



Original Article

A Study of Plant Species Diversity of Ornamental Flowers in Bukit Kor Marang, Terengganu, Malaysia

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Abstract: The agricultural sector comprises various subsectors, including food crops, horticulture, forestry, plantations, livestock, and fisheries. Within the horticulture subsector, segments such as fruits, vegetables, ornamental plants, and medicinal plants play a significant role. There is considerable potential for the growth of the horticulture subsector, which is expected to become an important contributor to national income in the coming years. Bukit Kor is one of the agricultural experimental lands handed over by the Government of Terengganu to the University of Malaysia Terengganu (UMT), which focuses on research and developing various types of horticultural crops. Ornamental plants have unique and distinctive shapes intended as decorative elements indoors and outdoors. The ornamental flower survey for this scientific expedition was conducted in September 2023 at Bukit Kor in the highland area of Terengganu, Malaysia. A total of 30 flower species from several families were collected and documented during the exploration. The collected flower plants include paper, telang, purslane, kirsan, and bride's tears flowers. Based on the results of data collection exploration of ornamental plants growing in Bukit Kor land, Terengganu, Malaysia, it can be concluded that there are 30 species of ornamental plants growing in Bukit Kor land, consisting of 17 different families whose growth is dominated by the *Nyctaginaceae* family with five (5) species (26%).

Keywords: Plant species; Ornamental flowers; Bukit Kor Marang, Terengganu



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1. Introduction

The agricultural sector involves several subsectors: food crops, horticulture, forestry, plantations, livestock, and fisheries. One part of the horticulture subsector includes fruits, vegetables, ornamental plants, and medicinal plants. Great potential is seen in the development of this horticulture subsector as one of the main contributors to national income in the future. Generally, cultivation activities in the horticulture subsector are carried out intensively, focusing on ornamental plants (Sulmi et al., 2015). Ornamental plants have unique and distinctive shapes as decorative elements indoors and outdoors. In the past, ornamental plants were only identified as flowering plants. Still, over time, the concept of ornamental

plants has evolved into beautiful plants, including leaves, flowers, stems, fruit, twigs, aroma, and roots with high artistic value. Currently, ornamental plants are becoming a trend to beautify the environment and provide fresh air and benefits as a natural coloring source (Sari et al., 2022).

Ornamental plant cultivation involves growing various plants often used as decorative elements. The term "cultivation" refers to human efforts aimed at providing benefits and producing products. There are several propagation techniques, one of which is vegetative propagation. This method has several advantages, such as maintaining the same traits as the parent plant, accelerating the flowering and fruiting process, and increasing resistance to pests and diseases. Vegetative plant propagation provides long-term benefits, including obtaining plants identical to their parents (Lei, 2010). Ornamental plants can be described as plants grown in pots or used for landscaping and yard purposes—the need for ornamental plants increases, indicating increased demand and promising business opportunities. Ornamental plants are often used to enliven various events.

In general, the beauty of a plant lies in its main parts, namely the leaves or flowers. Therefore, the terms "ornamental flower plants" and "ornamental leaf plants" emerge as relevant concepts (Marbun & Nasution, 2019). The potential of these plants is a natural wealth that can be utilized at any time for the benefit of all communities. Most of these plants are located in various regions that have yet to be used. Differences in the elevation of a location can produce climatic variations. Lowland areas tend to have high temperatures and low humidity. Plants that desire high temperatures and low humidity will thrive in these areas. Temperatures and humidity are lower in higher areas, such as the midlands. Plants that require moderate temperatures and moderate humidity will thrive in the midlands. Climatic differences due to differences in altitude will affect the choice of plants and home garden design, both in the selection of plant species and their arrangement (Scheepens et al., 2010).

The potential of ornamental plants is an excellent opportunity for development through breeding. In line with the increasing population, ecotourism places, and the importance of a comfortable and fresh environment and settlement, the demand for ornamental plants continues to increase. It is necessary to research plants with potential as ornamental plants. This study aims to determine the potential of lower plants and epiphytes as ornamental plants found in Bukit Kor Terengganu, Malaysia. The results of this study are expected to provide information on the types of plants that have potential as ornamental plants in the Bukit Kor Terengganu area, Malaysia, so that it can become primary data for management and development in efforts to preserve, protect, educate, and ecotourism.

