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Original Article

Identifying the Flowering Weeds in Bukit Kor Marang, Terengganu, Malaysia

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Abstract: Weeds are planted whose presence is not desired by humans. Competition between weeds and plants in taking up nutrients and water from the soil and receiving sunlight for the photosynthesis process, causes losses in production, both quality and quantity. Plant identification for this scientific expedition was carried out in September 2023. A total of 27 species from several families were successfully collected and documented during the expedition. Plants that were successfully collected included Babadotan, Putrimalu, and Israel grass. On the basis of the exploratory data collection on weeds growing on the Kor Hill land, Terengganu, Malaysia, this study concludes that the distribution of weeds on the Kor Hill land, Terengganu, Malaysia, shows that there are 27 plant species originating from 18 families, and dominated by the *Fabaceae* family.

Keywords: Flowers; Weeds; Bukit Kor Marang, Terengganu.

1. Introduction

Diversity is the expression of a variety of variations, forms, appearances, numbers, and properties that can be seen at the level of communion of beings, namely the ecosystem level, the species level, and the genetic level (Sastrapradja & Adisoemarto, 1989). Weeds that grow with cultivated plants can reduce quality and quantity yields (Widaryanto et al., 2021). Types of weeds include grass weeds, sedges, and broad-leaf weeds (Caton et al., 2011). Weeds compete for nutrients, water, light, and space to grow. The longer weeds remain in the planting area, the fewer leaves will decrease. Weeds have a strong competitive ability for CO2, water, sunlight, and nutrients. Weed growth can slow plant growth (Singh et al., 2005). This is in line with Aldrich & Kremer (1997) that weed diversity is influenced by environmental conditions (Perdana & Syam, 2013). Many factors affect the diversity of weeds at each observation location, such as light, nutrients, soil processing, plant cultivation methods, as well as different planting distances or densities of plants used, and the age of the citrus plants: plant density, soil fertility, cultivation patterns, and tillage influence weed species. Competition between weeds and plants in taking up nutrients and water from the soil and receiving sunlight for the photosynthesis process causes losses in production, both quality and quantity. Weeds absorb nutrients and water more quickly than staple plants (Brown & Brooks, 2003).

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Several factors can influence a plant community. One of these factors is the difference in location or height of a place. This can affect light intensity, temperature, and humidity, which are climatic factors. Apart from climatic factors, altitude will also influence edaphic factors, including soil moisture, soil organic matter, and soil pH. Therefore, weed communities vary greatly from one region to another due to the different environmental factors in each region. However, weeds, considered nuisance plants, benefit cultivated plants and insects. Insects and weeds are important components of the ecosystem. Weeds can function as trap plants, alternative insect hosts, and food providers for adult natural enemy insects because the weeds provide pollen for adult parasitoids. The distribution of weeds between regions differs according to the factors influencing it. Identification of weeds and recognition of dominant weed types is the first step in determining the success of weed control. The identification is derived from an identical word, which means identical or similar, and this can be excluded from the Latin name. Identification of plants is determining the correct name and its proper place in the classification. Plant identification is a way to study botany in biological learning. Identifying weeds and dominant weed types is the first step in determining the success of weed control and utilization. This study determines the diversity and dominance of weeds in the Bukit Kor, Terengganu, Malaysia.

2. Materials and Methods

The study was conducted from 12 to 21 September 2023 in Bukit Kor, Marang, Terengganu, Malaysia, at an altitude of ± 35 meters above sea level. The tools used in this research were branch scissors, paper, stationery, a board, and a camera. The materials used in this research are flowering weeds, such as *Asystasia gangetica, Cleome rutidosperma*, *Xenostegia tridentate*, and various others found around the exploration location. Identification of flowering weeds in the diversity of weeds in Bukit Kor was carried out on the Bukit Kor agricultural land, Marang, Kuala Terengganu, Malaysia using the exploration method. Identification of weeds found from each observation point is done by visually looking at the morphological shape of the weeds, then matched with the library (Caton et al., 2011). Descriptive research only describes what is about a symptom or condition. Explorative research is research carried out as exploration research (Arnyana, 2007). Exploration was carried out on empty land next to the plant nursery, which looked bushy, by selecting weeds with flowers and then taking them to photograph them on a white background and then identifying the family and species of the weeds. The man identified the unknown specimen through careful study and then placed its description alongside detailed pictures of the parts of the plant with its diagnostic characteristics (Babu et al., 2015; Subbarao et al., 2019; Utami et al., 2020).

