



A GUIDE TO EDIBLE LEGUMES FOUND IN ETHIOPIA

For Extension Officers and Researchers

Legume Diversity Project

Dedication

This book is dedicated to our late mother, wife, friend and colleague Sue Edwards who passed away while we were preparing this book.



Suesan Burnell Edwards in Gothenburg, awarded for her hard work in 2011

Ethiopian Legume Diversity Team Members

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Table of Contents

1. General Introduction	1
2. Taxonomic Keys to Edible Legumes Found in Ethiopia.....	3
2.1. The characters used in the keys.....	3
LEAVES	3
FLOWERS.....	3
2.2. Legume Subfamilies and Scientific names	4
2.3. Keys to Subfamilies.....	5
2.3.1. Keys to Species in the Subfamily CAESALPINOIDEAE.....	5
2.3.2. Keys to Species in the Subfamily MIMOSOIDEAE.....	6
2.3.3. Key to Species in the Subfamily PAPILIONOIDEAE	6
3. Distribution Range Maps.....	10
4. Additional Plants.....	12
5. Descriptions of Edible Legumes reported to be Found in Ethiopia.....	17
5.1. Leguminous Plants which are Cultivated as Crops in Ethiopia	17
5.1.1. <i>Arachis hypogea</i> L.....	17
5.1.2. <i>Glycine max</i> (L.) Merr.....	21
5.1.3. <i>Canavalia ensiformis</i> (L.) DC.....	24
5.1.4. <i>Phaseolus vulgaris</i> L.....	26
5.1.5. <i>Phaseolus lunatus</i> L.....	29
5.1.6. <i>Phaseolus coccineus</i> L.....	31
5.1.7. <i>Vigna subterranean</i> (L.) Verd.....	33
5.1.8. <i>Vigna unguiculata</i> (L.) Walp.....	34
5.1.9. <i>Vigna radiata</i> (L.) Wilczek variety <i>radiata</i>	37
5.1.10. <i>Lablab purpureus</i> (L.) Sweet	39
5.1.11. <i>Cajanus cajan</i> (L.) Millsp.....	41
5.1.12. and 5.1.13. <i>Lupinus</i>	43
5.1.12. <i>Lupinus albus</i> L.....	44

5.1.13. <i>Lupinus mutabilis</i> Sweet	46
5.1.14. <i>Trigonallafoenum-graecum</i> L.	47
5.1.15. <i>Cicer arietinum</i> L.....	50
5.1.16. <i>Pisum sativum</i> L.	53
5.1.17. <i>Vicia faba</i> L.....	57
5.1.18. <i>Lens culinaris</i> Medik.....	60
5.2. Non-Cultivated Edible Legumes Found in Ethiopia.....	65
5.2.1. <i>Cordeauxia edulis</i> Hemsl.	66
5.2.2. <i>Tamarindus indica</i> L.....	67
5.2.3. <i>Senna occidentalis</i> (L.) Link.....	70
5.2.4. <i>Prosopis juliflora</i> L.....	72
5.2.5. <i>Acacia albida</i> Del.	74
5.2.6. <i>Pithecellabium dulce</i> (Roxb.) Benth.....	75
5.2.7. <i>Erythrina melanacantha</i> Taub. ex Harms.....	77
5.3. Leguminous Plants Reported as Edible in Other Counties, and Found, but Not Eaten in Ethiopia	79
5.3.1. <i>Caesalpinia pulcherrima</i> (L.) Sw.	79
5.3.2. <i>Senna petersiana</i> (Bolle) Lock.....	80
5.3.3. <i>Senna bicapsularis</i> (L.) Roxb.	82
5.3.4. <i>Bauhinia purpurea</i> L.	83
5.3.5. <i>Tylosema fassoglensis</i> (Kotschy ex Shweinf.) Torre & Hillc.....	85
5.3.6. <i>Acacia tortilis</i> (Forssk.) Hayne.....	86
5.3.7. <i>Acacia edgeworthii</i> T. Andres.	88
5.3.8. <i>Acacia saligna</i> (Labill.) Wendl.....	89
5.3.9. <i>Pterocarpus lucens</i> Guill. & Perr.	91
5.3.10. <i>Indigofera linifolia</i> (L.f.) Retz.....	92
5.3.11. <i>Eriosema shirensense</i> Bak. f.....	94
Appendix	96
A. Bibliography.....	96
B. Index for Common Names.....	98

English Common Names	98
Ethiopian Common Names.....	102

1. General Introduction

Green plants capture light from the sun, and a gaseous chemical called carbon dioxide from the air to synthesize chemical compounds that we call carbohydrates. These carbohydrates give animals, including human beings, the energy which they need to live and to fulfil their respective functions.

Green plants also uptake nutritious compounds from the soil or the water in which they grow and, using the energy they have stored in the carbohydrates; they synthesise the various other chemicals they need to build their bodies, go on living and reproduce.

Animals, including human beings, and many other forms of life that we can see, as well as, those we cannot see with our eyes, without magnifying instruments, e.g. microscopes, depend on the carbohydrates that the green plants manufactured, for growth, development and reproduction.

That is why we, humans, need to eat plants (usually grown as crops) and animals, e.g. cattle, goats, sheep, fish, to get both the energy and the nutrients our bodies need to enable us to grow, be active and reproduce. It should be noted that when we eat animals to get the energy and the chemicals that we need from them, they have got these directly, and sometimes indirectly, from plants which have used the sun's energy and the soil's nutrients to live and grow.

Animals, when they get rid of their dung/droppings and urine, provide some nutrients needed by plants, including other living organisms, such as fungi and bacteria. The droppings and the urine fertilise the soil with essential nutrients for plants, including crops, to grow well and improve the soil quality for plant growth.

The group of plants which we call legumes, besides providing carbohydrates, fat, protein, minerals and vitamins to animals, including humans, can work with bacteria in the soil to take up nitrogen from the air, and with the help of rhizobia bacteria fix it through Biological Nitrogen fixation, resulting in high quantities of nitrogen in their roots, that are also translocated into stems, leaves and proteins in the seeds. Therefore, their value as food for humans is high. They also enrich the soil where they grow, by releasing chemicals containing nitrogen, such as amino acids and nitrates.

Because of this, eating legumes makes human food more complete than eating cereals alone. This is not to imply that cereals provide no proteins for humans, but that legumes certainly provide more (at least 2-3 times more protein than cereals).

This is one of the main reasons for making us, the Ethiopian Legume Team, study and share in this book our experience about legumes that grow and are used as human food in Ethiopia.

We however, have not included all the legumes that are eaten or said to be eaten. Children eat wild legumes that they find and know when they are out taking care of animals or at play: for example, the bark of *Acacia negrii* is chewed by boys in the Benishangul Gumuz Region, and the seeds of *Acacia seyal* are eaten by Mursi children in the Southern Nations Nationalities and Peoples' Region. There are also other leguminous plants eaten by children in different parts of Ethiopia. Our focus in this book is on legumes that are said to be eaten as components of the family meal.

Another very important contribution of leguminous plants is to local biodiversity is as a rich source of nectar that attracts pollinators, such as bees and many other animals including bats.

2. Taxonomic Keys to Edible Legumes Found in Ethiopia

2.1. The characters used in the keys

The legumes that are either cultivated or found growing in Ethiopia are herbs, climbers, shrubs or trees. The climbers may be woody throughout their lengths, woody only at the base, or may be entirely herbaceous.

LEAVES

The leaves of leguminous plants are alternate, i.e. one above the other along the stem. They are never opposite each other on the stem. Each alternating leaf may be simple, with two or three lobes, or divided into smaller leaves called leaflets, which are mostly directly opposite to each other along the leaf-stalk. These leaflets may seem to be many small leaves, but they are all part of the same leaf. The leaflets can again be divided into smaller similarly opposite leaflets along a side branch of the leaf stalk. The base of the leaf stalk usually has two small leaflets called **stipules**, one on each side of the leaf stalk. In *Acacia* and some other groups of legumes, the stipules are **spines**.

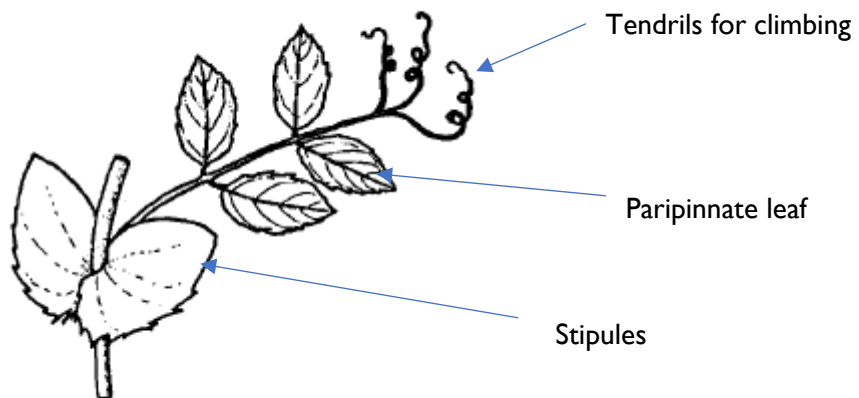


Figure 1, Legume leaf, Courtesy Damtew T, Flora Volume 3, Inga Hedberg and Sue Edwards, (1989).

FLOWERS

Each flower develops inside a bud.

The five leaf-like structures are called **sepals**. They are usually green, but can also be coloured. They cover and protect the developing flower. When the

flower opens, the sepals usually stay green and cover the developing pod while the seeds are being formed.

The **petals** are usually colourful. They open to attract pollinators, particularly bees. There are, usually, five petals, though in some species there may be fewer or none. The petals can all be more or less the same size and free from each, or one petal may be larger than the others. However, in the sub-family that includes beans and peas, the outer petal is usually the largest and called the *standard*, then there are two free side petals called the *wings*, and two smaller inner petals that are usually joined together to form a *keel*.

The male parts of the flower (**stamens**) are inside the petals. There are usually 10 stamens, sometimes more, in each flower. Each stamen has a stalk (*filament*) holding a bag (*anther*) at its end containing *pollen*. The stamens stick out of the flower when they are ready to release their pollen grains onto visiting pollinators, usually flying insects.

The **ovary**, the female part of the flower, is in the middle of the flower. Each legume flower, usually, has only one ovary with at least one, usually, two or more ovules containing the egg cells, in a row along one side of the ovary. After fertilisation, the ovules develop to become seeds, and the ovary becomes a pod or legume (from which the family gets its name).

The **pod** splits open when ripe. The seeds can be flung out of the pod, when it splits explosively, so they get scattered, other pods open slowly, and the seeds may hang by their seed stalks or fall to the ground and attract seed-eating animals, including domestic and wild animals. In most legume crops, the pods need to be crushed and opened to release the seeds.

Most flowers are cross-pollinated, i.e. the ovules need to be fertilised with male cells from the pollen of a different plant of the same species. For this to happen, the flowers attract pollinators by producing colour, scent and nectar as a reward. In some species, for most crop legumes, self-pollination without the need for pollinators can occur.

2.2. Legume Subfamilies and Scientific names

The group of plants which we call legumes belong to one family, which we call LEGUMINOSAE (also called FABACEAE), which has three subfamilies, which we call MIMOSOIDEAE, CAESALPINOIDEAE and PAPILIONOIDEAE. Each sub-family has several **genera** (singular: **genus**), and each genus has one or more **species**. [The word 'species' can be singular or plural. A singular species is abbreviated as sp., while several species in the same genus are abbreviated as spp.]. Scientific names are either underlined or written in italics.

The species are the different types of plants we see growing. For international communication, the name of each species is in Latin and is made up of the

name of the genus it belongs to, followed by its own name: for example, *Pisum sativum*. *Pisum* is the Latin name for pea, and *sativum* indicates that it is edible. In headings and lists, the scientific name is followed by the shortened name of the person or persons (the authority) that first described and published the scientific name of the species: for example, *Pisum sativum* L. 'L.' is the abbreviation for Linnaeus, the person who first described and published the scientific name of pea.

2.3. Keys to Subfamilies

1a. Flowers can be cut into two equal halves from whichever direction we choose (called regular or radially symmetrical); leaves branched twice, i.e. each leaflet is divided into many usually very small leaflets (for example *Acacia* spp.).
MIMOSOIDEAE

1b. Flowers can only be cut into two equal halves in one direction (called irregular or bilaterally symmetrical); leaves usually only branched once, i.e. leaflets not entire, not divided; 2

2a. Sepals not united, free from each other to the base; in the bud, the larger petal is covered by the side petals; stamen filaments not united, free from each other to the base; seeds not curved at either end (for example *Senna* spp.).
CAESALPINOIDEAE

2b. Sepals united at their lower ends, the base; in the bud the larger petal covers the other petals; stamen filaments, usually, united at least at their base; seeds curved at the end, where roots emerge upon germination (for example *Phaseolus* spp.). PAPILIONOIDEAE

2.3.1. Keys to Species in the Subfamily CAESALPINOIDEAE

- | | |
|---|-------------------------------|
| 1a. Leaves simple, with two lobes. | 2 |
| 1b. Leaves with four or more leaflets. | 3 |
| 2a. A small tree, stems woody. | <i>Bauhinia purpurea</i> |
| 2b. Stem herbaceous, trailing on the ground or climbing on shrubs or trees. | <i>Tylosema fassoglensis</i> |
| 3a. Shrub or tree with spines only at the bases of leaves or on the leaves. | 4 |
| 3b. Shrub without spines or with small spines or prickles scattered throughout the stem. | <i>Caesalpinia pulcherima</i> |
| 4a. Plant without red swellings (glands). | 5 |
| 4b. Shrub with conspicuous red glands (swellings) on stems and on lower surfaces of leaves. | <i>Cordeauxia edulis</i> |

- 5a. Herb, shrub or small tree; each flower with five petals, stamens free, not joined. 6
- 5b. Tree; each flower with three petals, stamens joined half way. *Tamarindus indica*
- 6a. Herb, shrub or tree, each stalk with a flower at its end without any leaflet (bract) at its base. 7 (*Senna*)
- 6b. An erect herb, which may have a slightly woody base; each leaf with a gland at its base; leaflets of each leaf in four or five pairs. *Senna occidentalis*
- 7a. Each leaflet with a pointed tip. *Senna petersiana*
- 7b. Each leaflet with a rounded tip. *Senna bicapsularis*

2.3.2. Keys to Species in the Subfamily MIMOSOIDEAE

- 1a. Each leaf with more than one pair of leaflets. 2
- 1b. Each leaf with only one pair of leaflets. *Pithecellobium dulce*
- 2a. Stamens in each flower more than 10; flowers tightly clustered into balls (forming heads) at the end of a branch, or attached along a stem at the end of a branch (forming spikes). 3
- 2b. Stamens 8 or 10 in each flower; the flowers always attached along the end of a branch of the stem (flowers in spikes). *Prosopis juliflora*
- 3a. Leaves are branching twice (bipinnate), into many opposite parts, with each part having opposite leaflets along its length. 4
- 3b. Leaves not branched (simple) and flat. *Acacia saligna*
- 4a. A tall tree with a conspicuous gland between each pair of the opposite branches of the leaf that carry the leaflets. *Acacia (Faidherbia) albida*
- 4b. A shrub without a conspicuous gland between each pair of the opposite branches that carry the leaflets. *Acacia edgeworthi*

2.3.3. Key to Species in the Subfamily PAPILIONOIDEAE

- 1a. Herb, shrub or tree with leaves that come out of the stem on the inner (stem-side) part of a pair of leaf-like growths (stipules); pods without wings along the edges. 2
- 1b. Herb, with thin twisting stems (tendrils) coming out of the stem on the inner stem-side base of a leaf-like piece that comes out of the stem (stipule);

tendrils enable the plant to latch onto and be supported by other plants; each pod has a wing along both edges. *Lathyrus sativus*

2a. Annual herb, shrub or tree; each leaf divided into two or more leaflets. 3

2b. An annual herb, which twists around and climbs on other plants, or grows spreading over the ground; leaf simple or with two or three lobes. 3
(*Vigna*)

3a. Pod buries itself inside the soil to ripen. *Vigna subterranea*

3b. Pod ripens above ground. 4

4a. Herb with a hairy stem; leaf-like growths (stipules) rounded at the tips; leaf entire or with 2 or 3 lobes. *Vigna radiata*

4b. Herb with smooth stem (i.e. without hairs); stipules with pointed tips. *Vigna unguiculata*

5a. Herb, shrub or tree; each leaf with two or more leaflets; pod maturing above ground. 6

5b. Herb; each leaf has four leaflets that are broad at the base; plant pushes the pod into the soil to mature underground. *Arachis hypogea*

6a. Herb, shrub or tree; each leaf having several leaflets; end of the leaf with a single leaflet, or a simple point (without a tendril). 7

6b. Herb; each leaf having two or four opposite leaflets; the end of the leaf forming a coiled tendril to enable the plant to climb onto and be supported by other plants. *Pisum sativum*

7a. Herb, shrub or tree; each leaf having 6 or more leaflets. 8

7b. Erect herb; each leaf having two, four or six leaflets. *Vicia faba*

8a. Herb, shrub or tree with at least some of its leaves branched twice into leaflets (bipinnate); stamens uniform and joined to each other to form a tube. 9

8b. Herb, stamens free, not joined into a tube. 10

9a. Herb or small shrub; leaflets arranged like the fingers on a hand (palmate); stamens all the same length, united into a tube. *Lupinus*

Stem smooth, i.e. without hairs; flowers usually blue. *Lupinus mutabilis*

Stem with short, usually soft and silvery hairs; flowers usually white. *Lupinus albus*

- 10a. Tree; stamens joined together to form a tube. *Pterocarpus lucens*
- 10b. Herb; stamens free, not united into a tube; pods with one or two seeds.
11
- 11a. Herb grown as a crop; hairs on stem simple, not T-shaped,, i.e. without two branches. *Cicer arietinum*
- 11b. Plant growing wild; hairs on stem T-shaped, with 2 branches. *Indigofera linifolia*
- 11c. Herb, shrub or tree; without a tendril at the end of each leaf. 12
Herb grown as a crop; each leaf with two or four leaflets, the end with a coiling projection (tendril) to enable the plant to climb onto other plants, *Pisum sativum*
12. Herb, shrub or tree; each leaf having more than 6 leaflets. 13
Herb grown as a crop; each leaf with two, four or six leaflets, *Vicia faba*
13. Stamens joined to form a tube inside the flower. 14
Stamens free, not forming a tube inside the flower. 15
14. Herb or small shrub; leaflets all attached to the top of the leaf stalk, like the fingers on a hand (palmate), stamens all the same length and joined together to form a tube. *Lupinus*
- Tree; leaflets arranged along either side of the leaf stalk (pinnate). *Pterocarpus lucens*
- 14a. Stem smooth, i.e. without hairs; flowers usually blue. *Lupinus mutabilis*
- 14b. Stem covered with short, usually silvery hairs; flowers usually white. *Lupinus albus*
15. Herb or tree; pod usually with only one or two seeds. 16
Herb or tree; pod with many seeds. 17
16. Plant grown as a crop; hairs on stems and leaves simple, i.e. not branched. *Cicer arietinum*
- Plant growing wild; hairs on stems and leaves T-shaped, i.e. hairs have two branches. *Indigofera linifolia*
17. The plant has a strong musty smell; pods 3x or more the length of the sepals; each with many seeds and a long up-curved beak. *Trigonella foenum-graecum*

- Plant without a strong musty smell; pods 2-3x the length of the sepals without a long beak. 18
18. Herb or tree; leaflets not silvery in colour. 19
- Plant grown as a crop; leaflets silvery and shiny. *Cajanus cajan*
19. Plant without small thorns. 20
- Tree; with small thorns on leaves, stems and branches. *Erythrina melanacantha*
20. Herb with pod less than 10 cm long, without ridges along its length. 21
- Herb with twining stems; pod 10-35 cm long, with ridges along its length. *Canavalia ensiformis*
21. A plant that grows with one or several stems from the same root. 22
- Plant grows only one stem from its root, and climbs on other plants or grows over the ground. *Lablab purpureus*
22. An annual herb, or else a perennial with stems that climbs on other plants. 23
- A perennial herb that produces many stems from a thick root; stems grow straight and erect, not climbing. *Eriosema shirensense*
23. Bushy annual herb grown as a crop; stems grow straight, not climbing. *Glycine max*
- Annual herbs grown as crops; stems grow erect or climbing. *Phaseolus*
- 23a. Pods straight, containing five or more seeds. 23b
- Pods curved, containing two, three or four seeds. *Phaseolus lunatus*
- 23b. Herb with few usually white flowers, each 1.5 cm or shorter in length. *Phaseolus vulgaris*
- Herb with many usually bright red flowers, each about 2 cm long. *Phaseolus coccineus*

3. Distribution Range Maps

For the non-cultivated plants, potential range maps are made to identify areas where each species is most likely to be found. Species descriptions from the Flora of Ethiopian and Eritrea reviewed to identify the Flora zones where the species have been observed (see map below), elevation ranges, and vegetation types. Maps are generated using ArcGIS (ESRI, version 10.4), elevation data from the United States Geological Survey, and vegetation data from the Vegetation Map for Africa (Atlas of the Potential Vegetation of Ethiopia).

We would like to acknowledge the combination and use of these resources.



Figure 2, Flora of Ethiopia and Eritrea Floral Zones, adapted from the book by Inga Hedberg and Sue Edwards, (1989). Note: the description of each flora zones is presented in tables.

Table 1. Floral zone definition from the flora book as also shown in Figure 2 and Table 2

Region code	Floral Region
AF	Afar region, Ethiopia
AR	Arsi region, Ethiopia
BA	Bale region, Ethiopia
GD	Gondar region, Ethiopia
GG	Gamu Gofa region, Ethiopia
GJ	Gojjam region, Ethiopia
HA	Harerge region, Ethiopia
IL	Ilubabor region, Ethiopia
KF	Kefa region, Ethiopia
SD	Sidamo region, Ethiopia
SU	Shewa upland, above 1000m contour to west, Ethiopia
TU	Tigray region, Ethiopia
WG	Welega region, Ethiopia
WU	Wello region, Ethiopia

4. Additional Plants

We have only addressed well known and published plants in this book despite recent studies, including those done by team members, showing that there are many other edible legumes in Ethiopia. The following is a list of plants and the parts used as food that have not been mentioned in this book, **Error! Reference source not found..** This table only addresses studies that have been published, hence it is safe to assume there could be other leguminous trees and shrubs with edible parts that can be found in future studies.

Table 2. List of plants with edible parts with references to the studies that provide information on them.

