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RESEARCH ARTICLE

MACROMORPHOLOGICAL STUDY OF SOME SPECIES IN FAMILY CUCURBITACEAE

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Abstract

Nine genera in the family Cucurbitaceae were subjected to morphological study with a view to find additional diagnostic characters of taxonomic importance within the family. Qualitative and quantitative data were taken.Quantitative data were subjected to SPSS analysis and Duncan Multiple Range Test to show significant differences. Result of this study reveals that there are similarities in many vegetative morphological characters in the family. However, characters useful in the delimitation of the species include stem surface; mature fruit colour, where it is almost taxon-specific; seed colour; seed surface; leaf type: simple palmately lobed leaves and compound palmate leaves; tendril type: simple unbranched and branched, with the simple unbranched tendrils occurring in Cucumeropsis mannii, Cucumis sativus and Momordica charantia. Tendrils in these species are more advanced than the branched ancestral tendrils observed in the other species of the family studied. An overall trend for the transformation of flower colour from yellow to white was observed and documented. Flowers of Telfairia occidentalis are unique in having reddish-purple colour at the base, while those of Trichosanthes cucumerina are also unique in having deeply fringed or lacy petal edges. All the species of the family studied are sexually monoecious except in Telfairia occidentalis where they are dioecious, suggesting the ancestral state of sexuality in Telfairia occidentalis in comparison with the other species of the family studied.This study also documents the noteworthiness of seed morphology in the taxonomy of family Cucurbitaceae. Result generated from the quantitative data shows that the characters are quantitatively taxon-specific. An indented artificial dichotomous key was constructed to simplify the relatedness and identification of the species studied.

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Introduction:-

The Cucurbitaceae family include nearly 1000 species that are primarily native to tropical and subtropical regions of the world, but a small number of species are also found in temperate region (Schaefer and Renner, 2011, Guo et al., 2020; Markin-Gomez et al., 2024). They are largely tendril climbers and have characteristic pepo fruits (Guo et al., 2020). The ability of climbing plants to grow upward along others to reach the canopy for photosynthesis is hypothesized as a key innovation in flowering plants. Guo et al. (2020), reported that the cucurbit-specific tendril identity gene TEN originated from a paleo-polyploidization event at the origin of the family.

Cucurbitaceae members include many important vegetables and fruits such as, cucumber (Cucumis sativus), melon (Cucumis melo), watermelon (Citrullus lanatus), and bitter gourd (Momordica charantia) (Guo et al., 2020). Cucurbits have also served as model systems for understanding molecular regulation of tendril development and bitter compound biosynthesis (Zhou et al., 2016).

Cucurbits exhibit antioxidant properties because of a variety of bioactive components, such as cucurbitacins B and E and ellagitannins, which are tannins and have the ability to scavenge free radicals (Guo et al., 2020). Majority of the vegetables in the Cucurbitaceae family are also high in carotenoids which increase the nutritional value and safety of food due to their antioxidant capacity.

According to Ajuru and Okoli (2013), about three genera of Cucurbitaceae bear the common name melons. They acre Cucumis, Citrullus and Cucumeropsis. The genus Cucumis includes Cucumis melo L. (true melon), Citrullus includes Citrullus lanatus Thunb. Matsum and Nakai (watermelon, and brown-seeded melon or egusi melon in Nigeria) and Cucumeropsis is represented by one species in Nigeria, Cucumeropsis mannii Naud. (Synonym Cucumeropsis edulis (Hooker f.) cogn.) (white seeded melon or Mann's Cucumeropsis).

The study of plant morphology and anatomy in the era of climate change provides valuable insights into plant adaptation, resilience, resource use efficiency, carbon dynamics and ecosystem dynamics, all of which are essential for sustainable management and conservation efforts in a changing environment (Adamakis, 2025). Ikechukwu and Ndukwu, (2004) in their study on some Cucurbita species reported that leaf morphological features such as shape, size, margin and colour were diagnostic for the genus, either at the generic or specific level. Agbagwa and Ndukwu, (2004) also reported on the morphological features of the three species of Cucurbita cultivated in Nigeria.

The general morphology in the family Cucurbitaceae is very similar. This has contributed to confusion in the taxonomy and classification of the family and has been fraught with ambiguity and abounding synonymy (Jeffrey, 2005; Zhang et al., 2006; Schaefer et al., 2009).To complement the existing taxonomic evaluation of species in this family, morphological characters of some species of plants from nine genera of the family namely; Luffa, Citrullus, Cucurbita, Cucumis, Telfairia, Trichosanthes, Cucumeropsis, Lagenaria and Momordica have been studied.

Materials and Methods:-

A preliminary study of herbarium materials of the family Cucurbitaceae was carried out in Obafemi Awolowo University Herbarium (IFE) and Forestry Research Institute of Nigeria Herbarium (FRIN). The Flora of West Tropical Africa by Hutchinson and Daziel (1972) was consulted for further clarifications and guidance. Seeds of the cultivated plants were collected from National Center for Genetic Resources and Biotechnology (NACGRAB) research institute, Moor Plantation Ibadan, Oyo State and Teaching and Research Farm OAU Ile – Ife while seeds of the non- cultivated ones were collected from the wild.The species in the family Cucurbitaceae studied are distributed within nine genera and are: Citrullus lanatus (Thunb.) Matsum. and Nakai (Black seeds), Citrullus lanatus (Thunb.) Matsum. and Nakai (Brown seeds), Luffa aegyptiaca Mill. (Synonym: Luffa cylindrica M. Roem.), Lagenaria siceraria (Molina) Standl. (Spatulate fruit shape), Lagenaria siceraria (Molina) Standl. (Oval fruit shape), Cucumeropsis mannii Naudin (Synonym: Cucumeropsis edulis (Hook.f.) Cogn.), Cucumis sativus L., Momordica charantia L., Telfairia occidentalis Hook.f., Cucurbita maxima Duchesne, Trichosanthes cucumerina L. (Synonym: Trichosanthes anguina L.).

The seeds were identified and confirmed in the IFE herbarium before planting them and were planted in the Botanical Garden of Obafemi Awolowo University Ile-Ife Nigeria, in order to have free access to the plant species for the research work. Matured plants were further authenticated at the IFE and FRIN Herbaria. Qualitative morphological characters were observed and recorded for each species, these include: Flora type, life cycle, habit, stem shape, stem surface, stem colour, leaf type, leaf shape, leaf apex, leaf base, leaf margin, leaf venation,

phyllotaxy, leaf lamina surface, leaf colour, petiole surface, tendril type, flower colour, fruit shape, fruit colour, seed shape, seed colour, seed surface, sex description. Quantitative morphological characters measured and recorded were leaf length (cm) and breadth (cm), petiole length (cm), sepal length (cm) and breadth (cm), petal length (cm) and breadth (cm), seed length (cm) and breadth (cm). Photographs of diagnostic morphological characters were taken. Voucher specimens of each species used for this study were deposited in the Obafemi Awolowo University herbarium (IFE).

Quantitative data generated from this work were subjected to SPSS analysis and one - way Analysis of Variance using Duncan Multiple Range Test to show significant differences.

Results and Observations:-

The quantitative and qualitative characteristics of the species studied are recorded below (Plates 1 – 11, Tables 1-6):

Citrullus lanatus (Black seeds) (Thunb.) Matsum. and Nakai (Plate 1, Tables 1-6).

Common name is watermelon. It is commonly cultivated in gardens or homes. It is an annual trailing or climbing herbaceous vine. Stem is green in colour, angular and slightly ridged, covered with whitish to brownish hairs. Petiole is green in colour and about 4.7 – 8.5 cm long. The Leaf is simple and alternate in arrangement, palmately lobed, the base is slightly cordate to flat, apex acute to slightly acuminate, 8.5 – 17.2 cm in length and 8.2 – 13.7 cm in breadth, its major vein pattern is actinodromous perfect basal, though middle veins tend to be camptodromous cladodromous.The flower is monoecious. Male flowers: 5 yellow petals, 3 stamens largely, no ovary. Female flowers: solitary and axillary, yellow in colour. Sepal pentamerous, and green in colour, 0.3 – 0.6 cm in length and 0.1 – 0.2 cm in breadth while petal is pentamerous, pubescent and yellow in colour, 1.2 – 2.0 cm in length and 0.4 – 1.2 cm in breadth.The pedicel is green in colour, 2.4 – 2.8 cm. The fruit is a berry or pepo, green when immature and matured, oval to round in shape. The seeds are black in colour, oval in shape, smooth, 1.0 – 1.3 cm in length and 0.6 – 0.8 cm in breadth, tendril branched and coiled at the tail end.

