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Traditional Knowledge and Botanical Description of Edible Bitter Plants from Besut, Terengganu, Malaysia

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ABSTRACT

Most elders in Malaysia like to consume ulam as side dishes with rice. The bitter taste of ulam attracts people to give good perception in certain plants and use them for alternative medicine or supplement. Most of them are believe; bitter plants have good potential in medicinal aspect and contribute great benefits for human which improve their health condition. However, there were plants in Besut which undiscovered for the scientific name and only known in local names. Botanical description is still lack for the edible bitter plants in Besut which consumed by local people. Thus, field visit by botanists may confirm the appropriate name of the plants. While, interview session and personal communication may reveal traditional knowledge from elders before it could be deteriorated. Selection for respondents was done by method of purposive sampling. A number of 50 respondents were interviewed for traditional knowledge about wild edible bitter plants which commonly used by villagers. Botanical descriptions were documented and herbarium specimens were prepared after plants confirmation in field. The keys and iconographies from experts had been referred and details were most helpful. From our research, we identified 17 species from 15 families of the edible bitter plants as alternative medicine by villagers. The botanical description of 17 species were successfully made as an important source for better reference related to edible bitter plants in Besut. Traditional knowledge of elders had been revealed, where it will be useful for research and development of sustainable natural product of edible bitter plants in future.

Keywords: Perception of elders, bitter plants, purposive sampling, Besut

INTRODUCTION

Grasses, shrubs and trees can be found everywhere and they play important roles in a balanced ecosystem, provides geographical protection to the Earth, maintain for balance respiration gases cycle, provide food and so the continuity of its own life (Harborne, 1977; Colfer, 2008; Saw *et al.,* 2010). Some plants in Besut area were consumed to improve body healthiness especially by elder people. Edible plants were also consumed as medicinal plants where people had been used them for many centuries to obtain improvement in human health and wellbeing (Sujaidi, 2011; Ong, 2013).

The word bitter was used in Malay proverbs with the relationship to some useful bitter plants that found in the villages. However the special of using the word bitter is more to highlight the positive outcomes in giving advices to people. More important, the statement was the fact and indirectly being as a guide for plants utilisation. One of the Malay proverbs said, "as bitter as 'Mambu', its astringent substances still to be useful as a medicine". The 'Mambu' here is referred to the plant species of *Melia indica* and *Millettia sericea*. The bitter taste (in Malay, 'pahit') is actually different to astringent (in Malay, 'kelat'), where astringent results adhesive effect on tongue when it had been tasted (Ainon and Abdullah, 2008). The definition of bitter according to DBP (2015) is a gall-like or the taste of coffee. There was special perception among elders showed by their attention on eating bitter plants as their way in curing certain diseases that traditionally used since ancient time. While, the medicine men and midwives in Besut district play important roles in guiding people to choose plants as alternative medicines for post-partum, minor injuries, broken bones, insect bites, flatulence and any problems related to gastro-intestinal. There were lot of evidences that Malaysian people effectively used plant materials as resources for food, health care, cosmetics and religious purposes (Awang *et al.,* 2016).

Another proverb used by Malay to show how bitter plants became important in Malay society was, "as bitter as a gourd, but still it to be eaten", meaning; even though bitter, it has own benefits and may consumed by people. In reality, the plants that mentioned in both proverbs are important in traditional medicines as the 'Mambu' (*Melia indica*) used in treating fever and malaria (Hasan, 1997). While, the 'Sekebah' (*Millettia sericea*) had been used in treating fever, post-partum blues, tooth-ache and urination problem. The bitter gourd vegetable (*Momordica charantia*) had been used widely in treating diabetes, asthma and arthritis (Norhayati *et al.,* 1999; Ismail, 2000; Sujaidi, 2011).

Vegetables with soft and succulent such as stem, leaves, flowers, fruit, rhizome and vegetative buds were eaten with staple food such as rice in Malaysian culture and to improve food appetite (Ismail, 2000). People in Besut were consumed edible plants such as *Anacardium occidentale, Syzygium polyanthum, Leucas zeylanica, Crateva religiosa, Oroxylum indicum* and *Musa balbisiana* as healthy foods in order to obtain the medicinal effects for treating diseases such as diabetes, hypertension, constipation, less food appetite, arthritis and diarrhea (Awang *et al*., 2016). Eating fresh vegetables which called *ulam* is also one of the familiar ways in traditional methods for a healthier life. The consumption of fresh vegetables is not only as a flavourful side dish but more important is the practices were related to the history in folk medicinal uses either to prevent or to cure certain ailments (Reihani and Azhar, 2012). Some plants which consumed for the purpose of improving body healthiness by elder people are still not described in scientific name. Hence, confuse may occur for people to identify bitter plants used by elders because of the unavailability of standard description of the local plants.

This study was conducted to investigate and identify edible bitter plants mainly used in Besut and to preserve traditional knowledge of elders in effort to prevent loss. The result from this research may guide people to give correct scientific name for the selected species of edible bitter plants found in Besut, where plant sources are rich in nature and relevant to be used as alternative medicines and supplements.