Species	Elevation	Vegetation	Flora Zones	Use as food
<i>Acacia abyssinica</i>	1500 to 2800 m	Woodland, wooded grassland, forest margins and along sides of streams and rivers	TU GD WU GJ WG SU AR BA IL KF SD	Gum chewed in Central Ethiopia (Asfaw and Tadesse, 2001; Teketay et al., 2010).
<i>Acacia etbaica</i>	differs among subspecies			Fruits consumed in Dejen (East Gojjam) (Fentahun Mengistu and Hager, 2009).
<i>Acacia hockii</i>	c. 700 m	Deciduous woodland and wooded grassland	GG	Bark used as a famine food (Hedberg and Edwards, 1989). Inner bark fibre has a sweet taste and is chewed for juices in GG (e.g. South Omo). Gum is also edible (Teketay et al., 2010)
<i>Acacia negrii</i>	2000 to 3100 m	Upland wooded grassland	GD WU GJ SU HA	Inner bark chewed by shepherd boys in Awi (Teketay et al., 2010)

Species	Elevation	Vegetation	Flora Zones	Use as food
<i>Acacia nilotica</i>	differs among subspecies			Bark and fruit pulp consumed in Southern and Southeastern Ethiopia. Pods consumed during times of food shortage. (Teketay et al., 2010)
<i>Acacia polyacantha</i>	500 to 1600 m	Wooded grassland, deciduous woodland and bushland, riverine and groundwater forest	TU GD GJ SU IL KF GG SD	Wood ash substituted for salt in southwestern Ethiopia (Teketay et al., 2010). Gum consumed raw as a snack by Nuer children (Asfaw, 2002).
<i>Acacia senegal</i> var. <i>senegal</i>	c. 600 to 1700 m	Wooded grassland, deciduous bushland, dry scrub	AF WU SU AR BA GG SD	Seeds consumed (Teketay et al., 2010).
<i>Acacia seyal</i>	500 to 2100 m	Woodland, wooded grassland	TU WU GD GJ SU AR HA IL KF SD	Fruits consumed by Mursi children (Teketay et al., 2010). Bark used as an additive for fermentation by Mejenger (Asfaw, 2002)
<i>Acacia sieberiana</i> var. <i>woodii</i>	c. 1700 to 2100 m	Woodland and wooded grassland	TU GD WU SU [AR] KF SD	Gum consumed by children in Yilmana Densa (West Gojjam) (Addis et al., 2005)
<i>Albizia grandibracteata</i>	1200 to 1700 m	Rain-forest, riverine forest	WG SU IL KF SD	Bark used to prepare alcoholic drink called 'Ogolli' in Gambella (Hedberg and Edwards, 1989), and for fermentation by Anywaa and Mejenger peoples (Asfaw, 2002)

Species	Elevation	Vegetation	Flora Zones	Use as food
<i>Albizia schimperiana</i>	1600 to 2600 m	Upland forest, evergreen bushland	[TU] GD WU GJ WG SU AR KF IL GG SD	Gum consumed by children in Yilmana Densa (West Gojjam) (Addis et al., 2005)
<i>Crotalaria incana</i>	differs among subspecies			Leaves consumed in Hamar and Konso (Lulekal et al., 2011).
<i>Crotalaria phillipsiae</i>	up to 1600 m	Deciduous bushland	HA SD	Leaves consumed in Hamar and Konso (Lulekal et al., 2011).
<i>Crotalaria polysperma</i>	1000-2000 (-2400) m	Deciduous woodland and grassland, also roadsides and cultivated ground	HA SU GG SD	Leaves consumed in Hamar and Konso (Lulekal et al., 2011).
<i>Delonix regia</i>	below 1700 m	Cultivated	HA and elsewhere	Seeds consumed in Hamar and Konso (Lulekal et al., 2011).
<i>Eriosema cordifolium</i>	1700 to 2500 m	Grassland and woodland, roadsides	TU GD WG SU KF SD	Roots consumed in Northwestern parts of Ethiopia, AR, BA (Guji), HA, SU, and WG (Teketay et al., 2010). Roots consumed raw as a snack by Gamo children/youth, and as an additive by Walaita children (Asfaw, 2002).
<i>Erythrina brucei</i>	1400 to 2600 m	Edges and open places of upland forests or woodlands	WU WG GJ SU BA HA IL KF GD GG SD	Roots consumed by children and young people in Dheeraa town (Arsi) (Wondimu et al., 2007).

Species	Elevation	Vegetation	Flora Zones	Use as food
<i>Ormocarpum trichocarpum</i>	700 to 2100 m	Wooded grassland and dry bushland	BA IL GG SD	Flowers boiled and consumed in GG (Tsemay); referred to as spaghetti of Tsemay' (Teketay et al., 2010)
<i>Parkinsonia acleata</i>	Unknown	Widely cultivated for ornament, shade and wind-breaks, and often becomes an escape.	TU SU HA SD	Seeds consumed raw as a snack by Nuer children (Asfaw, 2002). In GG (South Omo), pastoralists eat flesh surrounding seeds when dried like biscuits; leaves, green pods and seeds consumed as a famine food. Fruits consumed in GG (Gamo) and GJ (Benishangul Gumuz) (Teketay et al. 2010). Leaves and fruits consumed raw as a snack by Gumuz children; fruits consumed raw as a snack by Shinasha children; bark and seeds boiled, roasted, and consumed raw as a famine food by Komo people (Asfaw, 2002).
<i>Piliostigma thonningii</i>	500 to 2000 m	Deciduous woodland and wooded grassland, often in river valleys	TU GD GJ WG SU BA IL KF GG SD	Fruits consumed in Hamar and Konso (Lulekal et al., 2011)
<i>Rhynchosia allaudii</i>	1100 to 1900 m	Grassland, bushland, hill-slopes	BA GG SD	Leaves, flowers, and seeds consumed in Hamar and Konso (Lulekal et al., 2011).
<i>Rhynchosia minima</i>	differs among subspecies			Leaves cooked as a famine food by Anywaa and Nuer peoples; seeds roasted and consumed as an additive by Komo people (Asfaw, 2002).
<i>Senna obtusifolia</i>	(0-)500-2000 m	Weed of cultivation, roadsides and waste places, also in wooded	TU WG SU HA IL GG	

Species	Elevation	Vegetation	Flora Zones	Use as food
		grassland and often near lakes and streams		
<i>Vigna membranacea</i>	100 to 2400 m	Grassland, woodland, dry bushland	TU WU GD GJ WG SU AR HA IL KF GG SD	Flowers cooked as a famine food by Berta people; leaves cooked as a famine food by Anywaa and Komo peoples (Asfaw, 2002).

5. Descriptions of Edible Legumes reported to be Found in Ethiopia

5.1. Leguminous Plants which are Cultivated as Crops in Ethiopia

There are 19 leguminous species, which are cultivated as crops in various parts of Ethiopia. The seeds of these crops are often called pulses that are valued for their high protein content. Each description includes information on the following features of each crop.

- ❖ Scientific name.
- ❖ Local names in Ethiopian languages.
- ❖ Common names in English and other languages.
- ❖ Where it grows and the conditions under which it grows.
- ❖ Where it is found within Ethiopia.
- ❖ Uses as food / other uses.
- ❖ Description of the plant.
- ❖ Propagation.
- ❖ Management.

5.1.1. *Arachis hypogea* L.

Common Names

ለውዝ - Lewz (Amharic); ፉል - Ful (Tigrigna); ኦካሎን - Ocholony (virtually all languages in Ethiopia); Peanut, Groundnut; Monkey-nut (English).

Where and Under What Conditions is it Cultivated

Groundnut/Peanut is cultivated in the Tigray Region, in the eastern parts of the Oromia Region, Western Oromia (East Wellega), Western Oromia in East and West Hararge, Gambella, Gojeb (Keffa), Benishangul Gumuz Region (Metekel zone), SNNPR (Gamo Gofa Zone, Keffa) and in the Somali Region, where the temperature is consistently above 15°C, and the rainfall is more than 500 mm per year. When the annual rainfall exceeds 1,000 mm, the soil needs to be well drained. Peanut is generally nodulated by *Bradyrhizobium* to enable it to fix nitrogen.

In Ethiopia, groundnut is grown in lowland areas receiving an annual rainfall of 600-900 mm at altitudes not exceeding 1600 m. Groundnut is widely grown in hot to warm semi-arid lowlands (SA), hot to warm, humid lowlands (H), hot

to warm moist lowlands (M) and hot to warm sub-humid lowlands (SH). The crop can also grow in the arid hot to warm lowland plain, but only under irrigation. The mean daily temperature for optimum growth is 22°C to 28°C. Groundnut usually grows well in light sandy to sandy-loam and well-drained soil.

Use as Food

Peanut is grown for food. Its seeds are roasted and eaten as a snack or pounded to make a paste (peanut butter), which is spread on bread and eaten. It is also used to make a hot drink, and sometimes also in fasting sauces or stews. The whole groundnut and groundnut meal, produced by expressing the oil, are rich in protein, minerals and vitamins.

The seeds have a high content of oils making groundnut the second most important source of vegetable oil, after soybean, in developing countries, as well as a source of proteins, and it is thus good for balanced nutrition. The dry seed has 30.4 percent protein, 47.4 percent fat and 11.7 percent carbohydrate. Oil for cooking can also be produced by grinding the seeds. Out of the total fat in ground nut, 85.4% is unsaturated, while 14.6% is saturated. From 100 grams of peanut, we get 570 kcal energy, 9 grams dietary fibre, and though not complete, it contains some amount of all the nine essential amino acids ranging from 0.24 to 1.3 grams. In addition, the 100 grams meets 52% Thiamine vitamin B1, 86% of Niacin vitamin B3, 62% of Folate vitamin B9, 52% magnesium, and 95% manganese of our daily dietary requirement, assuming we have a daily need of 2000 calories. Peanut beans are good sources of all the above listed dietary needs.

Description

Peanut is an annual herb with a branching stem growing about 30 cm tall. The leaf is divided into two pairs of opposite leaflets; and it has no leaflet at its tip. The leaflets are broad narrowing only slightly towards their tips. Each leaflet is 1 to 7 cm long and 0.7 to 3.2 cm wide at its widest part. The leaf-like projection at the base of the leaf (i.e. the stipule) is connected to the base of the leaf for part of its length. Both the main stem and branches produce flowers. Each flower is at the end of a projection (receptacle) directly attached to the stem growing on its own or with a few other flowers. The receptacle is long, thread-like and covered with small hairs. The five green sepals that form the outer part of the flower (calyx) are united into a tube with five lobes. The five yellow petals have a red line along their lengths in the middle of each petal. The 10 anthers of each flower are joined into a tube for more than half

their length. The flowers are usually self-pollinated. Each pod is 2 to 6 cm long and 1 to 1.5 cm wide. The number of seeds inside a pod are usually 1 or 2, sometimes up to 3. The fruit is a pod and consists of a shell containing 1-3 seeds (occasionally up to 6). The shell constitutes about 30-40% of the total weight of the fruit.

The stalk, which carries a developing pod, grows downwards into the soil for up to 20 cm in length and buries the pod in the soil to a depth of 2 to 7 cm below the surface. This process of burying may take place even before the flowers open. This is because the self-pollination process can also take place underground. The pods mature underground and are harvested by digging them out of the soil.

Propagation

Peanut is usually grown by sowing seeds directly into the soil. However, though not typical, cuttings from branches can also be planted in the soil from which new plants will grow.

Peanuts are often planted in rotation with cotton, maize and other cereals. They are also inter-planted with other crops. This is advantageous to the other crops, because peanuts increase the availability of nitrogen in the soil. They can also cover the soil and suppress weeds.

The recommended distance between the peanut plants along a row is about 15 cm, and the distance between rows is about 30 cm. Planting can be done at inter-and intra-row spacings of 30-45 cm and 15-25 cm, respectively.

Management

The addition of chemical fertilisers does not have much benefit for the crop. But natural/organic fertilisers, e.g. compost, improve the soil structure and increase yield. It has the ability to utilise soil nutrients that are relatively unavailable to other crops, and can, therefore, make good use of residual fertility. The crop is frequently sown on loose, friable sandy soils of poor fertility. Well-drained sandy loams are the most favourable soil for growing ground nuts. Earthing-up (covering young pods with soil) improves yield.



Figure 3, *Arachis hypogea* seeds, and spods, courtesy Dereje Abebe; and plants in the field, flower and nodules, courtesy Alemtsehay Tsegay.

5.1.2. *Glycine max* (L.) Merr

Common Names

አኩሪ አተር - Aquri-ater (Amharic); Soy, Soya bean, Soybean (English)

Where and Under What Conditions is it Cultivated

Soya bean was introduced into Ethiopia only recently in the 1950s, but now it is cultivated in many parts of the country at medium altitudes, i.e. about 520 to 1,900 m asl, where there is a growing season of 4 or more months with adequate rainfall. The soybean producing regions of Ethiopia are Benishangul Gumuz region, Oromia, Amhara, Tigray, SNNPS, and Gambella regions. It grows on a wide range of soil types, but deep, loam with good drainage is most suitable for growth. Soya bean needs a bacterial species, *Bradyrhizobium japonicum*, in its root nodules, to enable it to fix nitrogen from the atmosphere. It may need to have this bacterium applied to the seeds during sowing, particularly if the crop is being introduced to a new area. Without *B. japonicum* in its root nodules, soya bean takes the nitrogenous chemicals it needs directly from the soil. If the bacterium is present, however, the crop enriches the soil with nitrogenous chemicals and improves soil fertility and can be used in rotation with cereals like maize and sorghum. Due to its potential to improve soil fertility, soya bean fits well into crop rotations and intercropping systems.

Use as Food

Soya bean is a multipurpose crop which can be used for a variety of purposes, including preparation of different kinds of soybean foods, animal feed, soy milk, raw material for the processing industry, and recently for bio-energy. It is a good source of protein, unsaturated fatty acids, minerals like Ca and P, and vitamins A, B and D that meet different nutritional needs.

Soya bean produces more protein and oil per unit of land than almost any other crop. The protein content is high, and thus, soya bean is good for nutrition. Dry seeds are 29.6 to 50.3 percent protein, 13.5 to 24 percent fat and 14.0 to 23.9 percent carbohydrate. Because of its high-fat content soya bean is a globally important oil crop, the second most important vegetable oil after palm oil. In Ethiopia, soya bean has been used to make cereal food for babies and infants. Soya milk and soya bean milk powder are also being produced more recently. From the fats, 85.5% is unsaturated fats; while 14.5% is saturated. From 100 grams of soy, we get 446 kcal energy, 9.3 grams dietary fibre, and though not complete, some amount of all nine essential amino acids ranging from 0.5 to 3.3 grams. In addition, the 100 grams meets 76% Thiamine vitamin B1, 73% Riboflavin vitamin B2, 86% of Niacin vitamin B3, 94% of Folate vitamin B9, 83% copper, 100% iron, 79% magnesium, 100% manganese, 100%

phosphorus and 51% zinc of our daily dietary requirement, assuming a daily need of 2000 calories. Soy beans are good sources of all the above listed dietary needs. Thus, soya bean consumption is helpful in solving protein-intake nutritional problem among poor people. In addition, soya beans are a source of high-value animal feed. The oil cake that remains after the oil is crushed is a very good feed supplement for cattle fattening, dairy, poultry and swine industry.

Description

Soya bean is a bushy and hairy annual herb, whose stems grow up to 200 cm tall. Each of its leaflets is widest towards the base or about the middle narrowing towards the tip, usually, 3 to 10 cm long though sometimes up to 15 cm long with the widest part being 2 to 6 cm.

Its flowers are clustered in bunches of about 5 to 8 flowers. Its petals are 5 to 7 mm long, and are white or pale pink in colour. The flowers are self-pollinated. Each pod is about 25 to 80 mm long and 8 to 15 mm wide. It is curved a little and hairy. There are usually 2 to 3 seeds in each pod, though they can be as few as 1 or as many as 5. The seed is usually shaped like a little ball, 6 to 11 mm in diameter. Its colour is yellow, green or brown, with or without spots.

A non-cultivated species, *Glycine wightii* (Wight & Am.) Verdc., which is a climbing perennial with narrower leaflets occurs at higher altitudes (2,100 to 2,800 m asl) throughout Ethiopia.

Propagation of Soya Bean

Propagation is from sowing seeds in the ploughed soil, although, as is the case with virtually all plants, transplanting of seedlings is possible, though not common. Germination in the soil takes 5 to 7 days.

Management

If the inoculating bacterium, *Bradyrhizobium japonicum*, is present in the soil, supplementary nitrogen chemical fertilisers might not be needed. From the application of the bacterium a benefit can be obtained a starter dose of nitrogen and phosphorus fertiliser that can enhance the nitrogen fixation capacity of soya bean. Phosphorous is good, because phosphorus influences overall plant growth and development including nodule development. Commercial bio-fertilisers can also be used to inoculate soya bean seeds with *Bradyrhizobium japonicum*, particularly, in areas, where the crop is being newly introduced. Otherwise, soya bean obtains nitrogenous fertilisers from organic fertilisers, e.g. compost, that also, increase yields by improving the soil structure and general fertility as other compounds are also realised from the

organic matter. The need for other chemical fertilisers depends on their availability in the soil. A standard recommendation of phosphorus (P_2O_5) and potassium (K_2O) at the rate of 35 to 70 kg/ha and 36 to 84 kg/ha, respectively, is typical.

The recommended spacing is about 5 cm between plants and 60 cm between rows. Normally 10 cm x 40 cm or 5 cm x 40 cm are used for early maturing varieties. However, this recommendation could vary depending on growth habit, variety and environmental conditions.





Figure 4, *Glycine max* pod, seeds, plant and root nodules, courtesy of Ethiopian Biodiversity Institute and Amsalu Nebiyu.

5.1.3. *Canavalia ensiformis* (L.) DC.

Common Names

አደንጓሬ - adenguarrie (Amharic and Guragegna); አዳጉራ - adagura (Tigrigna); ዲር ዳጎር - dir-dagwer; ሳዳር ሳዳር - sa'arsa'ar (Somaligna); ዎህያ - wohya (Welayitigna); jackbean, swordbean, horse bean (English)

Where and Under What Conditions is it Cultivated

Jackbean is cultivated as an edible crop in North-Western Ethiopia, in South-Eastern Ethiopia and South-Western Ethiopia, up to altitudes of about 1,800 m asl. It is important as fodder and for improving the quality of acidic soils, through the decomposition of organic matter, either as green manure or compost of jackbean crop residues.

Use as Food

The young pods, as well as the dried seeds of Jackbean, can be boiled and eaten. However, this legume is not grown or eaten widely, because it is considered an unimportant crop.

Jackbean has 25.8% protein, 11.6% fat. Of the fat, 85.5% is unsaturated fat, while 14.5% is saturated. From 100 grams of jackbean, we get 456.5 kcal energy, 10.1 g dietary fibre, 3.6 g ash, and though not complete, some amount of the eight essential amino acids, except for Tryptophan, ranging from 1.1 to 7.03 g. Jackbeans are good sources of all the above listed dietary needs.

Description

Jackbean is cultivated as an annual crop, but it can survive from one growing season to the next to become perennial. It is a strong climber with stems growing 1 m or more long. Each leaf consists of 3 leaflets, two of which are opposite each other and the third at the end of the leaf. Each leaflet is slightly pointed. Its edges are smooth (i.e. not toothed), and broadest below its middle. It has an oval outline like that of a chicken's egg, about 20 cm long and about 11.5 cm wide at its broadest part. Leaves are either hairless or with some scattered hairs on either side. Its calyx is tubular, 6 to 9 mm long with 2 or 5 lips each about 5 mm long.

The petals are also joined at their lower parts, but have conspicuous lips, which are rose to purple in colour. Each pod is 15 to 35 cm long and 3 to 3.5 cm wide. Each seed is 1.4 to 2.1 cm long, and white in colour.

A related non-cultivated species, *Canavalia africana* Dunn, is a perennial with stems 3 to 15 m long, growing as a climber or lying along the ground. Its pod is about 10 to 20 cm long, and from about 2 to 5.3 cm wide. Its seed is about 1.6 to 2 cm long and brown in colour. It grows in grassland or bush-land at altitudes of 400 to 1,800 m asl in North-Western, South-Eastern and South-Western Ethiopia.

Propagation of *Canavalia ensiformis*

Jackbean seeds are scattered on fields and then buried, when the soil is ploughed. The seedlings emerge after a few days.

Management

Jackbean has been grown in Ethiopia for a long time, and there is no need to introduce nodule forming bacteria when it is planted. As all legumes do, it works with local bacteria to enrich the soil with nitrogenous chemicals. Currently though, it is one of the neglected traditional crops with large potential.



Figure 5, *Canavalia ensiformis* branch with leaf and flower, courtesy Purseglove and Carr in Flora Volume 3, Inga Hedberg and Sue Edwards, (1989).

5.1.4. *Phaseolus vulgaris* L.

Common Names

አደንጓሬ - adenguarrie, ቦሎቄ - boloqqie (for the dry seed), ፋሶሊያ - fasolya (for vegetable green pods) (Amharic); አዳጎራ - adagura (Tigrigna); አሻንጓረ - ashanguarre (Oromigna); ባዶ - bado (Gamogna); ፋሶሊያ - fasolya (Aderegna); ሎኮማቲያ - locomatiya (Welayitigna); ጳቃሌ - paqalie, ሽተረ - shetere (Gofagna); ሰልቦኮቡሉክ - selbokobulluk (Somaligna); ወአ -weë (Kembatigna); common bean (dry bean), green bean, haricot bean, kidney bean, string bean, field bean, flageolet bean, French bean, garden bean, pop bean, snap bean

Where and Under What Conditions is it Cultivated

Common bean is cultivated throughout Ethiopia at lowland and medium altitudes (around 1000 to 1,900 m asl; i.e. in kola and woina dega areas). It can grow at lower altitudes, if the rainfall is high enough or if the field is irrigated.

However, too much rain often causes the crop to be infected with foliar diseases, such as angular leaf spot, floury leaf spot, and anthracnose.

Common bean grows well on most soil types, ranging from light sand to heavy clay, but the soil should be well drained.

Use as Food

The immature green pods are boiled and eaten as a vegetable. The dried seeds are also boiled and eaten on their own, mixed with boiled rice or other grain or even mixed with spices to make a sauce (wot either split or powdered), which is eaten with flatbread (injera). Dried common beans contain 22.0-25 % protein, 1.6 % fat and 57.8 % carbohydrate. From the fat, 80% is unsaturated fat; while 20% is saturated. From 100 grams of haricot/common bean, we get 305 kcal energy, 22.6 grams dietary fibre, and though not complete some amount of all the nine essential amino acids ranging from 0.19 to 2.5 grams. In addition, the 100 grams meets 100% of Folate vitamin B9, 72% of manganese of our daily dietary requirement, assuming we have a daily need of 2000 calories. Common beans are good sources of all the above listed dietary needs.

Description

Common bean is an annual small bush or climber. There are diverse botanical varieties of the species, *Phaseolus vulgaris*, that vary in terms of market class, growth habit, colour, seed, pod characteristics, agronomic features, and response to environmental stresses. Cultivated forms are herbaceous annuals, which are determinate (bush types) or indeterminate (climbers) in growth habit. The determinate types are short, self-supporting or bushy and of short growth duration. Indeterminate ones show a wide range of node number on the main stem, climbing tendency and long growth duration. Each leaf is hairy and has two opposing leaflets with the third leaflet between them. Each leaflet has an oval outline in the shape of a chicken's egg, but with a thin tip. Its length is 4.5 to 15 cm, and its width is 2.5 to 10 cm at its broadest part.

The flowering stem grows upwards from a point between a leaf base and the stem. This branch continues growing with groups of a few flowers coming out of it at regular intervals. The sepals are united, but have 5 lips, which point upwards. The petals are 5, free, and not united into a tube; white, yellow or pink in colour. The pod is about 10 to 20 cm long, 1 to 1.5 cm wide and contains 5 to 10 seeds. Common bean is self-pollinated with pollination occurring at the time the flower opens.

Propagation

Common beans are sown in the field, which is ploughed to cover them in the soil. They usually germinate in few days. The transplanting of seedlings is also possible.

Management

Common beans can be grown sole or inter-cropped with other crops, such as maize, sorghum, coffee and the like. This intercropping of common bean is beneficial for the other crops, because common bean increases the availability of nitrogen in the soil. If indigenous rhizobia that nodulate roots of common bean do not exist in the soil, inoculating with commercial biofertilisers specific to common bean is recommended. Application of phosphorus fertiliser is also beneficial to improve nodulation and nitrogen fixation of common bean, as well as to enhance plant growth and development. Moreover, application of starter fertilizer 18-20kg/ha during planting would be advantageous for the growth of the crop until it starts fixing nitrogen. A spacing of 7-10 centimetres between plants, and 40-50 centimetres between rows is recommended. The climber common bean can be intercropped with maize or sorghum or can also be grown around fences, but if it is not intercropped with these crops, climber bean needs a support structure for climbing, otherwise the pods' quality might be affected by soil and rain.

When the pods are ready to be eaten as a vegetable, they are picked, while they are still green. When the dried seeds are needed, the pods are left on the plant to become yellow and dry. Then, before the pods split open, either the whole plant is pulled up, or the pods are pulled off, and left in small piles to dry. When the pods are fully dry, they are beaten with sticks to break open the pods and for the beans to fall out. Motor based threshers might also be used to thresh the dried bean.





Figure 6, *Phaseolus vulgaris* crop and climber plants, flower, pods on plant and dry pod, and seeds, courtesy of, Ethiopian Biodiversity Institute and Rameto Roba.

5.1.5. *Phaseolus lunatus* L.

Common Names

አደንጓሬ - adenguarrie, ቦሎቄ - boloqqie (Amharic); አዳጉራ - adagura (Tigrigna); አሻንጓረ - ashanguarre (Oromigna); አባ ጽማ - Aba-choma (Oromigna); ባዶ - bado (Gamogna); ፋሶሊያ - fasolya (Aderegna); ሎኮማቲያ - locomatiya (Welayitigna); ጳቃሌ - paqalie, ሻተረ - shotere (Gofagna); ሰልቦኮቡሉክ - selbokobulluk (Somaligna); ወኦ -weë (Kembatigna); lima bean, sieva bean, butter bean, Madagascar bean, Burma bean (English).