Morphology of Citrullus lanatus (Black Seeds)

BT – Branched Tendrils, FL – Flower, FR – Fruit, S – Stem, PT – Petiole.

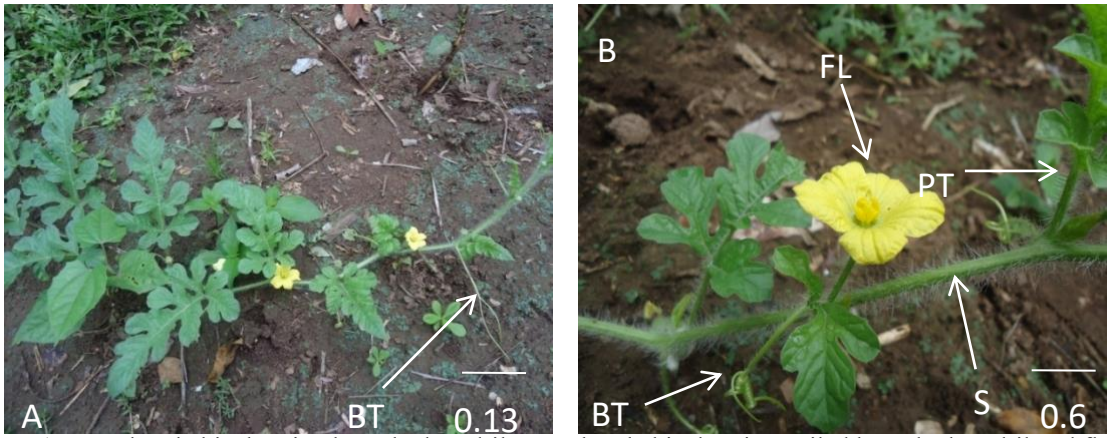
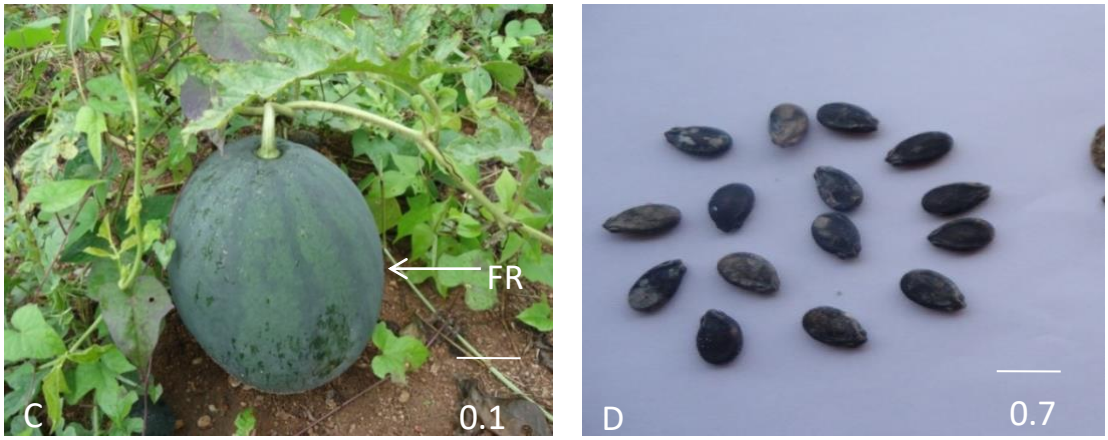


Plate 1: A – Plant habit showing branched tendril; B – Plant habit showing coiled branched tendril and flower; C Fruit; D – Seeds.



Citrullus lanatus (Brown seeds) (Thunb.) Matsum. and Nakai (Plate 2, Tables 1-6).

Common name is watermelon. It is an annual climbing or trailing plant cultivated in gardens or homes, the stem is angular, green in colour, covered with whitish hairs. Petiole is green in colour and round, 5.3 – 13.0 cm long. Leaves are simple and alternate in arrangement, palmately lobed, the base is slightly cordate to flat, apex is acute to acuminate. Leaf is 9.4 – 19.0 cm in length and 7.0 – 16.0 cm in breadth. Major veins pattern is actinodromous perfect basal, though middle veins tend to be camptodromous cladodromous. Flower is monoecious. Male flowers: 5 yellow petals, 3 stamens largely, no ovary. Female flowers: solitary and axillary, with yellow colour. Pedicel green in colour, 2.3 – 2.9 cm.Sepal is pentamerous and green in colour, 0.3 – 0.6 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, pubescent and yellow in colour, 1.2 – 2.0 cm in length and 0.4 – 1.3 cm in breadth. Fruit is a pepo, green when mature and immature, oval to round in shape. Seeds are brown in colour, oval in shape, smooth, 0.7 – 0.9 cm in length and 0.4 – 0.6 cm in breadth and tendril is branched and coiled at the tail end.

Morphology of Citrullus lanatus (Brown seeds)
BT – Branched Tendril, S – Stem, FL – Flower, FR - Fruit, PT – Petiole,

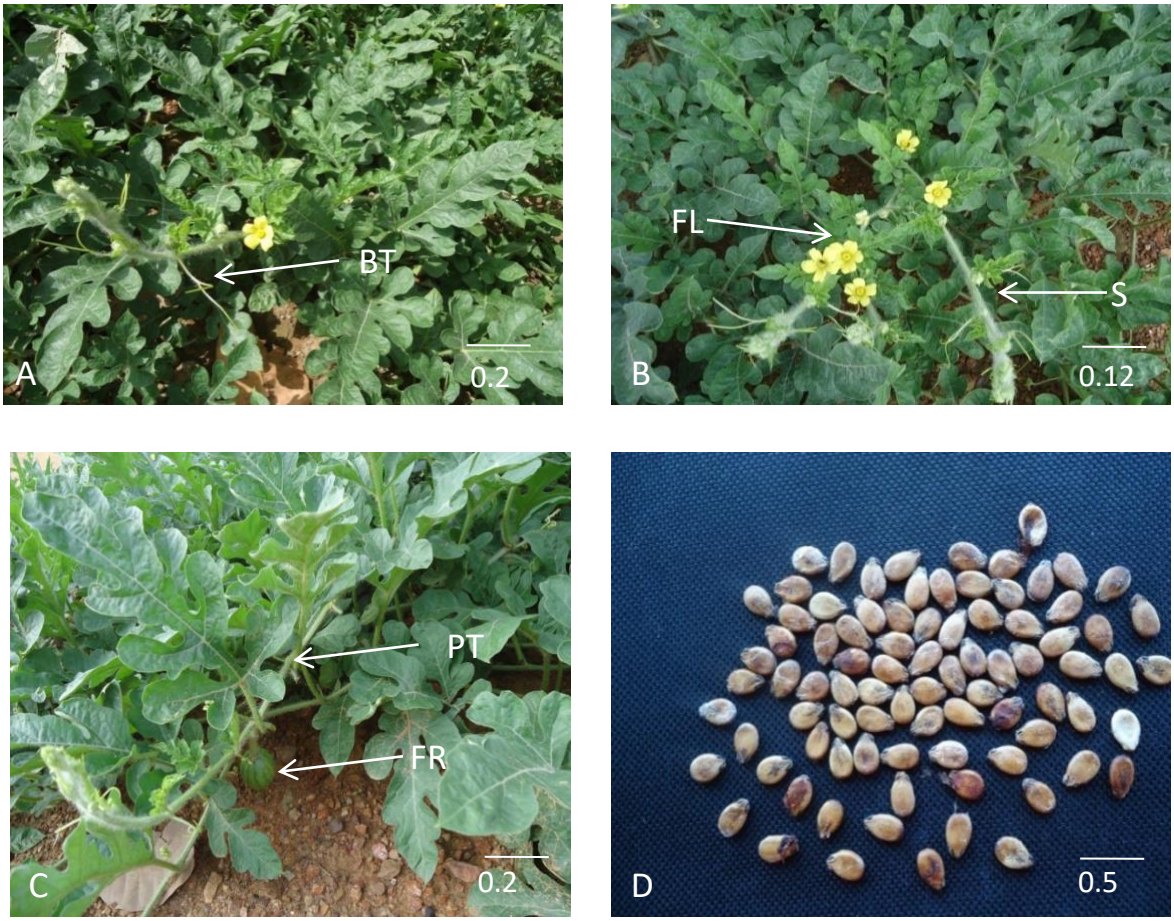


Plate 2:- A – Plant habit showing branched tendril; B – Plant habit showing flowers and stem; C –Plant habit showing petiole and fruit; D – Seeds.

