

BIODIVERSITY OF LEGUMINOUS PLANTS (FABACEAE) IN IBADAN SOUTH EAST LOCAL GOVERNMENT AREA OF OYO STATE NIGERIA

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Abstract

Bio-diversity study was conducted and the information of leguminous plant (Fabaceae) in Ibadan South East Local Government Area of Oyo State was documented. Field work was carried out to collect the plant parts. A voucher specimen was prepared for all the plants collected and deposited in the herbarium (Parkiabiglibosa (Jacq.), Tamarindusindica (L.), Acacia nilotica (L.), Indigoferaastragalina (Mill.), Acacia sieberiana (D.C), Bauhinia reticulata (L.), Sennasinguineana (L.), Sennaoccidentalis (L.), Sennaobtusifolia (L.) Crotalaria spp. (L.), Vignavexillata (L.), Arachishypogaea (L.), Glycine max (L.), Phaeolus vulgaris (L.), Vignasubterranea (L.)). This research work identifies, document and classifies the various leguminous taxa found according to their growth patterns and economic uses. Suggestions were offered on cultivation of leguminous plants because of their economic value.

Key words: Biodiversity, legume, leguminous plants

Introduction

The *Fabaceae* or *Leguminosae*, commonly known as the legume, pea, or bean family, are a large and economically important family of flowering plants. It includes trees, shrubs, and perennial or annual herbaceous plants, which are easily recognized by their fruit (legume) and their compound, stipulated leaves. Many legumes have characteristic flowers and fruits. The family, is widely distributed, and is the third largest land plant in terms of number of species, behind only the *Orchidaceae* and *Asteraceae*, with about 751 genera and some 19,000 known species (Christenhusz and Byng, 2016). The five largest of the genera are *Astragalus* (over 3,000 species), *Acacia* (over 1000 species), *Indigofera* (around 700 species), *Crotalaria* (around 700 species) and *Mimosa* (around 500 species), which constitute about a quarter of all legume species. The 19,000 known legume species amount to about 7% of flowering plant species (Judd, et al., 2002). *Fabaceae* is the most common family found in tropical rainforests and in dry forests in the America and Africa (Burnham and Johnson, 2004).

Farmed legumes can belong to many agricultural classes, including forage, grain, blooms, pharmaceutical/industrial, fallow/green manure, and timber species. Most commercially farmed species fill two or more roles simultaneously, depending upon their degree of maturity when harvested. Grain legumes are cultivated for their seeds. The seeds are used for human and animal consumption or for the production of oils for industrial uses. Grain legumes include beans, lentils, lupins, peas, and peanuts (Kurlovich and Repyev, 2005).

Legumes are a significant source of protein, dietary fiber, carbohydrates and dietary minerals; for example, a 100g serving of cooked chickpeas contains 18 percent of the

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Daily Value (DV) for protein, 30 percent DV for dietary fiber, 43 percent DV for foliate and 52 percent DV for manganese. Like other plant-based foods, pulses contain no cholesterol and little fat or sodium (Conde, 2014).

The Leguminosae have a wide variety of growth forms including trees, shrubs or herbaceous plants or even vines or lianas. The herbaceous plants can be annuals, biennials, or perennials, without basal or terminal leaf aggregations. Many legumes have tendrils. They are upright plants, epiphytes or vines. The latter support themselves by means of shoots that twist around a support or through caudine or foliar tendrils. Plants can be heliophytes, mesophytes or xerophytes (Watson and Dallwitz, 2007).

Statement of the Problem

Despite the abundance and diversification of legumes, there is little or no clue that shows the distribution or the diversity of leguminous plant in the study area (Ibadan South East, Oyo, Oyo State). Many plant species diversity are also being lost, but it remains uncertain at what rate we are losing plant species diversity (Yahara et al., 2012). Therefore there is need to investigate the diversities of legumes in Ibadan South East Local Government.

Scientific Classification of Legumes

Legumes are flowering plants (class Angiospermae) that belong to the family Leguminosae or Fabaceae in the order Fabales. There are three major subfamilies: (Angiosperm Phylogeny Group, 2009)

- a) Mimosoideae (Acacia subfamily),
- b) Caesalpinoideae (Pride-of-Barbados subfamily), and
- c) Papilioideae (Bean subfamily)

A fourth subfamily, Kramerioideae, with a single genus is also recognized by plant taxonomists.

