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DISTRIBUTION OF PLANT SPECIES WITH POTENTIAL THERAPEUTIC EFFECT IN AREA OF THE UNIVERSITI TEKNOLOGI MARA (UiTM), KUALA PILAH CAMPUS, NEGERI SEMBILAN, MALAYSIA

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Abstract

Knowledge of species richness and distribution is decisive for the composition of conservation areas. Plants typically contain many bioactive compounds are used for medicinal purposes for several disease treatment. This study aimed to identify the plant species distribution in area of UiTM Kuala Pilah, providing research scientific data and to contribute to knowledge of the use of the plants as therapeutic resources. Three quadrat frames (1x1 m), which was labeled as Set 1, 2 and 3 was developed, in each set consists of 4 plots (A, B, C and D). Characteristics of plant species were recorded, identified and classified into their respective groups. Our findings show that the most representative classes were Magnoliopsida with the total value of 71.43%, followed by Liliopsida (17.86%) and Lecanoromycetes (10.71%). A total of 28 plant species belonging to 18 families were identified in all sets with the largest family of Rubiaceae. The most distribution species are *Desmodium triflorum*, *Dactyloctenium aegyptium*, *Flavoparmelia caperata*, *Xanthoria elegans* and *Phlyctis argena*. Most of the plant possesses their potential to treat skin diseases, fever, ulcers and diabetes as well as digestive problems with their antimicrobial, anti-inflammatory and antioxidant properties. This study suggests that study site and plant species can be delineated as an important area to preserve these therapeutic resources. Finally, this study could also be useful for preliminary screening of potential therapeutic plant found in the study area and useful for the researchers in the pursuit of novel drug discovery.

Keywords: Plant species, Therapeutic, UiTM Kuala Pilah, Negeri Sembilan

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Introduction

Plants as one of the land resources play an important role on the living of creatures, nature, preservation and given structure to ecosystems (Arora, 2018; Goyal et al., 2016). Developing technology and industry may lead an increase in the population and some other factors have urged the natural resources (Hao & Xiao, 2020; Ndah et al., 2013). For many years, natural products obtained from diverse sources notably from plant have been acting as a source of therapeutic and aromatic agents. Compared with chemical synthesis, plant derived natural products represent an attractive source of bio-active agents, which is typically result from the secondary metabolites such as alkaloids, steroids, tannins, and phenol compounds. Traditionally, various types of plant species have been used for medicinal purposes and shown beneficial uses to treat several diseases such as cough, stomachache, fever, asthma and wounds (Goyal et al., 2016; Joseph et al., 2013; Bakar et al., 2018). Some parts of plants are applied in traditional medicine to treat eczema or other skin diseases (Hao & Xiao, 2020; Goyal et al., 2016; Mabona & Van Vuuren, 2013; Kumar et al., 2012). For example,

leaves and roots of *Uvaria grandiflora Roxb* are reported to treat colds and shivers for children as well as for poultice to wrap around the abdomen (Aziz et al., 2016b). People are also fascinated with *Aloe vera* because of the plant leaves are known to repair damaged skin cells and some other related to wound healing (Rajeswari et al., 2012). The component of anti-inflammatory fatty acids is highly effective in skin treatment (Rajeswari et al., 2012).

Based on some literature, the quantity of plant species in Malaysia is appraised to be more than 23,500 species (Aziz et al., 2016a; Shah et al., 2016). Malaysia comprised of west (including Negeri Sembilan) and east is a country, where abundance species of plants were recognized. Universiti Teknologi MARA (UiTM) Kuala Pilah, Negeri Sembilan is mainly located at an area of 160 acres in Mukim Parit Tinggi and surrounded by hill forest. The biotic and abiotic components of the environment function together as an ecological system. Several activities such as agriculture, deforestation, burning, and rearing livestock especially from the local people are also a part, have been involved in environment modification (Noormi et al., 2018; Bamidele et al., 2017; Shah et al., 2016). It was reported that some species of plants have lived in UiTM Kuala Pilah for many years (Noormi et al., 2018). However, high demands of large populations and uncontrolled activities might increase the risk of extinction of some plant species and habitat destruction (Hao & Xiao, 2020; Chen et al., 2016; Riyazzudin et al., 2016). Continued depletion of ecosystems may also lead to loss of potential several plant species as therapeutic agents. There are few methods can be applied in order to measure and obtain ecology such as transect, netting and quadrat sampling. In general, a series of squares (quadrats) of a set size are placed in a habitat of interest and the species within those quadrats are identified and recorded. Abundances of organisms found at the study site can be obtained using the number found per quadrat and the size of the quadrat area. Hence, this study aimed to identify the plant species distribution in area of UiTM Kuala Pilah, providing research scientific data and to contribute to knowledge of the use of the plants as therapeutic resources.