Luffa aegyptiaca Mill. (Synonym: Luffa cylindrica M. (Roem)) (Plate 3, Tables 1-6).
Common name is sponge gourd or loofah. It is a weed commonly found in the bush and by the road side. An annual climbing or trailing herbaceous vine that climbs on wall and vegetation, often found in the wild. The stem is green in colour, angular and pubescent. Petiole is green in colour and round, 5.5 cm – 15.5 cm long. Leaf is simple and alternate in arrangement, palmately lobed, the base is cordate, apex acute to occasionally acuminate, 8.0 cm – 11.0 cm in length and 9.3 – 14.5 cm in breadth. Major veins pattern is actinodromous perfect marginal basal. The flower is monoecious. Male flowers: 5 yellow petals, 5 stamens, no ovary. Female flowers: solitary and axillary, with yellow colour. The pedicel is green in colour, 1.4 cm – 4.0 cm in length. Sepal is pentamerous, and green in colour,

1.0 – 1.3 cm in length and 0.3 – 0.5 cm in breadth. Petal is pentamerous, and yellow in colour, 2.5 – 4.5 cm in length and 2.0 – 2.8 cm in breadth. Fruit is a pepo, green when young, brown when mature and cylindrical to oblong in shape, with longitudinal ridges. Seeds are dull black in colour, elliptical in shape, smooth, 1.0 – 1.1 cm in length and 0.7 – 0.8 cm in breadth. Tendril branched and coiled.

Morphology of Luffa aegyptiaca

FR – Fruit, S – Stem, FL – Flower, BT – Branched Tendril

Plate 3:- A – Plant habit showing branched tendril and stem; B – Plant habit showing flower; C – Plant habit showing fruit with sharp longitudinal ridges; D - Seeds.

Lagenaria siceraria (Spatulate Fruit Shape) (Molina) Standl. (Plate 4, Tables 1-6).

Common name is calabash or bottle gourd. It is a cultivated plant commonly found in gardens or homes. They are largely annual herbaceous vine, usually trailing or climbing. Stem is green in colour, angular and often pubescent (covered with white hair). Petiole is green in colour and round, 8.5 cm – 21.0 cm long. Leaf simple and alternate in arrangement, palmate, shape is broadly ovate to orbicular, margin undulate and shallowly lobed, the base is cordate, apex acute to slightly acuminate, 10.2 cm – 19.0 cm in length and 13.5 – 26.9 cm in breadth. Major veins pattern is actinodromous perfect reticulate basal. The flower is monoecious. Male flowers: 5 white petals, 3 stamens, no ovary. Female flowers: solitary and axillary with white colour. Pedicel is green in colour, 4.0 – 6.0 cm in length. Sepal is pentamerous, green in colour, 0.4 – 0.6 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, white in colour, 3.4 – 5.5 cm in length and 2.0 – 3.3 cm in breadth. Fruit is a pepo, spatulate in shape, green when young, yellow or brown at maturity. Seed shape is oblong to oval, cream to light brown in colour, rough with 2 – 3 flat facial ridges, 1.3 – 1.5 cm in length and 0.7 – 0.9 cm in breadth. Tendril branched and coiled.

Morphology of Lagenaria siceraria (Spatulate Fruit Shape)
FR – Fruit, S – Stem, FL – Flower, BT – Branched Tendril

Plate 4:- A – Plant habit; B – Showing flower closed on a cool day and petiole; C – Showing branched tendril; D – Showing fruit shape; E – Seeds.

Lagenaria siceraria (Oval Fruit Shape) (Molina) Standl. (Plate 5, Tables 1-6).

Common name is calabash or bottle gourd. It is a cultivated plant commonly found in gardens, homes and farms**.** They are largely annual herbaceous vine, usually trailing to climbing. Stem green in colour, angular and pubescent. Petiole green in colour and round, 8.5 – 19.0 cm long. Leaf issimple and alternate in arrangement, palmately lobed, shape broadly ovate to orbicular with undulate margin, the base is cordate, apex is acute to slightly acuminate. Leaf

is 9.0 – 24.1 cm in length and 9.0 – 24.1 cm in breadth. Major veins pattern is actinodromous perfect marginal basal. The flower is monoecious. Male flowers: 5 white petals, 3 stamens, no ovary. Female flowers: solitary and axillary with white colour. Pedicel is green in colour, 13.0 – 14.0 cm in length. Sepal is pentamerous, pubescent and green in colour, 0.3 – 0.6 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, and white to cream in colour, 3.6 – 5.7 cm in length and 2.8 – 3.6 cm in breadth. Fruit is a pepo, green in colour when immature, yellow or brown at maturity, oval in shape. Seeds are cream to light brown in colour, oblong to oval in shape, no facial ridges, 1.7 – 2.3 cm in length and 0.6 – 0.9 cm in breadth. Tendril branched and coiled at the tail end.

Morphology of Lagenaria siceraria (Oval Fruit Shape)
FR – Fruit, S – Stem, FL – Flower, BT – Branched Tendril

Plate 5:- A – Plant habit; B – Flower; C – Plant habit showing fruit; D – Plant habit showing branched tendril; E – Seeds.

Cucumeropsis mannii Naudin. (Synonym: Cucumeropsis edulis (Hooker.f) Cogn.) (Plate 6, Tables 1-6).
Common name is melon seed or white-seed melon or "egusi itoo". It is a cultivated plant commonly found in gardens or homes, an annual to perennial herbaceous vine, usually climbing. Stem is green in colour, angular and

pubescent (with few hairs). Petiole green in colour and round, up to 5.0 cm – 14.0 cm in length. Leaf is simple and alternate in arrangement, shape broadly ovate to reniform cordate, margin slightly serrated or undulate, base cordate, apex acute or slightly acuminate, 6.0 cm – 13.5 cm in length and 10.5 – 15.2 cm in breadth. Major veins pattern is actinodromous perfect reticulate basal. The flower is monoecious. Male flowers: 5 yellow petals, 3 stamens, no ovary. Female flowers: solitary and axillary with yellow colour. Pedicel green, 1.4 – 4.0 cm in length. Sepal is pentamerous, and green in colour, 0.4 – 0.5 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, and yellow in colour, 1.2 – 1.5 cm in length and 1.0 – 1.3 cm in breadth. Fruit a pepo, green when immature, pale green to yellow when mature, oval to oblong to round in shape. Seeds are white in colour, flat, oval in shape, smooth, 1.6 – 2.1 cm in length and 0.7 – 0.9 cm in breadth. Tendril simple, unbranched and coiled

Morphology of Cucumeropsis mannii

FL – Flower, S – Stem, FR – Fruit, ST – Simple Tendrils.