Where and Under What Conditions is it Cultivated

Lima bean is cultivated in the South-Western parts of Ethiopia. It can grow from sea level up to 2,400 m asl, if it receives enough rain or if the field is

irrigated. However, it cannot tolerate any frost. It cannot grow in water-logged soils. Neither does it grow well in acidic soils, though in South Western Ethiopia it is being grown in areas with acidic soils.

Use as Food

Lima bean contains hydrocyanic acid, and it can thus become poisonous. It should not be eaten raw. The toxic cyanide compound can be deactivated upon cooking. The leaves and the green pods, which have not dried up can be boiled and eaten as a vegetable. The dried seeds are also boiled and eaten. However, in either case, the water in which they are boiled has to be discarded, and the leaves, pods and seeds have to be boiled for a second time and the water discarded again. This is needed to remove the poison.

The dried seed contains 20.7% protein, 1.3% fat and 57.3% carbohydrate. Therefore, provided that it is boiled twice, and the water is discarded, it is a nutritious crop. From the fats, 76% is unsaturated fat, while 24% is saturated. From 100 grams of lima bean, we get 316 kcal energy, 19.1 grams dietary fibre, and though not complete, some amount of all nine essential amino acids ranging from 0.5 to 3.3 grams. In addition, the 100 grams meets 100% of Folate vitamin B9, and 89.5% manganese of our daily dietary requirement, assuming we have a daily need of 2000 calories. Lima beans are good sources of all the above listed dietary needs.

Description

Lima bean is a perennial climber that can grow for several years; sometimes, however, it dries up after 2 years. Each leaf has two opposing leaflets with a third leaflet between them. Each leaflet has the oval outline of a narrow chicken's egg, with its tip pointed. It is either smooth or only with scattered hairs, 3 to 15 cm long, and 1.2 to 10 cm wide at its broadest part. The flowering branch grows upwards from a point just between a leaf and the stem. This branch continues growing with groups of only a few or several flowers coming out of it at regular intervals. The sepals are joined to each other, but have 5 lips which point upwards. The 5 petals are white and free from each other. Each pod is 5 to 12 cm long, and 1.5 to 3.0 cm wide. It is smooth or hairy, and each pod contains 2 to 4 seeds.

Lima bean is self-pollinated with pollination occurring at the time the flower opens.

Propagation

Lima beans are sown in the field and are buried in the soil, when the field is ploughed. Seeds can also be germinated in a seedbed and the resulting

seedlings transplanted to the field. In Ethiopia hydro-priming and direct sowing is commonly practiced.

Management

Lima beans are mostly cultivated in home gardens or planted with cereals (e.g., maize, and sorghum) and root and tuber crops (e.g., yam, cassava). If it is not intercropped with these crops, lima bean needs support structure. The companion crops in the same field benefit from the nitrogenous chemicals which the lima beans release into the soil. Lima beans prefer well-aerated soils with pH 6-7. However, Lima beans cannot grow in acidic soils.



Figure 7, *Phaseolus lunatus* pods, flower and seeds, courtesy of Ethiopian Biodiversity Institute and Betelhem Abera.

5.1.6. *Phaseolus coccineus* L.

Common Names

አደንጓሬ - adenguarrie, ቦሎቄ - boloqqie (Amharic); አዳጉራ - adagura (Tigrigna); አሸንጓረ - ashanguarre (Oromigna); ባዶ - bado (Gamogna); ፋሶሊያ - fasolya (Aderegna); ሎኮማቲያ- lokomatiya (Wolaitigna); ጳቃሌ - paqalie, ሸተረ - shotere

(Gofagna); ሶልቦኮቡሉክ - solbokobulluk (Somaligna); ወአ - woë (Kembatigna); scarlet runner bean, Dutch case-knife bean (English).

Where and Under What Conditions is it Cultivated

The scarlet runner bean is cultivated in the highlands of South Western Ethiopia. It can grow at altitudes above 1,900 m asl, if it is protected from frost. However, it is killed by frost. This means that it can be grown only as an annual crop at higher altitudes.

Use as Food

The green pods of the scarlet runner bean are boiled and eaten as a vegetable crop. The dry seeds are boiled and eaten directly or mixed with other kinds of food, e.g. rice.

The raw seeds of the red runner bean have 24.5% protein, 2.1% fat, 35.9% starch and 4.66% ash. The ash is a good indicator of the presence of minerals, but further analysis is needed to see which minerals are present. The seeds contain anti-nutritional factors, such as trypsin inhibitors and must be cooked before being eaten to breakdown these compounds.

Description

At higher altitudes, where there is frost, the scarlet runner bean grows as an annual climbing crop. At lower, frost-free altitudes, it is a perennial climbing crop. Each leaf has two opposing leaflets with a third leaflet between them. Each leaflet has small scattered hairs and an oval outline shape like a chicken's egg, with a thin tip. Its length is 5 to 12.5 cm with its width at the broadest part being 3.5 to 8.5 cm. The flowering branch grows upwards from a point between a leaf base and the stem. This branch continues growing with groups of several flowers coming out of it at regular intervals. The sepals are united, but have 5 lips which point upwards. The petals are 5 free; not united into a tube. Their colour is bright red, though sometimes they may be white. Each pod is rough and slightly curved. It is about 5 to 20 cm long, and 1.5 to 2.0 cm wide. Each pod contains 3 to 5 seeds.

Propagation

Seeds are planted mixed with other crops, and they germinate after a few days. The tuberous roots with a piece of stem can also be used as planting material. Stems also sprout from the thick roots of existing scarlet runner beans. The transplanting of seedlings is also possible.

Management

To obtain high-quality pods, the crop is grown on trellises, poles, fence lines or other support structure. The inter-planting of scarlet runner beans benefits the other crops by increasing the availability of nitrogenous chemicals in the soil.

Scarlet runner beans are also often planted as ornamentals near houses.

3.1.7. *Vigna subterranean* (L.) Verd.

Voandzeia subterranean (L.) Thou is another scientific name for the same crop.

Common Names

ለውዝ - lewz (Amharic); Bambara groundnut (English).

Where and Under What Conditions is it Cultivated

Bambara groundnut is cultivated in some parts of South Western Ethiopia. It grows well in eroded and nutrient-poor soils, as well as under hot and arid conditions. Nitrogen-rich soils promote vegetative growth at the expense of seed yield. Sandy soils enhance pod penetration into the soil.

Use as Food

The seeds are roasted or boiled and eaten. The dried seed contains 16 to 21% protein, 4.5 to 6.5% fat and 50 to 60% carbohydrate. Therefore, it is nutritious, especially under conditions where other pulses cannot grow well. From the fats, 62.1% is unsaturated, and 37.9% is saturated. From 100 grams of Bambara groundnut, 10.3 grams dietary fibre, and though not complete, it contains some amounts of all the nine essential amino acids, ranging from 0.6 to 10.2 grams. In addition, the 100 grams meets 48.9% iron of our daily dietary requirement, assuming we have a daily need of 2000 calories. Bambara groundnuts are good sources of all the above listed dietary needs.

Description

Bambara groundnut is an annual legume with only a few scattered hairs. The stem creeps along the ground, and has many branches, it also produces roots in certain places, where the leaves also grow upwards. The leaves have long leaf-stalks. Each leaf has 3 leaflets. Two of them are opposite each other with the third one in between them. Each leaflet has the oval outline of a chicken's egg or may be narrower. Each leaflet is smooth without hairs, 3 to 8 cm long and 0.8 to 4.0 cm wide at its broadest part. The branch of the stem which carries flowers is 0.5 to 2.0 cm long with 1 to 3 flowers coming out of it. The

flowers have sepals, which are smooth and united to form a tube with 5 lips about 2 mm long. However, some of the flowers have no petals; these are female flowers. Other flowers have yellow petals and are male only. The flowers are self-pollinated. Each pod is 1 to 2.2 cm long and 1.2 to 1.8 cm wide. The pods are hairless and smooth. Most pods contain only 1 seed, but a few have 2 seeds. The plant pushes the pod into the soil, where it ripens underground. The seed may be white, red or black, with or without spots.

Propagation

Seeds of Bambara groundnut are scattered on the field to be buried in the soil when the field is ploughed. They then grow out of the soil after a few days. It is also possible to transplant Bambara groundnut seedlings.

Management

Weeding is a very important management practice and should take place 1-3 times. Earthing-up (covering the young pods with soil) improves yield. Bambara groundnut takes about 4 months to produce mature pods. Harvesting is done by pulling up the whole plant with the pods attached. The harvested plants can be left to dry before the seed pods are collected.

Bambara groundnut is not easily attacked by pests or diseases.

5.1.8. *Vigna unguiculata* (L.) Walp.

Common Names

አደንጓሬ - adenguarrie, አሳቤ - asabe, ደገራ - degeraፕክሌ -chekele, የላም አተር-ye lam atere (Amharic); አዳጉራ ቆላ - adaguraquolla (Tigrigna); አተራ አርጎባ - atera Argobba, ፋሶልያ ዲማ - fasolya dima, አተራ ባብሌ - atera babile (Oromigna); ውቸ - wuche, ኤካዎኔ - ekawohe (Wolaytigna); ድግር - digir (Somaligna); ጎሪ - gnori (Agnwak); cowpea, black-eye pea, catjang, yard-long bean, snake bean, black-eye bean (English).

Where and Under What Conditions is it Cultivated

Cowpea is one of the most ancient food legumes where Ethiopia is one of the centres of origin or diversity (Vavilov, 1956). It grows in Tigray region, Amhara region, Gambella region, Oromia region, and SNNPR, Several subspecies of this variable species are found in Ethiopia, and a debate is currently underway about whether Ethiopia is indeed the centre of domestication of cowpea. Cowpea is susceptible to frost, and thus, grows well only below 2,000 m asl. Following are five subspecies, where they grow and some of their distinct characteristics.

Vigna unguiculata subspecies *unguiculata* cultivated in Eastern parts of the Oromia Region.

Vigna unguiculata subspecies *sesquipedalis* cultivated in Northern Ethiopia.

Vigna unguiculata subspecies *cylindrica* cultivated in the Eastern parts of the Oromia Region.

Vigna unguiculata subspecies *dekinditiana* is cultivated in Northern Ethiopia, and in the Gambella Region at altitudes of 350 to 1,500 m asl. It also occurs, as a wild plant in grasslands and other types of vegetation.

Vigna unguiculata subspecies *mensensis* cultivated in Western and Southern Ethiopia. It also occurs in the wild in any type of vegetation at altitudes below about 1,500 m asl.

All varieties of cowpea grow well on all soil types, including on acidic and nutrient-poor areas. They help improve soil fertility.

Use as Food

The green pods, leaves and young shoots of cowpeas are boiled and eaten as a vegetable.

The dried seeds can also be boiled on their own or with other crops, e.g. maize, sorghum, rice and the like and eaten. They can also be mixed with spices to make a sauce or stew (wot), when cooking either split or powder form and eaten with flatbread (injera). It is also grown as an animal fodder.

A dry cowpea seed contains 23.4 percent protein, 1.3 percent fat and 56.8 percent carbohydrates. Therefore, cowpea is a nutritious crop. From the fats, 75.8% is unsaturated, while 24.2% is saturated. From 100 grams of cowpea, we get 324 kcal energy, 10.6 grams dietary fibre, and though not complete, some amounts of all the nine essential amino acids, ranging from 0.25 to 1.76 grams. In addition, the 100 grams meets 74% Thiamine vitamin B1, 100% of Folate vitamin B9, 64% iron, 52% magnesium, and 61% phosphorus of our daily dietary requirement, assuming we have a daily need of 2000 calories. Cowpea beans are good sources of all the above listed dietary needs.

Description

The cowpea plant is an annual or perennial herb that can grow straight up or climb on other plants or structures. The stem and leaves are usually hairless but may have a few hairs. The leaf has 3 leaflets with 2 being opposite to each other and the third in between. Each leaflet is shaped like the oval outline of a chicken's egg or like a triangle, 1.5 to 16.5 cm long and 1 to 12.5 cm wide at its broadest part. Cowpea flowers are few at the tip of a flowering branch.

The sepals are hairless. The petals are white, yellow or violet. Each pod is 5.5 to 10 cm long, although sometimes longer.

Key to the subspecies

- A. The lips of the joined sepals longer than the tube subspecies *mensensis*.
 The lips of the joined sepals shorter than the tube B
- B. Pod 0.3 to 0.5 cm wide and dark subspecies *dekindtiana*
 Pod wider than 0.5 cm C
- C. Pod 30 to 90 cm long subspecies *sequipedalis*
 Pod shorter than 30 cm. D
- D. Plant a climber subspecies *unguiculata*
 Plant stems erect subspecies *cylindrical*

It should be noted that the keys to subspecies do not always work.

Cowpea can be self-pollinated or cross-pollinated depending on the sizes of the pollinating insects available.

Propagation

Cowpea seeds are sown in the field and covered with soil, when the field is ploughed. If the soil is moist, they can germinate in a few days.

Management

Cowpeas are usually grown mixed with other crops, e.g. sorghum, maize, and the like. The other crops benefit from the increase in nitrogenous chemicals in the soil produced by the cowpeas. The cowpea benefits from having strong support to climb up.



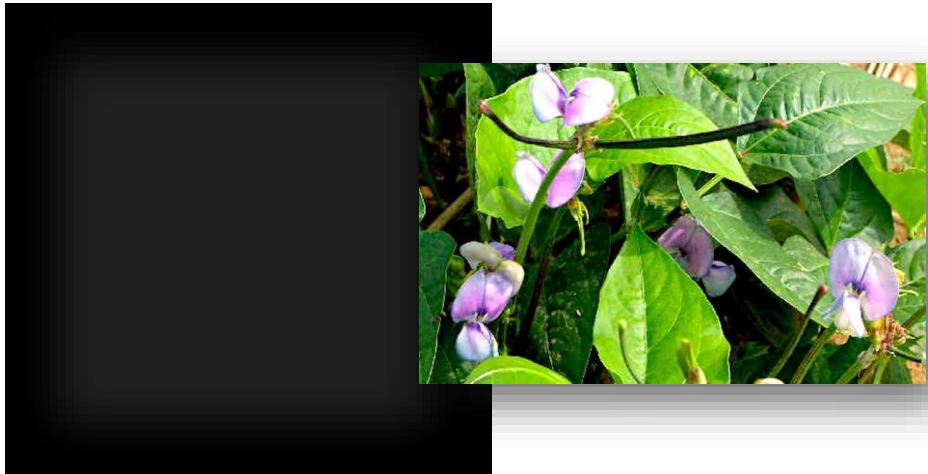


Figure 8, *Vigna unguiculata* plants, pods, seeds and flower courtesy of Berhanu Amsalu Fenta, Melkassa Research Centre.

5.1.9 *Vigna radiata* (L.) Wilczek variety *radiata*

Also referred to as *Phaseolus radiatus* L. or *Phaseolus aureus* Roxb.

Common Names

ማሽ - masho (Amharic); ፉጃጃሎ - fudjeelee (Oromigna) ;አጎድድ - ogodde (Anuak); green gram, golden gram, mung bean (English).

Where and Under What Conditions is it Cultivated

Mung bean was introduced into Ethiopia only a few decades ago. But it is now cultivated throughout the country below 1,900 m asl (*woinadega* and *qolla*). It grows in Amhara region, Tigray, Benishangul Gumuz region, Oromia region. It is a warm-season crop, and grows well where the rainfall is less than 350mm per year. It is a short duration crop which matures in 2 to 3 months. It cannot tolerate water-logging, is sensitive to frost but withstands drought.

Use as Food

The green pods of mung bean are boiled and eaten as a vegetable.

The dried seeds are boiled and eaten as they are or mixed with other grains, e.g. maize, sorghum, and rice.

The dried beans are also boiled as they are or after being split or made into powder and mixed with various spices to make a sauce or stew (*wot*), which is eaten with flat bread (*injera*).

The dried beans can also be wetted and eaten, as sprouts, when they begin to germinate in about one week. This can be eaten mixed with different vegetables or mixed with salad. The raw mung bean seeds have 23.9% protein, 1.15% fat and 62.6% carbohydrate. From the fats, 85.5% is unsaturated fat; while 14.5% is saturated. From 100 grams of mung bean, we get 347 kcal energy, 16.3 grams dietary fibre, and though not complete some amount of all the nine essential amino acids ranging from 0.22 to 1.48 grams. In addition, 100 grams meets 54% Thiamine vitamin B1, 100% of Folate vitamin B9, 52% iron, 53% magnesium, 49% manganese, and 52% phosphorus of our daily dietary requirement, assuming we have a daily need of 2000 calories.

Description

Mung bean is a deep-rooted annual crop that resists erratic rainfall, because of its deep roots. The plant grows either straight up or bending over with many stems 0.5 to 1.3 m tall. The stems are covered with long hairs. Each leaf has 3 leaflets, including two that grow opposite each other and the third growing in between. The leaflets may or may not have hairs on the upper and lower sides. The leaflets have the oval shape, like the outline of a chicken's egg, or they may be narrower. Each leaflet is 1.5 to 12 cm long, and 2 to 10 cm wide at its broadest part. The flowering branch is 2 to 13 cm long with 10 to 20 flowers in the upper part. The sepals are joined together to form a tube with 5 lips. The lobes are hairy, but the tube is not. The petals are greenish yellow. Each pod is 40 to 90 mm long and 5 to 6mm wide, covered with short brown hairs, and containing 8 to 14 seeds. The seeds are green or brown.

A variety of green gram, called *Vigna radiata* variety *sublobata*, is found growing uncultivated in Northern Ethiopia. It is a climber or grows on the ground and has smaller pods than the cultivated variety. In other countries, this same variety is cultivated as a crop.

Propagation

The seeds can be sown in rows or broadcast in the field, and get buried into the soil when the field is ploughed.

Management

Mung bean seeds are small, so the field has to be ploughed well before sowing. It is usually sown on its own. However, it can also be sown with other crops, e.g. maize, sorghum, and sesame, which will benefit from the increase in nitrogenous soil nutrients because it fixes nitrogen from the atmosphere. However, since it needs to be harvested after 70 to 120 days, the crop with which it is growing may have to be harvested separately. Mung bean is resistant to most crop diseases.



Figure 9, *Vigna radiata* flower, pods and seeds, courtesy of Ethiopian Biodiversity Institute.

5.1.10. *Lablab purpureus* (L.) Sweet

This species is also referred to as: *Dolichos purpureus* L.; *Dolchos lablab* L.; *Lablab niger* Medik.; *Dolichos uncinatus* Schweinf.

Common Names

ያሞራ ጓያ - yamora guaya (Amharic); ኦካላ - okala (Conso); dolichos bean, seim bean, Egyptian kidney bean, Indian bean, bataw, Australian pea, lablab, hyacinth bean, bonavist bean (English).

This is a very variable species that is reflected in the large number of common names.

Where and Under What Conditions is it Cultivated

Hyacinth bean/Lablab is cultivated in arid areas and can grow in poor soil. It is cultivated throughout Ethiopia in dry areas of altitudes below about 2,000 m asl (*woinadega* and *qolla*).

Use as Food

The young pods are boiled and eaten as a vegetable. The dry seeds are boiled and eaten as they are or mixed with other seeds, e.g. sorghum, maize, and rice. The dried beans are also boiled as they are or after they have been split, then mixed with spices to make a sauce or stew (*wot*) and eaten with flat bread (*injera*). It is also grown as forage crop.

The raw lablab has 23.2% protein, 1.5% fat and 44.2% carbohydrate. From the fats, 71.3% is unsaturated fats; while 28.7% is saturated. A hundred grams of lablab, can provide 316 kcal energy, 16.2 grams dietary fibre, and though not complete, some amount of all the nine essential amino acids ranging from 0.29 to 1.79 grams. Lablab beans are good sources of all the above listed dietary needs.

Description

Hyacinth bean/Lablab is a perennial herb, though it is often grown as an annual crop. It is a climber or twining herb with stems up to 6 m tall or long. Each leaf has 3 leaflets. Two of the leaflets are opposite each other with the third between them. Each leaflet is shaped like the oval outline of a chicken's egg with its tip pointed. Its edges are smooth, without teeth. Each leaflet is 2.5 to 15 cm long and 1.5 to 14 cm wide at its broadest part. Its surface is nearly smooth or with some soft hairs.

The flowering stems are 30 cm or more in length. The flowers grow alone or in clusters of 1 to 5 close together towards the end of the stem. All 5 sepals are joined at their bases; they look like 4, because the upper 2 are joined all the way to their tips. The petals are white or purple in colour and not joined to one another. The stamens are 10.

Each pod is usually curved, and with swellings at its edges, pods are 3.5 to 14 cm long and 1.2 to 4 cm wide, with or without hairs on the surfaces. There are 2 to 5 seeds in a pod; each seed is shaped like a small chicken's egg.

Propagation

The seeds are usually sown mixed with other crops, e.g. finger millet in the same field that is ploughed to bury them in the soil. The seeds germinate in about 5 days. The first pair of leaves are un-branched into leaflets. Though not common in Ethiopia, the transplanting of seedlings is also possible.

Management

The use of manure or compost in the field helps the hyacinth bean to grow well, though, since it is a legume, it increases the availability of nitrogenous chemicals in the soil, and this benefits the crops that are growing with it.

Hyacinth bean remains green and continues producing leaves also in the dry season.



Figure 10, *Lablab purpureus* leaves, pods and flower, courtesy of Friis and Perdue Flora Volume 3, Inga Hedberg and Sue Edwards,(1989).

5.1.11. *Cajanus cajan* (L.) Millsp.

Also referred to as *Cajanus indicus* Spreng.

Common Names

የወፍ ዓተር - yewef ater, የእርግብ ዓተር - yeërgb ater (Amharic); ፋረንጎታ - farengota, ኦሆታ ፋረንጎታ - ohota farengota (Konso); ጊተክ - giteë (Hadiyagna); ካፎ ኣታራ - kafo atara, ካፍዋ ኣተሪያ - kafwa ateriya (Welayitigna); ሳልቦኮ ገድ - salboko ged (Somaliga); pigeon pea, red gram (English).

Where and Under What Conditions is it Cultivated

Pigeon pea is cultivated in Western Ethiopia, Central Ethiopia, Southern Ethiopia and Eastern Ethiopia at altitudes of 1,000 to 2,400 m asl.

Pigeon pea grows well in all soil types which are not deficient in calcium. Its deep roots make it drought resistant, and can grow in arid areas, which receive

less than 600 mm of rain per year. It is susceptible to frost, cannot tolerate water-logging and needs well drained soils.

Use as Food

The young green seeds are boiled and eaten as a vegetable.

The dry seeds are boiled and eaten on their own or mixed with other crops, e.g. sorghum, maize, and rice.

They are also cooked as they are or split or powdered before cooking and mixed with spices to make a sauce (wot) to be eaten with flatbread (injera). It is also grown as animal fodder and as biological soil and water conservation around the terraces for stability and productivity.

The dry seed contains 19.2% protein, 1.5% fat and 57.3% carbohydrate. Out of the total fats, 75% is unsaturated fats; while 25% is saturated. Hundred grams of pigeon pea provides 343 kcal energy, 15 grams dietary fibre, and though not complete, some amount of all the nine essential amino acids, ranging from 0.21 to 1.86 grams. In addition, the 100 grams meets 56% Thiamine vitamin B1, 100% of Folate vitamin B9, 52% magnesium, 85% manganese, and 52% phosphorus of our daily dietary requirements, assuming we have a daily need of 2000 calories. Pigeon pea beans are good sources of all the above listed dietary needs.

Description

Pigeon pea is an erect perennial shrub that grows 1 to 4 metres tall producing many branches. The stem has ribs along its length, and it is covered by hairs. It has diverse growth habits i.e., it could be short duration, medium duration and long duration. The first two are annual types and the later (long duration) is a perennial type.

Each leaf has 3 leaflets. Two of them are opposite each other with the third being between them. Each leaflet has the oval outline of a chicken's egg or narrower with a pointed tip. Each leaflet is 2.5 to 10 cm long, and 1.5 to 3.5 cm wide at its broadest part. Its lower surface is silvery, hairy and with yellow or orange dots. Even the upper surface of the leaflet may have these dots.