Ecosystem Functions of Legumes

Fabaceae is a dominant family in terms of species-richness and biomass in many forests of the Neotropics and Africa (including Madagascar). For example, TerSteege et al., (2006) demonstrate the dominance of legumes in the Amazon rain forest (see also Du Puy et al., 2002), and legumes are the most species-rich family in both Neotropical dry forests and savannas (Ratter et al., 2006). Legume abundance is a significant factor that influences the rate of carbon and nitrogen accumulation in ecosystems (Knops et al., 2002). The presence of legumes often has a positive effect on ecosystem nitrogen pools which can significantly increase above-ground biomass (Spehn et al., 2002). In addition, nitrogen-fixing leguminous trees (Sprent, 2009) are key invaders on several continents (Lewis et al., 2009) and oceanic islands (Caetano et al., 2012), having strong impacts on savanna and grassland ecosystems (Chaneton et al., 2004). On the other hand, there are many Fabaceae trees that grow slowly and produce very heavy wood such as *Dalbergia* L. f. Such heavy wood has slow decomposition rate and contributes to carbon storage in ecosystems (Weedon et al., 2009).

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Forage and Grain Legumes

Forage legumes play an important role in dairy and meat production being sources of protein, fibre and energy. They are usually richer in protein, calcium, and phosphorus than other non legume forages, such as grass. They include alfalfa (*Medicago sativa*), clover (*Trifolium* spp.), birdsfoot trefoil (*Lotus corniculatus*) and vetch (*Vicia* spp.) among others. Alfalfa is one of the most important forage crops. In 2006, the worldwide production was around 436 million tons. U.S. is the largest alfalfa producer, with 15 million Ha planted in 2010. Canada, Argentina (primarily grazed), Southern Europe, Australia, South Africa, and the Middle East have also considerable production.

Grain legumes are also called pulses, which according to FAO (Food and Agriculture Organization) are crops harvested exclusively for the dry seeds, play an important role in the nutrition of many people due to their high protein content in seeds. They represent a major source of protein in many developing countries, especially among the poorest population, and are rich in essential amino acids such as lysine, supplementing thus the nutritional value of cereal and tuber diets (Graham and Vance, 2003).

Materials and Methods

Brief Description of Study Area: The study area is Ibadan South East Local Government Area of Oyo State. Ibadan South East, Oyo is a Local Government Area in Oyo State, Nigeria. Its headquarters are in the town of Ibadan South East, Oyo, home to the Federal Polytechnic Ibadan South East, Oyo. It has an area of 868km² and a population of 281,367 during 2006 census. Its coordinates are 12°36'0"N 6°35'23"E. It is characterized by Sudan Savanna vegetation.

Materials and Equipments Used: Cardboard paper, knife, newspaper, gum, plant press, camera, biro, notebook, box, alcohol.

Method of Plant Collection: A field survey was conducted around the Ibadan South East, Oyo Local Government Area of Oyo State and the fresh voucher specimens (leaf, flower and fruit) of plants considered to be legumes was collected and brought to the Biology Laboratory Department of Science Laboratory Technology for preservation.

Method of Preservation: The fresh voucher specimens collected was preserved by putting it in between the sheets of a newspaper and using a plant press to compress it. The newspaper absorbs the moisture content from the specimen with the specimen retaining its morphology and physiology. But, depending upon the material, some were stored in boxes and other preservatives.

Method of Classification and Identification

The various species collected were identified as legumes by their fruit (pods) and their compound, stipulated leaves. They were classified according to their subfamilies and genera.

Preparation of the Herbarium

- 1) Cardboard sheet was cut into A4 size.

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- 2) The voucher specimens were dried by putting it in between the sheets of a newspaper and using a plant press to press the newspaper. The sheets were changed at intervals to allow proper drying of the specimen.
- 3) After been dried, the voucher specimens were mounted on the cut cardboard sheets by the use of glue.
- 4) At the bottom right corner of each sheet, a label was made containing information such as: Name of Collector, Date of Collection, Taxon names etc for each leguminous species.
- 5) The voucher specimens were documented for further studies.