3. Results and Discussion

Table 1. Results of identification of Acanthaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Acanthaceae	*Asystasia gangetica*		*Asystasia gangetica*, often referred to as spinach, breech fig, Israel grass, or China violet, is a type of forage weed that grows in the shade of agricultural land and plantations, especially palm oil(Suarna et al.2019).

Table 2. Results of identification of Asteraceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Asteraceae	*Erigeron Sumatrensis*		Jelantir (*Erigeron sumatrensis*) is a species of flowering weed plant originating from the genus Conyza belonging to the *Asteraceae* family. This plant grows wild in yards, gardens, and rice fields as a weed, but

			it can be used as medicine to treat headaches, aches, pains, and bumps caused by insect bites.
Asteraceae	*Ageratum conyzordes*		Bandotan or Wedusan (*Ageratum conyzoides*) is a type of agricultural weed belonging to the *Asteraceae* family. This annual herb originates from tropical America, especially Brazil, but has long been introduced and wild in the archipelago. Also called babandotan or babadotan (Sd.); wedusan (Jw.); dus-bedusan (Md.); balam grass (Ptk.); as well as Billygoat-weed, Goatweed, Chickweed, or Whiteweed in English, this plant gets its name because the smell it emits resembles the smell of a goat.
Asteraceae	*Cyanthillium cenereum*		*Sky mustard* (botanical name *Cyanthillium cinereum*; formerly classified as Vernonia cinerea) is an annual weed from the family *Asteraceae*. With various geographical distributions, it is not difficult to find this plant because it is the same as other weeds that grow wild in the open, not many people know about the function and use of this wild plant because most of us assume this plant is just a weed for other plants.

Table 3. Results of identification of Balsaminaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Balsaminaceae	*Impatiens balsamina L*		Water henna (Latin: *Impatiens balsamina L.*) is a plant that originates from South Asia and Southeast Asia but was introduced to America in the 19th century (Bole et al.2013). This annual or biennial plant has white, red, purple, or pink flowers. The shape of the flowers resembles small orchids. This plant can reach a height of one meter with thick but not wilting stems and leaves with serrated edges.

Table 4. Results of identification of Boraginaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Boraginaceae	*Heliotropium indicum*		Sangketan or rat tail (*Heliotropium indicum*) is a flowering plant from the genus *Heliotropium*. This weed grows wild and can be found in fields, edges of rice fields, house yards, and empty land. However, this plant can also be used in traditional medicine

Table 5. Results of identification of Cleomaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Cleomeceae	*Cleome rutidosperma*		Maman lanang (*Cleome rutidosperma*) is a weed plant member of the *Cleomaceae* family. This plant is locally known as maman lanang, purple maman or male maman. Maman lanang weed (*C. rutidosperma*) is one of the weeds that grows in oil palm plantations and other plantations. The presence of weeds in plantations can result in a decrease in crop production.

Table 6. Results of identification of Convolvulaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Convolvulaceae	*Xenostegia tridentate*		*Xenostegia tridentata* is a slender climbing plant from tropical and subtropical areas. This plant produces distinctive flowers like morning glory flowers with dark red throats. On some Pacific islands, this vine is considered a weed.
Convolvulaceae	*Ipomoea pestigridis*		*Ipomoea pes-tigridis* is a species of the genus Ipomoea and the family *Convolvulaceae*. This species is distributed in Asia, Africa, Australia, and the Pacific islands. This plant lives on roadsides and beaches at heights between 0 and 400m(Selvam et al,2015).

Table 7. Results of identification of Cyperraceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Cyperaceae	*Kyllinga brevifolia*		Teki or Jukut pendul is a grass plant belonging to the *Cyperaceae* family with flowers resembling small balls.
Cyperaceae	*Cyperus iria*		*Cyperus iria,* or teki jekeng, belongs to the *Cyperaceae* family. This species is also part of the order Poales. The *Cyperus iria* species is part of the *Cyperus* genus. First published, the scientific name of this species.

Table 8. Results of identification of Dilleniaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Dilleniaceae	*Tetracera indica*		The *Tetracera* genus is a type of plant that thrives in the tropical forests of Asia from Malaysia, Indonesia, Vietnam, Thailand, and China to Guinea. This genus has various species which have almost the same benefits and uses, namely as anti-inflammatory, antioxidant and has hepatoprotective activity which is caused by the presence of various chemical contents in it, namely flavonoids and their derivatives such as quercetin, kaempferol, apigenin, luteolin, myrisetin, rhamnetin, isorhamnetin, and azaleatin.