Methods

Study Area

Universiti Teknologi MARA (UiTM) Kuala Pilah Campus is situated around 8 km from Kuala Pilah town (2.7415628° N, 102.248835° E). The campus is surrounded by natural greenery forest. The annual temperature is ranged between 29 to 38 ºC and the slope of the study area was 30 º. Figure 1 represented the study area in the current work. The selection of sampling area was based on the potential location surrounding the jungle.

Figure 1. Detailed map of the study site (a) Peninsular Malaysia showing the location of the study area in the district of (b) Google image of Kuala Pilah, specifically to show the Universiti Teknologi MARA (UiTM) Kuala Pilah Campus and (c) A plot of UiTM nearby the study area.

Data Collection and Species Identification

Quadrat sampling technique was employed in this work for studying the presence of the plant species. Three quadrat frames (1x1 m), which was labeled as Set 1, 2 and 3 was develop, in each set consists of 4 plots (A, B, C and D). Any physical characteristics of species were observed and recorded. The plant species were then identified and classified into their respective groups, families and genera. The classification system of plant species were confirmed in the database of the USM Herbarium Collection, available at "https://ush.mybis.gov.my/search.php" and Catalogue of Life: 2020-02-24 at "http://www.catalogueoflife.org/col/info/websites".

Result and Discussion

Species Richness and Composition

In this study, there were 28 plant species identified in all sets. These species are from the three classes namely Magnoliopsida, Liliopsida and Lecanoromycetes (Table 1). The most representative classes were Magnoliopsida with the total value of 71.43%, followed by Liliopsida (17.86%) and Lecanoromycetes (10.71%). Subsequently, the total number of 18 families was obtained in four different plots, developed in the current work. Rubiaceae is the family with the largest number of plant species identified. Rubiaceae have adapted to a range of environmental conditions. Thus, abundance of this plant was found in sampling area and even almost any type of habitat around the world (Arora, 2018). Several plant species found in the study area was shown in Figure 2.

Figure 2. Several plant species found in the study area are (a) *Praxelis clematidea* (b) *Mimosa pudica* (c) *Spermacoce exilis* (d) *Desmodium triflorum* (e) *Plantago aristata* (f) *Hylotelephium maximum* (g) *Oxalis barrelieri* (h) *Mitracarpus hirtus* (i) *Trichosanthes kirilowii* (j) *Dactyloctenium aegyptium* (k) *Richardia scabra* (l) *Melastoma malabathricum* (m) *Croton glandulosus* (n) *Brachiaria mutica* (o) *Diodia virginiana* and (p) *Flavoparmelia caperata*

Table 1. Taxonomic classification of identified plant species in three different quadrate (Set 1, 2 and 3).

Class	Order	Family	Scientific name	Local name
Magnoliopsida	Asterales	Asteraceae	*Praxelis clematidea*	Billygoat weed
	Asterales	Asteraceae	*Ageratum conyzoides*	Billygoat weed
	Caryophyllales	Amaranthaceae	*Amaranthus spinosus*	Spiny amaranth
	Sapindales	Anacardiaceae	*Mangifera indica*	Mango tree
	Saxifragales	Crassulaceae	*Hylotelephium maximum*	Grosse fetthenne
	Cucurbitales	Cucurbitaceae	*Trichosanthes kirilowii*	Chinese cucumber
	Malpighiales	Euphorbiaceae	*Croton glandulosus*	Tropic eroton
	Malpighiales	Euphorbiaceae	*Euphorbia dentata*	Green poinsettia
	Fabales	Fabaceae	*Desmodium triflorum*	Threeflower beggarweed
	Fabales	Fabaceae	*Mimosa pudica*	Sensitive grass
	Myrtales	Melastomataceae	*Melastoma malabathricum*	Malabar melastome
	Oxalidales	Oxalidaceae	*Oxalis barrelieri*	Oseille-marron
	Lamiales	Plantaginaceae	*Plantago aristata*	Largebracted plantain
	Gentianales	Rubiaceae	*Borreria laevicaulis*	Broadleaf buttonweed
	Gentianales	Rubiaceae	*Diodia virginiana*	Virginia buttonweed
	Gentianales	Rubiaceae	*Spermacoce exilis*	Pacific false button weed
	Gentianales	Rubiaceae	*Mitracarpus hirtus*	White girdle-pod
	Gentianales	Rubiaceae	*Richardia scabra*	Mexican clover
	Sapindales	Simaroubaceae	*Ailanthus altissima*	Choucum tree
	Solanales	Solanaceae	*Solanum dulcamara*	Climbing nightshade
Liliopsida	Alismatales	Araceae	*Pinellia ternata*	Crow dipper
	Poales	Poaceae	*Dactyloctenium aegyptium*	Egyptian crowfoot grass
	Poales	Poaceae	*Brachiaria mutica*	Buffalo grass
	Poales	Poaceae	*Eleusine indica*	Goose grass
	Poales	Poaceae	*Cyrtococcum patens*	Bow grass
Lecanoromycetes	Lecanorales	Parmeliaceae	*Flavoparmelia caperata*	Common green shield lichen
	Ostropales	Phlyctidaceae	*Phlyctis argena*	Whitewash lichen
	Teloschistales	Teloschistaceae	*Xanthoria elegans*	Elegant sunburst lichen