MATERIALS AND METHODS

Sampling and interview sessions

The procedures of non-random probability sampling and method of purposive sampling had been followed and applied in this research. Sample size is not needed to be determined in this sampling method (Chua, 2014). Research works had been conducted in January to July 2017. To carry on this research, the areas of Kuala Besut, Jerteh and Kampung Raja were visited for looking the elders with the age of 50 to 80 years old. We selected 50 respondents who willingly to share their knowledge related to edible bitter plants. Selection of the sites was made by justify the factors of; Kuala Besut area may represented by people who live near sea at in the North and possibly will use different plants compare to Jerteh area which not located near the sea and Kampung Raja area was in the middle of sea area in the East and paddy area in West side.

Data collection

Field visit had been done in 14 villages in Besut district (**Table 1**) after consider for well cooperated respondents who willing to share their knowledge and highly interest to show the plants in the original habitat. We also justify preferences of local people for the edible bitter plants that they experienced use to treat certain ailments and they used as supplement. In this research we only focused on the basic uses of the edible bitter plants in aspect of general purposes. The respondents are qualified to take part in purposive sampling as they more reasonably expected to represent correct knowledge (Palys, 2008). Steps in purposive sampling were referred to Tongco (2007). We firstly decided on the research problem and were determine the type of information needed. Then, respondents were selected based on defined qualities before conducting field visit.

Table 1. Location of sampling and respondent number.

Division	Village	Coordinate[a]	Number of Respondent
Jerteh	Kampung Gerai	5.704397 °N, 102.537870 °E	3
	Kampung Dengir Dalam	5.759935 °N, 102.488270 °E	3
	Kampung Pusu Tinggi	5.778636 °N, 102.491630 °E	3
Besut	Kampung Gong Bayor	5.762852 °N, 102.560460 °E	2
	Kampung Alor Lintang	5.763166 °N, 102.560819 °E	3
	Kampung Gong Badang	5.763174 °N, 102.560460 °E	3
Kuala Besut	Kampung Gong Manok	5.794755 °N, 102.495210 °E	4
	Kampung Lampu	5.796148 °N, 102.513133 °E	4
	Kampung Beris Pak Abu	5.797737 °N, 102.514208 °E	5
	Kampung Gong Nering	5.797745 °N, 102.515850 °E	5
	Kampung Cawat	5.810886 °N, 102.546475 °E	4
	Kampung Tok Saboh	5.814028 °N, 102.510056 °E	3
	Kampung Alor Teratai	5.817298 °N, 102.548268 °E	3
	Kampung Baharu	5.819472 °N, 102.529480 °E	5

Notes: [a]Coordinate were referred to Google Maps during sampling.

Plants observation and herbarium preparation

Plants from the research area were collected and studied; then specimens sent to Universiti Sultan Zainal Abidin (UniSZA) Herbarium for experts' confirmation. Common names, family and scientific name of plants were recorded. Tools that most important in this research were the field guides and keys. The field guides had been referred to reveal the identity of the selected plants, by firstly to have clear physical descriptions for the unfamiliar edible bitter plants. Keys applied for the identification of plants to match with the correct scientific names (Imes, 1990).

Comparison made between specimens and keys; then the description for the selected edible bitter plants in Besut had been created as part of documentation. The entire plants or its certain organ had been observed by a magnifier and a stereoscopic microscope to observe the botanical identification. Series procedures of specimen preparation were followed to provide label system and to deposit the preserved specimen into the herbarium (Tomovic *et al.,* 2002).

RESULTS AND DISCUSSION

Herbarium

The specimens were preserved and attached with the herbarium label. After the procedures, the specimens were organized in families and genera, arranged in alphabetically before deposited in UniSZA Herbarium. The ambient conditions of the storage was maintained at always 18°C, in low air humidity and periodically treated with naphthalene for protection from pest (Tomovic *et al.,* 2002). The voucher number of the specimens listed in **Table 2**.

Table 2. Voucher number of the specimens in UniSZA Herbarium.

References	Family	Specimen	Voucher Number
1	Anacardiaceae	*Anacardium occidentale* Linn.[a, b]	00376
2	Arecaceae	*Nypa fruticans* Wurmb.[b]	00375
3	Asteraceae	*Vernonia amygdalina* Del.[a, c]	00377
4	Bignoniaceae	*Oroxylum indicum* Vent.[a, b]	00379
5	Capparaceae	*Crateva religiosa* G. Forst[a, b, c]	00380
6	Cleomaceae	*Cleome gynandra* Linn.[d]	00400
7	Lamiaceae	*Leucas zeylanica* R. Br.[d]	00401
8	Musaceae	*Musa balbisiana* Colla[1]	00378
9	Myrtaceae	*Rhodomyrtus tomentosa* Wight[a, c]	00382
10	Myrtaceae	*Syzygium polyanthum* Wight[a]	00381
11	Pteridaceae	*Acrostichum aureum* Linn.[a]	00390
12	Rhamnaceae	*Zizyphus mauritiana* Lam.[a, b]	00383
13	Rubiaceae	*Morinda citrifolia* Linn.[a, b]	00385
14	Rubiaceae	*Morinda elliptica* (Hook.f.) Ridl.[a,] b	00384
15	Rutaceae	*Clausena excavata* Burm. f.[a, c]	00386
16	Sapindaceae	*Lepisanthes rubiginosa* Roxb.[a, b]	00387
17	Verbenaceae	*Vitex pubescens* Vahl.[a]	00388

Notes: [a]Leaf , [b]Fruit, [c]Flower, [d]Whole plant.