Table 9. Results of identification of Fabaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Fabaceae	*Arachis pintoi*		The *Arachis pintoi* plant originates from the South American continent, specifically Brazil. In Indonesia, this plant is popularly known as the ornamental bean. It was originally introduced in Singapore by several golf course entrepreneurs, but now it is often found in office parks, shops, hospitals, housing complexes and street gardens.
Fabaceae	*Mimosa pudica*		Putri Malu or *Mimosa pudica L* is a short shrub belonging to the legume tribe is easily recognized because of its leaves, which can quickly close/wither by themselves when touched. Although some members of the legume can do the same thing, the shy princess reacts more quickly than other types. This

			weakness is temporary because, after a few minutes, the condition will return to normal.
Fabaceae	*Macroptilium Atropurpureum*		The Siratro plant (*Macroptilium atropurpureum*) is a plant that can grow with grass without suppressing grass growth. The Siratro plant has tube-shaped flowers with dark purple and red near the base of the flower. Siratro plants can also improve forage quality, especially with a crude protein content of 16.60% at 4 weeks of age. Siratro plants also can produce lots of seeds.
Fabaceae	*Crotalaria retusa*		*Crotalaria* is a genus of flowering plants in the family *Fabaceae*, subfamily *Faboideae*. This genus includes more than 700 species of herbaceous plants and shrubs. Africa is the continent with the majority of *Crotalaria* species (around 400 species), which are mainly found in moist grasslands, floodplains, basins and along the edges of swamps and rivers, but also in deciduous heathlands, roadsides and fields. Some species are grown as ornamental plants.

Table 10. Results of identification of Lamiaceae family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Lamiaceae	*Lycopus europaeus*		*Lycopus europaeus* (*Lycopus europaeus*) comes from Europe. Its name comes from the gypsies, who once used it to dye their clothes and skin. *Lycopus europaeus* thrives in natural water

Family	Species	Picture	Description
			habitats like lakes, rivers, and swamps.

Table 11. Results of identification of *Malvaceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Malvaceae	*Urena lobata*		Pulutan (*Urena lobata*) is a plant that belongs to the *Malvaceae*/cotton family, meaning this plant is related to gandapura, cotton, hibiscus, hibiscus, sidaguri, and cemplak - a type of grass that is very smelly
Malvaceae	*Melochia corchorifolia*		*Melochia corchorifolia* (name *Melochia corchorifolia*) is a weed that breeds along highways, in uncultivated fields and other forgotten spaces. The name comes from an earlier taxonomic identification that mistakenly placed it in the same family as chocolate. They don't provide much nutrition but the fiber can be woven into rope.

Table 12. Results of identification of *Melastomataceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Melastomataceae	*Clidemia hirta*		*Clidemia hirta*, commonly called feather spring, is a perennial herbaceous plant. This plant is an invasive species in many tropical regions and can cause serious damage.
Melastomataceae	*Melastoma malabathricum*		Senbangun (*Melastoma malabathricum*) is a shrub and belongs to the *Melastomataceae* family. This plant has bright purple flowers with hairy reddish stems, usually in open grasslands or forests. This

Family	Species	Picture	Description
			plant comes from Melanesia, Japan, and Australia and is widespread throughout the tropics. It can also be found in Indonesia. One of the distribution places is in Ndoso sub-district, West Manggarai, East Nusa Tenggara.

Table 13. Results of identification of *Onagraceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Onagraceae	*Ludwigia decurrens*		*Ludwigia decurrens* (name *Ludwigia decurrens*) thrives best in environments with lots of moisture such as freshwater bogs, wet bogs, or peat bogs. Another name is seedbox because the seed capsule is box-shaped. Ducks and other water birds enjoy a feast on these seeds.

Table 14. Results of identification of *Oxalidaceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Oxalidaceae	*Oxalis barrelieri*		*Oxalis barrelieri* is a shrub that originates from South America. It has cylindrical stems, smooth and brownish green in color. Compound flowers with long stalks that grow in the axils of the leaves, white with greenish petals with yellowish spots and a bright yellow center. trumpet shaped. Trifoliate leaves consist of three oval-shaped leaves with a rounded base and a pointed tip.

Table 15. Results of identification of *Passifloraceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Passifloraceae	*Passiflora foetida*		Rambusa or ermot (*Passiflora foetida*) is a type of small fruit that is covered by enlarged flower petals when ripe. This fruit is also known by various regional names such as ceplukan blungsun, senthiet (Jw.), penyetkemut (Mhy.), permot, cermot, knitting, kaceprek or ki leuleu'eur

Family	Species	Picture	Description
			(Sd.), kambuik kambuik (Mng.) and timun dendang or meadow cucumber (Mel.). Another term that is also used is mini passion fruit or forest passion fruit.