Size of the Study

The size of the study was the leguminous species available in Ibadan South East, Oyo State at the time of the study.

Method of the Study

The method used in the study was:

- i. Identification
- ii. Documentation
- iii. Classification

Identification: This involves the method used in identifying and authenticating the species collected as legumes by the characteristic features they possess – pods, compound leaf, and root nodules.

Documentation: This method involves putting down the relevant information of each leguminous species collected in typed form and keeping it for reference purposes; this method also covers the preparation of the herbarium.

Classification: This involves the method of placing the leguminous species into different taxa according to their growth pattern and economic use.

Result and Presenation

Result of the Study: The Leguminous species collected during this study was 15 from different locations in the study area (Ibadan South East, Oyo, Oyo State).

Presentation of the Result: The leguminous species collected are presented below with their coloured photographs, taxonomy and nomenclature, botanical description, distribution and habit, flowering and fruiting habit.

1. Taxonomy and Nomenclature

Family:	Fabaceae,	Subfamily: Faboideae
Common Name:	Groundnut	
Hausa Name:	Gyada	

Botanical Description: Groundnut is an annual herbaceous plant growing 30-50cm (1.0-1.6ft) tall. As a legume, it belongs to the botanical family Fabaceae (also known as the Leguminosae or bean family). Like most other legumes, peanuts harbor symbiotic nitrogen-fixing bacteria in their root nodules.

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Flowering and Fruiting habit: The flowers are 1.0-1.5cm (0.4-0.6in) across, and yellowish orange with reddish veining. They are borne in axillary clusters on the stems above ground and last for just one day. Groundnut pods develop underground, an unusual feature known as geocarpy

Uses: Its seed (groundnut) is used in the production of groundnut oil which is often used in cooking, because it has a mild flavor and a relatively high smoke point. It is also used in making peanut butter, peanut flour, boiled peanuts, dry-roasted peanuts which is mostly used as snacks.

2. Taxonomy and Nomenclature

Family:	Fabaceae,	Subfamily: Faboideae
Common Name:	Zombi pea, wild cowpea	
Hausa Name:	Waken damo	

Botanical Description: It is a strong twiner with fusiform, tuberous roots. Its stems are usually clothed with brownish silky hairs, or trichomes. Its leaflets come in three, which are oval-shaped and pointed at the tip, with the terminal leaflet being 7.5-15cm (3.0-5.9in) long.

Distribution and Habit: It thrives in a wide range of conditions, mostly in grasslands and in the disturbed areas, as well as a weed. In India, the plant flourishes from 1,200-1,500m in altitude in the foothills of the Himalayas and in the hills of Eastern and North-eastern India.

Uses: Its use has spread beyond its native range and the plant is now sometimes cultivated for its edible tubers. It is also grown as a green manure and ground cover crop especially in soils. The root is also consumed raw or cooked.

3. Taxonomy and Nomenclature

Family:	Fabaceae;	Subfamily: Caesalpinoideae
Common Name:	Chinese senna or sickle pod	
Hausa Name:	Tafasa	

Distribution and Habit: It grows wild in North, Central and South America, Asia, Africa, and Oceania, and is considered a particularly serious weed in many places. It has a long-standing history of confusion with Sennatoria and that taxon in many sources actually refers to the present species.

Uses: The green leaves of the plant are fermented to produce a high-protein food product called “Kawal” which is eaten by many people in Sudan as a meat substitute. Its leaves, seeds, and root are also used in folk medicine primarily in Asia. It is believed to possess a laxative effect, as well as to be beneficial for the eyes.

4. Taxonomy and Nomenclature

Family:	Fabaceae;	Subfamily: Caesalpinoideae
Common Name:	Coffee senna	
Hausa Name:	Tafasar masar	

Uses: In Jamaica, the seeds are roasted, brew and serve as tea to treat Diuretic, hemorrhoids, gout, laxative, rheumatism, diabetes, rheumatism. Mogdad coffee seeds

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can be roasted and used as a substitute for coffee. They have also been used as an adulterant for coffee.