2. Materials and Methods







This study was conducted using a descriptive statistics analysis through direct observation of the agricultural land of Bukit Kor Marang, Terengganu, Malaysia. A total of 30 species of ornamental flowers grow well on the land. Also, the image data was taken using a cell phone camera. The observed variables are exploration/ sealing of each ornamental flower plant, starting from species, family, flower documentation, and plant descriptions in the Bukit Kor farmland area. The observation method is a data collection technique carried out through observation, accompanied by notes on the condition or behavior of the target (Nasri, 2023). This study was conducted in September 2023 at Bukit Kor, Marang, Terengganu, Malaysia, at an altitude of ± 35 meters above sea level. The tools used in this study are knives, pencils, notebooks, cell phone cameras, and laptops, and also the materials used are decorative flowers.

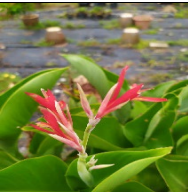

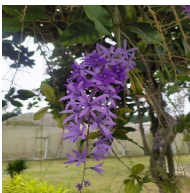



3. Results







Bukit Kor is in a highland area in the Marang region, Terengganu, Malaysia. The soil around Bukit Kor has a rock and sand texture. Still, the soil in the valley has a fertile organic nature, making it suitable for growing various horticultural plants, especially ornamental flowers. It can be seen in Table 1 that 35 species have been identified as thriving in the Bukit Kor area of Marang, Terengganu, Malaysia, with their respective beauty. Table 1 displays the list of ornamental flowers in Bukit Kor Terengganu, Malaysia shows that there are 30 plant species, consisting of 17 different families and 6 have the same family, of the 17 families include: *Oleaceae*, *Fabaceae*, *Asteraceae*, *Bromeliaceae*, *Portulacaceae*, *Bignoniaceae*, *Cannaceae*, *Scrophulariaceae*, *Verbenaceae*, *Baiasamiaceae*, *Euphorbiaceae*, *Malvaceae*, *Turneraceae*, *Nyctaginaceae*, *Amaranthaceae*, *Rubiaceae*, *Polygonaceae* and the same family sari viz: 1. The *Asteraceae* family has 4 different species in one family, consisting of *Tegetes erecta* L., *Cosmos Sulfureus*, *Erigeron anus* L., and *Erigeron glaucus* L. species, Family *portulacaceae* 3 different species in one family, consisting of *Leucophyllum frutescens*, *Torenia furnieri*, and *Aglonia angustifolia* Benth. Family *Bignoniaceae* has 2 different species in one family, consisting of *Campsis grandiflora*, and *Tecoma stans* L. species, 4. Family *Scrophulariaceae* has 3 different species in one family: *Leuchopyllum frutescens*, *Torenia fournieri*, and *Anglonia angustifolia* Benth. species, 5. The family *Nyctaginaceae* has 5 different species in one family, consisting of the *Bougainvillea juss* species, *Bougainvillea spectabilis* Willd, *Bougainvillea black maria*, *Bougainvillea yellow monalisa*, and *Carlls garden bougainvillea.*, and the 6th. The family *Rubiaceae* has 2







different species in one family consisting of the species *Musaenda frondosa*, and *Musaenda philippica* A, Rich.

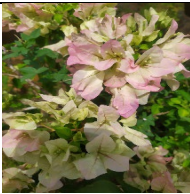





Table 1. List of Flower Species in Bukit Kor Marang Farmland, Terengganu, Malaysia

