers at the leafless nodes. Fruits are roughly warted and highly eated by monkeys.



Fig. 15. Leaves and Fruits of G. semseii taken at Kimboza Forest Reserve, Morogoro district.

This plant is endemic to Tanzania and its range description indicates to be known only from four localities including Kimboza forest reserve, Chita and Kihansi within the Udzungwa mountains and at Nguru mountain in Morogoro region.



### 1.4.13 Garcinia smeathmannii (Planch. & Triana) Oliv.

It is a small tree that grows to about 20 m high and haaving a bole of over 1 m in girth. It has a dark orangeish scaly bark exuding some yellow latex when cut. Leaves are simple and opposite while petioles are short or normal and entire margin. Flowers are dioecious and in fascicles of 5–30 in the axils of leaves. Fruits are purplish-green turning to yellow with 1-2 5 cm in diameter.





Fig. 16. Leaves and Flowers of G. smeathmannii.

The plant always grows in riverines and uplands to about 1500 m elevation. The distribution ranges from Angola, Congo, Gabon, Cameroon, Central African Republic and DR Congo. In Tanzania, it is reported from 48 km South of Kibondo at Mukugwe River, Rungwe at Mwalesi River, Njombe (upper Ruhudje river and Lupembe area-north of the river).

# 1.4.14 Garcinia volkensii Engl

This is a highly branched plant growing to about 20 m high. Its bark is grey or brown and gives white/yellow exudates when cut. Leaves are simple, opposite or whorled while petioles are angled and/or narrowly winged. Flowers



are dioecious cream/green-white/pink and infloresence in axillary cymes. Fruits are green and turning yellow/orange/brown when ripe.



Fig. 17. Aerial parts of G. volkensii at Shagayu Forest Reserve, Lushoto, Tanzania.

The ecology of this plant is in understorey of evergreen rainforest as well as dry evergreen forest to an elevation of up to 2400 m. Its distribuition in Tanzania is from Ikwamba Forest Reserve, Kanga Forest Reserve, Mamboto Forest Reserve (all from Morogoro region), Amani Nature Reserve, Shagayu Forest Reserve (from Tanga region), Useri at Barankata area (Kilimanjaro region) and Mwanihana Forest Reserve (West Udzungwa-Iringa).

# 1.4.15 Garcinia xanthochymus Hook. F.

It is a small evergreen tree growing up to about 15 m high with horizontal branches and a dense pyramidal crown. Leaves are narrowly oblong while fruits are pale orange to dark yellow with a diameter of about 9 cm. The fruit is edible



and has a pleasant acid taste. It usally contains two seeds, sometimes is called yellow mangosteen or camboge. Flowering occurs between March and May.



Fig. 18. Aerial parts and fruits of G. xanthochymus at Amani Nature Reserve, Tanzania.

The tree is well adapted to shade and humid conditions. In Tanzania, the plant was cultivated at Amani Nature Reserve, near Sigi river, Muheza district, Tanga region.