Botanical Description: It is an annual undershrub, subglabrous, foetid, few feet high. Its leaves are alternate, compound, paipinnate; rachis channelled presence of a gland at the base of the rachis; stipulate stipule obliquely cordate.

Fruit and Flower description: Its flower is complete, bisexual, slightly irregular, zygomorphic, pentamerous, hypogynous, pedicelate; bractate, bracts white with pinkish tinge, thin, ovate-acuminate, caduceus; yellow. Its pod is dehiscent, woody, 12.5cm x 0.7cm, glabrous, recurved, subcompressed, distinctly torulose, 23-30 seeded.

5. Taxonomy and Nomenclature

Family:	Fabaceae;	Sub-family: Mimosoideae
Common Name:	African locust bean	
Hausa Name:	Dorowa	

Distribution and habit: Geographically, *Parkia biglobosa* can be found in a belt stretching from the atlantic coast in Senegal to Southern Sudan and Northern Uganda. The tree currently exists within a wide range of natural communities but is most abundant in anthropic communities (Agroforest Tree Database, 2013).

Botanical Description: It is a deciduous perennial that grows to between 7-20 metres high, in some cases up to 30 metres (Ntui, et al., 2012). The tree is a fire resistant heliophyte characterized by a thick dark gray-brown bark. The pods of the tree, commonly referred to as locust beans, are pink in the beginning and turn dark brown when fully matured.

Uses: The yellow pulp, which contains the seed, is naturally sweet and is processed into a valuable carbohydrate food known as daddawa among Hausa. The fruit pulp, the leaves and the seeds are also used to feed livestock and poultry.

6. Taxonomy and Nomenclature

Family:	Fabaceae;	Subfamily: Detarioideae
Common Name:	Tamarind	
Hausa Name:	Tsamiya	

Botanical Description: The tamarind is a long-lived, medium-growth tree, which attains a maximum crown height of 12-18 meters (39-59ft). The crown has an irregular, vase-shaped outline of dense foliage. It prefers clay, loam, sandy and acidic soil types, with a high resistance to drought and aerosol salt.

Flowering and fruiting habit: The tamarind flowers (although inconspicuously), with red and yellow elongated flowers. Flowers are 2.5cm wide, five-petalled, borne in small racemes, and yellow with orange or red streaks. Buds are pink as the four sepals are pink and are lost when the flower blooms. The fruit is an indehiscent legume, sometimes called a pod, 12-15cm in length, with a hard, brown shell.

Uses: Tamarind lumber is used to make furniture, carvings, turned objects such as mortars and pestles, chopping blocks, and other small specialty wood items. The fruit

exhibit laxative effects due to its high quantities of malic acid, tartaric acid, and potassium bitartrate.

Acacia nilotica (L.) P.J.H. Hurter & Mabb.



Fig. 4.7: Photograph of Gum Arabic tree Acacia nilotica (L.)
Source: Field Survey conducted 2018

7. Taxonomy and Nomenclature

Family:	Fabaceae;	Subfamily: Mimosoideae
Common Name:	Gum Arabic tree	
Hausa Name:	Bagaruwa	

Botanical Description: *Acacia nilotica* is a tree 5-20m high with a dense spheric crown, stems and branches usually dark to black coloured, fissured bark, grey-pinkish slash, exuding a reddish low quality gum. The tree has thin; straight, light, grey spines in axillary pairs, usually in 3-12 pairs, 5-7.5cm long in young trees, mature trees commonly without thorns.

Distribution and Habit: It is native from Egypt, across the Maghreb and Sahel, South to Mozambique and KwaZulu-Natal, South Africa, and east through Arabian Peninsula to Pakistan, India and Burna. It has become widely naturalized outside its native range including Zanzibar and Australia. It is spread by livestock.

Uses: Its pods are used as a supplement to poultry ratios. Dried pods are particularly sought out by animals or rangelands. The tender twig of this plant is used as a tooth brush in South-East Africa, Pakistan and India. The exudates gum of this tree is known as gum Arabic and has been collected from the pharaonic times for the manufacture of medicines, dyes and paints.

Glycine max (L.) Merr.