Table 16. Results of identification of *Pedaliaceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Pedaliaceae	*Sesamum radiantum*		*Sesame radiatum* is a species of flowering plant in the *Pedaliaceae*. It is in the same genus as sesame, and is known by the common English names benniseed, black benniseed, black sesame, and vegetable sesame. This plant is native to western and central Africa, has been cultivated since ancient times in Africa, and is also sometimes used in tropical Asia where it has naturalized to a small extent.

Table 17. Results of identification of *Poaceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Poaceae	*Dactyloctenium aegyptium*		*Dactyloctenium aegyptium* comes from Africa and can function as an anchor for loose soil or sand. Because it always appears in barren lands and grows quickly, it is considered an invasive species in the United States and some other regions.
Poaceae	*Bulbous bluegrass*		*Poa bulbosa* is a species of grass known as *bulbous bluegrass* or *bulbous meadow-grass*. It is native to Eurasia and North Africa but is present almost worldwide as an introduced species. It is widespread in the United States and southern Canada. It was introduced to the eastern United States around 1906 and the western United States in 1915 as a

Family	Species	Picture	Description
			contaminant in alfalfa seed shipments. This plant is deliberately planted on the east and west coasts to control weeds and prevent erosion.

Table 18. Results of identification of *Rubiaceae* family flowering weeds around the Bukit Kor agricultural land

Family	Species	Picture	Description
Rubiaceae	*Spermacoce*		*Spermacoce* is a genus of flowering plants in the family *Rubiaceae.* This genus consists of approximately 275 plant species in tropical and subtropical regions. The highest diversity is in the Americas, followed by Africa, Australia, and Asia.

The table above shows 27 plant species consisting of 18 different families, from the 18 families, among others: *Acanthaceae, Asteraceae, Balsamiaceae, Boraginaceae, Cleomeceae, Convulvulaceae, Cyperaceae, Dilleniaceae, Fabaceae, Lamiaceae, Malvaceae, Melastomacea, Onagraceae, Oxalidaceae, Passifloraceae, Pedaliaceae, Poaceae, Rubiaceae*. It is in line with the findings of Utami et al. (2020). Weeds are plants that grow in a certain place at a certain time and are not desired by humans. The weeds that grow among the plants vary greatly in type and dominance. Types of weeds with high dominance will be detrimental and reduce crop yields (Utami et al., 2020). According to the ecological aspects, weeds are pioneers in secondary succession, especially on agricultural land (Mangoensoekarjo and Soejono, 2015). The distribution of weeds in Bukit Kor Terengganu, Malaysia, consists of *Asteraceae* totaling 3 (17%). *Asteraceae* is one of the plant families with the largest number of types and is distributed worldwide. *Convalvulaceae* number 2 (12%), *Cryperaceace* number 2 (12%), *Fabaceae* number 4 (23%), *Malvaceae* number 2 (2%), *Melastomataceae* number 2 (12%), *Poaceae* number 2 (12%), as seen in Figure 1.

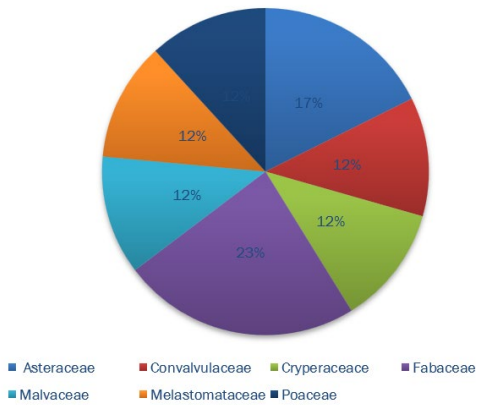

Figure 1. Diversity of weeds

Several factors, such as feed sources and environmental conditions, including temperature, humidity, light intensity and wind speed, can cause the diversity of weeds in an area (Normasari, 2012). Flowering grass plays a role as a micro-habitat that provides a spatial and temporal shelter for natural enemies of pests, such as predators and parasitics, as well as supporting biotic interaction components in ecosystems, like pollinators or pollinator insects (Keppel et al., 2012). Flowering plants around agricultural land are potentially a refuge from natural enemies, including *Coccinelidae, Dolichopodidae, Reduviidae,* and *Oxyopidae* (Lisdayani & Wahyuni, 2022; Tirtosuprobo & Wahyuni, 2006). The presence of pollinator insects

of the *Hymenoptera* and *Diptera* orders on flowering weeds can help pollination by transferring the pollen to the puffy head to help the plant properly plant (Lailiyah & Haryadi, 2021).