Uses of edible bitter plants

From the information obtained from the selected 50 respondents; we found that edible bitter plants in Besut were not only consumed as food but also in their perception, taken as a supplement and as alternative medicines in treating certain diseases. The uses of the plants may vary but commonly taken orally (**Table 3)**. There were 22 common ailments treated by consuming bitter plants in many ways. While in five other conditions, they use edible bitter plants for supplement such as for increasing food appetite, anti-aging, post-partum, menstrual tonic and women contraceptive. The highest consumption in edible bitter plants is for diabetes and helminthic infection treatments. Diabetes and helminthic infection were two common ailments that had been treated by consuming edible bitter plants in Besut. There were seven species comprised of; *Cleome gynandra* (Maman), *Crateva religiosa* (Dala), *Lepisanthes rubiginosa* (Terajan), *Morinda citrifolia* (Mengkudu Besar), *Morinda elliptica* (Mengkudu Kecil), *Oroxylum indicum* (Beka) and *Vernonia amygdalina* (Pokok Pahit) had been used for diabetes treatment. Seven species were also used for anthelminthic, such as; *Acrostichum aureum* (Paku Piai), *Anacardium occidentale* (Ketereh), *Clausena excavata* (Semeru), *Leucas zeylanica* (Ketumbit), *Nypa fruticans* (Nipah), *Oroxylum indicum* (Beka) and *Vernonia amygdalina* (Pokok Pahit).

Table 3. Traditional knowledge and list of edible bitter plants consumed by elders in Besut district.

Family	Botanical Name	English / Local Name	Uses	Edible Part of Plants	Method of Uses
Anacardiaceae[b]	*Anacardium occidentale* Linn.[f]	Cashew-tree / Ketereh	Anthelmintic, gout, sex debility, shingles, toothache	Young leaf, ripe fruit, seed	Young leaf taken as salad eaten together with rice; mashed and apply on shingles; ripe fruit eaten fresh or cooked with coconut and fish as vegetable; resin from toasted seed apply for toothache
Arecaceae[a]	*Nypa fruticans* Wurmb.[g]	Nipah palm / Nipah	Anthelminthic, diarrhoea, hypertension	Young fruit husk, sap / nectar juice	Tea made from dried young fruit husk, nectar juice from inflorescence taken as drink / tonic
Asteraceae[b]	*Vernonia amygdalina* Del.[e]	Bitter leaf / Pokok pahit, Pokok bismillah	Anthelminthic, cough, fever, post-partum	Young leaf	Boiled young leaf and taken three times daily as tonic
Bignoniaceae[b]	*Oroxylum indicum* Vent.[f]	Midnight horror / Beka	Diabetes, rheumatism, haemorrhoid	Young leaf, young pod	Fresh or blanched young leaf taken as vegetable; blanched young pod were mixed with fish and coconut, made salad (kerabu)
Capparaceae[b]	*Crateva religiosa* G. Forst[f]	Spider tree, Ghost pangium / Dala	Diabetes, food appetizer, hypertension	Young leaf, flower	Pickle form (in salt water and little bit cooked rice), taken with rice as salad
Cleomaceae[b]	*Cleome gynandra* Linn.[d]	Spider flower / Maman	Diabetes, hypertension, skin problem, stomach ache, itchiness	Leaf, stem, flower, pod	All edible part prepared as pickle (in salt water and little bit cooked rice), taken with rice as salad; for itchiness by apply crushed leaf on skin
Lamiaceae[b]	*Leucas zeylanica* R. Br.[d]	Ceylon slitwort / Ketumbit	Anthelmintic, constipation, flatulence	Young leaf, flower	Young leaf and flower taken as salad for adults; for flatulence in baby, by apply leaf paste on the stomach
Musaceae[a]	*Musa balbisiana* Colla[d]	Wild banana / Pisang benggala	Anti-aging, diabetes, fever, food appetizer, post-partum, splenomegaly, ulcer	Inflorescence, young fruit	Blanched inflorescence taken as vegetable; young fruit cooked as dish and eaten with rice; sap from banana stem apply for ulcer in mouth
Myrtaceae[b]	*Rhodomyrtus tomentosa* Wight[e]	Rose myrtle / Kemunting	Diabetes, haemorrhoid, hypertension, post-partum	Young leaf, young and ripe fruit	Young leaf cut into small pieces and eaten as salad, boiled young and ripe fruit taken as tonic
Myrtaceae[b]	*Syzygium polyanthum* Wight[f]	Indian bayleaf / Serai kayu	Diarrhoea, fever, rheumatism, pimples	Young leaf	Young leaf eaten as salad, boiled leaf water made tonic, crushed young leaf apply on skin for pimple
Pteridaceae[c]	*Acrostichum aureum* Linn.[e]	Golden feather fern / Piai	Anthelmintic, gout, shingles, toothache, ulcer	Young frond	Blanched young frond taken as salad; mixed with fish and coconut, made salad (kerabu), taken with rice; boiled frond water used as wash for shingles and ulcer
Rhamnaceae[b]	*Zizyphus mauritiana* Lam.[f]	Indian jujube / Bidara	Anthelmintic, diabetes, food appetizer, hypertension	Leaf, young and ripe fruit	Crushed fresh leaf in water made drinks; young and ripe fruit eaten fresh
Rubiaceae[b]	*Morinda citrifolia* Linn.[f]	Great morinda / Mengkudu besar	Diarrhoea, headache, hypertension, parturition blues	Young leaf	Blanched young leaf taken as salad; also mixed with fish and coconut, made salad (kerabu) and taken with rice
Rubiaceae[b]	*Morinda elliptica* (Hook.f.) Ridl.[f]	Black morinda / Mengkudu kecil	Anti-aging, bleeding, women contraceptive, salad /tonic for women on menstrual	Young leaf	Blanched young leaf taken as salad; also mixed with fish and coconut, made salad (kerabu), taken with rice
Rutaceae[b]	*Clausena excavata* Burm. f.[e]	Pink-lime berry / Semeru, Cemumar	Anthelmintic, diabetes, hypertension	Young and mature leaf	Blanched young and mature leaf taken as salad with rice
Sapindaceae[b]	*Lepisanthes rubiginosa* Roxb.[f]	Rusty sapindus / Terajan, Mertajam	Fever, flatulence, muscle pain, parturition blues	Young leaf, ripe fruit	Crushed young leaf applied on muscle pain; ripe fruit eaten for fever, flatulence and parturition blues
Verbenaceae[b]	*Vitex pubescens* Vahl.[f]	Malayan teak, Chaste tree / Halban, Leban	Anti-aging, digestion problem, fever, gingivitis, menstrual tonic	Young leaf	Young leaf eaten as salad, boiled leaf water made gargle for gingivitis