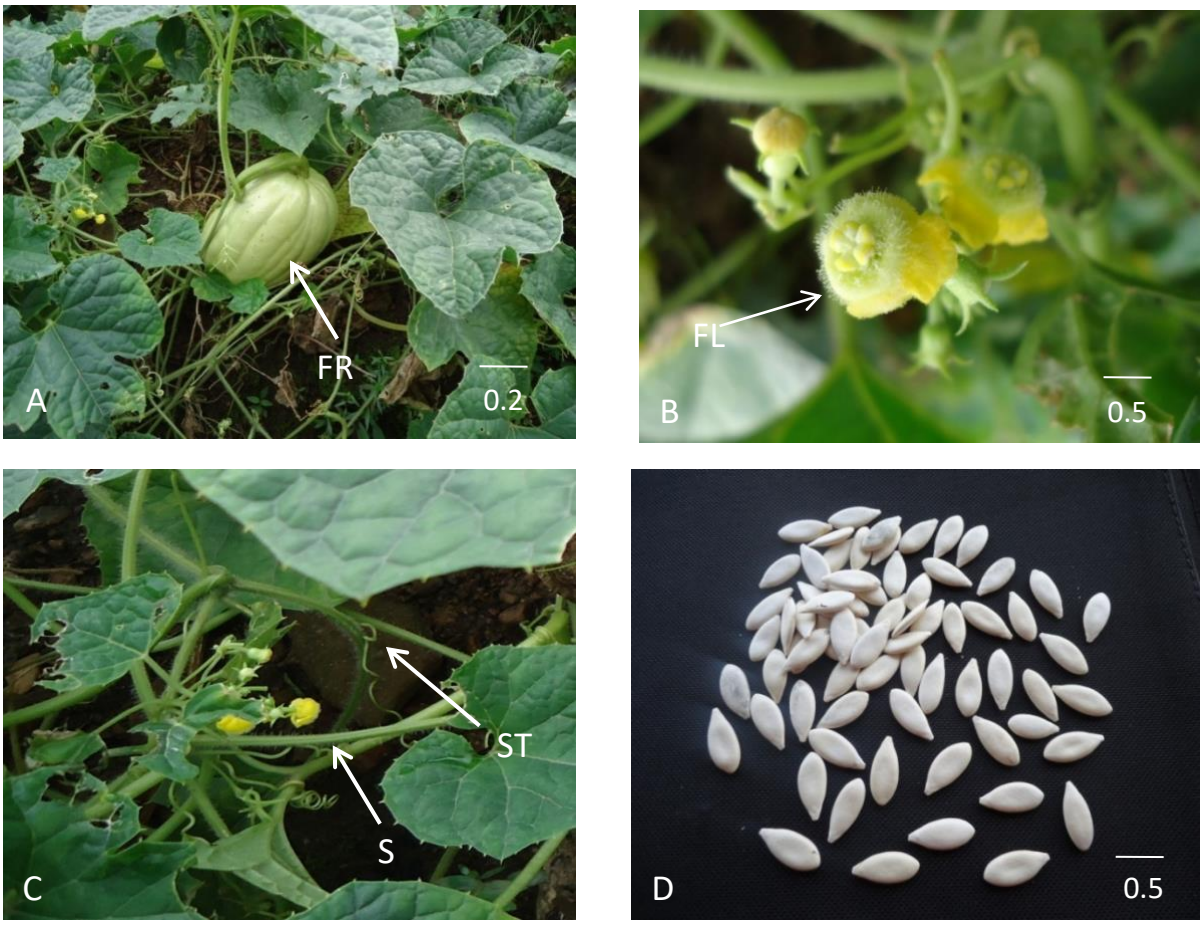


Plate 6:- A – Plant habit and fruit shape; B – Showing the flower; C – Plant habit and flowers; D – Seeds.

Cucumis sativus Linn. (Plate 7, Tables 1-6).

Common name is cucumber. It is a cultivated plant commonly found in gardens or homes. An annual herbaceous vine, usually trailing, occasionally climbing. Stem is green in colour, angular and pubescent. Petiole is green in colour and round, 11.8 – 12.5 cm long, Leaf is simple, palmately lobed and alternate in arrangement, shape is triangular to broadly ovate, margin slightly serrated or undulate, the base is deeply cordate, apex acute to slightly acuminate, 4.7 – 12.2 cm in length and 5.0 – 15.0 cm in breadth, leaf surface slightly wrinkled. Major veins pattern is actinodromous perfect marginal basal. The flower is monoecious. Male flowers: 5 yellow petals, 3 stamens, no ovary. Female flowers: solitary and axillary with yellow colour. Pedicel green in colour, up to 0.5 – 0.9 cm in length. Sepal pentamerous, pubescent and green in colour, up to 0.3 – 0.4 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, and yellow in colour up to 1.3 – 1.5 cm in length and 0.8 – 1.1 cm in breadth. Fruit is a pepo, of varying sizes and shape, green in colour when immature, orange-yellow when mature, globose to cylindrical in

shape. Seeds are cream or dirty white in colour, oval to oblong in shape, smooth, 0.7 – 0.8 cm in length and 0.3 – 0.4 cm in breadth. Tendril is simple and coiled at the tail end.

Morphology of Cucumis sativus

LF – Leaf, FL – Flower, FR – Fruit, ST – Simple Tendril.

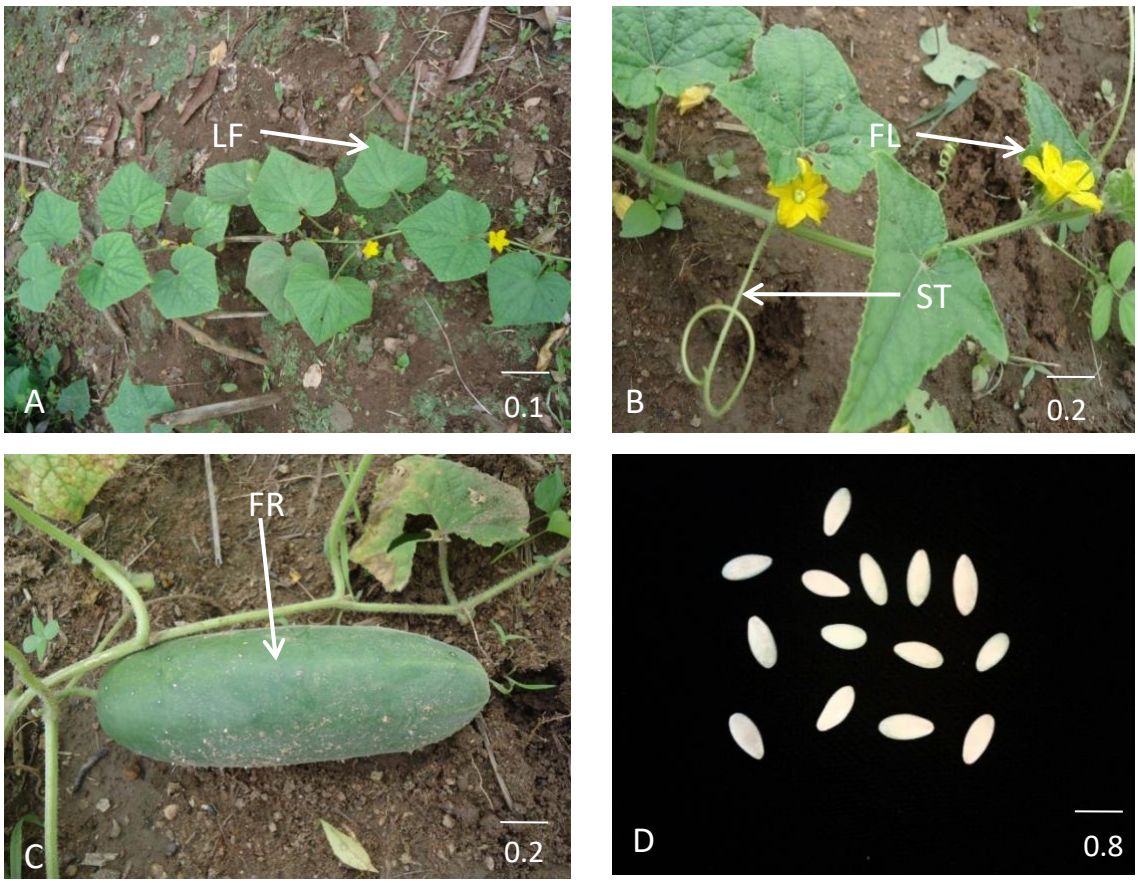


Plate 7:- A – Plant habit; B – Showing leaves and flowers; C – Fruit; D – Seeds.