The flowers are small and found at the ends of branches. The sepals are 5 and joined along their edges. They have 5 lips though, sometimes, even the lips of the top 2 are joined. The petals are not joined and are yellow in colour.

Pigeon pea is both self-pollinated and cross-pollinated with bees and other flying insects as its cross-pollinators.

Propagation

Pigeon peas are sown in the field, which is ploughed to bury them in the soil so that they can germinate.

The transplanting of pigeon pea seedlings is difficult, though it can be done, if the seedling is taken with the soil surrounding its roots undisturbed.

Management

Pigeon pea is usually cultivated by intercropping with other crops, e.g. sorghum, finger millet, maize, and sesame.

The crop with which the pigeon pea is being cultivated is harvested first, and the pigeon pea usually continues to grow until it is harvested later. New branches grow from the root after those that have produced pods have been cut and removed for threshing.



Figure 11, *Cajanus cajan* leaves with flower, pods and seeds, courtesy of Ethiopian Biodiversity Institute.

5.1.12. and 5.1.13. *Lupinus*

Five species in the genus *Lupinus* are found in Ethiopia. They can be identified as follows:

- 1a. The sepals are joined into a tube, which is divided into two lips, and the upper lip is split into two smaller lips toward its end. 2
- 1b. The sepals are joined into a tube, which is divided into two lips, but the upper lip is not split (or split only slightly) into two smaller lips toward its end. 4
- 2a. Petals yellow. *Lupinus luteus*

- 2b. Petals white, or blue and white, or blue and yellow and white. 3
- 3a. Leaflets narrow, hairy on their upper surface, pods 1.5 to 2 cm wide. *Lupinus princei*
- 3b. Leaflets very narrow, without hairs on their upper surface, pods about 1 cm wide. *Lupinus angustifolius*
- 4a. Stem hairless; individual flower stalks 7 to 10 mm long, *Lupinus mutabilis*
- 4b. Stem hairy, individual flower stalks 2 to 6 mm long. - 5
- 5a. Stem with long hairs, seeds 0.6 cm long or shorter. *Lupinus mexicanus*
- 5b. Stem with short hairs, seeds 0.8 to 1.4 cm long. *Lupinus albus*

Of these 5 species, only the seeds of *Lupinus albus* and *Lupinus mutabilis* are used as human food. The other three species are used for animal fodder and/or for soil protection and fertility restoration.

5.1.12. *Lupinus albus* L.

This species is also referred to as: *Lupinus termis* Forssk. And/or *Lupinus prolifer* Desr.

Common names

ግብጥ - gibto (Amharic); ግብጽ - gibtso (Tigrigna); white lupin (English).

Where and Under What Conditions is it Cultivated

White lupin is cultivated at altitudes of 1,800 to 3,000 m asl mostly in Gojjam, Amhara Region, and to a lesser extent, it is also cultivated in other parts of the Amhara Region, also in the Oromia Region and in the Tigray Region. It grows best in areas, where the average maximum temperatures are between 15°C and 25°C, and the soils are well drained. It cannot grow in waterlogged areas. It can tolerate a low level of acidity in the soil, and it can grow well enough in nutrient-poor soils.

Use as Food

The seeds contain poisonous alkaloids that must be removed by soaking in running water, and then boiling them in water with the water being thrown away after each boiling. Traditionally, the seeds are first put in a sack, and left in a stream for 2 to 3 days to soak before being boiled. Then, they have to be boiled in water, with the water being thrown out, and they have to be boiled again, and the water is thrown out again. It is only after this process that they can be eaten. Because the seeds require such a long treatment to make them edible, the boiled seeds are eaten mainly in times of food scarcity.

The seeds are also used in preparing a local alcoholic drink known as *arekie*. This practice is very common in Gojjam, Amhara region. *Arekie* is commonly prepared by women of lower economic status, as a means of earning extra income.

White lupin raw seeds have 33.2% protein, 8.8% fat and 12.7% carbohydrate. From the fats, 83% is unsaturated fats, while 17% is saturated. From 100 grams of white lupin, we get 328 kcal energy, 32.4 grams dietary fibre, and though not complete, some amount of the nine essential amino acids ranging from 0.18 to 2.47 grams. In addition, the 100 grams meets 90% of Folate vitamin B9, and 100% manganese of our daily dietary requirement, assuming we have a daily need of 2000 calories. White lupin is a good source of all the above listed dietary needs.

Description

White lupin is a bushy annual herb that can grow up to 120 cm tall. The stems are covered with short hairs. Each leaf has 5 to 7 leaflets. Each leaflet is broadest towards its end, though it gets narrower at its tip. When the leaf is lower down on the stem, its leaflets are 25 to 35 mm long and 14 to 18 mm at its broadest part. Leaves higher up on the stem, have longer leaflets, 40 to 50 mm with their width being 10 to 15 mm. Each leaflet is almost hairless, and thus, smooth on its upper surface, but there are more hairs on the lower surface.

The branch which carries the flowers is 5 to 10 cm long. The 5 sepals are joined to form a tube with 2 lips. The upper lip consists of 2 sepals, and the lower one consists of 3 sepals. The edges of the lips have small projections. The tube made of sepals is 8 to 9 mm long. The petals are also 5 and united, but the tube is split into an upper part of 2 petals and a lower part of 3 petals. The petals are 15 to 16 mm long, and white or blue in colour. The stamens within each flower are all joined to form a tube.

Each pod is 6 to 10 cm long and 1.1 to 2 cm wide, with short hairs, and thus, nearly smooth. Each pod contains 4 to 6 seeds. Each seed is 8 to 14 mm long, rectangular in outline, smooth and white.

Propagation

The seeds are sown, and then the field is ploughed to bury them in the soil. They germinate after a few days. Seeds can easily be stored for 2-4 years under normal conditions for future use. The transplanting of lupin seedlings is possible.

Management

White lupin is a hardy plant that can grow in soils which are poor in nutrients. It does not require any special care. However, it cannot be cultivated in waterlogged fields. It is sensitive to potassium (P) deficiency, but its roots can make more P available through acidification of the rhizosphere whereby associated or following crops may benefit.



Figure 12, *Lupinus albus* plant with flower, courtesy Ethiopian Biodiversity Institute.

5.1.13. *Lupinus mutabilis* Sweet

Common Name

Pearl lupin, Andean lupin, South American lupin, Peruvian field lupin (English).

Where and Under What Conditions is it Cultivated

Pearl lupin is cultivated in the highlands of Wello in the Amhara Region and in the highlands of Southern Nations, Nationalities and People's Region. It was introduced to Ethiopia in the 1960s for growing in degraded environments.

Use as Food

Pearl lupin is processed for use as human food in the same way as white lupin, because it also contains poisonous alkaloids. It also has to be soaked in water, and then boiled twice with the water being thrown away before it can be eaten.

Pearl lupin has 43.3% protein, 18.9% fat, and 32.9% carbohydrate. Out of the total fats, 80% is unsaturated, while 20% is saturated. From 100 grams of pearl lupin, we get 551 kcal energy, 8.2 grams dietary fibre, 3.9% ash, and though not complete some amount of all nine essential amino acids ranging from 0.6 to 7 grams. Also, the 100 grams of lupin can provide 50% copper, 71% magnesium, 100% manganese, and 61% phosphorus of our daily dietary requirement, assuming we have a daily need of 2000 calories. Pearl lupin is a good source of all the above listed dietary needs. It also contains traces of Thiamine vitamin B1, Riboflavin vitamin B2, and Niacin vitamin B3.

Description

Pearl lupin is a shrub-like herb growing up to 150 cm tall. The stem has no hairs and is smooth. Its leaflets have the same size throughout the plant. Each leaflet is about 6 cm long and 1.4 cm wide at its broadest part, which is towards its end. Its upper surface is smooth without hairs, but its lower surface is hairy and feels as if it is covered by wax.

Each flowering branch is 6 to 20 cm long. The sepals are joined to form a tube with 2 lips. The upper lip is sometimes, but not always, slightly split at its end or without any such split. The petals are 1.8 to 2 cm long, and white, blue or yellow coloured.

Each pod is about 8 cm long, and about 1.6 cm wide and hairy with the hairs lying flat on the surface of the pod.

Propagation

Pearl lupin seeds are sown in the field, which is then ploughed to bury them in the soil. They germinate after a few days.

Management

Pearl lupins do not require any special management. However, the farm where they are growing must not be waterlogged

5.1.14. *Trigonallafoenum-graecum* L.

Also referred to as: *Bucerasfoenum-graecum* All., *Foenum - graceumsativum* Med., *Foenum - graecumofficinale* Moench

Common Names

አብሽ - absh (Amharic); ሲላን - silan (Geëz); ሲንቆ - sinqo, ሱንቆ - sunqo, አቢሽ - abishi (Oromigna); አባዕኸ - ab'akhe (Tigirigna); አቢዕካየ - abi'kaye (Afarigna); አቢሽ - abish, ግራሮ - graro (Kefagna); አቢሽ - abishe (Guragegna); ኸልበት - h'lbet (Adergna); ሻቆታ - shiqota (Hadiyagna); ሹኦ - shuö (Kembatigna); ሹቆ - shuqo (Gamogna); ሹቆዋ - shuqwa (Welayitigna); fenugreek (English).

Where and Under What Conditions is it Cultivated

Fenugreek is cultivated throughout Ethiopia, between 1,600 and 2,300 m asl, as a garden spice or as a field crop. It grows in the highland areas all over Ethiopia.

Use as Food

In Ethiopia, the crop is produced either as a spice or for other special purposes, such as food for nursing mothers and infants, as a breakfast beverage for others. The seeds are blanched (boiled for a short time), and then dried in the sun. They are then roasted, ground and mixed with ground chilli pepper, other spices and salt to make a sauce (wot), which is eaten with flatbread (injera). Another option is to sprinkle the spice mixture over the flatbread. It is also added to teff as an ingredient of *teff* flour in a small proportion to improve the injera flavour, flour longevity/shelf life, and to improve the baked injera flavour and to increase the lysine content.

Ground fenugreek powder is also mixed with spices to flavour and preserve butter, or mixed with honey or sugar and water to make a non-alcoholic beverage. Furthermore, it is common to use ground fenugreek mixed with water and honey or sugar, and whipped until foamy as a good food and good appetiser, during breakfast. The liquid made from the fenugreek flour mixed water is given to babies as a milk substitute.

Fenugreek is often mixed with faba bean to make a dish called 'hilbet'. Four measures (by volume) of faba bean, one measure of lentil, and one measure of fenugreek are separately washed and dried. If lentil is not to be included, then five measures of faba bean can be used. The faba bean seeds and the lentil seeds are split using a grinder. The seed coats of the faba bean and lentil are removed. All the seeds are roasted, then mixed and boiled for a short time. The water is discarded. The mixture is then spread out on a metal tray to be sun-dried, during the day and chilled by frost at night for seven days and nights. After seven days, the mixture is ground into flour and stored. To prepare 'hilbet', a certain amount of the flour is mixed with water and cooked, so it becomes a thick paste. The paste is left to cool. Just before serving, a little water is added, and the 'hilbet' is beaten by hand (usually by a woman), until it produces a white froth. The froth is served with a spicy sauce and eaten with

flatbread (injera). The 'hilbet' should be eaten within minutes of preparation before the froth collapses.

Fenugreek seeds can also be boiled with milk and tea to add to its flavour. Fenugreek seeds contain 23% protein, 6.4% fat, and 58% carbohydrate. From the fats, 77% are unsaturated fats; while 23% are saturated. From 100 grams of fenugreek, we get 323 kcal energy, 24.6 grams dietary fibre and though not complete some amount of all the nine essential amino acids ranging from 0.5 to 3.3 grams. Also, the 100 grams meets 100% iron, and 48% magnesium of our daily dietary requirement, assuming we have a daily need of 2000 calories. Fenugreek beans are good sources of all the above listed dietary needs.

Description

Fenugreek is an annual crop that grows up to 50 cm tall. It is slightly hairy and has a strong smell. Its leaf has three leaflets, two opposite each other and the third in between. The edges of the leaflets are toothed, and the shape is broadest towards its tip, 2 to 5cm long and 0.8 to 1.7mm wide at its broadest part. Fenugreek leaves have small projections along their edges.

Fenugreek flowers, usually grow on their own, or occasionally next to one other flower. There are five sepals, which are joined to form a very short tube, about 4.5mm long. The end of the tube has 5 separate lips that differ in their lengths. The petals are 1.2 to 1.8mm long, either pale yellow or white. There are 10 stamens in each flower. Nine of these are joined together, and the tenth is free. Each stamen is about 5mm long. The pods are thin, slightly swollen over the seeds, 8 to 19 cm long, and 2 to 4mm wide. The tips of the pods are long and thin. Each pod contains 7 to 18 seeds.

Propagation

Fenugreek is usually cultivated in home gardens, or small fields. The seeds are sown and buried in the soil using hand tools. The seeds germinate in a few days.

Management

Except for weeding, fenugreek does not require any special care, but to enhance its productivity, organic manures and adequate amount of phosphorus and potassium are required.



Figure 13, *Trigonalla foenum- graecum* seed and plant with pods, courtesy of Rameto Roba and Alemu Mamuye.

5.1.15. *Cicer arietinum* L.

Also referred to as: *Cicer grossum* Salisb., *Cicer sativum* Schkuhur, *Cicer physodes* Reichb., *Cicer rotundum* Jord.

Common Names

ሸምብራ - shmbra (Amharic and Tigrigna); ግተር - äter, ግተር:ቀይሕ - äter qeyh (Tigrigna); ግተር - äter, ዚፋል- zifal, ሳንጥ - sant (Ge'ez); ሸምብራ - shumbura (Oromigna, Guragegna, Hadiagna, Welaitigna and Gamogna); ግተር - ätir, ስምብራ- sumbura (Afarigna); ስምብራ - sumbura (Aderegna); ስምብሮ - sumbuuro (Kembatigna); chickpea, garbanzo bean (English).

Where and Under What Conditions is it Cultivated

Chickpea is cultivated throughout Ethiopia, usually higher than 1,400 m asl. It is sown towards the end of the rainy season, because it does not grow well under wet conditions, as the rain hampers seed set. It grows well in nutrient-poor soils, as well as dense/heavy clay soils (especially, in *Vertisols*, or walka). Chickpea is one the main food crop in Ethiopia.

Because it does not require much rain, chickpea is often sown after another crop has been harvested from the same field, as relay or double cropping. It is grown in rotation with cereals, mainly with *teff*. It improves soil fertility by releasing nitrogenous chemicals.

A non-cultivated relative of chickpea, *Cicer cuneatum* Hochest., is found in grasslands or as a farmland weed, between 1,000 to 2,200 m asl, in the Tigray Region and in Shewa (Amhara Region). *Cicer cuneatum* is called ግተር: አንጭዋ - äter-anchwa or ግተር:ጸሶት - äter-guasot in Tigrigna and የአይጥ:ሽምብራ - yeäyt shimbra in Amharic. Though not cultivated as a crop, the green seeds are often eaten by passers-by.

Use as Food

Chickpea seeds can be removed from the green pods and eaten raw. The dried seeds are roasted alone or with other seeds, for example with safflower, sorghum, maize, barley, or wheat. The immature seeds are consumed fresh, or roasted and salted as snacks.

The dried seeds can be split using a grinder, the seed coats removed, and the seeds cooked with spices such as chilli pepper to prepare a sauce (*wot*), which is eaten with flatbread (*injera*). A similar sauce can be prepared with whole (rather than split) seeds.

The dry seeds can also be boiled for a short time, then sun-dried, split with a grinder, and the seed coats removed. The clean split seeds are mixed with spices and ground to prepare powder. This powder is the main ingredient to prepare a popular dish known as *shiro*, which is eaten with flatbread (*injera*). Split chickpea seeds can also be ground into a flour that is used to make a special kind of bread (*qitta*). Finally, chickpea seeds can be soaked in water until they start germinating and the sprouts (*boqolt*) can be eaten.

The dried chickpea seed is 17.1% protein, 5.3% fat and 61.2% carbohydrate. From the total fats, 88% is unsaturated, while 12% is saturated. From 100 grams of chickpea, we get 337 kcal energy, 20.7 grams dietary fibre, 2.8 grams ash, and though not complete some amount of all the nine essential amino acids ranging from 0.2 to 1.5 grams. Also, the 100 grams meets 100% of Folate vitamin B9, and 100% manganese of our daily dietary requirement, assuming

we have a daily need of 2000 calories. Chickpeas are good sources of all the above listed dietary needs.

Description

Chickpea is an annual crop that can grow 0.2 to 1 metre tall. The whole plant is hairy.

Each leaf is about 5 cm long, and includes 7 to 17 leaflets. Each leaflet is toothed along its edges. Each leaflet is 7 to 19mm long and 3 to 10mm wide at its broadest part.

The flowers grow alone on branches from the main stem. The sepals are joined together to form a tube at their base, but with 2 to 5 small teeth at the end.

The petals are 1 to 2.2 cm long, and are white or purple. There are stamens in each flower, and all of them are the same length. Nine of the stamens are joined together, and the tenth one is free.

The flowers are usually self-pollinated, but they are occasionally cross-pollinated by bees and other flying insects. Chickpea pods are 2 to 3.5 cm long and 1 to 1.7 cm wide. Each pod contains 1 or 2 seeds. The seeds are reddish-brown or black.

The non-cultivated relative of chickpea, *Cicer cuneatum*, has tendrils (small, spiralling branches growing from its leaves) that help it climb onto other plants. Because cultivated chickpea never has tendrils, this makes it easy to tell the two types apart.

Each seed is reddish brown or black. Within cultivated chickpea two main groups are commonly known: the large seeded, cream coloured Kabuli types, and the small seeded, darker coloured, smooth or wrinkled Desi types. Desi type chickpeas are bushy plants with relatively small leaflets and blue-violet flowers. The Kabuli types have erect growth and white flowers. The Kabuli types cook faster and have less dietary fibre than those of the Desi types. Seed colour is an important characteristic of chickpea determining its quality, and acceptance. In East Africa brown, Desi chickpea are most popular.

Propagation

The seeds are sown in fields buried in the soil by ploughing. They germinate after a few days. The transplanting of seedlings is possible.

Management

Chickpeas require no special care. Minimal weeding is necessary because chickpea is, usually, grown after most weeds have dried up. However, the crop can be affected by a disease called fusarium wilt caused by the fungus *Fusarium*

oxysporum. The use of resistant varieties is recommended, as a control measure against this disease.



Figure 14, *Cicer arietinum* flower, pod and seed, courtesy of Ethiopian Biodiversity Institute

5.1.16. *Pisum sativum* L.

Common Names of *Pisum sativum* var *sativum*

አተር - ater (Amharic); ሳይኒ:ሳተር - äyni äter (Tigrigna); አተራ - atera, አተራ:ደንጎሎ - atera dongolo, ዳንጉላ - dangulle (Oromigna); አታራ - atara, አተሪያ - atariyya (Welaitigna); አተረ - atere (Guragigna and Gofagna); አተሮ - atero (Haiyagna); ጊሻ:ሻአቶ gisha shaäto (Gofagna); ጊተክ - giteë (Hadiyigna); ቁሻወ - qishewe (Guragigna); pea, garden pea, field pea (English).

Common Names of *Pisum sativum* var *abyssinicum*

Common Names of *Pisum sativum* variety *abyssinicum*; now called *Pisum abyssinicum* A. Braun (International Legume Database and Information Service 2010) ደቅቆ - deq'o'qo (Tigrigna); ትንሹ አተር tinishu ater (Amharic) means "minute-seeded"; abyssinian pea (English).

Where and Under What Conditions it is Cultivated

Pea is cultivated throughout Ethiopia above 1,200 m asl. Hot and dry weather reduces its germination and growth. It grows best in fertile soils, but it can also be cultivated in nutrient-poor eroded soils. It cannot grow in acidic soils or waterlogged areas. It is one of the main food legumes of Ethiopia.

Pea is often grown on its own, but is also commonly planted in the same fields as faba bean.

A close relative of field pea (*Pisum abyssinicum* A. Braun) known as deq'o'qo in Tigrigna and Abyssinian pea in English was once cultivated in many parts of Ethiopia, but is now found mainly in the highlands of the Southern Tigray and Northern Wello.

Use as Food

Fresh green peas can be removed from their pods and eaten without cooking. Dried seeds can be boiled or roasted alone or with other foods, for example, maize, sorghum, or wheat. More often, dried seeds are washed, sun-dried, split using a grinder, the seed coats removed and the split peas cooked with spices to make a sauce or stew (wot) that is eaten with flatbread (injera). Deq'o'qo is the most preferred sauce or stew (wot) from the grain legumes.

Pea seeds can also be cooked without splitting and used to prepare a sauce that is eaten with flatbread (injera).

Dry seeds are also boiled for a short time, sun-dried, split with a grinder, the seed coats removed, the clean split seeds mixed with spices and ground to make a powder. This powder 'shiro' is used to make a popular dish known as 'shiro wot', which is eaten with flatbread (injera).

The dry pea seed is 22.5% protein, 1.0% fat and 58.5% carbohydrate. From the fats, 83.5% is unsaturated; while 16.5% is saturated. Hundred grams of dry peas provides 331 kcal energy, 11.6 grams dietary fibre, and though not complete, some amount of all the nine essential amino acids, ranging from 0.2 to 1.6 grams. Also, the 100 grams meets 47% Thiamine vitamin B1, 50% of Folate vitamin B9, and 57.5% manganese of our daily dietary requirement, assuming we have a daily need of 2000 calories. Dry peas are good sources of all the above listed dietary needs.

Description

Pea is an annual herb that can grow up to 2 metres tall. It climbs on other plants using tendrils that grow from the tips of leaves. A leaflet-like projection on the outer side of each leaf (stipule) is bigger than any of the leaflets. The stipules can grow up to 10 cm long.

The stems of pea are hairless and smooth. Each leaf has 4 or sometimes 6 leaflets. Each leaflet has the shape of the shadow of a chicken's egg, while the tip is narrower and longer. The edges of the leaflets are smooth or have small teeth. Each leaflet is 1.5 to 5.5 cm long, and 1 to 3 cm wide at its broadest part.

There are 5 sepals, which are joined into a tube with 5 lips; the tube is about 6mm long. The petals are white or purple and 15 to 35mm long. There are 10 stamens; 9 of them are joined together, and 1 is free (not joined). Each pod is 3.5 to 9.5 cm long and 1 to 1.8 cm wide. Each pod contains 2 to 9 seeds. The seeds are shaped like a small ball. The flowers are almost always self-pollinated.

The abyssinian pea (*Pisum abyssinicum*) is easily distinguished from the field pea (*Pisum sativum*), because it has only 2 leaflets on each leaf, whereas the field pea has 4 or 6. In addition, the Abyssinian pea has shorter petals, which are 15 mm long as compared to 20 mm for the field pea and has serrate leaflet margins (like teeth of saw).

Propagation

Pea seeds are sown on fields, and then, buried in the soil by ploughing. They germinate in a few days. The transplanting of seedlings is possible.

Management

Field pea grows better and produces more seeds, if natural/organic fertiliser, for example, compost, or else chemical fertiliser are applied to the fields. Weeding is usually necessary. The critical period of weed competition is 3-8 weeks after emergence.

Use as Food

The food use is like peas. The local communities consider it to have a higher body building nutritious value. The cotyledon flour has 25% protein, 1.9% fat, 37% starch, and 13% fibre. The most important amino-acids found in Abyssinian pea includes: 39% Arginine, asparagine, and glutamine; 7% lysine and 3% Sulphur containing amino acids. Compared to the field pea, the Abyssinian pea was found to have less calcium and magnesium, but higher phosphorous.



Figure 15, *Pisum sativum* flower, flowering plant, pod and seeds, the last two pictures of *Pisum abyssinicum* serrated leaves and smaller seeds, courtesy Ethiopian Biodiversity Institute, Yirga Gufi and Morgan Ruelle.

5.1.17. *Vicia faba* L.