Notes: [a]Monocotyledons, [b]Dicotyledons, [c]Fern, [d]Herb, [e]Shrub, [f]Tree, [g]Palm

The consumption of the bitter plants were widely occurred and well accepted before the modern medicines had been introduced (Arif, 2006). The traditional knowledge is still being practiced in daily life by Besut people however it is possible to be deteriorated if no step of preservation taken. The purposive sampling method that had been applied for this research is necessary to collect information of the wild plants throughout interviews. The respondents who represented by people in the age range of 50 to 80 years old, male and female were helpful as they have empirical knowledge in research topic (Tardio *et al.,* 2005). Purposive sampling technique, also called judgement sampling, was the deliberate choice of an informant due to the qualities the informant possesses. It is a non-random technique that does not need underlying theories or a set number of informants. This method enabled researcher to decide what needs to be known and set out to find people who can and are willing to provide the information by virtue of knowledge or experience (Tongco, 2007).

Botanical descriptions

Keys and iconographies of the families and species by Elpel (2013) and Samy *et al.* (2014) were referred for general description of all accessions. Identification for angiosperms was mostly referred to Pandey (1969), Cronquist (1981), Hsuan Keng (1983), Corner (1988) and Bhattacharyya (2009). Description of banana species was referred to Joe *et al.* (2014). Holttum (1977) and Whitmore (1979) were the important sources for palms. Identification for native fern was based on the details by Piggott (1988), Smith *et al.* (2008), Dong *et al.* (2013) and Noraini *et al.,* (2013). There were 15 families comprised of 17 species had been confirmed and the compilation of botanical description prepared in alphabetically order of its family respectively as follows;

(1) Anacardiaceae

Habit: Trees contain caustic resin which usually turns black on expose. Leaf: Alternate, opposite, simple or compound and exstipulate. Flower: Small, green white or pink, often unisexual, in panicles. Sepals and petals are often five (or 3 to 7) each. The disc are annular; stamens from base of disc, often twice the number of the petals, some sterile. Gynoecium may one to three (or five), carpellate; ovary with one to three-loculate, each with one ovule, usually only one fertile; styles one to three. Fruits are often drupaceous and endosperm is absent. The simple alternate leaves of *Anacardium* often spirally arranged. The calyx are usually persistent, four to five with lobed. Petals are deciduous and fruit seated at the end of the flowering stalk and kidney shape.

Anacardium occidentale Linn. (English: Cashew-tree, Malay: Ketereh, Gajus) (**Fig. 1-A**)

It is a low sprawling evergreen tree, up to 12 m high, with heavy crown of green, upright; brown bark, rugged with exuding gum. The leaf-blade 7 cm to 18 cm × 4.5 cm to 19 cm, obovate, entire, often widely at the apex; side-veins 10 to 18 pairs; stalk 1.3 cm to 2 cm long, flattened on the upper side. Flowers are 1.3 cm wide, in terminal panicles up to 23 cm long, five petals and greenish white to rose-pink with red stripes. Stamens are 20 cm to 25 cm, one longer than others. The fruits are kidney-shaped with nut 3.2 cm long, greyish brown with a hard shell enclosing one seed and seated at the end of the pear-shaped; fleshy cushion (stalk) about 7 cm long and wide, yellow or red.