Momordica charantia Linn. (Plate 8, Tables 1-6).

Common name is bitter melon, bitter gourd, bitter squash, or balsam pear. It is a wild plant commonly found by the road side and in the bush. An annual herbaceous vine, usually trailing or climbing. Stem is green in colour, angular, and occasionally sparsely pubescent to pubescent. Petiole is green in colour and round, 1.2 cm – 7.5 cm long. Leaf is simple and alternate in arrangement, palmately lobed, broadly ovate to reniform or orbicular in shape, base is cordate, apex is acute to acuminate, margin irregularly serrated, 3.5 cm – 8.5 cm in length and 4.2 – 10.5 cm in breadth. Major veins pattern is actinodromous perfect basal. The flower is monoecious. Male flowers: 5 yellow petals, 3 stamens, no ovary. Female flowers: solitary and axillary with yellow colour. Pedicel is green, 5.4 – 11.0 cm in length. Sepal is pentamerous, and green in colour, 0.4 – 0.5 cm in length and 0.1 – 0.3 cm in breadth. Petal is pentamerous, pubescent and yellow in colour, 1.1 – 1.9 cm in length and 0.5 – 1.0 cm in breadth. Fruit is a pepo, green when immature and orange in colour when mature, shape is ovate-elliptic to cylindrical. Seeds are brown in colour often encased in red warty exterior or arils, oval to oblong in shape, 0.7 – 1.0 cm in length and 0.4 – 0.5 cm in breadth. Tendril is simple and coiled at the tail end

Morphology of Momordica charantia
FL – Flower, S – Stem, FR – Fruit, ST – Simple Tendril.

Plate 8:- A – Plant habit; B – Plant habit showing fruit; C – Plant habit showing simple unbranched coiled tendril and flower; D – Seeds.

Telfairia occidentalis (Hook.f) (Plate 9, Tables 1-6). Common name is fluted pumpkin, fluted gourd or 'ugwu". It is a cultivated vine plant commonly found in gardens, a perennial herb, trailing to climbing. Stem is green in colour, angular and glabrous to sparsely pubescent. Petiole is green in colour and round, 4.5 cm – 11.7 cm long. Leaf is compound, 3-5 foliolate with short petiole. They are alternate in arrangement, with entire or slightly wavy margin, leaf shape broadly ovate, base rounded to slightly cordate, apex acute to acuminate, 6.8 cm – 15.6 cm in length and 3.1 – 7.9 cm in breadth. Major veins pattern is actinodromous perfect basal. Flower is dioecious: Male flowers: 5 creamy white petals, 5 stamens, no ovary. Female flowers: solitary and axillary, creamy white with reddish-purple colour at the base. Pedicel green, 3.0 – 4.2 cm in length. Sepal is pentamerous, and green in colour, 0.5 – 1.0 cm in length and 0.3 – 0.4 cm in breadth. Petal is pentamerous, creamy white in colour, with reddish-purple colour at the base, 2.5 – 3.5 in length and 0.8 – 1.5 in breadth. Fruit is a pepo, green in colour when immature, pale green when mature, cylindrical to ellipsoid in shape, often with 10 prominent ribs or ridges on it. Seeds are brown to black in colour, oval in shape 3.0 – 3.4 cm in length and 3.1 – 3.4 cm breadth. Tendril branched and coiled towards the end.

Morphology of Telfairia occidentalis

FLF – Flower of Female, FLM – Flower of male, FR – Fruit, BT – Branched Tendril, S – Stem.

Plate 9:- A – Plant habit showing trailing nature of plant; B – Plant habit showing climbing nature of plant, branched tendril and stem; C – Showing flower of female Telfairia occidentalis; D – Showing flower of male Telfairia occidentalis; E – Fruit; F – Seeds.

Cucurbita maxima Duch.ex Lam. (Plate 10, Tables 1-6).

Common name is giant pumpkin or squash. It is a cultivated plant commonly found in gardens and homes. It is an annual herbaceous vine, usually trailing or climbing. Stem is green in colour, round to angular and pubescent. Petiole is green in colour and round, 16.0 – 21.5 cm long. Leaf is **s**imple, palmate and alternate in arrangement, shape is orbicular to peltate to reniform, with entire or very slightly serrated margin, base is cordate, apex acute to

rounded, 13.2 – 21.5 cm in length and 19.5 – 30.5 cm in breadth. Major veins pattern is actinodromous perfect basal. The flower is monoecious. Male flowers: 5 yellow petals, 5 stamens, no ovary. Female flowers: solitary and axillary with yellow colour. Pedicel is green in colour, 14.4 – 20.7 cm in length. Sepal is pentamerous, pubescent and green in colour, 1.4 – 1.8 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, and yellow in colour, 8.0 – 8.7 cm in length and 3.0 – 3.5 cm in breadth. Fruit is a pepo, green in colour when immature, orange when mature, oval to round in shape. Seeds are white to light brown in colour, smooth to occasionally slightly rough, oval to oblong in shape, 1.2 – 2.2 cm in length and 0.9 – 1.2 cm in breadth. Tendril is branched and coiled at the tail end.

Morphology of Cucurbita maxima

DFR – Developing fruit, BT – Branched Tendril.

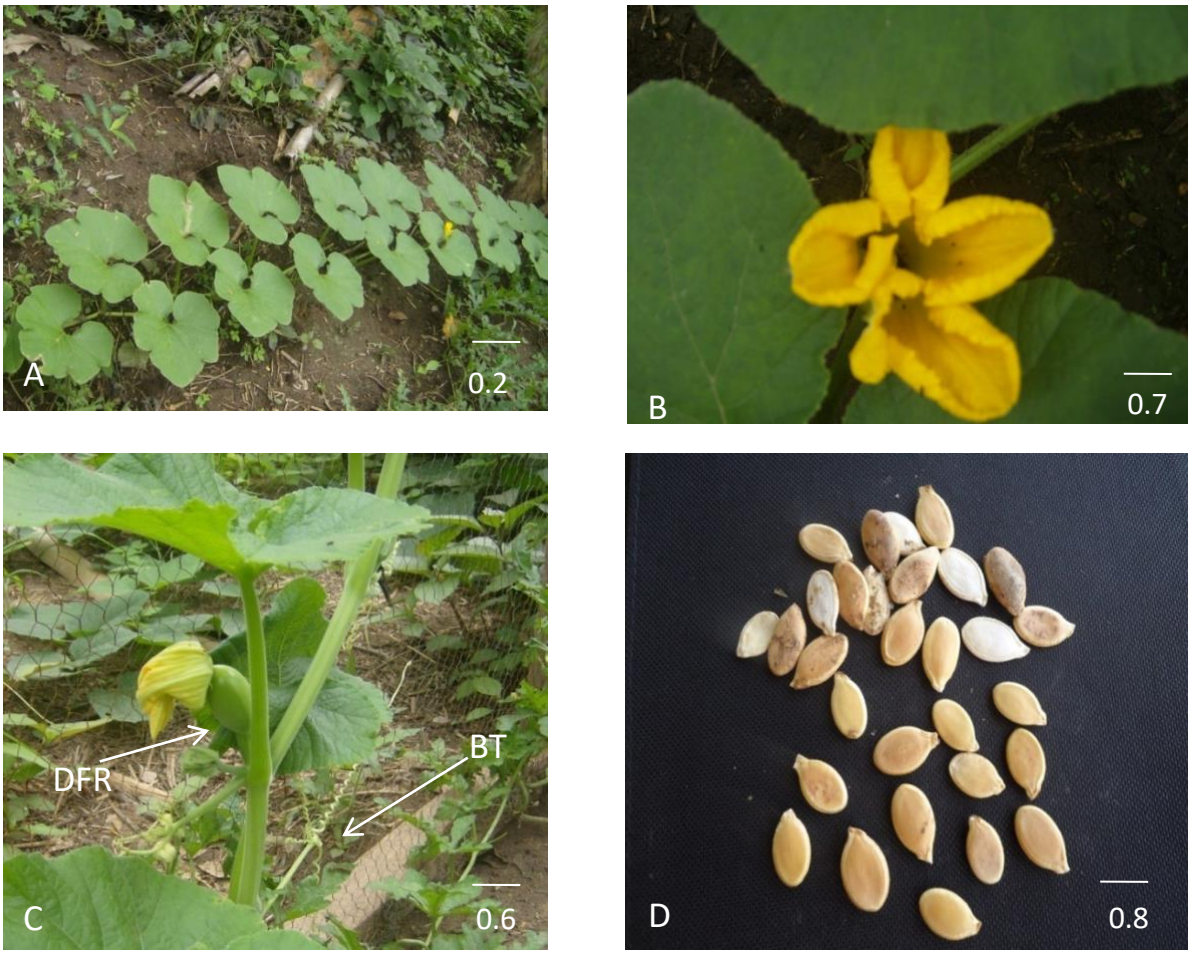


Plate 10:- A –Plant habit; B – Flower; C – Plant habit showing developing fruit, branched tendrils and stem; D – Seeds.