Plant Distribution

The distribution of plants species found in plot A, B, C and D is shown in Figure 3. The most distribution species are *Desmodium triflorum*, *Dactyloctenium aegyptium*, *Flavoparmelia caperata*, *Xanthoria elegans* and *Phlyctis argena*. The species had distribution from 22 to 32 of total plants (284 individuals). *D. aegyptium* was the highest species (11 individuals) detected in Plot A and C. The plant also known as Egyptian crowfoot grass and found in Europe, Africa and Asia (Naik et al., 2016; Fatima et al., 2018). Traditionally, *D. aegyptium* is used for anti-anthelmintic to treat gastrointestinal, biliary and urinary ailments for the treatment of heart burn, cough, fevers smallpox, polyurea, immunodeficiency, gastric ulcers and wounds healing (Fatima et al., 2018). The phytochemical analysis revealed that this plant contain amino acids, proteins, carbohydrates, terpenoids, saponins, alkaloids, tannins as well as flavonoids (Kumar et al., 2015; Naik et al., 2016). The pharmacological investigations showed that *D. aegyptium* possessed antimicrobial and antioxidant properties. Study done by Khan et al., (2013) revealed that the methanolic extract of *D. aegyptium* exhibited antibacterial activity against *Stapylococcus aureus* and *Escherichia coli* with MIC of 6.5 - 7.0 mg/mL (Khan et al., 2013). In other report, the *n*-hexane extracts of *D. aegyptium* showed very strong antiviral activity against HSV-2, HSV-1 and HSV-10 viruses (Janbaz and Saqib, 2015).

Subsequently, the highest number of *Richardia scabra* species (10 individuals) was obtained in Plot B. *R. scabra* with the local name of Mexican clover, belongs to the Rubiaceae family is widely found in the tropical and temperate region (Rahmatullah et al., 2010; Kala, 2015). Rubiaceae is considered the biggest family obtained in this study. Several reports from local herbal medical therapeutic indicate that the methanolic extract of this plant is utilized to treat wound healing, skin disease, urinary tract infection, asthma as well as stomach ache (Poonkodi, 2016; Aziz et al., 2016b; Poonkodi & Ravi, 2016). Based on research study, *R. scabra* contain several metabolite compounds such as alkaloids, flavonoids, steroids and terpenoids (Poonkodi & Ravi, 2016). The extracts of *R. scabra* also showed potent antibacterial activity againsts several pathogenic bacteria such as *S. aureus, Klebsiella pneumoniae, Salmonella paratypi, Vibrio cholerae, S. albus* and *E. coli* (Poonkodi & Ravi, 2016). In addition, zone of inhibition in range of 14 to 21 mm was detected when methanol extract of *R. scabra* was tested as antifungal activity against *Candida albicans* and *Aspergillus fumigatus* (Poonkodi & Ravi, 2016).