(2) Arecaceae/Palmae

Habit: Trees or shrubs without bark and cambium. Leaf: Rigid pinnate or palmate and petioles sheathing below, bearing a number of small leaf; which remains very short and produces a succession of rather large leaves that grow upright. Flowers are mostly regular, small, usually in large panicles. Perianth segments are three, coriaceous and fleshy; stamens mostly six. Ovaries are usually three-loculate, with one ovule in each. Fruits are ovoid, drupe or nut. Endosperms are copious, with small embryo. The cotyledons are enlarging greatly at germination stage.

Nypa fruticans Wurmb. (English: Nipa Palm; Malay: Nipah) (**Fig. 1-B**)

It is stiffly erect palms, without aerial stems or if present it may very short; live in salt-water swamps. The height of leaves are up to 6 m tall, once pinnate with two ranks of 1 m long. Lanceolate leaflets, pointing upwards and slightly forward, borne on the upper surface of the round section rachis, leaf bases stout overlapping, similar to the rhizome, light and spongy. Leaf-sheath neither leathery nor tubular, stems tufted, with underground rhizome, often fibrous. Inflorescence is sub-terminal and erect; stalk 1 m, stout with big long sheathing spathes and a few major ascending spathed, orange branches, tipped olive green. Male flowers are cream, with the part not overlapping, three straps shaped 3 mm sepals, tips inflexed, petal smaller, three stamens on a central column protruding from perianth. Female flowers have six tiny 3 mm tepals and 4 mm woody angular carpels. Large spherical head of fruits come from the horizontal trunk. Fruits are in globose heads; big angular nuts, narrowing to the beak; tipped by the persistent woody stigma 8 cm long, fibrous with a woody stone and one seed which penetrated on one side by its wall.

(3) Asteraceae/Compositae

Habit: Perennial herbs or shrubs and may contain milky sap. Leaf: Alternate or opposite; simple or dissected and exstipulate. Flower: Small, bisexual or unisexual in an involucrate head (or capitulum). Calyx reduced or transformed and replaced by pappus. The corollas are tubular, ligulate or bilabiate. Stamens are five, epipetalous; anthers introrsely, one loculate, one ovulate; style simple, two-branched. The fruits may present as an achene or a cypsela and seeds are exalbuminous.

Vernonia amygdalina Del. (English: Bitter Leaf, Iron-weed; Malay: Pokok Pahit, Pokok Bismillah) (**Fig. 1-C**)

The trees are small but the height may reach 10 m tall, erect stem, light grey or brown bark, fissured and brittle branches. Lanceolate leaves; oblong up to 28 cm long, but usually 10 cm to 15 cm × 4 cm to 5 cm, medium to dark green, with or without sparse hairs above, with fine, soft, pale hairs below. Conspicuous red-veining; apex and base tapering, base always almost symmetric, margin entire or very finely toothed. Petiole usually very short but may be 1 cm to 2 cm long.Inflorescences are racemose, capitula arranged in panicled corymbs or simple corymbs. Homogamous flowers, all tubular, hermaphrodites, actinomorphic. Bracts, many seriate, involucre of bracts present, receptacle slightly hairy or naked. Flower heads-thistle like, small, creamy white, 10 mm long, grouped in dense heads, axillary and terminal, forming large flat clusters, 1 cm in diameter, sweetly scented. Calyx represented by pappus, superior and valvate aestivation.

(4) Bignoniaceae

Habit: Trees or shrubs, some have scandent. Leaf: Opposite, compound pinnate and exstipulate. Flower: Showy, bisexual, pentamerous, irregular, racemose or paniculate. Calyx campanulate or tubular, or split down one side and spathe-like. Corolla tubular, often gibbous in front. Stamens usually four (or two), in two (or one) pairs, or the fifth stamens usually represented by a staminode. Ovary two-loculate with one or two placentas in each locule, or one-loculate with two-valved capsule with flattened and winged seeds or rarely indehiscent with wingless seeds embedded in pulp. Fruit: Septicidally capsular, the septum thus parallel to the valves; including *Bignonia* and *Oroxylum* species.

Oroxylum indicum Vent. (English: The Midnight Horror; Malay: Beka, Beka Kampung, Kulai) (**Fig. 1-D**)

Partly deciduous, tree up to 18 m high, sparingly branched. Grey bark, fissured, glabrous. Twigs pale grey, big scars, simply from lenticels. Leaves 1 m to 2 m long, very large, spreading, the main stalk and side-stalks arched, swollen and jointed at the attachment of the side-stalks. Leaflets 6.3 cm to 12 cm × 4.5 cm to 8 cm, elliptic, shortly tipped, stalked, thin, with wavy edge, light green and dark along the veins, the base narrowed or heart shaped, generally asymmetric. Flowers have a foxy stink, inflorescence up to 0.6 m to 1.8 m long flowering in the upper part, fruiting below. Calyx 2.5 cm to 3.8 cm long corolla 10 cm long 12 cm wide, fleshy, lurid reddish purple to liver brown outside greenish white and yellow on the inside and wrinkled lobes. Pods 50 cm × 7 cm curved at the base, with a fine ridge on each side 7.5 cm × 3.8 cm.