Also referred to as *Faba vulgaris* Moench

Common Names

ባቆላ - baqiela (Amharic, Adereгна, Welytigna, Afarigna and Kembatigna); አውጤበድል - awtiebedl, ful (Ge'ez); ዓልቋይ - äliqway, ዓተር:ባሕሪ - äter bahri, ባልደንጌ - baldengwa (Tigrigna); አተረ - atere, ባኤላ - baiëla (Gurageгна); ባቀል - baqel (Hadiyagna); ባቀላ - baqela (Oromigna); ቆሞሎ - qomolo (Gamogna); faba bean, fava bean, horse bean, broad bean, field bean, tick bean, Windsor bean (English).

Where and Under What Conditions is it Cultivated

Faba bean is cultivated throughout Ethiopia between 1,800 and 2,500 m asl. It is not suited to the lowlands, where it may flower well, but usually does not produce pods. A mean daily temperature of about 13 °C is optimal for growth. Chocolate spot, Rust and orobanche are the major production constraints at altitudes below 1,800 meters and frost above 3000 meters. It is one of the main pulse crop grown in Ethiopia to serve as a staple food.

Faba bean requires fertile soils that are high in calcium content. It grows well on dense/heavy clay soils, especially Vertisols (walka). It does not withstand a shortage of water.

Use as Food

Faba bean seeds can be removed from green pods and eaten raw. They can also be roasted in the pod and eaten. Hulled, soaked and boiled seeds, spiced with onions, garlic and minced with butter are served as breakfast food called “ful”. The soaked and swollen whole grain is also boiled and spiced with onion, garlic, chilly powder and served with bread called “fulhaja”. Dried seeds are boiled alone or mixed with other food, for example, maize, sorghum, or wheat.

They may also be left until they germinate and eaten as fresh or boiled sprouts. Low heat roasted and boiled faba bean is served as a snack called “Ashuk”.

Dried faba bean seeds are split, their seed coats removed, and cooked with spices to make a sauce or stew (wot), which is eaten with flatbread (injera).

Split faba beans – either alone or mixed with other split pulses, are mixed with spices and ground to make a powder that is used to make a popular dish (Shiro), which is eaten with flatbread (injera).

The dried faba bean seed is 25.4% protein, 1.5% fat and 48.5% carbohydrate. Out of the total fats, 85% is unsaturated; while 15% is saturated. A hundred grams of faba bean provides 341 kcal energy, 25 grams dietary fibre, and though

not complete, some amount of all the nine essential amino acids ranging from 0.17 to 1.8 grams. Also, the 100 grams meets 48% Thiamine vitamin B1, 100% of Folate vitamin B9, 52% iron, 54% magnesium, 77% manganese, and 60% phosphorus of our daily dietary requirements, assuming we have a daily need of 2000 calories. Faba beans are good sources of all the above listed dietary needs.

Description

Faba bean is an annual crop that grows straight up. Its stem is hairless and smooth, hollow, but strong, and appears rectangular, if cut straight across. Each faba bean plant has 1 to 7 branches coming out of its base, none of them branching again higher up. Each leaf has 2 to 6 leaflets. The leaflets have the shape of the shadow of a chicken's egg or are narrower towards the base and tip. Each leaflet is 40 to 100mm long and 10 to 40mm wide at its broadest part.

The branch, which bears the flowers that appear alone or in clusters of 2 to 6, is short.

The five sepals in each flower are joined into a hairless tube, which is about 7mm long, with 5 pointed teeth at the end, and each of these teeth is 5 to 8mm long.

The five petals are about 2.5 cm long and 1.5 cm wide at their broadest part. They are white, but two of them have a conspicuous black spot that face each other.

The pods have pointed tips, are slightly hairy, and are 3 to 8 cm long and 1.0 to 1.5 cm wide. Each pod contains 2 to 5 seeds.

Each seed is 1 to 2 cm in diameter, with a black scar at one end, which is attached to the pod during growth.

The flower is, usually, self-pollinated, though some cross-pollination might occur.

Propagation

After the rainy season has started, the seeds are sown on fields in rows or broadcasted in the field, and buried in the soil by ploughing. They germinate in a few days. Transplanting faba bean seedlings is possible.

Management

Faba bean yields increase, when the nutrient content of the soil is high. Therefore, the application of natural/organic fertilisers, e.g. compost, or even chemical fertilisers can increase yields. Nitrogen fertiliser application may not be necessary, as the crop has a high capacity of fixing atmospheric N.

The most important faba bean diseases in Ethiopia, include chocolate spot (*Botrytis fabae*), rust (*Uromyces vicia-fabae*) and black root rot (*Fusarium* spp). Suggested control measures include: the use of resistant varieties, cultural practices (e.g., crop rotation).

Since faba beans are sown at the beginning of the rainy season, weeds grow up with them and so removing them is necessary.



Figure 16, *Vicia faba* plant in the field, plant with flowers, plant with pods and the seeds, courtesy of Ethiopian Biodiversity Institute and Asmamaw Andualem.

5.1.18. *Lens culinaris* Medik.

Also referred to as *Ervum lens* L., *Lens esculenta* Moench, *Vicia lens* coss. And Germ., *Envum lens* var. *abyssinica* Hochst. ex Rich., *Lens esculenta* var. *abyssinica* Alef., *Lens eulinaris* var. *abyssinica* (Hochst. ex Rich) Chiov., *Vicia lens* var. *abyssinica* (Hochst. ex Rich.) Fiori, *Lens abyssinica* A. Br. ex Chiov.

Common Names

ምስር - mssr (Amharic, Adereгна and Afargna); ብርስን - brsn (Ge'ez and Tigrigna); ማሺራ - mishira (Hadiagna and Kembatigna); ማሺረ - mishire (Guragegna); ማሲራ - misira (Oromigna); ማሲሪያ - misiriyya, ሙጧ - mutwa (Welayitigna); lentil (English).

Where and Under What Conditions is it Cultivated

Lentil is cultivated, mainly, in the northern, central and eastern highlands of Ethiopia. It is cultivated at higher elevations (1,800 to 2,700 m asl) as a cool season crop. It is not suited to the hot and humid climates. In Ethiopia, the crop is grown in the short rainy season ('belg', February - May) and during the main rainy season ('kiremt', June - December), the latter being predominant. To avoid water logging, the 'kiremt' crop is sown on vertisols at the end of the rainy season (September) and grown on residual soil moisture. It grows in all types of soils, but does not tolerate flooded or water-logged soils

A non-cultivated relative of lentil, *Lens ervoides* (Brign.) Grande is found in the Amhara and Tigray Regions in grasslands at altitudes of 2,500 to 3,300 m asl.

Use as Food

It is the main pulse crop used as a food in the country. The whole seed or the split seed is cooked with spices to make a sauce (wot), which is eaten with flatbread (injera). Lentil is a major component in making Sambusa in Ethiopia. Sambusa a deep fried wheat covered filling of various sorts, and in Ethiopia cooked and spiced lentils are a dominant form of filling used. Lentil is a nutritious crop. The dry seed consists of 25.0% protein, 1.0% fat and 55.8% carbohydrate. From the fats, 82% is unsaturated fats, while 18% is saturated. From 100grams of lentil, we get 353 kcal energy, 10.7 grams dietary fibre, and though not complete, some amount of all the nine essential amino acids ranging from 0.22 to 2.05 grams. In addition, 100 gram lentil meets the 76% Thiamine vitamin B1, 43% Pantothenic acid B5, 42% of vitamin B6, 100% of Folate vitamin B9, and 50% of our daily dietary requirement, assuming we have a daily need of 2000 calories. Lentils are good sources of all the above listed dietary needs.

Description

Lentil is an annual crop that grows straight up to 20 to 60 cm tall. It has thin, softly hairy stems and many branches.

Each leaf includes 8 to 16 leaflets. The leaflets have the shape of a narrow shadow of a chicken's egg. Each leaflet is about 20mm long and about 8mm wide at its broadest part. The leaf has tendrils (small coiling projections used to climb on other plants and structures) at its tip.

The flowering branches are thin, with 1 to 3 flowers at its tip. The 5 sepals are joined at their base to form a tube. They are quite thin, both on the flower and the pod. The petals are pale blue or violet and about 5mm long. There are 10 stamens in each flower, nine of the stamens are joined, and one remains free.

Each pod is 10 to 17mm long and 6 to 12mm wide. The pods are hairless, and thus, smooth. Each pod contains 1 or 2 seeds. Each seed has the shape of a small ball, which is pressed down.

The non-cultivated relative of lentil, *Lens ervoides* (Brign.) Grande, can be distinguished from lentil as follows: lentil has a longer (10 to 17 mm) and broader (6 to 12 mm) pod than *Lens ervoides*, whose pod is only 9 mm long or shorter, and 4 mm wide or narrower. Lentil seeds are bigger (4 to 6 mm in diameter) than those of *Lens ervoides* (about 2 mm in diameter). Lentil is also taller (20 to 60 cm tall) than *Lens ervoides* (less than 20 cm tall). Lentil has more leaflets on each leaf (8 to 16). Compared to *Lens ervoides* are generally fewer (4 to 6, sometimes 8 leaflets per leaf).

Propagation

Lentil seeds are sown on fields and buried into the soil by ploughing. The seeds can remain viable for more than 5 years under cool and dry storage conditions.

The transplanting of seedlings is also possible.

In Ethiopia, lentil is, usually, grown alone; but in some other counties, lentil is grown with other crops in the same field, as intercropping.

Management

Since lentils, is sown at the beginning of the rainy season, weeds grow with it and removing them is necessary. In areas with ample rain, it can be sown at the end of the rainy season, where the weeds will have been ploughed in making management easier. It is a poor competitor with weeds, especially when it is young. Weeding should be, generally, done within three weeks after emergence.

Rust, Fusarium wilt and root rot are the most important lentil diseases in Ethiopia. Yield losses of 10%, due to rust, and 50%, due to Fusarium wilt, and root rot have been recorded on vertisol grown lentil in Ethiopia. Suggested control measures include: the use of resistant varieties, crop rotation and treatment of seeds with fungicides.

Lentil can be grown in the dry season, if the farm is irrigated. Lentil is harvested by pulling the whole plant out of the soil, when the pods turn yellow-brown, and the lower ones are still firm, after which they are left in the field to dry. Further delay may lead to shattering.



Figure 17, *Lens culinaris* flower and leaves, plant with pods and seeds, courtesy of Ethiopian Biodiversity Institute.

5.1.19. *Lathyrus sativus* L.

Also referred to as: *Cicerula alata* Moench., *Cicerula sativa* Alef., *Lathyrus sativus* var. *coeruleus* (Alef.) Asch. & Graeb., *Lathyrus abyssinicus* A. Braun ex Chiov., *Lathyrus sativus* var. *abyssinicus* (A. Braun) Chior.

Common Names

ጻጾ - gwayya (Amharic and Tigrigna); ሰበረ - sebbere (Tigrigna, Amharic and Afarigna); ጻጾ - gayya (Oromigna and Guragegna); grass pea, chickling pea, chickling vetch (English).

Where and Under What Conditions is it Cultivated

Grass pea is cultivated throughout the Ethiopian highlands at medium altitudes up to 2,200 m asl. It is sown towards the end of the rainy season, usually in black clay soils (Vertisols, locally known as walka) on residual soil moisture. It withstands heavy rains in the early growth stage and prolonged drought during grain filling.

There are two non-cultivated relatives of grass pea found in Ethiopia. *Lathyrus pratensis* L. is found in central and eastern parts of the Oromia Region, in grasslands between 3,000 and 3,200 m asl. *Lathyrus sphaericus* Retz. grows in Amhara, Tigray and in the northern parts of Oromia Regions in grasslands between 1,800 and 3,000 m asl.

Use as Food

The seeds are split with a grinder, the seed coats removed, and the cleaned split seeds cooked with spices to make a sauce (wot), which is eaten with flatbread (injera).

The split seeds – either alone or with other split pulses - mixed with spices and ground into a powder that is used to make a popular dish (Shiro), which is eaten with flatbread (injera).

The cleaned split seeds are also mixed with grains and ground into a flour. The flour mixed with water, kneaded and baked into a flatbread (qitta).

A dried grass pea seed is 28.2% protein, 0.6% fat and 58.2% carbohydrate. From 100 grams of grass pea, we get 14.8 grams dietary fibre, and 2.8 grams ash.

If grass pea is consumed, excessively, it can cause a disease called lathyrism, which affects nervous system. Lathyrism can cause paralysis of the legs, meaning that walking is impossible, in people and animals. This paralysis is called lathyrism. Lathyrism is caused by the water-soluble non-protein amino acid called ODAP. ODAP is present in all parts of the plant. Lathyrism is irreversible, but not fatal. Lathyrism occurs when food ratios containing at least 25% grass pea are consumed continuously over 1.5 - 6 months. Outbreaks of lathyrism, often, occur during near famine conditions that force people to rely too heavily on grass pea. In general, soaking and boiling can reduce ODAP levels in the seeds, and this effect is enhanced, if water is changed after soaking and during cooking. In the traditional processing of this grain, removal of water after soaking and boiling is widely used as a pre-process treatment. This makes its further consumption possible.

Description

Grass pea is a hairless annual crop with many branches growing from its main stem. The stem has a flat projection (wing) running along its length.

Each of the leaves includes 2 leaflets, located opposite each other, with a tendril growing from in between. Each leaflet is long and narrow, 30 to 65mm long, and 3 to 11mm wide at its broadest part.

The 5 sepals are joined together at their base, forming a tube that is about 3mm long. Each of the 5 lips at the end of this tube is 3 to 6mm long and narrowing towards their tips. The petals are white or purple and about 15mm long. Nine out of the 10 stamens are joined up for about half of their length; the one other stamen is free.

Each pod is 25 to 35mm long and 10 to 18mm wide, containing 2 to 5 seeds. Each seed is shaped like a small ball, 4 to 7mm in diameter.

Grass pea is easily distinguished from its non-cultivated relatives, because both of those lack the thin, flat extension (wing) along its stem that is observed for grass pea. Furthermore, the flowers of *Lathyrus pratensis* are yellow, and those of *Lathyrus phaeicus* are red or white.

Propagation

Grass pea seeds are sown in a field and then buried in the soil by ploughing. They germinate after a few days. Seedlings can also be transplanted.

Management

Since the grass pea is sown at the end of the rainy season, weeds are usually dried up and do not compete with the crop, so removing them is not necessary. Grass pea grows well in Vertisols (walka). Application of fertilisers is not necessary.

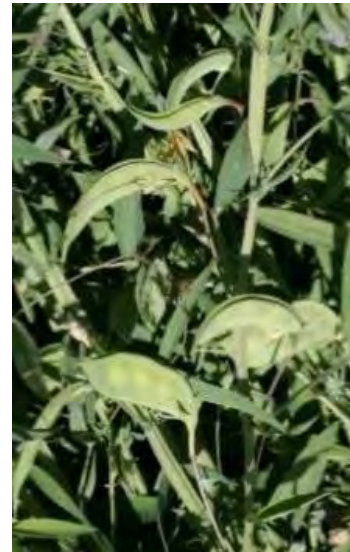


Figure 18, *Lathyrus sativus* flower, pod and seeds, courtesy Ethiopian Biodiversity Institute.

5.2. Non-Cultivated Edible Legumes Found in Ethiopia

In addition to the cultivated legumes described in the previous section, there are non-cultivated edible legumes that are found in Ethiopia. In the next section, we shall focus on those species that are known to be used as food. For the non-cultivated plants, maps were made to identify areas where each species is likely to be found based on available information. Species descriptions from the Flora of Ethiopian and Eritrea were reviewed to identify the Flora Zones (see map below) where the species have been observed, as well as elevation ranges and vegetation types. Maps were generated using ArcGIS (ESRI, version 10.4), elevation data from the United States Geological Survey, and vegetation data from the Vegetation Map for Africa (Atlas of the Potential Vegetation of Ethiopia). The potential distribution of indigenous species are displayed in green, whereas those of non-indigenous species are

displayed in orange. With those distributions, areas where consumption has been reported are coloured purple.

5.2.1. *Cordeauxia edulis* Hemsl.

Common Names

ቁድ - qud, ቁዳ - quda, ኣኩብ - ehb (Somaligna); yeheb nut (English).

Where and Under What Conditions it Grows

Yeheb nut grows in the Somali Region around 400 to 500 m asl. It is found on sandy soils in the semi-desert bush-land.

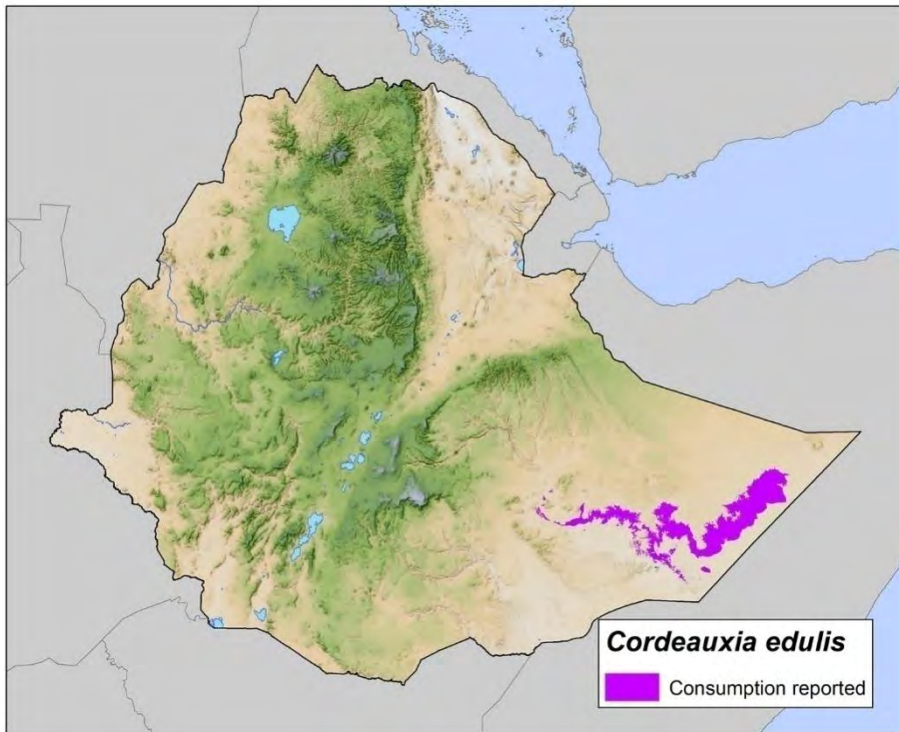


Figure 19, Potential distribution of *Cordeauxia edulis*

Use as Food

Yeheb nuts (the seeds) are boiled or roasted before eating. The seeds are said to be highly nourishing, containing 13% protein, 11% fat, 37% starch and 24%

sugar. It has 38 – 43.5% saturated fats in the form of palmitic and stearic acid, and 56 to 62% unsaturated fats in the form of oleic and linoleic acid.

Description

The yeheb nut is a shrub or small tree that grows up to 2.5 m tall. It has many branches, but no thorns. Its stem and leaves are marked with clearly visible red spots.

Each of its leaves has 2 to 12 leaflets, which are opposite each other in pairs. Each leaflet has the oval outline of a chicken's egg or narrower, 3 to 5 cm long and 1.5 to 2.5 cm wide at its broadest part. The lower surfaces of the leaflets are marked with red spots.

The flowers grow at the end of branches, in clusters of 2 or 3. There are 5 sepals on each flower, each one is about 10mm long, and the tips are round, not pointed. There are 5 petals on each flower, which are yellow and about 15mm long. There are 10 stamens within each flower, which are free (not joined together).

The pods are 4 to 6 cm long with thin, beak-like tips. Each pod contains one seed. The seed (nut) is 2.5 to 4.5 cm long and has the oval shape of a chicken's egg. Attempts have been made in Kenya and Uganda to plant yeheb nut as a perennial crop, with mixed success due to difficulties in survival rate due to tap root damage and mycorrhizae needs. Further studies and work is needed to meet the full potential this plant offers.

5.2.2. *Tamarindus indica* L.

Also referred to as *Tamarindus somalensis* Mattei, *Tamarindus erythraea* Mattei, *Tamarindus indica* var *emarginata* Chiov

Common Names

ሐመር - humer (Tigrigna and Somaligna); ሁመር - humer, ጃዋ - chowa, ሞጢ - motti (Amharic); ሮቃ - roqa (Amharic, Oromigna, Benagna and Somaligna); ዶማይ - domia, ኮነ - kone, ኮረ - kore (Gamogna); ራጋይ - ragai (Guragegna); ሮጎታ - rogota (Konsogna); ራጋይ - ragai, ራራይ - rarai (Mursigna); ቃድ - qad (Nuerigna); ሩቄ - ruqe (Tsemarigna); ኮርያ - koria (Welaitigna); የፕዮ - yepho (Zaysigna); tamarind (English).

Where and Under what Conditions it Grows

Tamarind grows in grasslands, woodlands and riparian forests in the Amhara, Tigray, Oromia, Southern Nations Nationalities and People's and Somali Regions below 1,500 m asl.

Tamarind grows well in most soil types, but well-drained soils near rivers suit it best.

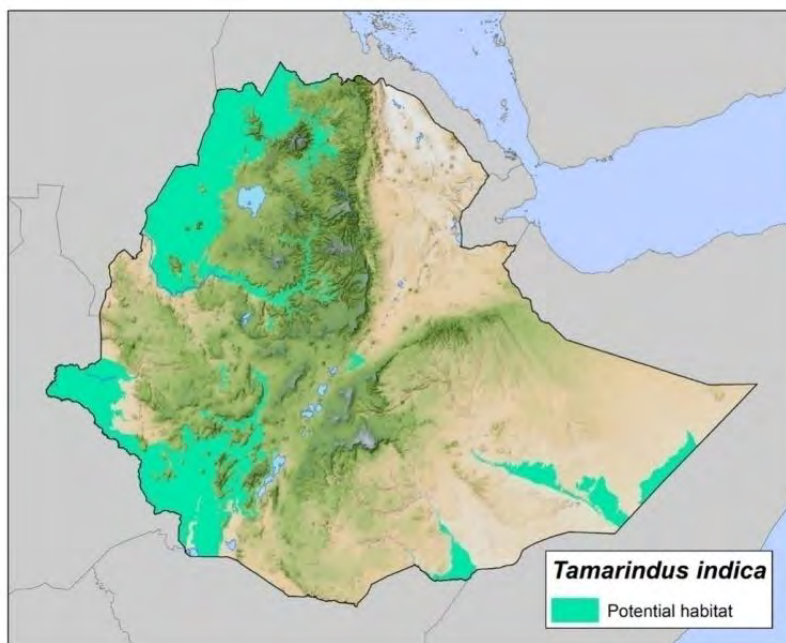


Figure 20, Potential distribution of *Tamarindus indica*

Use as Food

The pods of tamarind are thick. Their soft inner parts are scraped, mixed with sugar and/or jam and eaten. The scraped powder can also be cooked and eaten. It can also be mixed with water to make a drink.

The seeds are boiled or cooked in any other way before eating. The ripe, raw pods have 3% protein, 1.08% fat, 52.97% carbohydrate, 7.7% crude fibre, and 2.28% ash. From 100 grams of the fruit, we get 260 kcal energy.

Description

Tamarind is an evergreen, deciduous tree 3 to 24 meters tall.

Each leaf is 5 to 16 cm long, including 10 to 18 pairs of opposite leaflets. The tip of the leaf has no leaflet. The leaflets are hairless, 0.8 to 1.2 cm long and 0.3 to 1.1 cm wide. They are almost rectangular in shape.

Each flowering branch is 1 to 22 cm long. Flowers are found along its length (known as a raceme). There are 4 sepals around each flower, and each 0.8 to 1.2 cm long, and reddish on its outer surface. The neighbouring sepals overlap each other. There are 5 petals. The upper 3 are 1.0 to 1.3 cm long, and the lower 2 are much smaller. The petals are gold with red lines. The stamens are joined together into a tube up to about half their lengths.

The pods are 3 - 14 cm long and 2 to 3 cm wide. Each pod contains 1 to 10 seeds. The seeds are brown, 11 to 17mm long and 10 to 12mm wide.



Figure 21, *Tamarindus indica*, tree, leaves, flower and pod, courtesy of Hailay Girmay.

5.2.3. *Senna occidentalis* (L.) Link

Also referred to as: *Cassia occidentalis* L.