Family	Species	Pictures	Description
Oleaceae	<i>Jasminum sambac</i> L.	 Jasmine flower	Jasmine plants can grow up to 10-1600 MASL. The length of the flower is \pm 2-3 cm. The flower color is white, has 5 petals, and grows slightly bushy, with a stiff stem (Navya et al., 2024).
Fabeaceae	<i>Clitoria ternata</i> L.	 Butterfly pea flower	The telang flower plant has 2-5 cm long elliptical leaves, and the flowers can grow 2-7 cm long. They are bright blue and purple, with funnel-shaped petals and a butterfly-shaped Corolla (Yuliana et al., 2024).
Asteraceae	<i>Tagetes erecta</i> L.	 Chicken dung flower	Chicken dung flowers have a round flower shape with a yellow color. About 100 types of lantana, which are hump-shaped and gathered, have a flower size of 4-6 cm (Sanjaya et al., 2024)
Bromeliaceae	<i>Ananas comosus</i> (L.) merr.	 Pineapple flower	The pineapple flower's fruit is 20.5 cm in size. The leaves are elongated and narrow, 130-150 cm in size, with old leaves shorter than young ones. The flowers of the red pineapple fruit are simple in color (Sugiura et al., 2024).
Portulacaceae	<i>Portulaca grandiflora</i> klait	 Pursland flower	This plant can grow in moist areas, reaching a height of 15-30 cm and a maximum of 1,400 MASL. Its leaves are single, thick, and fleshy; the flowers grow at the end of the stem and have 15-25 petals (Salama et al., 2019).
Bignoniaceae	<i>Campsis grandiplora</i>	 Trumpet flower	This plant is a climbing plant; the color of the flowers is orange, shaped like a trumpet flower, and blooms when summer arrives; the flower size is 3-5 cm, can grow up to 10 m high (Markovic & Klett, 2020).

Family	Species	Pictures	Description
Cannaceae	<i>Indica canna</i>	 Prayer beads	This plant grows well in the tropics; its flowers have varied colors, such as red, pink, and yellow. This plant can live in lowlands with an altitude of 1,000 MASL (Munawaroh, 2023).
Scrophulariaceae	<i>Leucophyllum frutescens</i>	 Cypress bush flowers	This flower is commonly called Purple sage which is where this plant grows in shrubs and vines; the color of this type of flower is a single flower type, with a size of 4-6 cm (Ghiselli et al., 2023).
Verbenaceae	<i>Patrea volubilis</i> L.	 Amlas vine flower	The plant can grow to a height of 12 m. The leaves are oval, the flowers are pale blue, hanging at a length of 30 cm, and the petal length is 0.2-0.7 cm (Ingole, 2016)
Asteraceae	<i>Cosmos sulfureus</i>	 Kenikir flower	This annual herbaceous plant has compound leaves of old haiku color, single-flowered yellow flowers with a diameter of 5 cm, and a tank length of 10-20 cm (Markovic & Klett, 2020).
Baiasamiaceae	<i>Impatiens walleriana</i>	 Impantiens flower	This plant can grow to a height of 0.6 m, with red and white flowers. The flower is large, like a plate, and has 5 petals with a 3-4 cm flower length (Blanusa et al., 2009).
Euphorbiaceae	<i>Euphorbia milli</i>	 Blunt flower	This plant can grow to a height of 0.6 m, with red flowers, and also the euphorbia plant has oval leaves and is slightly elliptical; this plant grows creeper, has red flowers measuring 1 cm, and can grow to a height of 60-240 MASL (Mahfudhah & Anggarani, 2024).

Family	Species	Pictures	Description
Malveacea	<i>Hibiscus rosa-sinensis</i>	 Hibiscus flower	This flower has 5 petals, a slender-shaped pistil, and is surrounded by a stamen stalk. Flower Diameter 6-20 cm, plant height is 2-5 meters, and can grow in high 1200 MASL (Ahmad Nazarudin, 2012).
Bignoniaceae	<i>Tecoma stans</i> (L.) <i>Juss. mantan kunth</i>	 Trumpet flower	This flowering plant is commonly called a yellow trumpet flower and is very easy to cultivate in various places, high 10-1200 MASL. The Diameter of this flower is 4-6 cm, which is a single flower (Makovic and Klett, 2020).
Turneraceae	<i>Turnera subulata</i>	 flowers at eight o'clock	This plant can grow 10 -250 MASL, flower length 0.8 cm yellow, hairy leaf surface thirsty, single flowering, Oval Crown, growing at the end of the stem, stamens 1.5-2 cm long (Robert, 2022).
Scrophulariaceae	<i>Torenia fournieri</i>	 Wishbone flower	This plant is an annual plant, with a flower size of 6-12 inches and, a width of 6-9 inches. The flower's color is blue-purple, and this plant's height is only 15-30 cm. This plant can grow at an altitude of 1-1800 MASL (Suryati et al., 2022).
Scrophulariaceae	<i>Angelonia angustifolia</i> Benth.	 Angel flower	Angelonia plants can grow at an altitude of 0-2000 MASL, have linear and serrated sempit leaves, and bluish-purple flowers with a size of 2-3 cm this plant grows clumps and shrubs (Chang et al., 2023)
Asteraceae	<i>Erigeron anus</i> L.	 Cyrisan flower	This flower grows at the end of a yellow round stalk and is surrounded by 10-30 small white petals, ranging from 1 inch, with a plant height of 20-30 cm (Tristi Indah DK, 2023).