Trichosanthes cucumerina L. (Synonym: Trichosanthes anguina L.) (Plate 11, Tables 1-6).

Common name is snake gourd or serpent gourd or snake tomato. It is a cultivated plant commonly found in gardens, anannual to perennial herb usually a climber. Stem is green in colour, angular and pubescent. Petiole is green in colour and round, 4.5 cm – 9.0 cm long. Leaf is simple, alternate in arrangement, palmately lobed with entire or wavy margin, the base is cordate to truncate, apex acute to slightly acuminate, 7.7 cm – 11.0 cm in length and 11.2 – 15.9 cm in breadth. Major veins pattern is actinodromous perfect marginal basal. The flower is monoecious. Male flowers: 5 white petals with fringed or lacy petal margins, 5 stamens, no ovary. Female flowers: solitary and axillary, white in colour with deeply fringed or lacy petal edges. Pedicel isgreen, 2.7 – 3.1 cm in length. Sepal is pentamerous and green in colour, 0.1 – 0.3 cm in length and 0.1 – 0.2 cm in breadth. Petal is pentamerous, white with deeply fringed or lacy petal edges, 3.4 – 4.8 cm in length and 3.1 – 5.2 cm in breadth. Fruit is a pepo, green in colour when immature, red when mature, sickle or snake-like to cylindrical in shape. Seeds are oblong to oval in shape, brown in colour with wavy ridges, 1.3 – 1.5 cm in length and 0.7 – 0.9 cm in breadth. Tendril branched and coiled at the tail end.

Morphology of Trichosanthes cucumerina
FL – Flower, FR - Fruit, BT – Branched Tendril, S - Stem.

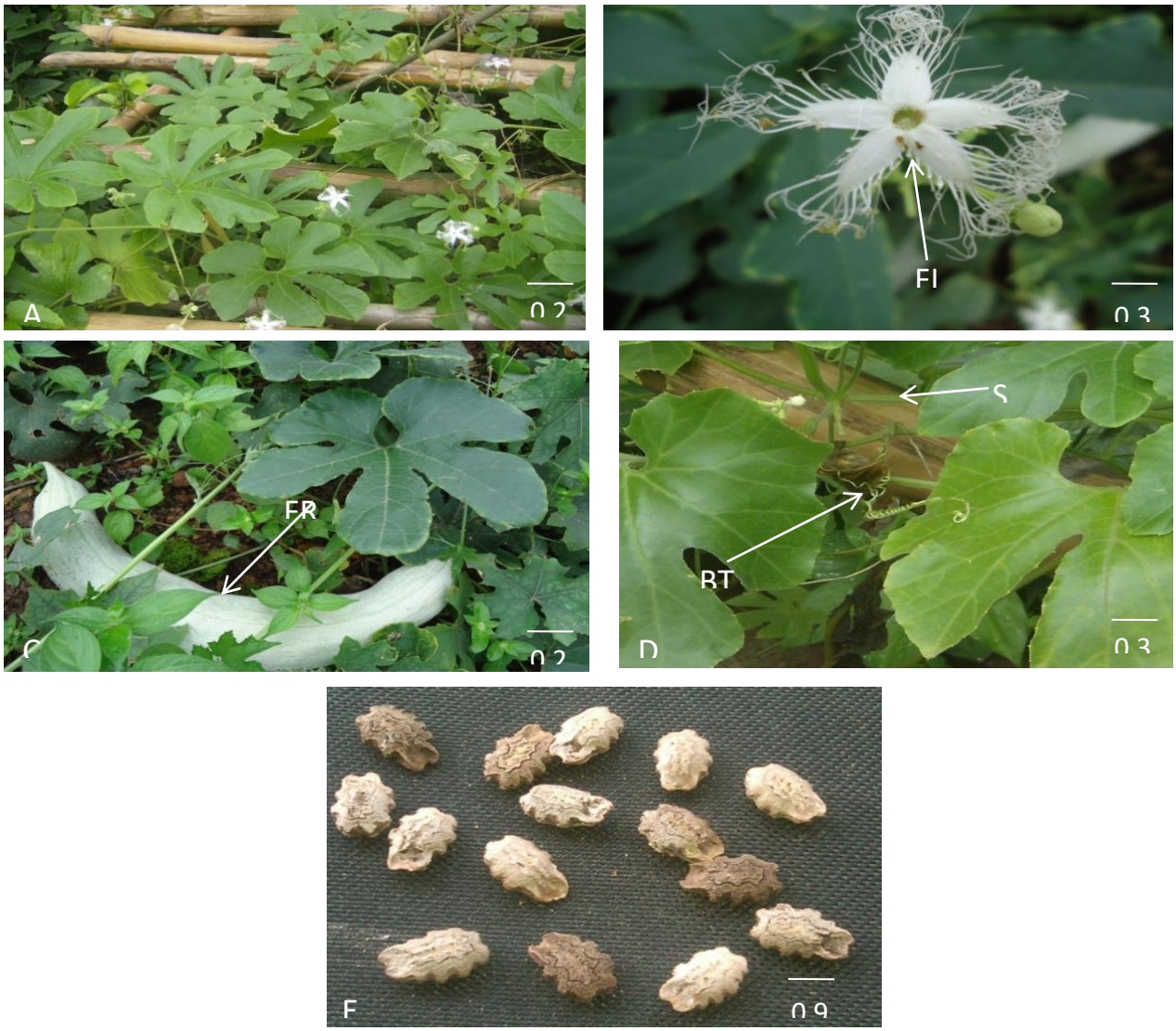


Plate 11:- A – Plant habit; B – Showing flower; C – Plant habit showing fruit; D – Showing branched tendril and stem; E - Seeds.

Table 1:- Summary of Flora Type, Life Cycle, Plant Habit and Stem Characteristics of the Species of Family Cucurbitaceae Studied.

Species	Flora type	Life Cycle	Plant Habit	Stem Shape	Stem Surface	Stem Colour
Citrullus lanatus (Black Seeds)	Cultivated	Annual	Trailing, Climbing	Angular	Pubescent	Green
Citrullus lanatus (Brown Seeds)	Cultivated	Annual	Trailing, Climbing	Angular	Pubescent	Green
Luffa aegyptiaca	Wild	Annual	Trailing, Climbing	Angular	Pubescent	Green
Lagenaria siceraria (Spatulate Fruit Shape)	Cultivated	Annual	Trailing, Climbing	Angular	Pubescent	Green
Lagenaria siceraria (Oval Fruit Shape)	Cultivated	Annual	Trailing, Climbing	Angular	Pubescent	Green
Cucumeropsis mannii	Cultivated	Annual to Perennial	Climbing	Angular	Pubescent	Green
Cucumis sativus	Cultivated	Annual	Trailing, Climbing	Angular	Pubescent	Green
Momordica charantia	Wild	Annual	Trailing, Climbing	Angular	Pubescent	Green
Telfairia occidentalis	Cultivated	Perennial	Trailing, Climbing	Angular	Glabrous to sparsely pubescent	Green
Cucurbita maxima	Cultivated	Annual	Trailing, Climbing	Angular	Pubescent	Green
Trichosanthes cucumerina	Cultivated	Annual to Perennial	Trailing, Climbing	Angular	Pubescent	Green

Table 2:- Summary of Leaf and Tendril Characters of the Species of Family Cucurbitaceae Studied.