Common Names

የአይጥ ዳያ - ye'ayt guayya (Amharic); ሳቻራ - sachara (Oromigna); ሹና፡ሹና - shuna shuna (Somaligna); coffee senna (English).

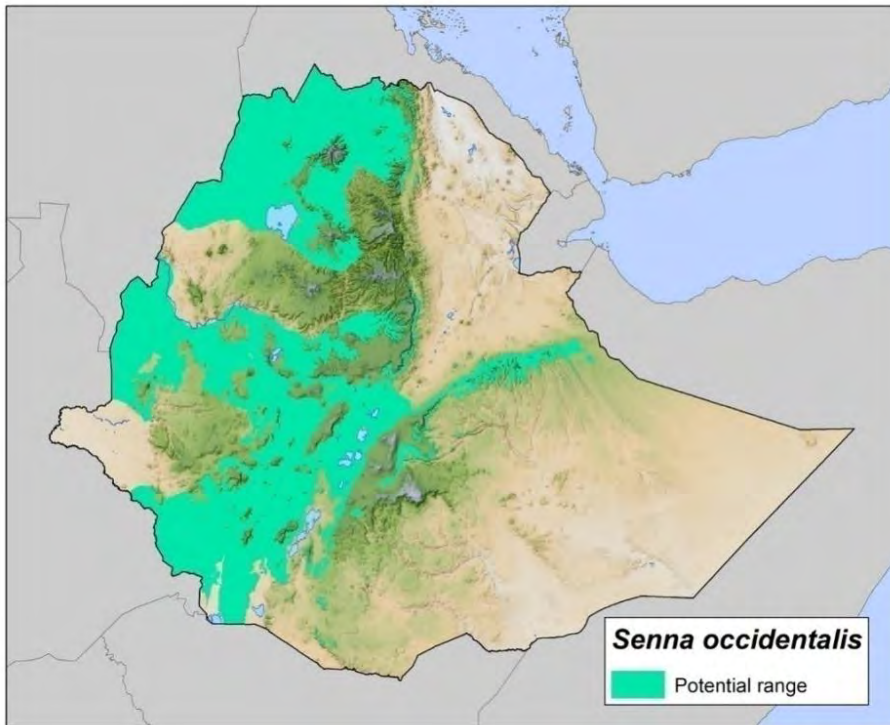


Figure 22, Potential distribution of *Senna occidentalis*

Where and Under what Conditions it Grows

Coffee senna is found at altitudes ranging 250 to 2,400 m asl in the Amhara, Tigray, Afar, Oromia, Southern Nations Nationalities and Peoples' and Somali Regions. It grows as a weed in crop fields, along roadsides, in wooded grasslands and near lakes and streams.

Use as Food

The roasted seeds are pounded, boiled and drunk as a substitute to coffee. The roasted or boiled seeds can also be eaten.

The leaves are boiled and the water drunk as a painkiller and a number of other medicinal uses.

Description

Coffee senna is an erect herb, sometimes slightly woody at the base, growing 0.2 to 2 metres tall.

Each of its leaves is 10 to 25 cm long, with swelling below its attachment to the stem. Each leaf includes 3 to 6 pairs of leaflets (6 to 12 leaflets per leaf). Each leaflet is 2.5 to 12 cm long, and 1.5 to 2.4 cm wide at its broadest part. The tips of the leaflets are pointed. Its upper surfaces of the leaflets are hairless and smooth, but the edges of the leaves are hairy, and the bottom surfaces may show a few faint spots.

The flowers are each at the end of a branch that is 3 to 8mm long. There are five sepals in each flower, and these are rounded at their tips. The petals are yellow, and 0.9 to 1.5 cm long. There are 10 stamens in each flower, 3 of them are large, 4 are medium, and 3 are small.

The pod is, usually, slightly curved upwards, 5 to 13 cm long, and 0.5 to 1 cm wide. It is hairless and smooth. There are many seeds in each pod. The seeds are light brown 4.5 to 5mm long, 3.7 to 4.5 wide, and with very small swellings on its surface.

There are 18 species of *Senna* found in Ethiopia, of which only one species is coffee senna. Two other species, *Senna petersiana* and *Senna bicapsularis*, are eaten by humans in other countries. Coffee senna can be distinguished from those two species as follows:

In *Senna occidentalis*, there is a swelling just below each leaf; and the thin branch which bears the leaflets is 10 to 25 cm long.

In *Senna petersiana*, there are swellings along the thin branch, which carries the leaflets, at the base of each opposite pair of leaflets; and the thin branch, which bears the leaflets is 20 to 40 cm long.

In *Senna bicapsularis*, there is only one swelling on the thin branch that bears the leaflets, at the base of the first opposite pair of leaflets; the thin branch which bears the leaflets is 4 to 10 cm long.



Figure 23, *Senna occidentalis*, flower and pod, courtesy of Ethiopian Biodiversity Institute.

5.2.4. *Prosopis juliflora* L.

Common Names

ፕሮሶፒስ - prosopis (all Ethiopian languages); mesquite (English).

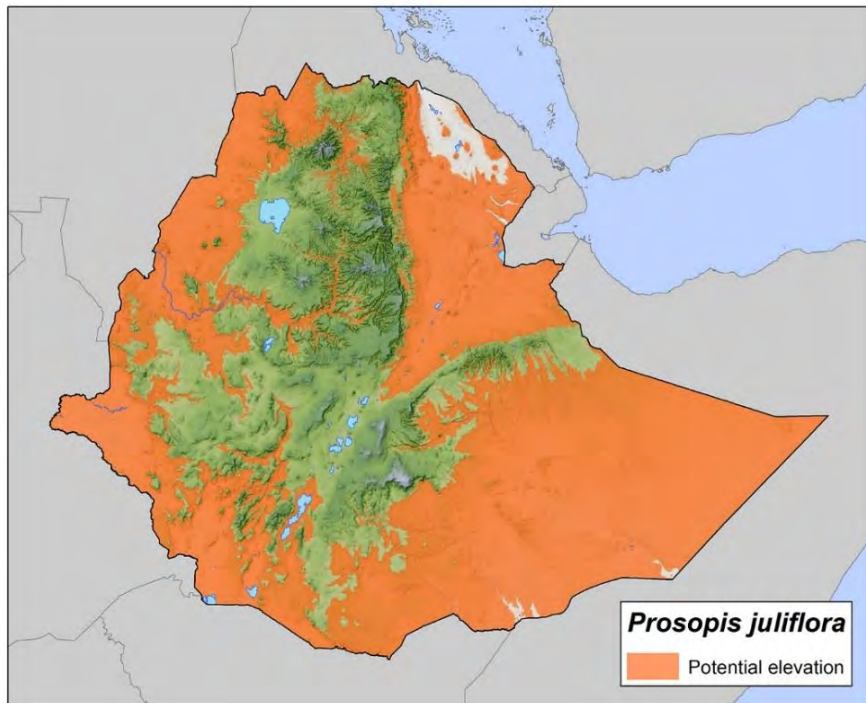


Figure 24, Potential distribution of *Prosopis juliflora*

Where and Under what Conditions it Grows

Mesquite grows in the Afar Region at altitudes of 400 to 1,600 m asl. It is a recent introduction into Ethiopia and is likely to expand into other semi-arid and arid areas of Ethiopia. It tolerates salty soils.

Use as Food

The pods are ground into flour and cooked to make bread. The pods and leaves are also boiled and eaten. The wood makes high-quality charcoal. Here, we want to show that this invasive species, though problematic, as it already exists has multiple uses that we would benefit from, if appropriately used.

Description

Mesquite is a tree that grows up to 15 meters tall and has many branches. It can also grow to be a shrub with spines. The spines are 0.5 to 5 cm long.

The leaves are divided into 1 to 4 pairs of opposite branches, each bear 6 to 29 pairs of opposite leaflets. There is no leaflet at the end of the branch. The leaflets are hairless and smooth, 6 to 23mm long, and 1.5 to 5.5mm wide.

The flowers of mesquite are found at the ends of branches that are 5 to 15 cm long. There are 5 sepals around each flower, which are joined together at their base. There are 5 yellow petals in each flower.

The pods are light brown or yellow, straight or curved, 8 to 29 cm long, 0.8 to 1.7 cm wide. Each pod contains 10 to 20 seeds. The seeds are difficult to remove from their pod.

5.2.5. *Acacia albida* Del.

Also referred to as *Faidherbia albida* (Del.) A. Chev.

Common Names

ገርቢ - gerbi (Amharic and Guragegna); ዳሮት - darot, ጋርቢ - garbi, ጫዳቻ - chadacha (Oromigna); ሞሞና - momona, ጋርሻ - garsha (Tigrigna); ማማን - maman (Afarigna); ቀረቶር - qeretor (Gamogna); ጋራቢ - garabi (Somaligna); apple ring acacia (English).

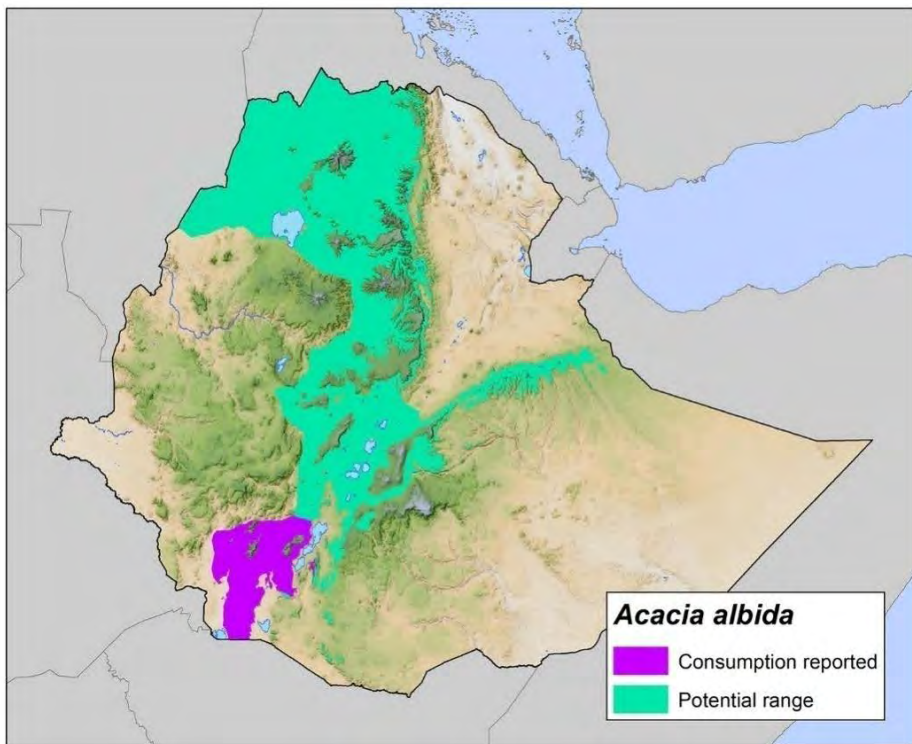


Figure 25, Potential distribution of *Acacia albida*

Where and Under what Conditions it Grows

Apple ring acacia is found throughout Ethiopia in woodlands, grasslands and on seasonally water-logged land below 2,600 m asl. Because it sheds its leaves during the rainy season (enabling crops to grow very close to its stem), it is a tree which is valued in agro-forestry. The wood is good for making furniture and for construction.

The swellings (glands) on the leaves are used in making traditional perfumes.

The leaves and pods are good forage and fodder for domesticated animal, especially in the dry season.

By increasing nitrogenous chemicals in the soil, it raises crop productivity.

Use as Food

The seeds of apple ring acacia are boiled and eaten.

Description

The apple ring acacia is a tree that grows up to 30 metres tall. Its bark is rough and brown.

Its spines are straight and up to about 2 cm long.

Each leaf includes 3 to 10 pairs (i.e. 6 to 20) of opposite branches, each of which bears 6 to 23 pairs (i.e. 12 - 46) of opposite leaflets.

Each leaflet is 3.5 to 12mm long, and 0.7 to 4mm wide.

Flowers are located at the end of branches that are 3.5 to 17 cm long.

The sepals are joined at their bases and very short, up to 2mm long.

The petals are white and also short, up to 3.5mm long.

There are many stamens in each flower, which are joined to form a tube part of the way up.

Each pod is 6 to 25 cm long and 2 to 3.5 cm wide. The pods are whitish, orange or brown. Each pod contains 10 to 20 seeds. The seeds are 9 to 11mm long and 6 to 8mm wide.

5.2.6. *Pithecellabium dulce* (Roxb.) Benth.

Common Names

Madras thorn, manila tamarind (English)

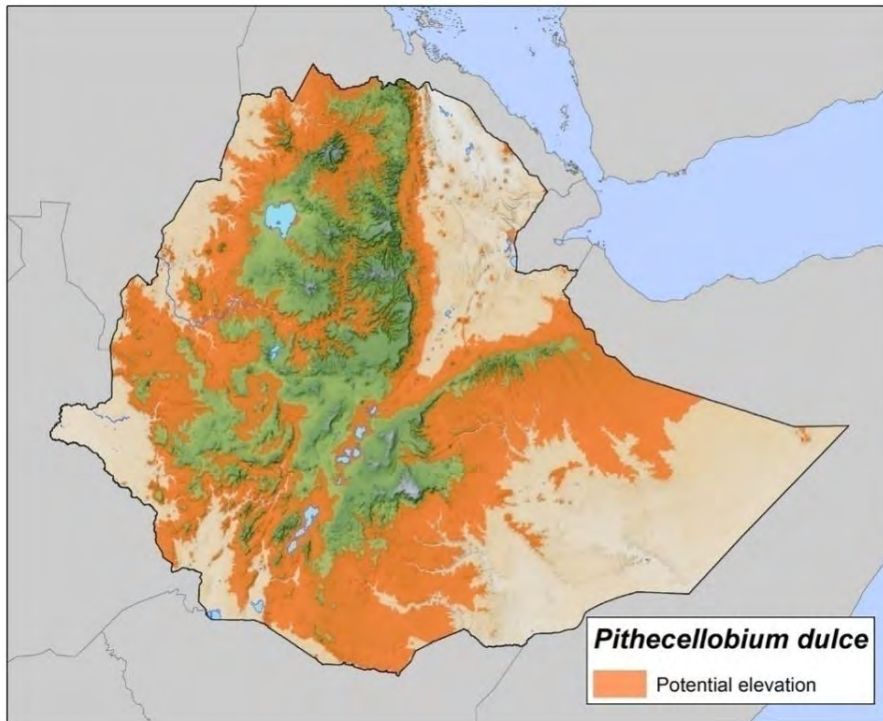


Figure 26, Potential distribution of *Pithecellobium dulce*

Where and Under what Condition it Grows

The Madras thorn grows in the Somali and Gambella Regions at altitudes of 500 to 1,600 m asl. It is a drought and salt tolerant plant.

Use as Food

The seeds are roasted or boiled and eaten.

The fleshy internal parts of the pods are sweet and edible.

Description

The Madras thorn is a shrub or a tree that grows 4 to 15 metres tall. Its stem is smooth and grey. Its branches bear thorns and bend towards the soil.

Each of the leaves includes 2 branches, with each branch bearing 2 opposite leaflets (in other words 4 leaflets per leaf)

The leaflets have the shape of the shadow of a chicken's egg and 0.7 to 5.0 cm long, and 0.3 to 2.3 cm wide at its broadest part. The leaves are usually hairless, but sometimes have a few hairs.

The flowering branches are short, but bear several flowers.

The five sepals on each flower are 1 to 1.5mm long; they are joined at their base into a short tube with 5 lips, but may have 4 or 6 lips. The lips of the sepals are covered with short hairs.

The five petals in each flower are light yellow, 3 to 4.5mm long, and covered with short hairs.

The lower parts of the stamens are joined into a tube. The free (unjoined) upper parts are 6.5 to 7mm long. The pods are curved or twisted, 10 to 15 cm long and 1 to 1.6 cm wide.

5.2.7. *Erythrina melanacantha* Taub. ex Harms

Common Names

No common names have been found.



Figure 27, Potential distribution of *Erythrina melanacantha*

Where and Under what Conditions it Grows

Erythrina melanacantha has two subspecies. *Erythrina melanacantha* subspecies *melanacantha* grows in Southern Ethiopia in the Oromia, Somali and Southern Nations, Nationalities and Peoples' Regions in the dry bush-lands and woodlands at altitudes of 1,200 to 1,300 m asl.

Erythrina melanacantha subspecies *somala* grows in the Somali Region in dry bush-lands at 600 to 700 m asl.

Use as Food

The roots of both subspecies are eaten in times of food shortage.

The sap from any part of the tree is drunk, when water is needed.

Description

Erythrina melanacantha is a tree that grows 6 to 20 metres tall. Its main stem is covered with swellings (knobs). Its branches bear small, curved thorns.

Each of its leaves includes two opposite leaflets with a third in between.

The shape of the leaflets is like the shadow of a chicken's egg. The leaflets are 2 to 9 cm long and 1.5 to 12 cm wide at its broadest part. The lower surfaces of the leaflets are covered with thin hairs, at least before they grow old and dry up. The middle branch of the leaf (which bears the central leaflet) is prickly with small thorns.

Each branch, which carries many flowers at its end, is, usually, found, when the leaflets have fallen to the ground.

The sepals are joined together, but with a split on one side and are covered with brownish-red hairs.

The petals are red.

Each pod is curved and 13 to 30 cm long. The pods are hairy, when it starts to grow, but becomes hairless as the seeds mature. Each pod contains 2 to 11 seeds.

The two subspecies *Erythrina melanacantha* can be distinguished as follows:

Subspecies *melanacantha*

The stems that bear each flower (pedicels) are up to 14mm long. The pods have a wide wing running along the side that opens. The seeds are yellowish or reddish brown.

Subspecies *somala*

The stems that bear each flower (pedicels) are up to 7mm long. The pods have no or at most a very small wing running along the side that opens. The seeds are bright yellow.

5.3. Leguminous Plants Reported as Edible in Other Counties, and Found, but Not Eaten in Ethiopia

Some of the legumes found in Ethiopia are consumed in other countries, but are not known to be edible in Ethiopia. Because food habits can change, they might be eaten in Ethiopia at some point in the future, therefore these are described briefly in this section.

5.3.1. *Caesalpinia pulcherrima* (L.) Sw.

Also referred to as: *Poinciana pulcherrima* L.

Common Names

Barbados pride, paradise flower (English)

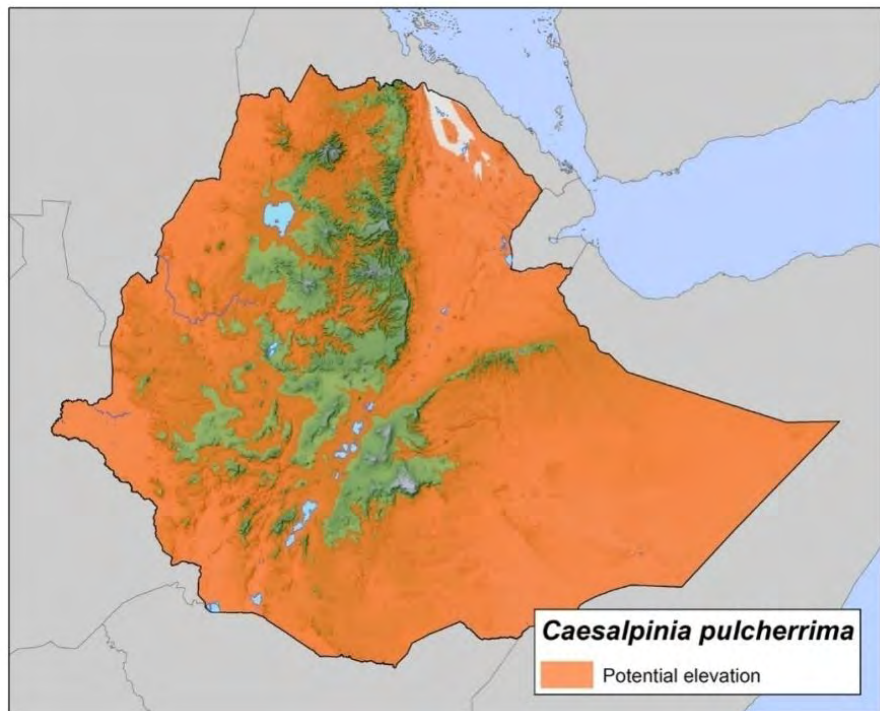


Figure 28, Potential distribution of *Caesalpinia pulcherrima*

Where and Under What Conditions it Grows

Barbados pride is said to be cultivated as an ornamental plant at low altitudes in Eastern Amhara Region (in Dessie), in the Gambella Region, in the southern part of the Oromia Region and in Dire Dawa City Administration.

Use as Food

The seeds are said to be edible in Asia, Americas and pacific islands.

Description

Barbados pride is an ornamental shrub with a smooth stem, which may or may not bear small thorns.

Each leaf includes 3 to 10 pairs (i.e. to a total of 6 to 20) of opposite branches, with each branch bearing 5 to 13 pairs (i.e. a total of 10 to 26) of opposite leaflets. There is no leaflet at the end of the branches that bear the leaflets. Each leaflet is 5 to 28mm long, and 4 to 15mm wide at its broadest part.

The flowers are clustered together along the top part of the branch that bears them. There are 5 sepals in each flower, and neighbouring sepals overlap each other. There are also 5 petals in each flower, which are red, yellow, or orange, and are 15 to 25mm long. There are 10 stamens in each flower. The stamens are bright red and 5 to 6.5 cm long.

5.3.2. *Senna petersiana* (Bolle) Lock

Also referred to as: *Cassia petersiana* Bolle

Common Names

ደቢሮ - debirro (Oromigna); ለሌባማር - leleba mar (Amharic); ኦሃ - oha (Welaitigna).

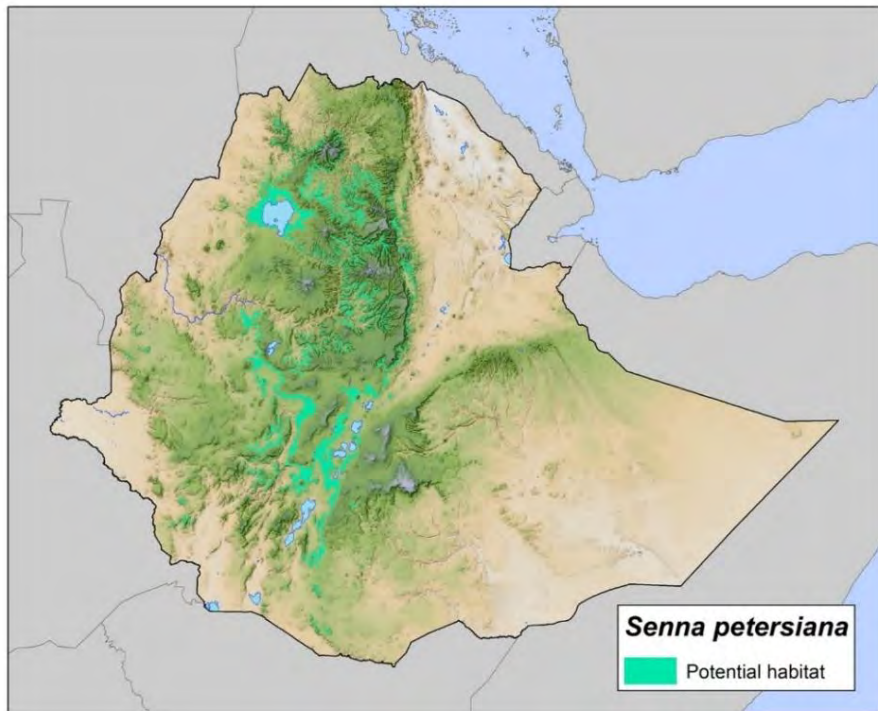


Figure 29, Potential distribution of *Senna petersiana*

Where and Under What Conditions it Grows

Senna petersiana is found in edges of forests, in woodlands, and on the sides of rivers in the Amhara, Oromia and Southern Nations Nationalities and People's Regions between 1,200 and 2,000 m asl.

Use as Food

The pods and seeds are said to be edible and used to make alcoholic drinks, all over Africa. The roots and leaves are said to be made into medicines for treating both humans and domestic animals.

Description

Senna petersiana is a shrub or a tree that grows 0.6 to 12 m tall.