Fig. 4.8: Photograph of Soybeans *Glycine max* (L.)
Source: Field Survey conducted 2018

8. Taxonomy and Nomenclature

Family:	Fabaceae;	subfamily: Faboideae
Common Name:	Soybean	
Hausa Name:	Waken soya	

Botanical Description: Like most plants, soybeans grow in distinct morphological stages as they develop from seed into fully mature plants. The first stage of growth is germination, a method which first becomes apparent as a seed radical emerges. It occurs within the first 48 hours under ideal growing conditions. The first true leaves develop as a pair of single blades. Subsequent to this first pair, mature nodes form compound leaves with three blades

Flowering and fruiting habit: Soybeans form inconspicuous, self-fertile flowers which are borne in the axil of the leaf and are white, pink or purple. Depending of the

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soybean variety, node growth may cease once flowering begins. The fruit is a hairy pod that grows in clusters of three to five; each pod is 3-8cm long.

Uses: Soybeans are a globally important crop, providing oil and protein. In the United States, the bulk of the harvest is solvent-extracted with hexane, and the toasted defatted soy meal (50% protein) then makes possible the raising of farm animals (e.g. chicken, hog, turkey) on a large industrial scale. Soybean products are used in a large variety of processed foods.

9. Taxonomy and Nomenclature:

Family:	Fabaceae;	Subfamily: Papilioideae,
Common Name:	Beans	
Hausa		Name: Waken

Botanical Description: The common bean is a highly variable species with a long history. Bush varieties form erect bushes 20–60 cm (8–20 in) tall, while pole or running varieties form vines 2–3 m (7–10 ft) long. All varieties bear alternate, green or purple leaves, which are divided into three oval, smooth-edged leaflets, each 6–15 cm (2–6 in) long and 3–11 cm (1–4 in) wide.

Distribution and Habit: Beans are grown in every continent except Antarctica. Brazil and India are the largest producers of dry beans, while China produces, by far, the largest quantity of green beans. Worldwide, 23 million tonnes of dry common beans and 17.1 million tonnes of green beans were grown in 2010. The wild *P. vulgaris* is native to the Americas. It was originally believed that it had been domesticated separately in Mesoamerica and in the southern Andes region.

Uses: Similar to other beans, the common bean is consumed for its high source of starch, protein, and dietary fibre, and is an excellent source of iron, potassium, selenium, molybdenum, thiamine, vitamin B6, and foliates.

10.Taxonomy and Nomenclature

Family:	Fabaceae;	Subfamily: Faboideae
Common Name:	Rattlepods	
Hausa Name:	Gyada awaki	

Uses: Several species of *Crotalaria* are cultivated as crops to be consumed by human populations throughout the world. To ensure the survival and optimal cultivation of these plants, they are often selected for resistance to diseases, yield, and nutritional quality. The flowers and pods of *Crotalaria tetragona* are eaten as vegetables, the flowers and buds are used as garnishing, and the seeds are eaten as pulse.

Distribution and Habit: Africa is the continent with the majority of *Crotalaria* species (approximately 400 species), which are mainly found in damp grassland, especially in floodplains, depressions and along edges of swamps and rivers, but also in deciduous bush land, roadsides and fields.

11.Taxonomy and Nomenclature

Family:	Fabaceae;	Subfamily: Mimosoideae
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Common Name: Paper bark acacia
Hausa Name: Farar kaya

Botanical Description: The tree varies from 3 to 25 m in height, with a trunk diameter of 0.6 to 1.8 m. It is not listed as being a threatened species. It is characterized by thorns.

Uses: *Acacia sieberiana* is valued largely as a source of forage, medicine and wood. The inner bark is a source of fibre purposes such as stringing beads. The gum is edible and both livestock and game animals browse the tree and feed on the dropped pods, spreading viable seeds in their dung. The flowers of the tree make good forage for bees and bee hives are put directly in the trees to exploit the resource.