Species	Leaf Type	Leaf Shape	Leaf Apex	Leaf Base	Leaf Margin	Leaf Venation (Major Veins)	Phyllotaxy	Leaf Lamina Surface	Leaf Colour	Petiole Surface	Tendril Type
Citrullus lanatus (Black Seeds)	Simple and palmately lobed	Oblong, Ovate to Triangular	Acute to slightly Acuminate	Slightly Cordate to Flat	Shallow Serrate or Wavy	Actinodromous Perfect Basal, middle veins tend to be Camptodromous Cladodromous	Alternate	Slightly pubescent	Green	Slightly pubescent	Branched and coiled at tail end
Citrullus lanatus (Brown Seeds)	Simple, palmately lobed	Oblong to Ovate to triangular	Acute to slightly Acuminate	Cordate to Flat	Slightly Serrated	Actinodromous Perfect Basal, middle veins tend to be Camptodromous Cladodromous	Alternate	Slightly pubescent	Green	Pubescent	Branched and coiled at tail end
Luffa aegyptiaca	Simple, palmately lobed often	Ovate, Orbicular to Reniform	Acute to occasionally Acuminate	Cordate	Shallowly Serrate to Undulate	Actinodromous Perfect Basal	Alternate	Pubescent	Green	Slightly pubescent	Branched and spirally coiled
Lagenaria siceraria (Spatulate Fruit Shape)	Simple, palmately lobed	Broadly Ovate to Orbicular	Acute to slightly Acuminate	Cordate	Undulate	Actinodromous Perfect Basal	Alternate	Pubescent	Green	Pubescent	Branched and spirally coiled
Lagenaria siceraria (Oval Fruit Shape)	Simple, palmately lobed	Broadly Ovate	Acute to slightly Acuminate	Cordate	Undulate	Actinodromous Perfect Basal	Alternate	Pubescent	Green	Slightly pubescent	Branched and coiled at tail end
Cucumeropsis mannii	Simple, unlobed or slightly palmately lobed	Broadly Ovate to Reniform-Cordate	Acute or slightly Acuminate	Cordate	Slightly Serrated or Undulate	Actinodromous Perfect Basal	Alternate	Pubescent, especially on veins	Green	Pubescent	Simple, Unbranched and Coiled
Cucumis sativus	Simple, palmately	Triangular to broadly	Acute to slightly	Cordate	Slightly Serrated	Actinodromous Perfect Basal	Alternate	Pubescent and	Green	Pubescent	Simple, Unbranched,

	lobed	Ovate	Acuminate		or Undulate			slightly wrinkled			coiled at tail end
Momordica charantia	Simple, palmately lobed	Broadly Ovate, Reniform or Orbicular	Acute to slightly Acuminate	Cordate	Irregularly Serrated	Actinodromous	Alternate	Pubescent	Green	Pubescent	Simple, Unbranched, coiled at tail end
Telfairia occidentalis	Palmately compound with 3-5 leaflets.	Leaflets broadly Ovate	Acute to Acuminate in each leaflet	Rounded to slightly Cordate	Entire or slightly Wavy	Actinodromous Perfect Basal	Alternate	Pubescent	Green	Pubescent	Branched, spirally coiled at tail end
Cucurbita maxima	Simple, palmately shallowly lobed	Orbicular, Peltate, Reniform	Acute to Rounded	Cordate	Entire or very slightly Serrated	Actinodromous Perfect Basal	Alternate	Pubescent	Green	Pubescent	Branched and spirally coiled at tail end
Trichosanthes cucumerina	Palmately lobed	Broadly Ovate or Sub-Orbicular	Acute or slightly Acuminate	Cordate to Truncate	Entire or Wavy	Actinodromous Perfect Basal	Alternate	Sparsely pubescent	Green	Pubescent	Branched and spirally coiled at tail end

Table 3:- Summary of Floral Morphological Characters of Species of the Family Cucurbitaceae Studied

Species	Flower Colour	Fruit Shape	Fruit Colour	Seed Shape	Seed Colour	Seed Surface	Sex Description
Citrullus lanatus (Black Seeds)	Yellow	Oval to Round	Immature: Green; Mature: Green	Oval	Black	Smooth	Monoecious
Citrullus lanatus (Brown Seeds)	Yellow	Oval to Round	Immature: Green; Mature: Green	Oval	Brown	Smooth	Monoecious
Luffa aegyptiaca	Yellow	Cylindrical to Oblong	Immature: Green; Mature: Brown	Elliptical	Dull Black	Smooth	Monoecious
Lagenaria siceraria (Spatulate Fruit Shape)	White	Spatulate	Immature: Green; Mature: Yellow or Brown	Oblong to Oval	Cream to light Brown	Rough with 2-3 flat facial ridges	Monoecoius
Lagenaria siceraria (Oval Fruit Shape)	White to Cream	Oval	Immature: Green; Mature: Yellow or Brown	Oblong to Oval	Cream to light Brown	Smooth	Monoecious
Cucumeropsis mannii	Bright Yellow	Oval to Oblong to Round	Immature: Green; Mature: Pale Green-Yellow	Oval	White	Smooth	Monoecious
Cucumis sativus	Bright yellow	Globose-Cylindrical	Immature: Green; Mature: Orange-Yellow	Oval	Dirty White to Cream	Smooth	Monoecious
Momordica charantia	Yellow	Ovate-Elliptic to Cylindrical	Immature: Green Mature: Orange	Oval to Oblong	Brown, often encased in red warty exterior or arils	Rough or warty with ridges	Monoecious
Telfairia occidentalis	Creamy White with Reddish-Purple colour at base	Cylindrical to Ellipsoid	Immature: Green Mature: Pale green	Oval	Brown to Black	Smooth	Dioecious
Cucurbita maxima	Yellow	Oval to Round	Immature: Green; Mature: Orange	Oval to Oblong	White to light Brown	Smooth to occasionally slightly rough	Monoecious

Trichosanthes cucumerina	White with deeply fringed or lacy petal edges	Sickle or Snake-like to Cylindrical	Immature: Green; Mature: Red	Oval to Oblong	Brown	Rough, with wavy ridges	Monoecious

Table 4:- Minimum and Maximum Values of Quantitative Morphological Characters of the Species of the Family Cucurbitaceae Studied

Species	Leaf Length (cm)	Leaf Breadth (cm)	Petiole Length (cm)	Seed Length (cm)	Seed Breadth (cm)	Pedicel Length (cm)	Sepal Length (cm)	Sepal Breadth (cm)	Petal Length (cm)	Petal Breadth (cm)
Citrullus lanatus seeds)	8.5 – 17.	8.2 – 13.7	4.7 – 8.5	1.0 – 1.3	0.6 – 0.8	2.4 – 2	0.3 – 0.6	0.1 –	1.2 – 2	0.4 – 1.2
Citrullus lanatus (seeds)	9.4 – 19.	7.0 – 16.0	5.3 – 13.	0.7 – 0.9	0.4 – 0.6	2.3 – 2	0.3 – 0.6	0.1 –	1.2 – 2	0.4 – 1.3
Luffa aegyptiaca	8.0 – 11.	9.3 – 14.5	5.5 – 15.	1.0 – 1.1	0.7 – 0.8	1.4 – 4	1.0 – 1.3	0.3 –	2.5 – 4	2.0 – 2.8
Lagenaria siceraria (Spatulate Fruit Sha	10.2 – 19	13.5 – 26.	8.5 – 21.	1.3 – 1.5	0.7 – 0.9	4.0 – 6	0.4 – 0.6	0.1 –	3.4 – 5	2.0 – 3.3
Lagenaria siceraria (Oval Fruit Shape)	9.0 – 24.	9.0 – 24.1	8.5 – 19.	1.7 – 2.3	0.6 – 0.9	13.0 –	0.3 – 0.6	0.1 –	3.6 – 5	2.8 – 3.6
Cucumeropsis mann	6.0 – 13.	10.5 – 15.	5.0 – 14.	1.6 – 2.1	0.7 – 0.9	1.4 – 4	0.4 – 0.5	0.1 –	1.2 – 1	1.0 – 1.3
Cucumis sativus	4.7 – 12.	5.0 – 15.0	11.8 – 1	0.7 – 0.8	0.3 – 0.4	0.5 – 0	0.3 – 0.4	0.1 –	1.3 – 1	0.8 – 1.1
Momordica charanti	3.5 – 8.5	4.2 – 10.5	1.2 – 7.5	0.7 – 1.0	0.4 – 0.5	5.4 – 1	0.4 – 0.5	0.1 –	1.1 – 1	0.5 – 1.0
Telfairia occidentali	6.8 – 15.	3.1 – 7.9	4.5 – 11.	3.0 – 3.4	3.1 – 3.4	3.0 – 4	0.5 – 1.0	0.3 –	2.5 – 3	0.8 – 1.5
Cucurbita maxima	13.2 – 21	19.5 – 30.	16.0 – 21	1.2 – 2.2	0.9 – 1.2	14.4 –	1.4 – 1.8	0.1 –	8.0 – 8	3.0 – 3.5
Trichosanthes cucur	7.7 – 11.	11.2 – 15.	4.5 – 9.0	1.3 – 1.5	0.7 – 0.9	2.7 – 3	0.1 – 0.3	0.1 –	3.4 – 4	3.1 – 5.2