Each leaf is 20 to 40 cm long. Each leaf includes 4 to 13 pairs of leaflets (i.e. a total of 8 to 26 leaflets). There are swellings (glands) at the base of the opposite leaflets. Each leaflet is 2 to 10 cm long and 0.7 to 4 cm wide at its broadest part. The lower surfaces of the leaflets are hairy. Each flowering branch has several flowers located near its end. There are five sepals around each flower.

The sepals have rounded tips and overlap with each other. There are also five petals, which are bright yellow and 1.5 to 3.5 cm long. There are 10 stamens in each flower, of which 3 are large, 4 medium and 3 very small.

The pods are 12 to 25 cm long, and 1 to 1.5 cm wide. There are many seeds in each pod. The seeds are brown, 5 to 7mm long, and 4 to 6mm wide.

5.3.3. *Senna bicapsularis* (L.) Roxb.

Also referred to as *Cassia bicapsularis* L.

Common Names

Rambling cassia (English).

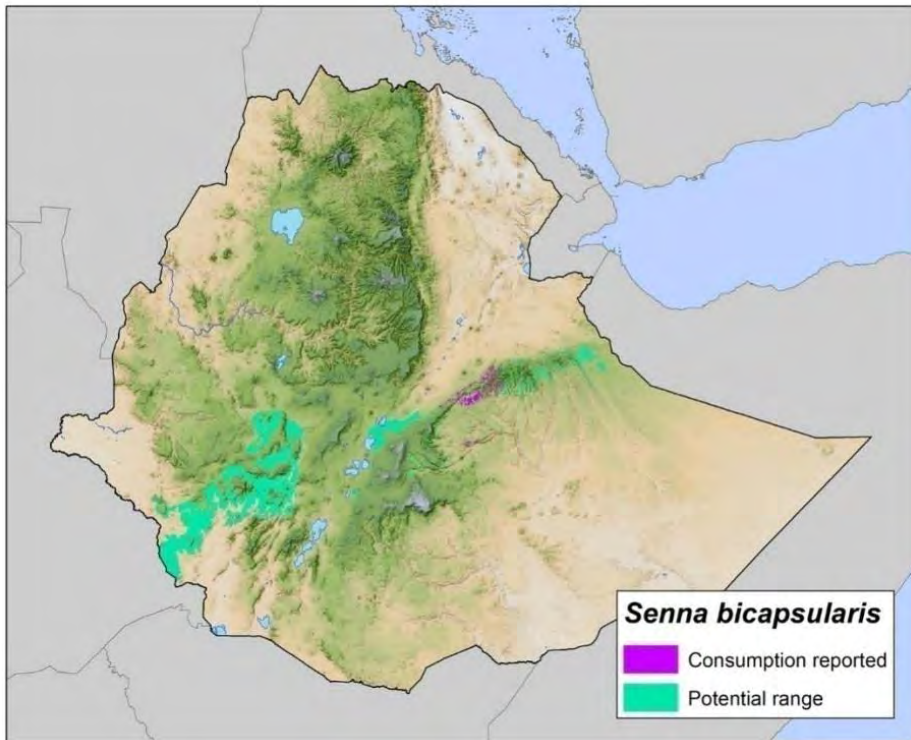


Figure 30, Potential distribution of *Senna bicapsularis*

Where and Under What Conditions it Grows

Rambling cassia is found in bush-lands, in grasslands with scattered trees, and beside rivers in the southern parts of Oromia Region and in the Southern Nations Nationalities and Peoples' Regions from 1,000 to 1,900 m asl. It is often cultivated as an ornamental shrub.

Use as Food

The pods of the rambling cassia are said to be eaten by people in other countries, in Africa and South America.

Description

Rambling cassia is a shrub that usually grows 1 to 3 metres tall, although sometimes it can grow up to 9 metres. It is hairless and has many branches.

Each leaf is 4 to 10 cm long with a swelling (gland) between the lowest pair of leaflets. Each leaf has 2 to 3 pairs (i.e. a total of 4 to 6) leaflets. Each leaflet is 1 to 4 cm long and 0.7 to 2.5 cm wide at its broadest part.

Each branch carries 3 to 15 flowers. There are 5 sepals around each flower, and they are rounded at their ends. There are also 5 petals in each flower, which are yellow or orange, and 1 to 1.3 cm long. The stamens are free from each other, i.e. not joined into a tube, and they are all the same length.

The pods are, usually, straight, 5 to 15 cm long, and 0.1 to 1.5 cm wide. Each pod contains many seeds. The seeds are smooth, brown, 5 to 6mm long and 3.5 to 4.5mm wide.

5.3.4. *Bauhinia purpurea* L.

Also referred to as *Phanera purpurea* (L.) Benth.

Common Name

Orchid tree, Hong Kong orchid tree, purple bauhinia, camel's foot, butterfly tree, and Hawaiian orchid tree (English).

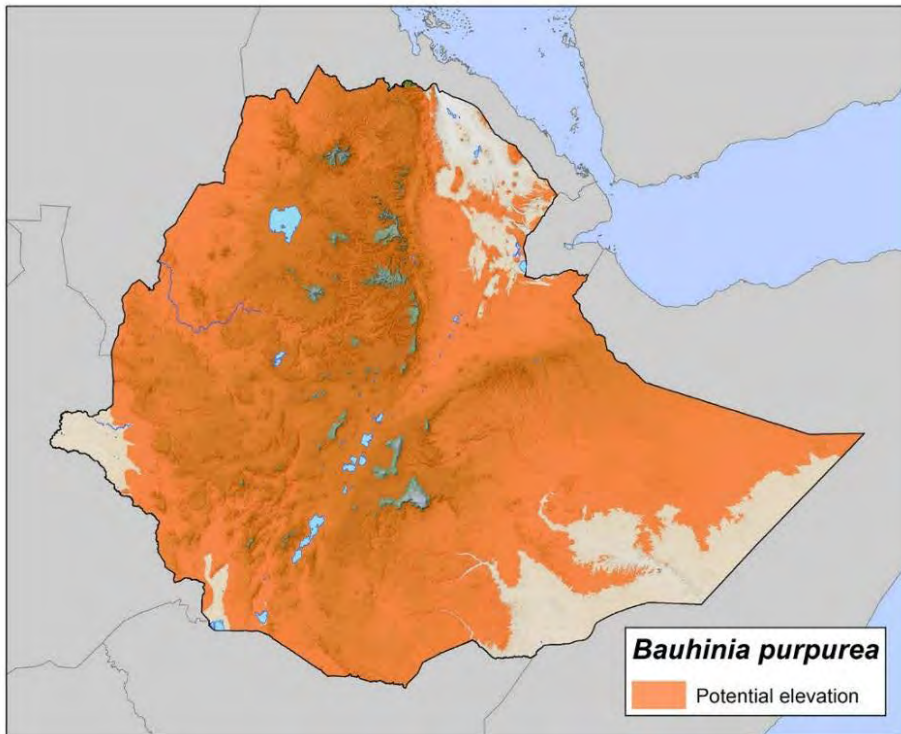


Figure 31, Potential distribution of *Bauhinia purpurea*

Where and Under What Conditions it Grows

Bauhinia purpurea is found in the Gambella Region and may be grown as an ornamental tree in other places.

Use as Food

The leaves and pods are said to be eaten in other countries, in Africa, Asia and Australia. Various parts of the tree are said to be used as medicine.

Description

Bauhinia purpurea is a small tree with many branches.

Its leaves are large and unbranched, the outline resembling the footprint of a camel. Each leaf is divided into two lobes in the top third. Each flower has 5 sepals with overlapping edges and 5 purple petals that are up to 6 cm long. There are only three stamens, which produce pollen grains, but there may be others that do not produce pollen.

5.3.5. *Tylosema fassoglensis* (Kotschy ex Schweinf.) Torre & Hillc.

Also referred to as *Bauhinia fassoglensis* Kotschy ex Schweinf.

Common Names

የጅብ፡አተር - yejib ater (Amharic); ሳከ - sake (Oromigna); አዲፋጋ - adifaga (Anuwak); ኢሉባሮች - illubaroch (Bodigna); ማዳቅብራ - madeqburde, ይርሽ - yrsho (Gamogna); ባላይ - balai (Mursigna); ቁፍቁፍለ - qufqufle (Somaligna); fish poison bean (English).

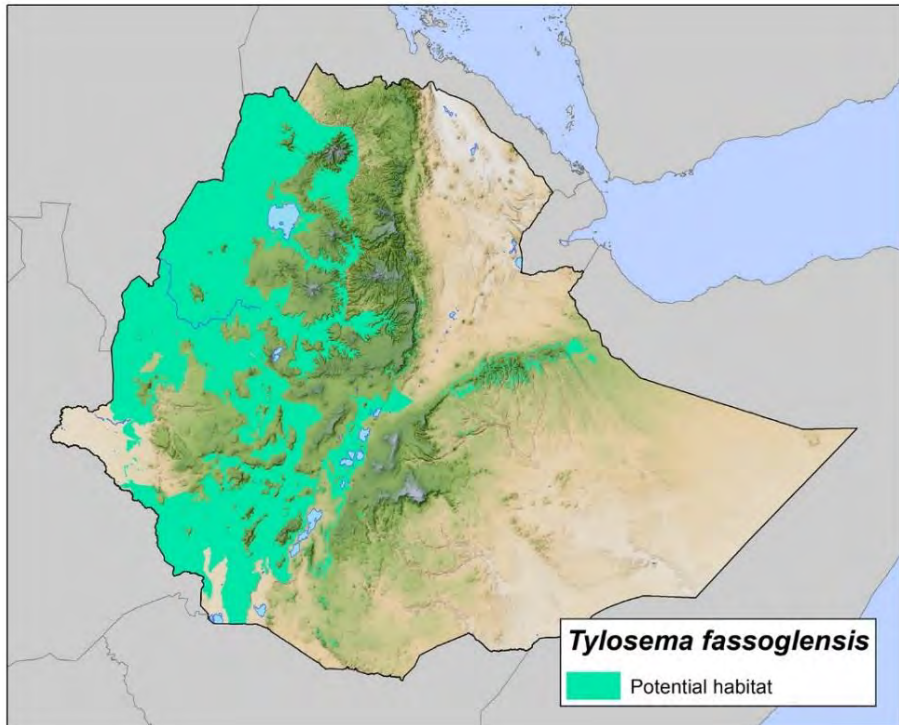


Figure 32, Potential distribution of *Tylosema fassoglensis*

Where and Under What Conditions it Grows

Fish poison bean grows in Amhara, Oromia and Southern Nations Nationalities and Peoples' Regions in forests and grasslands with scattered trees from 500 to 1,950 m asl.

Use as Food

The pods and the seeds are said to be eaten in other countries all over Africa. Demel Teketay *et al.* (2010) have reported that the Mursi people in Southern

Ethiopia eat the pods and seeds. The new growth at the ends of the branches can be cut, and squashed to produce water for humans to drink.

Description

The fish poison bean is a herb which climbs on other plants, holding on to them with its tendrils, or else growing along the surface of the soil. Its younger parts are hairy.

Each of the leaves is 5 to 20 cm long, and 5.5 to 23 cm wide. It is divided into two round lobes part of the way towards its base.

The branches, which bear flowers towards their ends are about 5 to 45 cm long. The five sepals are 1 to 1.7 cm long. Two of the sepals are joined together. These five petals are yellow and 2.2 to 4 cm long. Each pod is 7 to 12 cm long and 4.5 to 7.3 cm wide. The seeds are brown or black in colour, 1.7 to 2.8mm long and 1.5 to 2mm wide.

Fish poison bean might be confused with another species of *Tylosema* that occurs in Ethiopia (*Tylosema argentea* (Chiov.) Brenan), which is not reported as edible by humans. The two species can be distinguished as follows: whereas fish poison bean has leaves, which are 5 to 20 cm long, and 5.5 to 23 cm wide. *Tylosema argentea* leaves are 4 cm long or shorter and 4 cm wide or narrower. Whereas fish poison bean petals are 2.2 to 4 cm long, *Tylosema argentea* petals are 2 cm long or shorter.

5.3.6. *Acacia tortilis* (Forssk.) Hayne

Common Names

ደውኒግራር - deweni grar, ኮረራ - korera, ኮርሰራ - koresra (Amharic); ሎጦባ - lottoba, ጠደቻ - teddecha, ዳዳች - dadach, ድሃዳቸር - dhadachir, ጉራር - gurar, ሃራህ - harah (Oromigna); ላላ - älla, ላንጭባ - ängieba (Tigrigna); ላባክ - äbak, ላካብ - äkab, ላዳክ - ädak, ጉርሐ:ዳሩዩ - guruh'a daruye, ሐራሕ - h'arah', ኦራ - ora, ቁራ - qura, ቲማድ - timad (Somaligna); ቤከቤ - beh'bey, ቤከቤ - behebi, ጽዲ - ts'i (Afarigna); ሸራ - shera (Gamogna); ሰውት - sewut (Benigna); ድኔታታ - dhetata (Derashigna and Kusmigna); ድኔተኮ - dhettekko (Tsemagna); ኮረራ - korera (Welayitigna); ቸውና - chuwenna (Zaysigna); shittim wood, spiral fruit tree, thorn tree, umbrella tree (English).

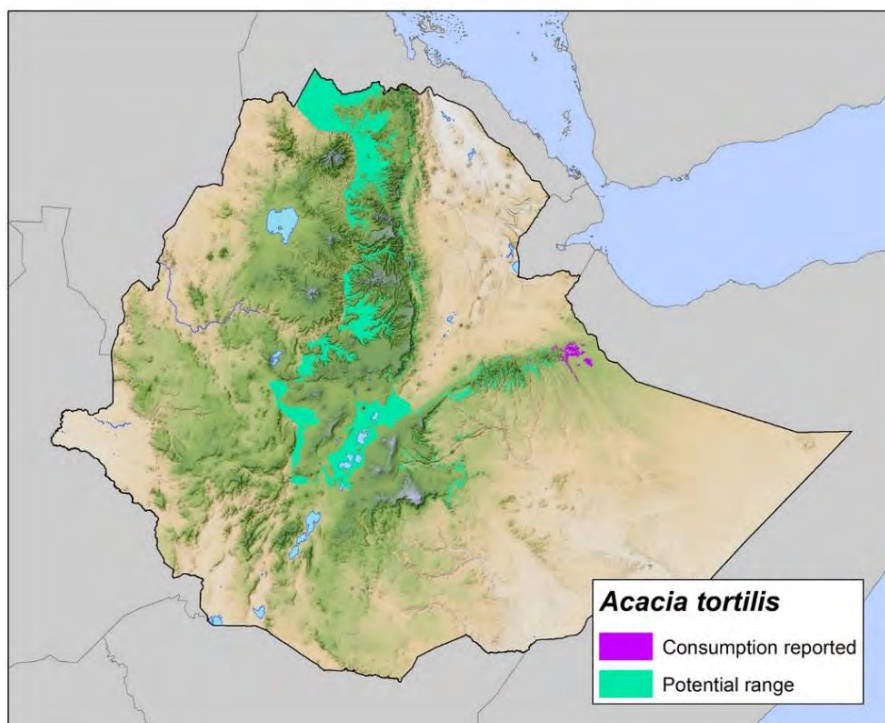


Figure 33, Potential distribution of *Acacia tortilis*

Where and Under What Conditions it Grows

Acacia tortilis is found growing as a tree throughout Ethiopia in woodlands and in grasslands with scattered trees between altitudes of 600 and 1,900 m asl.

Use as Food

Acacia tortilis seeds are said to be eaten as porridge in Kenya, and in times of food shortage. Demel Teklay *et al.* (2010) reported that in the Somali Region, it is, usually, the pods without the seeds that are eaten fresh.

Description

Acacia tortilis grows 4 to 21 metres tall. Its young branches may or may not be hairy. Its branches bear two types of thorns, some that are short and bent, up to 5mm long, and others that are long and straight, up to 10 cm long.

Each leaf includes 2 to 10 opposite branches (i.e. a total of 4 to 20), each of which bears 6 to 22 pairs of opposite leaflets (i.e. a total of 12 to 44 leaflets). The leaflets are 0.5 to 6mm long and 0.5 to 1 mm wide.

The flowers grow in clusters, forming a ball (head) at the end of a flowering branch. There are 5 sepals around each flower, which are joined to form a short tube 1 to 2mm long. These 5 petals are dull white and are also joined to form a short tube 1.5 to 2.5mm long.

The pods are twisted into a ring. The pods are twisted, covered with small hairs and many red spots, and are 6 to 13mm wide. Each pod contains up to 10 seeds. The seeds are brown, almost square in outline, 4 to 7mm, and 3 to 6mm wide.

5.3.7. *Acacia edgeworthii* T. Andres.

Also referred to as: *Acacia socotrana* Balf. f., *Acacia sultani* Chiov., *Acacia pseudosocotrana* Chiov., *Acacia humifusa* Chiov., *Acacia erythraea* Chiov.

Common Names

ጉሉ - gulu (Somaligna)

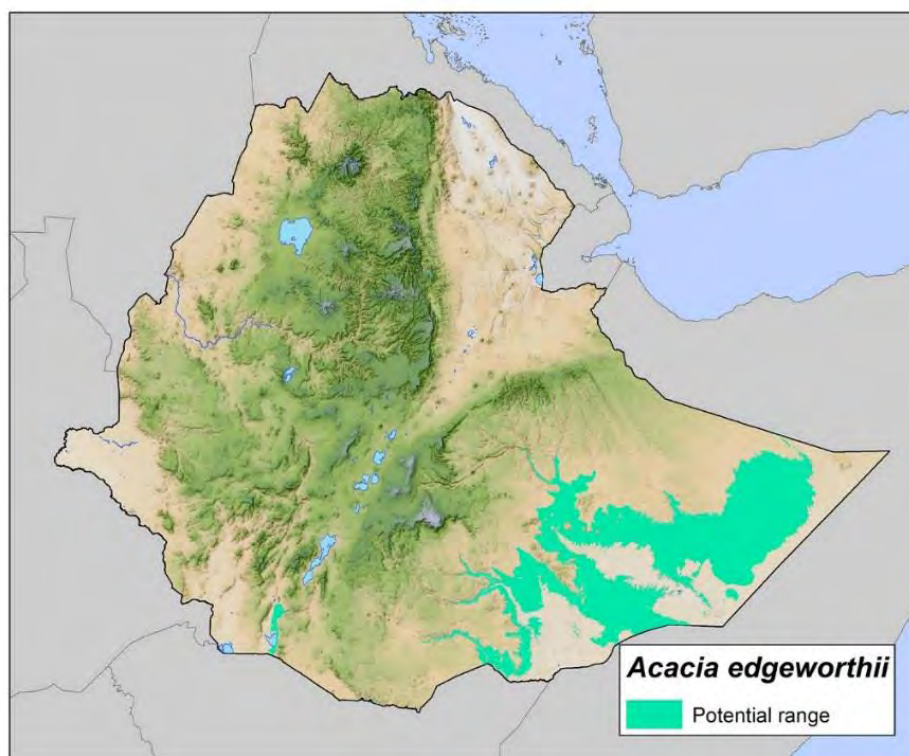


Figure 34, Potential distribution of *Acacia edgeworthii*

Where and Under What Conditions it Grows

Acacia edgeworthii is found in bush-lands in southern parts of the Oromia Region and in the Somali Region between 300 and 700 m asl.

Use as Food

The leaves are said to be boiled and cooked as a vegetable in other countries in Africa and the Middle East.

Description

Acacia edgeworthii is a shrub that grows 0.3 to 2 metres tall. Its young branches are hairy. Its thorns are straight and about 1 to 3.5 cm long.

Each leaf includes 4 to 10 opposite branches (i.e. a total of 8 to 20), each of which bears 6 to 20 pairs of opposite leaflets (i.e. a total of 12 to 40 leaflets). The leaflets are hairy, 0.75 to 5mm long, and 0.5 to 2mm wide.

The flowers are born in clusters that form balls (heads) at the end of branches. There are 5 sepals around each flower, which are joined into a small tube 1 to 2mm long. There are five white petals in each flower, which are 2.5 to 3mm long.

The pods may be curved or nearly straight, are brown, hairy, and 7 to 25 cm long. The seeds are black and 9 to 13mm wide.

5.3.8. *Acacia saligna* (Labill.) Wendl.

Also referred to as: *Acacia cyanophylla* Lindl.

Common Names

Weeping wattle, Port Jackson willow, willow wattle (English).

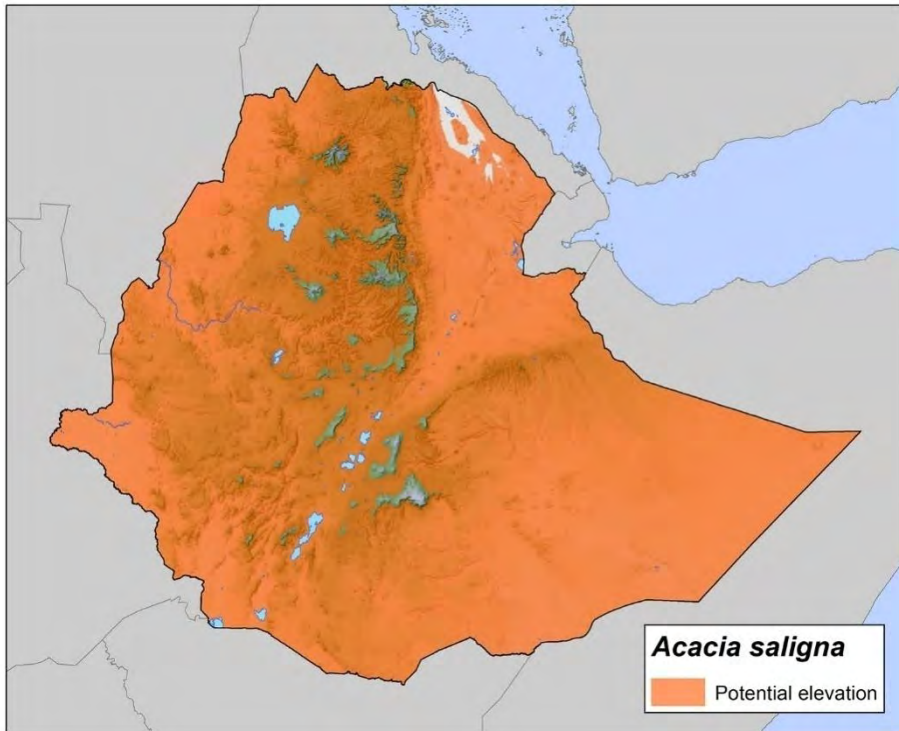


Figure 35, Potential distribution of *Acacia saligna*

Where and Under What Conditions it Grows

The weeping wattle is found at mid to high altitudes across Ethiopia. It was introduced by reforestation programs. It is a native tree of Australia.

Use as Food

It is said that in other countries the seeds are ground to make flour for cooking. The gums are also said to be used as food preservatives in other countries. Here, we want to show that this invasive species, though problematic, as it already exists has multiple uses that we would benefit from, if appropriately used.

Description

The weeping wattle is a shrub or small tree that grows up to 10 metres tall. It has no thorns. Its young branches are hairless.

Its leaves are simple (not divided into leaflets). Each leaf is 8 to 22 cm long and 0.5 to 1.4 cm wide.

Its flowers are grouped into balls (heads) at the end of a branch that is 6 to 22mm long. When flowering, there may be many flowering branches over the whole tree. The flowers produce a strong scent of 'wattle' that some people are allergic to. There are 5 sepals around each flower, joined into a small tube with small lips at the end. There are 5 petals in each flower that are bright yellow. There are many stamens within each flower, which are not joined into a tube.

The pods can be straight or slightly curved and are 5.5 to 15 cm long and 0.5 to 0.6 cm wide.

5.3.9. *Pterocarpus lucens* Guill. & Perr.

Also referred to as: *Pterocarpus abyssinicus* Hochst. ex A. Rich.