4. Conclusions

This study concludes that a distribution of weeds in Bukit Kor Terengganu, Malaysia, showed 27 plant species originating from 18 families and dominated by the *Fabaceae* family. Environmental conditions influence the diversity of flowering weeds. Flowering weeds are detrimental to crops and a micro-habitat for predator and pollinator insects.

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References

Aldrich, R. J., & Kremer, R. J. (1997). *Principles in weed management.* (Issue Ed. 2).

Arnyana, I. B. P. (2007). Dasar-Dasar Metodologi Penelitian. *Denpasar: Bagian Ilmu Faal Fakultas Kedokteran Universitas Udayana*.

Babu, S. M., Lakshmi, A. J., & Rao, B. T. (2015). A study on cloud based Internet of Things: CloudIoT. *2015 Global Conference on Communication Technologies (GCCT)*, 60–65.

Brown, K., & Brooks, K. (2003). *Bushland weeds: a practical guide to their management.* (WA) Inc. Perth WA.

Caton, B. P., Mortimer, M., Hill, J. E., & Johnson, D. E. (2011). Panduan Lapang Praktis Gulma Padi Asia. *International Rice Research Institute. Makati City, Philippine*.

Keppel, G., Van Niel, K. P., Wardell-Johnson, G. W., Yates, C. J., Byrne, M., Mucina, L., Schut, A. G. T., Hopper, S. D., & Franklin, S. E. (2012). Refugia: identifying and understanding safe havens for biodiversity under climate change. *Global Ecology and Biogeography*, *21*(4), 393–404.

Lailiyah, I., & Haryadi, N. T. (2021). Keragaman Arthropoda Pada Pertanaman Padi Dengan Pemanfaatan Gulma Sebagai Tanaman Border. *Jurnal HPT (Hama Penyakit Tumbuhan)*, *9*(1), 21–27.

Lisdayani, L., & Wahyuni, H. (2022). Pengelolaan Tanaman Refugia Sebagai Mikrohabitat Musuh Alami Pada Tanaman Cabai Merah (Capsicum annum L.). *AGRIUM: Jurnal Ilmu Pertanian*, *25*(1), 1–6.

Mangoensoekarjo, S., Soejono, A. T. (2015). *Ilmu Tanaman dan Manajemen Kekuatan Pertanian*. Universitas Gadjah Mada.

Normasari, R. (2012). Arthropod diversity in five habitats with diverse vegetation. *Unklab Scientific Journal*, 41–50.

Perdana, E. O., & Syam, Z. (2013). Analisis Vegetasi Gulma Pada Tanaman Buah Naga Merah (Hylocereus polyrhizus, L.) di Kecamatan Batang Anai, Kabupaten Padang Pariaman, Sumatera Barat. *Jurnal Biologi UNAND*, *2*(4).

Sastrapradja, D. S., & Adisoemarto, S. (1989). *Keanekaragaman hayati untuk kelangsungan hidup Bangsa*. Pusat Penelitian dan Pengembangan Bioteknologi, LIPI.

Singh, S., Singh, G., Singh, V. P., & Singh, A. P. (2005). Effect of establishment methods and weed management practices on weeds and rice in rice-wheat cropping system. *Indian Journal of Weed Science*, *37*(1and2), 51–57.

Subbarao, V., Srinivas, K., & Pavithr, R. S. (2019). A survey on internet of things based smart, digital green and intelligent campus. *2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU)*, 1–6.

Tirtosuprobo, S., & Wahyuni, S. A. (2006). Penerapan Teknologi Pengendalian Hama Terpadu untuk Meningkatkan Produksi dan Pendapatan Usahatani Kapas di Sulawesi Selatan. *Perspektif: Review Penelitian Tanaman Industri*, *5*(1), 36–45.

Utami, S., Kurniadie, D., & Widayat, D. (2020). Dinamika Populasi Gulma Akibat Aplikasi Herbisida Metil Metsulfuron pada Padi Sawah Sistem Tanam Pindah (Tapin) dan Tanam Benih Langsung (Tabela). *Jurnal Agrikultura*, *31*(3), 174–181.

Utami, S., Murningsih, M., & Muhammad, F. (2020). Keanekaragaman dan dominansi jenis tumbuhan gulma pada perkebunan kopi di hutan wisata nglimut kendal jawa tengah. *Jurnal Ilmu Lingkungan*, *18*(2), 411–416.

Widaryanto, E., Saitama, A., & Zaini, A. H. (2021). *Teknologi Pengendalian Gulma*. Universitas Brawijaya Press.