12. Taxonomy and Nomenclature

Family: Fabaceae; Subfamily: Faboideae
Common Name: silky
Hausa Name: Kai kai

Botanical Description: Species of *Indigofera* are mostly shrubs, though some are small trees or herbaceous perennials or annuals. Most have pinnate leaves. Racemes of flowers grow in the leaf axils, in hues of red, but there are a few white- and yellow-flowered species. The fruit is a legume pod of varying size and shape

Uses: Several species, especially *Indigofera tinctoria* and *Indigofera suffruticosa*, are used to produce the dye indigo. Several species of this group are used to alleviate pain. The herbs are generally regarded as an analgesic with anti-inflammatory activity, rather than an anodyne.

Distribution and Habit: They are widely distributed throughout the tropical and subtropical regions of the world.

13. Taxonomy and Nomenclature

Family: Fabaceae; Subfamily: Cercidoideae
Common Name: Mountain ebony
Hausa Name: Kalgo

Botanical Description: *Bauhinia* trees typically reach a height of 6–12 m and their branches spread 3–6 m outwards. The lobed leaves usually are 10–15 cm across.

Flowering and fruiting Habit: The five-petaled flowers are 7.5–12.5 cm diameter, generally in shades of red, pink, purple, orange, or yellow, and are often fragrant. The tree begins flowering in late winter and often continues to flower into early summer. Depending on the species, *Bauhinia* flowers are usually in magenta, mauve, pink or white hues with crimson highlights.

Distribution and Habit: It has a pan tropical distribution; many species are widely planted in the tropics as orchid trees, particularly in India, Sri Lanka, Vietnam and southeastern China. Other common names include mountain ebony and kachnar (India and Pakistan).

14. Taxonomy and Nomenclature

Family: Fabaceae; Subfamily: Caesalpinoideae
Common Name: Senna

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Hausa Name: Runhu

Botanical Description: Senna includes herbs, shrubs, and trees. The leaves are pinnate with opposite paired leaflets. The inflorescences are racemes at the ends of branches or emerging from the leaf axils. The flower has five sepals and five usually yellow petals. There are ten straight stamens. The stamens may be different sizes, and some are staminodes. The fruit is a legume pod containing several seeds.

Uses: Some Senna species are used as ornamental plants in landscaping. Cassia gum, an extract of the seeds of Chinese senna (*S. obtusifolia*), is used as a thickening agent. Senna is considered to be a bowel stimulant on the myenteric plexus of the colon to induce peristaltic contractions and decrease water absorption from inside the colon, effects that would provide relief from constipation

Distribution and Habit: This diverse genus is native throughout the tropics, with a small number of species in temperate regions. The number of species is estimated to be from about 260 to 350.

15. Taxonomy and Nomenclature

Family: Fabaceae.

Subfamily: Faboideae

Common Name: Bambara nut

Hausa Name: Kwa ruru

Distribution and Habit

The origin of the Bambara groundnut is West Africa and the region of cultivation is Sub-Saharan Africa's warm tropics. Bambara nut grows well anywhere groundnut (peanut) grows and so is vastly present from Kwara state and throughout the northern parts of Nigeria.

Uses: The seeds are used for food and beverage because of their high protein content and for digestive system applications. The entire plant is known for soil improvement because of nitrogen fixation. In West Africa, the nuts are eaten as a snack, roasted and salted, processed into cake, or as a meal, boiled similar to other beans. Just like Groundnut Cake (Kulikuli cake), the Bambara nut is processed to Kangu cake starting from Kwara through northern Nigeria, Chad and Niger. During the rainy season in many parts of central Nigeria like Jos, the fresh bambara beans are cooked with their shells still on them. The beans are then eaten as a snack just like boiled groundnuts.

Conclusion

From the study, fifteen (15) different leguminous plants were identified in the area of study thus indicating their diversity

Recommendation

Due to the diversification of legumes and the little clue that shows the distribution or the diversity of leguminous plant in the study area (Ibadan South East, Oyo, Oyo State). It is recommended that:

- i. Further study should be carried out in the study area to discover more leguminous species, as well as their distribution.

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- ii. Conservation agricultural practices should be put in place to avoid extinction of the available species.
- iii. Leguminous plants should be cultivated because of the large economic value derived from its species – nitrogen fixation, forage, cover-cropping and food for man and livestock etc.
- iv. More research should be carried out to discover the economic value which can be derived from the leguminous species considered to be weed

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