Common Names

ማቡንጎ - mabungo (Somaligna)

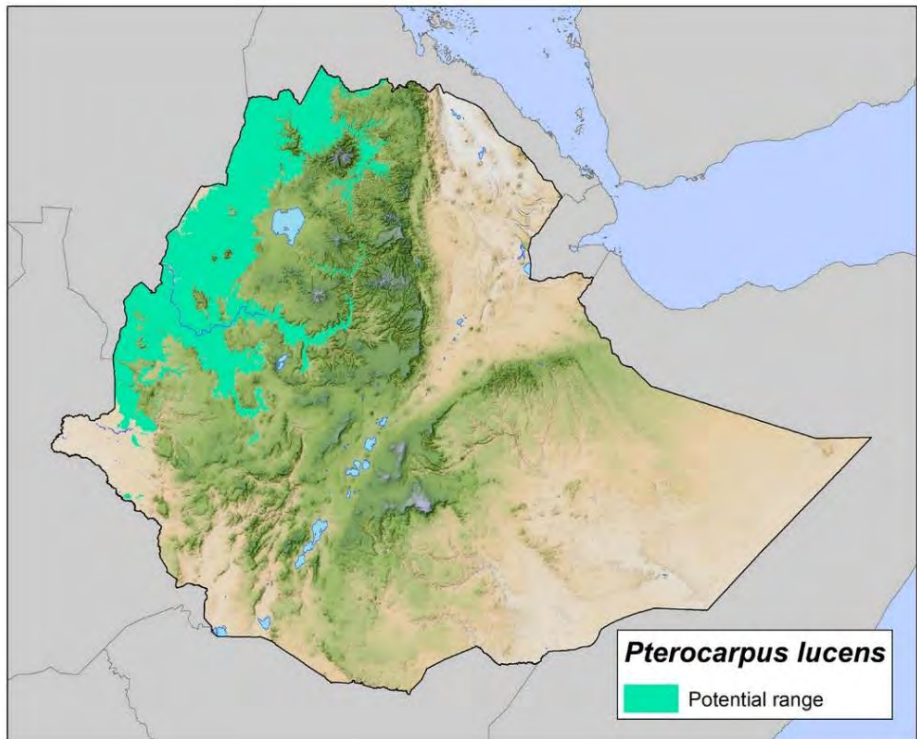


Figure 36, Potential distribution of *Pterocarpus lucens*

Where and Under What Conditions it Grows

Pterocarpus lucens is found in grasslands with scattered trees and on rocky mountain sides in altitudes from 550 to 1,520 m asl in the Amhara, Oromia, Tigray and Gambella Regions.

Use as Food

The leaves of *Pterocarpus lucens* are said to be eaten as a vegetable in other countries in Africa.

Description

Pterocarpus lucens is a tree that grows 7.5 to 18 metres tall. Its leaves dry up and fall off during the dry season.

Each leaf is 6.5 to 28 cm long and bears 3 to 11 leaflets.

Each leaflet has the oval outline of a chicken's egg. The leaflets are 4 to 10 cm long, and 2.4 to 4.8 cm wide at the broadest part. The lower surfaces of the leaflets are hairy, while the upper surfaces are smooth or with only a few scattered hairs.

Each flowering branch is 6 to 30 cm long with either a few or many flowers towards its end. There are five sepals around each flower, which are joined into a tube that is 4 to 6mm long, and with five short teeth at the tip. The tube is hairless and smooth. There are five petals in each flower, which are yellow and 10 to 14mm long.

The pods are an oval shape like a chicken's egg, with a thin wing running along its edges. It is smooth, 4.5 to 6.5 cm long, and 2 to 3 cm wide. Each pod, usually, contains only one seed. The seeds have the shape of a chicken's egg.

5.3.10. *Indigofera linifolia* (L.f.) Retz.

Also referred to as *Sphaeridiophorum abyssinicum* Jaub. & Spach

Common Names

No common name has been found for this species.

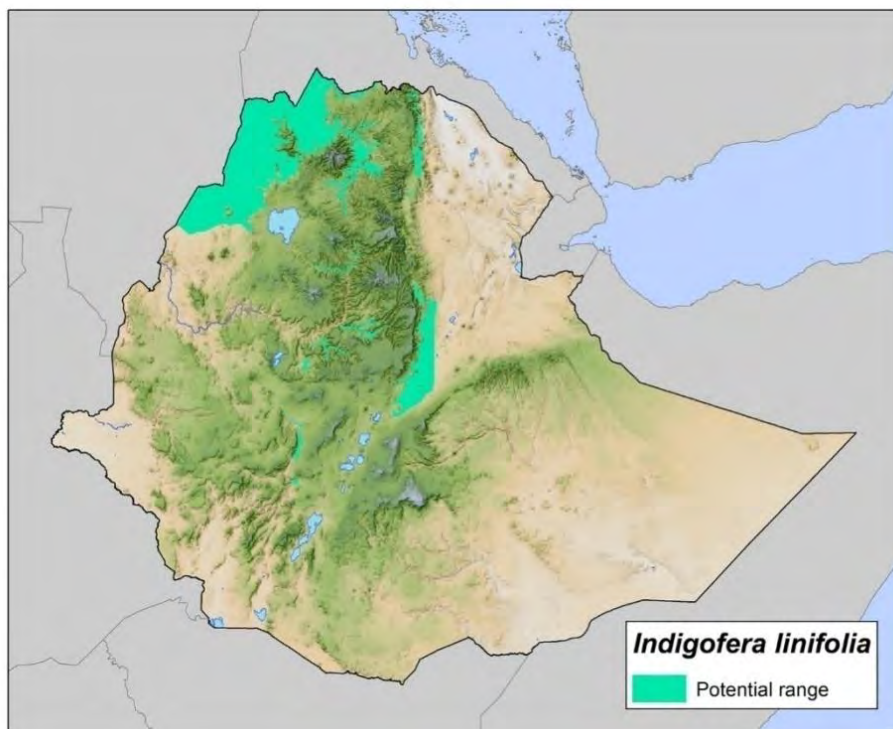


Figure 37, Potential distribution of *Indigofera linifolia*

Where and Under What Conditions it Grows

Indigofera linifolia is found in grasslands and bush-lands below 1,500 m asl in Amhara and Tigray Regions.

Use as Food

In other countries in Africa, Middle East, Asia and Australia the dry seeds of *Indigofera linifolia* are ground into flour, cooked and eaten in times of food shortage.

Description

Indigofera linifolia is an annual herb with many branches, growing about 25 cm tall. It is a hairy plant.

The leaves are simple (not divided), narrow, up to 50mm long and up to 3mm wide. The leaves are hairy, especially on their lower surface.

It has many flowering branches shorter than the leaf nearest to it. The flowers on each branch are many and crowded together. There are five sepals around

each flower, which are joined together, but only at their bases. The petals are silvery and about 2mm long. The stamens are about 2mm long, and not joined to form a tube.

The pods are silvery, about 2mm long, shaped like a ball, but with a thin point at one end. Each pod contains one seed.

5.3.11. *Eriosema shireense* Bak. f.

Common Names

No common names have been found for this species.

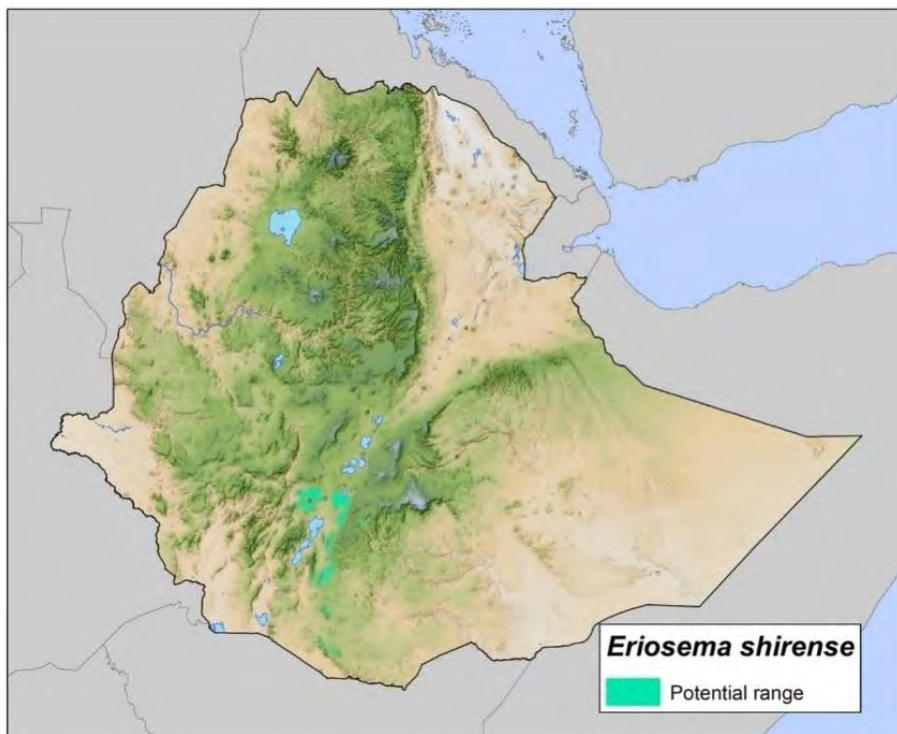


Figure 38, Potential distribution of *Eriosema shireense*

Where and Under What Conditions it Grows

Eriosema shireense is found in the Southern part of the Oromia Region in grasslands, some with scattered trees, at altitudes between 1,800 and 2,000 m asl.

Use as Food

It is said that in some countries in Africa the roots are dug up and eaten, especially by children.

Description

Eriosema shireense is an erect perennial herb with thick roots. Its young stems are covered with hairs which can grow up to 4mm long. The hairs are split into two arms to give a 'T' shape.

Each leaf includes 1 to 3 leaflets. Each leaflet is 2.5 to 13 cm long and 0.5 to 2.4 cm wide at its broadest part. It has a pointed end, and is covered with long hairs, especially towards its edges.

The flowering branches are 1 to 7 cm long. There are five sepals around each flower, which join to form a small tube with five distinct tips. The tips are 4.5 to 6mm long and have long hairs on their surfaces. The petals are yellow, hairy, and 7 to 11mm long. The stamens are not joined to form a tube.

Each pod is 10 to 13mm long, and 6.5 to 11mm wide at its broadest part. The pods are hairy. Each pod contains two seeds.

Appendix

A. Bibliography

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B. Index for Common Names

English Common Names

A

abyssinian pea.....	54
Andean lupin	46
apple ring acacia	74
Australian pea	39

B

Bambara groundnut.....	33
Barbados pride	79
bataw	39
black-eye bean	34
black-eye pea.....	34
bonavist bean	39
broad bean.....	57
Burma bean.....	29
butter bean	29
butterfly tree.....	83

C

camel's foot	83
catjang	34
chickling pea	62
chickling vetch.....	62
chickpea.....	50
coffee senna.....	70
common bean	26
cowpea.....	34

D

dolichos bean.....	39
--------------------	----

dry bean.....	26
Dutch case-knife bean	32

E

Egyptian kidney bean.....	39
---------------------------	----

F

faba bean.....	57
fava bean	57
fenugreek.....	48
field bean	26, 57
field pea.....	53
fish poison bean.....	85
flageolet bean	26
French bean	26

G

garbanzo bean.....	50
garden bean	26
garden pea.....	53
golden gram	37
grass pea.....	62
green bean.....	26
green gram.....	37
Groundnut.....	17

H

haricot bean.....	26
Hawaiian orchid tree.....	83
Hong Kong orchid tree	83
horse bean	57
horsebean.....	24
hyacinth bean.....	39

I	
Indian bean.....	39
J	
jackbean.....	24
K	
kidney bean.....	26
L	
lablab.....	39
lentil.....	60
lima bean.....	29
M	
Madagascar bean.....	29
Madras thorn.....	75
manila tamarind.....	75
mesquite.....	72
Monkey-nut.....	17
mung bean.....	37
O	
Orchid tree.....	83
P	
paradise flower.....	79
pea.....	53
Peanut.....	17
Pearl lupin.....	46
Peruvian field lupin.....	46
pigeon pea.....	41
pop bean.....	26
Port Jackson willow.....	89
purple bauhinia.....	83

R

Rambling cassia	82
red gram	41

S

scarlet runner bean	32
seim bean.....	39
shittim wood	86
sieva bean	29
snake bean.....	34
snap bean.....	26
South American lupin.....	46
Soy.....	21
Soya bean	21
Soybean.....	21
spiral fruit tree.....	86
string bean.....	26
swordbean.....	24

T

tamarind.....	67
thorn tree.....	86
tick bean	57

U

umbrella tree.....	86
--------------------	----

W

Weeping wattle	89
white lupin.....	44
willow wattle	89
Windsor bean	57

Y

yard-long bean	34
----------------------	----

yeheb nut	66
-----------------	----

Ethiopian Common Names

ሐ

ሐመር - humer (Tigrigna and Somaligna).....	67
---	----

ሁ

ሁመር - humer, ጃዋ - chowa, ሞጢ - motti (Amharic).....	67
--	----

ሐ

ሐልበት - h'lbet (Aderigna).....	48
-------------------------------	----

ለ

ለለባ፡ማር - leleba mar (Amharic).....	80
------------------------------------	----

ለውዝ - lewz (Amharic).....	33
---------------------------	----

ለውዝ - Lewz (Amharic).....	17
---------------------------	----

ሎ

ሎኮማቲያ - locomatiya (Welayitigna)	26, 29
--	--------

ሎኮማቲያ - lokomatiya (Wolaitigna).....	31
--------------------------------------	----

ሎጦባ - lottoba, ጠደቻ - teddecha, ዳዳች - dadach, ድጎዳቺር - dhadachir, ጎራር - gurar, ሃራሀ - harah (Oromigna)	86
---	----

ሚ

ሚሲሪያ - misiriyya, ሙጧ - mutwa (Welayitigna).....	60
---	----

ሚሲራ - misira (Oromigna).....	60
------------------------------	----

ሚሺራ - mishire (Guragegna).....	60
--------------------------------	----

ሚሺራ - mishira (Hadiagna and Kambatigna).....	60
--	----

ማ

ማማን - maman (Afarigna)	74
------------------------------	----

ማሾ - masho (Amharic)	37
----------------------------	----

ማቡንጎ - mabungo (Somaligna).....	91
---------------------------------	----

ማዳቅ፡ቡርደ - burdemadeqburde, ያርሾ - yrsho (Gamogna).....	85
---	----

ፆ	
ፆስር - mssr (Amharic, Adereгна and Afargna).....	60
ፇ	
ፇፆና - momona, ጋርሻ - garsha (Tigrigna).....	74
ሰ	
ሰልቦኮቡሉክ - selbokobulluk (Somaligna).....	26, 29
ሰበረ - sebbere (Tigrigna, Amharic and Afargna).....	62
ሱ	
ሱፆቡራ-- sumbura (Adereгна).....	50
ሱፆቡሮ - sumburo (Kembatigna).....	50
ሲ	
ሲላን - silan (Geëz).....	48
ሲንቆ - sinqo, ሱንቆ - sunqo, ኣቢሺ - abishi (Oromigna).....	48
ሳ	
ሳልቦኮ ገድ - salboko ged (Somaligna).....	41
ሳቻራ - sachara (Oromigna).....	70
ሳዓር ሳዓር - sa'arsa'arsa'ar (Somaligna).....	24
ሳክ - sake (Oromigna).....	85
ሶ	
ሶልቦኮቡሉክ - solbokobulluk (Somaligna).....	32
ሩ	
ሩቁ - ruqe (Tsemarigna).....	67
ራ	
ራጋይ - ragai (Gurageгна).....	67
ራጋይ - ragai, ራራይ - rarai (Mursigna).....	67
ሮ	
ሮቃ - roqa (Amharic, Oromigna, Benagna and Somaligna).....	67
ሮጎታ - rogota (Konsogna).....	67

ሸ

ሸራ - shera (Gamogna); ሰጧት - sewut (Benigna)	86
---	----

ሹ

ሹምቡራ - shumbura (Oromigna, Guragegna, Hadiagna, Welaitigna and Gamogna).....	50
ሹቅዋ - shuqwa (Welaitigna)	48
ሹቆ - shuqo (Gamogna).....	48
ሹናሹና - shuna shuna (Somaligna)	70
ሹኦ - shuö (Kembatigna).....	48

ሺ

ሺቆታ - shiqota (Hadiyagna).....	48
--------------------------------	----

ሻ

ሻምብራ - shmbra (Amharic and Tigrigna)	50
--	----

ቀ

ቀረቶር - qeretor (Gamogna).....	74
-------------------------------	----

ቁ

ቁድ - qud, ቁዳ - quda, ኦኮብ - ehb (Somaligna).....	66
ቁፍቁፍለ - qufqufle (Somaligna).....	85

ቂ

ቂሸወ - qishewe (Guragigna).....	53
--------------------------------	----

ቃ

ቃድ - qad (Nuerigna)	67
---------------------------	----

ቄ

ቄምሎ - qomolo (Gamogna)	57
------------------------------	----

በ

በኦበይ - beh'bey, በሐቢ - behebi, ጽዒ - ts'i (Afarigna).....	86
---	----

ባ

ባላይ - balai (Mursigna).....	85
ባቀላ - baqela (Oromigna)	57

ባቀል - baqel (Hadiyagna).....	57
ባቄላ - baqiela (Amharic, Adereгна, Welytigna, Afarigna and Kambatigna)	57
ባዶ - bado (Gamogna)	26, 29, 31

ብ

ብርሰን - brsn (Ge'ez and Tigrigna).....	60
---------------------------------------	----

ቸ

ቸንሹ አተር tinishu ater (Amharic).....	54
-------------------------------------	----

ቸ

ቸወና - chuwenna (Zaysigna)	86
---------------------------------	----

ኞ

ኞሪ - gnori (Agnwak).....	34
--------------------------	----

አ

አሸንጓሪ - ashanguarre (Oromigna).....	31
አሻንጓሪ - ashanguarre (Oromigna).....	26, 29
አቢዕካየ - abi'kaye (Afarigna)	48
አባ ሻማ - Aba-choma (Oromigna).....	29
አብሽ - absh (Amharic)	48
አኩሪ አተር - Aquri-ater (Amharic).....	21
አደንጓሬ - adenguarrie (Amharic and Guragegna).....	24
አደንጓሬ - adenguarrie, ቦሎቄ - boloqqie (for the dry seed), ፋሶሊያ - fasolya (for the green pod) (Amharic).....	26
አደንጓሬ - adenguarrie, ቦሎቄ - boloqqie (Amharic).....	29, 31
አደንጓሬ - adenguarrie, አሳቤ - asabe, ደገራ - degera ቸከሌ -chekele, የላም አተር-ye lam atere (Amharic)	34

ኢ

ኢሉባሮች - illubaroch (Bodigna).....	85
-----------------------------------	----

ዓ

ዓላ - älla, ዓንቁባ - ängieba (Tigrigna).....	86
ዓልቋይ - älqway, ዓተር:ባሕሪ - äter bahri, ባልደንጓ - baldengwa (Tigrigna).....	57

አ

አቢሽ - abishe (Guragegna)..... 48
አቢሽ - abish, ግራሮ - graro (Kefagna) 48
አባዕሽ - ab'akhe (Tigirigna)..... 48

ዓ

ዓባክ - äbak, ዓካብ - äkab, ዓዳክ - ädak, ጎርሐ:ዳሩየ - guruh'a daruye, ሐራሕ - h'arah', አራ - ora, ቁራ - qura, ቲግዳ - timad (Somaligna) 86

አ

አተረ - atere (Guragigna and Gofagna) 53
አተረ - atere, ባኤላ - baiëla (Guragegna) 57
አተራ - atera, አተራ:ደንጎሎ - atera dongolo, ዳንጎላ - dangulle (Oromigna)..... 53
አተራ አርጎባ - atera Argobba..... 34
አተር - ater (Amharic)..... 53

ዓ

ዓተር - äter ዓተር:ቀይሕ - äter qeyyh (Tigrigna) 50
ዓተር - äter-,ዚፋል- zifal ሳንጥ - sant (Ge'ez) 50

አ

አተሮ - atero (Haiyagna)..... 53

ዓ

ዓተር - ätir, ስምቡራ- sumbura (Afarigna)..... 50

አ

አታራ - atara, አተሪያ - atariyya (Welaitigna)..... 53
አውጤብድል - awtiebedl, ful (Ge'ez)..... 57

ዓ

ዓይኒ:ዓተር - äyni äter (Tigrigna)..... 53

አ

አዲፋጋ - adifaga (Anuwak)..... 85
አዳጎራ - adagura (Tigrigna)..... 24, 26, 29, 31
አዳጎራ ቐላ - adagura quolla (Tigrigna)..... 34

አ

አሃ - oha (Welaitigna)	80
አቸሎኒ - Ocholony (virtually all languages in Ethiopia).....	17
አካላ - okala (Conso)	39
አጎዴ - ogodde (Anuak).....	37

ከ

ከፎ አታራ - kafo atara, ከፍዋ አተሪያ - kafwa ateriya (Welayitigna).....	41
--	----

ኮ

ኮረራ - korera (Welayitigna)	86
ኮርያ - koria (Welaitigna).....	67

ወ

ወአ - weë (Kembatigna)	26, 29
ወአ - woë (Kembatigna).....	32

ው

ውቸ - wuche, ኤካዎሄ - ekawohe (Wolaytigna).....	34
--	----

ዎ

ዎህያ - wohya (Welayitigna).....	24
--------------------------------	----

የ

የአይጥ ጓያ - ye'ayt guayya (Amharic)	70
የወፍ ግተር - yewef ater, የአርግብ ግተር - yeërgb ater (Amharic).....	41
የጅብ:አተር - yejib ater (Amharic)	85
የገሆ - yepho (Zaysigna).....	67

ያ

ያሞራ ጓያ - yamora guaya (Amharic)	39
---------------------------------------	----

ደ

ደቕቕ deq'o'qo (Tigrigna)	54
ደቢሮ - debirro (Oromigna).....	80
ደወንግራር - deweni grar, ኮረራ - korera, ኮርሶራ - koresra (Amharic).....	86

ዲ	
ዲር ዳጉር - dir-dagwer	24
ዳ	
ዳሮት - darot, ጋርቢ - garbi, ጫዳቻ - chadacha (Oromigna).....	74
ድ	
ድሄተኮ - dhetteko (Tsemaigna).....	86
ድሄታታ - dhetata (Derashigna and Kusmigna).....	86
ድግር - digir (Somaligna)	34
ዶ	
ዶማይ - domia, ኮነ - kone, ኮረ - kore (Gamogna)	67
ገ	
ገርቢ - gerbi (Amharic and Guragegna)	74
ጉ	
ጉሉ - gulu (Somaligna)	88
ጊ	
ጊሻጻሻቶ gisha shaäto (Gofagna).....	53
ጊተኦ - giteë (Hadiyagna).....	41
ጊተኦ - giteë (Hadiyigna).....	53
ጋ	
ጋራቢ - garabi (Somaligna)	74
ጋያ - gayya (Oromigna and Guragegna)	62
ግ	
ግብጦ - gibto (Amharic)	44
ግብጾ - gigtso (Tigrigna)	44
ገ	
ገያ - gwayya (Amharic and Tigrigna)	62
ጸ	
ጸቃሌ - paqalie, ሸተረ - shetere (Gofagna).....	26

ጳቃሌ - paqalie, ሸተረ - shotere (Gofagna).....29, 32

ፋ

ፋል - Ful (Tigrigna)..... 17

ፋጂሌ - fudjeelee (Oromigna)37

ፋ

ፋሶሊያ - fasolya (Aderegna).....26, 29, 31

ፋሶሊያ ዲማ - fasolya dima, አተራ ባብሌ - atera babile (Oromigna).....34

ፋረንጎታ - farengota, ኦሆታ ፋረንጎታ - ohota farengota (Konso).....41

ፐ

ፐሮሶፕስ - prosopis (all Ethiopian languages).....72



Legumes are important sources of food, forage, soil fertility, and cash income for smallholder farmers throughout Ethiopia. This book serves as a guide to the legumes that are consumed across Ethiopia's diverse cultures, including 26 cultivated and non-cultivated trees, shrubs, and herbs. Extension officers and researchers can use the keys, color photos, distribution maps, and detailed descriptions to identify the legumes they observe in rural areas. Local names in multiple Ethiopian languages are provided for each species to facilitate discussion with farming communities. This book will inspire future generations of Ethiopian agricultural practitioners to protect and promote the country's vital legacy of legume diversity.

The Legume Diversity Project is an integrated research and education program aimed at building the knowledge base about Ethiopia's traditional legumes.



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