Family	Species	Pictures	Description
Asteraceae	<i>Erigeron glaucus</i> L.	 <p>Cyrisan flower</p>	This flower grows at the end of a white and purple round stalk in the middle consisting of 60-90 small petals, flower size ranges from 2-4 cm, with a plant height of 20-30 cm (Tristi Indah DK, 2023).
Portulacaceae	<i>Portulaca grandiflora</i>	 <p>Purslane flower</p>	This flower can grow 15-30 cm, is high 1400 MASL, has leaves with a length of 1-3.5 cm, and the tip is blunt, the flower color is yellow with a total of 10-15 petals (Sanjaya et al., 2024).
Purtulacaceae	<i>Portulaca grandiflora</i> Hook	 <p>Purslane flower</p>	This flower can grow to a height of 15-30 cm, at an altitude of 1400 meters above sea level, has a single leaf of 1-3.5 cm, and the tip is blunt, the flower is purple with several 4-6 petals (Sanjaya et al., 2024).
Nyctaginaceae	<i>Bougainvillea Juss</i>	 <p>Paper flower</p>	This plant has thorns on the stem, the shape of the leaves is oval, the color of the flowers is orange single flower type, and has 3 crown strands, this flower can grow at an altitude of 1-1400 MASL (Ati'ah et al., 2022).
Rubiaceae	<i>Mussaenda frondosa</i> .	 <p>Nusa indah flower</p>	This plant grows at 1-1700 meters above sea level with a plant height of 10 meters. The flowers are star-shaped with yellow and pink petals and are 10 mm in size (Kaffi, 2018).
Polygonaceae	<i>Antigonon leptopus</i>	 <p>Bridal tears</p>	This plant grows vines and can grow up to 12 meters. The flowers are arranged in bunches, white and pink, 2 cm long, with 5 crowns (Riswandi et al., 2023).

Family	Species	Pictures	Description
Nyctaginaceae	<i>Bougainvillea spectabilis willd</i>	 Paper flower	This flower can grow well when exposed to full sun. Hopefully, it is a white-collar flower with 3 strands of Crown flowers, size 3-4 cm. This flower can grow at an altitude of 1-1400 MASL (Ati'ah et al., 2022).
Nyctaginaceae	<i>Bougenvillea black maria</i>	 Paper flower	The plant is an annual or single-flowered plant that grows well when exposed to direct sunlight. The flowers are purplish-red. It has 3 crown strands and a size of 1-3 cm (Ati'ah et al., 2022).
Nyctaginaceae	<i>Bougenvillea yellow monalisa</i>	 Paper flower	This plant has an ovoid leaf shape that is whitish Green. It is the color of a single flower type with 3 crown strands. This flower can grow at an altitude of 1-1400 MASL (Ati'ah et al., 2022).
Nyctaginaceae	<i>Carlls garden bougenvillea</i>	 Paper flower	This plant is a perennial that is single-flowered, has 3 crown strands, and has a size of 2-4 cm. The Shape of this flower is very different from paper flowers in general, which look Whole (Ati'ah et al., 2022).
Rubiaceae juss	<i>Musaenda philippica A, Rich</i>	 Nusa indah flower	This flower can grow up to 2-5 m high. The leaves are elliptical or egg-shaped, and the tip is agile. The small yellow flowers are star-shaped. This plant grows well with full sun exposure (Kaffi, 2018).
Amaranthaceae	<i>Gomphrena globosa</i>	 Knop flower	The flowers of the knob are dark purple, the plant can grow up to 60 cm in height, and the leaves are thin like paper with a size of 2-4 cm. (Warni, 2012).