A **B** **C** **D**

Fig. 1. (**A**) *Anacardium occidentale* Linn. (Ketereh, Gajus, Janggus); (**B**) *Nypa fruticans* Wurmb. (Nipah); (**C**) *Vernonia amygdalina* Del. (Pokok Pahit, Pokok Bismillah); (**D**) *Oroxylum indicum* Vent. (Beka, Beka kampung, Kulai).

(5) Capparaceae

Habit: Shrubs or small trees. Leaf: Alternate, simple or digitately compound; stipules when present minutes or spiny. Flower: Regular or slightly irregular. Sepals and petals are often four. Stamens are four, six or many. The ovary typically with one-loculate and gynophore maybe long or short. Fruit: Berry or capsule, seeds without endosperm.

Crateva religiosa G. Forst (English: Spider Tree, Ghost Pangium Tree; Malay: Dala, Dangla, Dalur) (**Fig. 2-A**)

Trees, up to 9 m in height; greyish, stout trunk, un-armed. Leaflets 5 cm to 12 cm wide, rather broad, thin, nearly or quite sessile, with only 7 to 10 pairs of side-veins. Large flowers more than 5 cm wide; inflorescences 10 cm to 30.5 cm long, 25 cm wide and very showy; petals 3.2 cm long, stamens 10 to 16 and ovary-stalk 5 cm to 7.5 cm long. Fruits 6 m × 5 cm greyish white then brownish, seeds 1.3 cm wide, light brown, closely roughened on the outer margin.

(6) Cleomaceae

Habit: Herbs or shrubs. Leaf: Alternate, simple or digitately compound; stipules when present minutes or spiny. Flower: Regular or slightly irregular. Sepals and petals are often four. Stamens are four, six or many. The ovary is typically with one-loculate and gynophore maybe long or short. Fruit: Oblong or linear capsule, seeds without endo-sperm and small.

Cleome gynandra Linn. (English: Spider Flower; Malay: Maman, Maman Pasir) (**Fig. 2-B**)

Erect stem, cylindrical, branched, glandular pubescens, solid, 60 cm to 80 cm high. Palmate leaf, compound, alternate; petiole 5 cm to 10 cm long, pentafoliate, leaflets sessile, unequal obovate, entire or finely serrate margin, leaflet's venation unicostate reticulate. Inflorescence; racemose, terminal corymb. Flowers small, pedicellate, hermaphrodite, actinomorphic, complete bracteate (foliaceous and trifoliate. Calyx; four sepals arranged in two whorls of two each, corolla four petals and long clawed. Androecium: Six stamens. Gynoecium: Two carpels (bicarpellary), syncarpous, superior ovary, stalked or being situated on an elongated gynophore. Fruits are cylindrical, dry, dehiscent and capsule 3 cm to 11 cm long × 3 mm wide.

(7) Labiatae/Lamiaceae

Habit: Mostly herbs, some are subshrubs, often aromatic; stems and branches four-angled. Leaf: Opposite and decussate, exstipulate. Flower: Bisexual, zygomorphic, pentamerous; inflorescence mostly fascicled and axillary, often the opposite pairs form false whorls. Calyx typically five-toothed, some are two-lipped. Corollas are five-lobed and two-lipped. Stamens are two or four and epipetalous. Gynoecium two-carpellate; ovary two-loculate, each with two ovules (becoming four-loculate, each one-ovulate by intrusion of ovary wall). Styles are filiform, always gynobasic and arising from the lobes of the ovary. Fruit: Usually of four nutlets and the endosperm is scanty or absent.

Leucas zeylanica R. Br. (English: Ceylon Slitwort; Malay: Ketumbit, Ketumbak) (**Fig. 2-C**)

The herb has soft stem but woody at lower part; branches; slender, 30 cm to 60 cm height. Leaves are not finely dissected into narrow segments; ellipse-linear, calyx five-toothed; dentate margin. Length 3 cm to 7.5 cm, width 0.80 cm to 1.3 cm. Petiole is short and light green. Flowers are mostly terminal and in dense axillary. Clusters often capitate; white corollas appear from the cluster head; two to four young leaves protruding from around the stalk. Upper lips of corolla are pubescens. Calyx are six to ten, toothed; upper lip of the corolla densely woolly. Nutlets dry, many seeds, black and tiny.

(8) Myrtaceae

Habit: Trees or shrubs. Leaf: Usually opposite, glandular-punctate, exstipulate. Flower: Regular, mostly bisexual. Sepals and petals four to five each. Stamens are indefinite; filaments long and slender, sometimes in bundles. Ovary is inferior, one or many-loculate; ovules two or many in each locule; one style. Fruit: Berry drupe or capsule and seed without endosperm.