The total plants of 14 were obtained in Plot D with the species of *Desmodium triflorum* and *Flavoparmelia caperata*. *D. triflorum* with the local name of Threeflower beggarweed is a plant belongs to the family Fabaceae (Rani et al., 2011; Thankachan et al., 2017). From our observation, *D. triflorum* is a very small plant, approximately 15 to 45 cm long (Thankachan et al., 2017). This plant is a global species native to tropical and subtropical regions including the southern United States (Rani et al., 2011; Thankachan et al., 2017). It was reported that *D. triflorum* is employed medicinally for antioxidant, antibacterial and anti-inflammatory (Thankachan et al., 2017). It is believed that the leaves of this plant could treat ulcers, wounds and skin problems (Thankachan et al., 2017). Based on scientific study, *D. triflorum* showed strong antibacterial activity against *S. aureus*, *Micrococcus luteus*, *Bacillus pumilus*, *Pseudomonas aeruginosa*, *P. fluorescens* and *E. coli* (Thankachan et al., 2017). Several metabolite compounds such as alkaloid, glycoside, saponines, flavonoids, proteins and phenolic were also detected (Thankachan et al., 2017). The presence of flavonoids compound in *D. triflorum* has been reported to scavenging the free radicals in the human body and insulate advanced aging and cardiovascular disease (Thankachan et al., 2017). Subsequently, the species of *Flavoparmelia caperata* is a group of lichen. *F. caperata* belongs to the family Parmeliaceae with a local name of common green shield lichen. It was reported that these species of lichen contain atranorin, protocetraric and usnic acid (Odabasoglu et al., 2004). Phytochemical analysis done by Rashmi & Rajkumar (2014) revealed that *F. caperata* also contain tannins, flavonoids, proteins, triterpenes, carbohydrates and steroids. *F. caperata* showed a good inhibition zones (12.6 ± 0.5 mm) against *Fusarium solani* due to the fungicidal metabolites present in the lichen (Shivanna & Garampalli, 2015). Medical therapeutic indicate that the extract of this species is used to treat skin burns and fever (Gupta et al., 2007). Several others plant species obtained in this study and their potential as a therapeutic resource as well as scientific data-based are shown in Table 2.

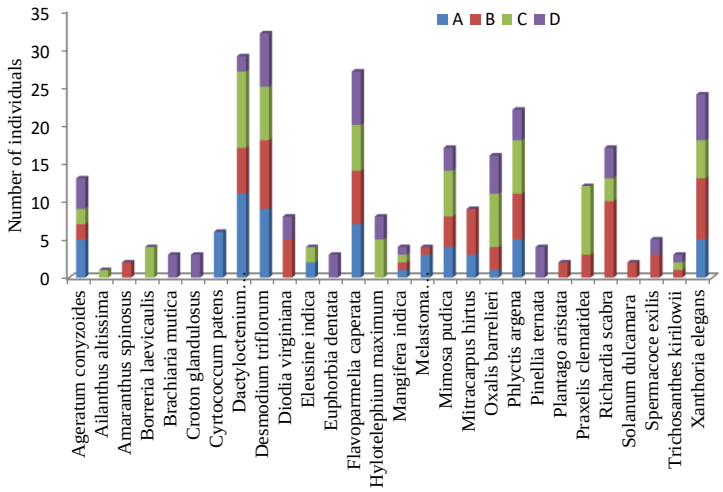

Figure 3. Distribution of plants species in Plot A, B, C and D.

Table 2. Therapeutic indication and scientific data-based of the plant species obtained in this study.