Table 5:- Mean Values and Standard Error of Quantitative Morphological Characters of the Species of the Family Cucurbitaceae Studied

Species	Leaf Length (cm)	Leaf Breadth (cm)	Petiole Length (cm)	Seed Length (cm)	Seed Breadth (cm)	Pedicel Length (cm)	Sepal Length (cm)	Sepal Breadth (cm)	Petal Length (cm)	Petal Breadth (cm)
Citrullus lanatus (Black seeds)	14.64±0.4	11.31±0.29	6.72±0.2	1.15±0.02	0.70±0.01	2.59±	0.48±0.01	0.13	1.47±	0.79±0.10
Citrullus lanatus (Brown seeds)	13.73±0.1	11.24±0.48	8.92±0.54	0.78±0.01	0.49±0.01	2.62±	0.45±0.01	0.13	1.60±	0.85±0.12
Luffa aegyptiaca	9.40±0.18	11.68±0.2(	9.82±0.6(	1.08±0.01	0.72±0.01	2.96±	1.16±0.04	0.39	3.51±	1.17±0.10
Lagenaria siceraria (Spatulate Fruit Sha	15.47±0.1	20.80±0.81	15.07±0.(	1.43±0.01	0.82±0.01	5.50±	0.51±0.01	0.17	4.24±	2.81±0.13
Lagenaria siceraria (Oval Fruit Shape)	15.28±0.1	19.79±0.6	13.65±0.(	2.02±0.03	0.80±0.01	13.64	0.50±0.01	0.15	4.67±	3.28±0.09
Cucumeropsis man	9.62±0.29	12.95±0.21	9.52±0.48	1.94±0.02	0.79±0.01	1.87±	0.44±0.02	0.16	1.38±	1.17±0.04
Cucumis sativus	8.40±0.4	10.32±0.54	6.86±0.52	0.76±0.01	0.36±0.01	0.74±	0.36±0.02	0.13	1.40±	0.92±0.05
Momordica charan	6.36±0.32	7.56±0.39	3.88±0.3(	0.84±0.01	0.46±0.01	8.13±	0.48±0.01	0.22	1.23±	0.66±0.06
Telfairia occidenta	10.85±0.4	4.97±0.26	7.14±0.3	3.24±0.02	3.23±0.02	3.73±	0.74±0.05	0.35	3.21±	1.25±0.08
Cucurbita maxima	16.62±0.1	24.41±0.48	17.96±0.2	1.86±0.04	1.11±0.02	17.96	1.60±0.05	0.16	8.40±	3.30±0.06
Trichosanthes cucumerina	9.42±0.18	13.50±0.2(	6.62±0.23	1.38±0.01	0.79±0.01	2.92±	0.22±0.01	0.15	4.05±	4.57±0.20

Table 6:- Summary of Quantitative Morphological Characters of Species in the Family Cucurbitaceae Studied with Duncan Multiple Range Test Values (Means with the Same Alphabet along the Same Column are not Significantly Different (Unit = cm)

Species	Leaf Length	Leaf Breadth	Petiole Length	Seed Length	Seed Breadth	Pedi Leng	Sepal Length	Sepal Brea	Petal Leng	Petal Breadth
Citrullus lanatus seeds)	14.64^{ef}	11.31^{d}	6.72^{bc}	1.15^{e}	0.70^{d}	2.59	0.48^{c}	0.13^{a}	1.47a	0.79^{abc}
Citrullus lanatus (seeds)	13.73^{e}	11.24^{d}	8.92^{d}	0.78^{bc}	0.49^{c}	2.62	0.45^{c}	0.13^{a}	1.60^{a}	0.85^{bc}
Luffa aegyptiaca	9.40^{b}	11.68^{d}	9.82^{d}	1.08^{d}	0.72^{d}	2.96	1.16^{e}	0.39^{d}	3.51^{d}	1.17^{f}
Lagenaria siceraria (Spatulate Fruit Shape)	15.47^{f}	20.80g	15.07^{g}	1.43^{f}	0.82^{ef}	5.50	0.51^{c}	0.17^{ab}	4.24^{e}	2.81^{g}
Lagenaria siceraria (Oval Fruit Shape)	15.28^{f}	19.79^{g}	13.65^{f}	2.02^{j}	0.80^{e}	13.6	0.50^{c}	0.15^{a}	4.67^{f}	3.28^{h}
Cucumeropsis mannii	9.62^{b}	12.95^{e}	9.52^{d}	1.94^{i}	0.79^{e}	1.87	0.44^{bc}	0.16^{a}	1.38^{a}	1.17^{de}
Cucumis sativus	8.40^{b}	10.32^{d}	6.86^{bc}	0.76^{b}	0.36^{b}	0.74	0.36^{b}	0.13^{a}	1.40^{a}	0.92^{bcd}
Momordica charantia	6.36^{a}	7.56^{c}	3.88^{a}	0.84^{c}	0.46^{c}	8.13	0.48^{c}	0.22^{b}	1.23^{a}	0.66^{ab}
Telfairia occidentalis	10.85^{c}	4.97^{b}	7.14^{c}	3.24^{k}	3.23^{i}	3.73	0.74^{d}	0.35^{cc}	3.21^{d}	1.25^{e}
Cucurbita maxima	16.62^{g}	24.41^{h}	17.96^{h}	1.86^{h}	1.11^{h}	17.9	1.60^{f}	0.16^{a}	8.40^{g}	3.30^{h}
Trichosanthes cucume	9.42^{b}	13.50^{e}	6.62^{bc}	1.38^{f}	0.79^{e}	2.92	0.22^{a}	0.15^{a}	4.05^{e}	4.57^{i}

Key to The Species of The Family Cucurbitaceae Studied (SFS: Spatulate Fruit Shape; OFS: Oval Fruit Shape)

1a. Tendril branched
2a. Mature fruit green
3a. Flower colour, creamy white
Telfairia occidentalis
3b. Flower colour, yellow
4a. Seeds colour black
Citrullus lanatus (Black seeds)
4b. Seeds colour brown
Citrullus lanatus (Brown seeds)
2b. Mature fruit not green
5a. Colour of seed black
Luffa aegyptiaca
5b. Colour of seed not black
6a. Petal edges deeply fringed or lacy
Trichosanthes cucumerina
6b. Petal edges not fringed or lacy
7a. Fruit colour at maturity orange
Cucurbita maxima
7b. Fruit colour at maturity yellow or brown
8a. Shape of fruit spatulate
Lagenaria siceraria (SFS)
8b. Shape of fruit oval
Lagenaria siceraria (OFS)
1b. Tendril unbranched
9a. Leaf surface slightly wrinkled
Cucumis sativus
9b. Leaf surface not wrinkled
10a. Fruit with warty exterior
Momordica charantia
10b. Fruit without warty exterior
Cucumeropsis