Also, this study found that the family that dominates the land is the *Nyctaginaceae* family, consisting of 5 species in 1 family. This is aligned with the literature of Nur Fatimah (2008), which states that planting media or soil is a place for the growth and development of the plant root system. Most mineral nutrients and organic matter plants need are taken from the soil. Therefore, good soil must have high organic matter,

good drainage and aeration, and contain mineral elements needed by plants that are taken and obtained from planting media. Bukit Kor is very suitable for horticultural crops because the land contains high organic elements that allow plants to grow well around the land. Several planting media are widely used as a medium for plant growth that supports growth, such as husks, husk charcoal, ferns, sand, and soil, and they are also good temperature factors on the land. Ornamental plants are among the most important garden elements. The diversity of shapes, textures, colors, sizes, and aromas of ornamental plants, each with its beauty, can, if combined properly, highlight the attractiveness and atmosphere of both the garden and the plants themselves (Schneebeli-Morrell, 2014).

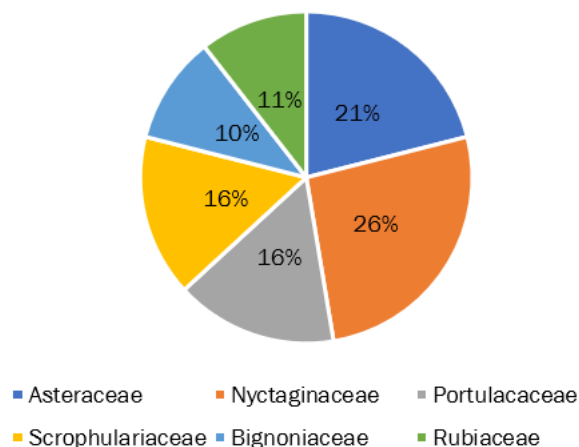


Figure 1. Decorative Flower Spread in Bukit Kor Terengganu, Malaysia

Figure 1 captures the distribution of flowers in Bukit Kor Terengganu, Malaysia, consisting of 4 *Asteraceae* (21%). *Asteraceae* is one of the plant tribes with the most prominent species and is spread worldwide. The *Asteraceae* tribe is often called the sunflower tribe because members of this tribe have flowers with characteristics shaped like sunflowers. The benefits of *Asteraceae* are frequently used as traditional medicine for specific diseases or to heal wounds. *Asteraceae* are also consumed as vegetables, animal feed, and ornamental plants and can be used as hair fertilizers (Syah et al., 2014). Besides being used as a traditional medicine, *Asteraceae* plants can also be utilized as natural herbicides because some species contain allelochemicals. The following are from the *Nyctaginaceae* family of 5 (26%). *Nyctaginaceae* is one of the tribes of flowering plant members. According to the APG II classification system, this tribe is included in the *Caryophyllales* nation, the core dicotyledonous clade (*core Eudicotyledonous*), but is not included in the two major groups, *Rosidae* and *Asteridae*. Its known members are *Bougainvillea* (*paper flower*, *bougainvillea*), *Flower at four* (*Mirabilis jalapa*), and *banda cabbage* (*Pisonia alba*), *Portulacaceae* A total of 3 (16%) *Portulacaceae* (*purslane-krokotan* tribe) is one of the tribes of flowering plant members. According to the APG II classification system, this tribe is included in the *Caryophyllales* nation, *core dicotyledonous clade* (*core Eudicotyledonous*), but is not included in the two major groups, *Rosidae* and *asteridae*. This family only has one plant genus, *Portulaca* (*purslane*), *Scrophulariaceae*, with 3 (16%). *Scrophulariaceae* is a family of flowering plants. According to the APG II classification system, this tribe is included in the order *Lamiales*. *Bignoniaceae* has 2 (10%), and *Rubiaceae* has 2 (11%). *Bignoniaceae* is a family of flowering plant members. According to the APG II classification system, this tribe is included in the *Lamiales* order.

4. Conclusions

This study has successfully explored ornamental plants growing in Bukit Kor, Terengganu, where there are 30 species of ornamental plants growing in Bukit Kor, consisting of 17 families. The distribution of flowers in Bukit Kor Terengganu, Malaysia, consists of *Asteraceae* with a total of 4 (21%); *Nyctaginaceae* with a total of 5 (26%); *Portulacaceae* with a total of 3 (16%), *Scrophulariaceae* with a total of 3 (16%), *Bignoniaceae* with a total of 2 (10%), and *Rubiaceae* with a total of 2 (11%). These ornamental plants dominate the growth of the *Nyctaginaceae* family, with a total of 5 (26%).

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and N.A.H.; visualization, W.A.S.; supervision, A.T.M. and N.A.H.; project administration, A.T.M.; funding acquisition, A.T.M. All authors have read and agreed to the published version of the manuscript.

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