Rhodomyrtus tomentosa Wight. (English: Rose Myrtle; Malay: Kemunting) (**Fig. 2-D**)

Bushy shrubs grow up to 3 m high. Young parts thin, whitish woolly. Leaf blade 2.5 cm to 10 cm × 1.3 cm to 3.2 cm oblong, blunt or slightly pointed, the underside thinly white and woolly. Stalks are 1.3 cm to 5 cm long. Flowers 3.2 cm to 3.8 cm wide on long stalks 1.3 cm to 2.5 cm long with a pair of bracts at the base of each flower not fragrant; petals magenta-pink fading white; stamens pink with yellow anthers. Berry 1.3 cm long, oblong, crowned with the blunt sepals, thinly woolly, green turn purplish and the seeds are in purplish pulp.

Syzygium polyanthum Wight (Walp.) (English: Indian Bayleaf; Malay: Serai Kayu) (**Fig. 3-A**)

Shrubs or trees, erect, brown or reddish stem with many branches. Leaves are opposite, ellipse lanceolate, 3-veined, acuminate tip and acute base; 7 cm to 12 cm long, 2.5 cm to 5 cm wide; 7 to 10 pairs of well-spaced side-veins. Green young leaves changed to dark green when matured. Stalks are 6 mm to 12 mm long. Leaves produce aroma or scents when rubbed. Clusters of inflorescence occur from the twig; white flowers 8 mm to 10 mm wide; white calyx; turned red when matured. Fruits are globose, 9 mm to 10 mm in diameter ripe fruits are dark red.

(9) Rhamnaceae

Habit: Shrubs, erect and some are small trees and spiny stem. Leaf: Simple, alternate or rarely opposite and stipulate. Flower: Small, in axillary cymes, green or yellow colour; calyx is four to five lobes. Petals are four to five in number. Stamens four to five, in a single whorl opposite the petals called antepetalous. Disc is present; where the ovary is superior and inferior, three (rarely, two to four) and loculate, free or immersed in a disc. The ovule is one in each locule, basal and erect; style simple. Fruit: Drupe, capsule or samara. Endosperm is little or none.

Zizyphus mauritiana Lam. (English: Indian Jujube; Malay: Bidara) (**Fig. 3-B**)

The trunk is thorny, brownish grey, deeply fissured, thick and stocky. Twigs are dangling, hairy, with thorns singly or in pairs at the leaf-bases. Leaves are 2.54 cm to 6.35 cm × 1.3 cm to 4.5 cm, elliptic, finely toothed, generally more or less asymmetric at the base, blunt dark green, the underside hoary or finely velvety, pale white to brownish or pale orange- brown. Young leaves hoary whitish. Stalk, 0.6 cm to 1.3 cm long. Flowers 0.6 cm wide, in clusters 1.3 cm to 2.5 cm wide, hairy, green, the tiny petals white, faintly fragrant. Fruit size 0.6 cm to 3.2 cm wide, round or oblong, green, ripening turns yellow, orange or brownish, often apple-shaped and tasting like a sour-sweet apple.

A **B** **C** **D**

Fig. 2. (**A**) *Crateva religiosa* Vahl. (Dala, Dangla); (**B**) *Cleome gynandra* Linn. (Maman, Maman Pasir); (**C**) *Leucas zeylanica* R. Br. (Ketumbit, Ketumbak); (**D**) *Rhodomyrtus tomentosa* Wight. (Kemunting).

(10) Rubiaceae

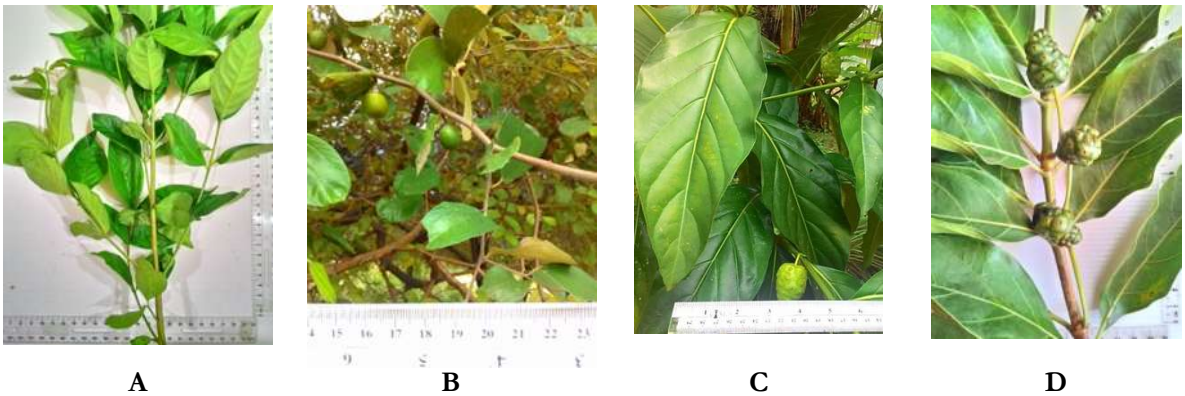
Habit: Shrubs or trees. Leaf: Opposite; entire; interpetiolar stipules mostly conspicuous. Flower: Usually bisexual, regular, four to five-merous, often in simple or compound cymes. Calyx-tube adnate to ovary. Corolla-tubes are short or long, the limb four to five, lobed. Stamens are as many as corolla lobes and alternate with them. Ovary is inferior, usually two loculate, each with one to numerous ovules on axile or seemingly basal placentation; one style. Fruit: Capsular, baccate or drupaceous. Embryo is large, in rich endosperm.