Species Composition	Therapeutic indication and scientific data-based	References
Ageratum conyzoides	i. treatment of scabies, ringworm, ulcers and some other skin diseases	Ogbalu & Williams, 2014
	ii. contain some phytochemical components like saponins, tannin, alkaloids	Cheesebrough, 2000
	iii. showed antibacterial activity against *B. subtilis*, *S. aureus*, *P. aeruginosa* and *E. coli*	Ogbalu & Williams, 2014
Ailanthus altissima	i. anti-inflammatory, antibacterial, antiviral, antioxidant, antidiarrheal, analgesic, antiparasitic	Al-Snafi, 2015
	ii. contain carbohydrates, flavonoids, tannins, cardiac glycosides, phenols, saponins, diterpenes, fats and oils	Bashir et al., 2019
Amaranthus spinosus	i. treatment of bronchitis, leucorrhoea, blood diseases, burning sensation and piles	Kumar et al., 2014
	ii. source of alkaloids, flavonoids, glycosides, phenolic acids, steroids, amino acids, terpenoids, lipids, saponin, betalain, *b*-sitosterol, stigmasterol, linoleic acid, rutin, catechuic tannins and carotenoids	Sable & Saswade, 2017
	iii. antidiabetic, antitumor, analgesic, antimicrobial, anti-inflammatory, spasmolytic, bronchodilator, hepato-protective, spermatogenic, antifertility, antimalarial and antioxidant properties	
	iv. Ethyl acetate extract showed the highest antioxidant activity with 61.47 ± 4.8% inhibition	
	v. Stem and flower of *A. spinosus* showed more antimicrobial activity against *Staphylococcus* sp., *E. coli*, *Pseudomonas* sp., *Klebsiella* sp., *Paracoccus* sp., *Fusarium* sp. and *Aspergillus* sp.	
Borreria laevicaulis	i. contain bioactive compounds such as tannins, terpenoids, alkaloids and flavonoids	Mohammed et al., 2014
	ii. used in the treatment of malaria, diarrhea, digestive problems, skin diseases, fever, haemorrhage, respiratory infections, headache, inflammation of eyes and gums	Taylor, 2013 Conserva and Ferreira, 2012
	iii. showed zone of inhibition against *S. aureus* (22.15 ± 0.07mm) and *C. albicans* (25.6 5± 0.78mm)	
Croton glandulosus	i. treatment of diabetes, external wounds, fever, hypertension, inflammation, malaria, ulcers, pain and digestive problems	Salatino et al., 2007 Fasola et al., 2016
	ii. contain steroids, pentacyclic triterpenoids, alkaloids, tannins and flavonoids	
Eleusine indica	i. Treatment of influenza, hypertension, oliguria and urine retention	Al-Zubairi et al., 2011
	ii. contain metabolites such as flavonoids, phenols and phenolic glycosides, saponins, cyanogenic glycosides, unsaturated lactones and glucosinolates	
	iii. possess antioxidant properties	

**Table 2, continued.*

Species Composition	Therapeutic indication and scientific data-based		References
Mangifera indica	i.	various parts are used as a dentrifrice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, anaemia, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, toothache, leucorrhoea, haemorrhage and piles	Kalita, 2014 Latha et al., 2012 Joona et al., 2013 Parvez, 2016
	ii.	contain polyphenolics, flavonoids and triterpenoids	
	iii.	possess very good source of Vitamin A and flavonoids (*betacarotene, alpha-carotene,* and *betacryptoxanthin*)	
	iv.	has significant antioxidant activity	
Melastoma malabathricum	i.	anti-inflammatory agents	Mazura et al., 2007
	ii.	methanol extracts showed antibacterial activities against *B. subtilis*, *E. coli*, *P. aeruginosa* and *S. aureus*	Diris et al., 2017 Zakaria et al., 2015
Praxelis clematidea	i.	showed antifungal activity against *C. albicans*	Oliveira-Filho et al., 2013
	ii.	contain phenolic and flavonoid	
Spermacoce exilis	i.	treatment of malaria, diarrheal, digestive problems, skin diseases, fever, headache, urinary and respiratory infections	Conserva and Ferreira, 2012
	ii.	contain alkaloids, iridoids, flavonoids and terpenoids	Sukari et al., 2013
	iii.	anti-inflammatory, antitumor, antimicrobial and antioxidant properties	
	iv.	showed antibacterial activity against *B. cereus*, *B. megaterium*, *B. subtilis*, *E. coli*, *S. typhi*, *S. paratyphi*, *S. aureus* and *P. aeruginosa*	
	v.	possess antifungal activity against *A. niger*, *A. ustus*, *A. ochraceus* and *C. albicans*	
Trichosanthes kirilowii	i.	treatment of diabetes	Lo et al., 2017 Xu et al., 2012
Xanthoria elegans	i.	treatment of ulcer and cancer	Turkez et al., 2012
	ii.	antioxidant properties	
	iii.	contain anthraquinone pigments and parietin	

Conclusion

A total of 28 plant species belonging to 18 families were identified in set 1, 2 and 3 with four different plots. The most representative classes were Magnoliopsida with the largest family of Rubiaceae. The most distribution species are *Desmodium triflorum*, *Dactyloctenium aegyptium*, *Flavoparmelia caperata*, *Xanthoria elegans* and *Phlyctis argena*. Most of the plant possesses their potential to treat skin diseases, fever, ulcers, diabetes as well as digestive problems. The findings of this study could be used as a baseline data for assessing the plant species in UiTM area and their potential as a therapeutic resource.

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