Morinda citrifolia Linn. (English: Great Morinda; Malay: Mengkudu Besar) (**Fig. 3-C**)

The height of the tree may reach 7.6 m and the shape is like a conical crown. Bark colour is pale grey or brown, shallowly fissured; glabrous. The leaf is broad, citrus-like, blade up to 30 cm × 16.5 cm broadly elliptic, with large stipules. Flowers are scarcely fragrant, heads 1.3 cm to 2 cm wide (excluding the corolla-tubes). Stalks solitary about 0.6 cm to 2.5 cm long; corolla-tube 7 cm to 13 cm long. Large fruits 5 cm to 8 cm × 3.8 cm to 5 cm, ripening greyish white with a very rank and rancid smell.

Morinda elliptica Ridl. (English: Black Morinda; Malay: Mengkudu Kecil) (**Fig. 3-D**)

Trees up to 18 m high, generally less than 12 m, flowering even as a bush. Dense crown forms a conical shape, straggling when old. Bark greyish brown, deeply and narrowly ridged or fissured. Narrow leaf, blade up to 18 cm × 6.5 cm narrowly elliptic with the sides up curled. Stipules are small. Fragrant flower, heads 7.5 cm to 10 cm wide excluding the corolla tubes, often 2 to 3 together, on stalks 2.5 cm to 5 cm long. Small fruits, 25 mm × 8 mm, ripening black, rather limply, slightly foetid, small rather dry.



A **B** **C** **D**

Fig. 3. (**A**) *Syzygium polyanthum* Linn. (Serai Kayu); (**B**) *Zizyphus mauritiana* Lamk.. (Bidara); (**C**) *Morinda citrifolia* (Mengkudu Kecil); (**D**) *Morinda elliptica* Ridl. ((Mengkudu Kecil).

(11) Rutaceae

Habit: Trees or shrubs. Leaf: Opposite or alternate, often presence of translucent pellucid compound. Flower: Strongly aromatic, usually bisexual and regular. Sepals and petals four to five each, imbricate. Stamens are as many or twice as many as the petals. Disc is present. Carpels usually 4 to 5, free or connate with 2 to many ovules in each; styles are free or connate. Fruit: Berry, capsule or schizocarp, strongly aromatic. Seed with or without endospermous.

Clausena excavata Burm. f. (English: Pink-lime Berry; Malay: Semeru, Cemumar, Cecamak) (**Fig. 4-A**)

Laxly branched and spreading, the branched ending in tassels of long, slender leaves. Bark pale grey, smooth. Twigs and leaf-stalks finely hairy, giving a nauseous smell of resin, lime and ivy. Leaves 20 cm to 60 cm long; leaflets 2.5 cm to 11.5 cm × 2 cm to 3.8 cm, 7 to 20 pairs, and dull green, thin, glabrous and tapered from the asymmetric base, the edge slightly wavy or faintly notched. Flowers greenish white with yellow anthers, in elongate, green panicles 10 cm. Fruits are round. The panicles are green then change to white or translucent pink, pulpy, gland-dotted with a smell of sour, resinous oranges when crushed; containing one to two green seeds.

(12) Sapindaceae

Habit: Trees or shrubs, some are climbing vines. Leaf: Alternate, compound. Flower: Small, often unisexual, some are zygomorphic. Sepals four to five and imbricate. Petals are four to five, or absent, often unequal. Disc is often unilateral. Stamens are usually eight (or five to ten). Ovary is entire or lobed, often three-loculate; usually one-style; ovules one to two in each locule. Fruit: Drupaceous or capsular. Seeds with or without arillate; commonly without endosperm and the embryo is curved.

Lepisanthes rubiginosa Roxb. Synonym: *Erioglossum rubiginosum* (English: Rusty Sapindus; Malay: Terajan, Mertajam) (**Fig. 4-B**)

Shrubs or medium-sized trees; compact bushy crown. Bark rusty brown, dingy and flaky; twigs reddish brown, faintly grooved when young. Light green, dropping leaflets; all parts softly hairy, the buds and young shoots bronze silky. Blunt, thin, with 10 to 15 pairs of side-veins, stalk and flushed reddish brown on the upper side and at the swollen base with a faint groove on each side of the base. Leaves 15 cm to 50 cm long; leaflets 7.5 cm to 19 cm × 3.2 cm to 5.7 cm, 4 to 6 pairs, rather large, shortly stalked, narrowly elliptic. Flowers wide, very fragrant (honey sweet), never opening fully, in small groups arranged in upright panicles 12 cm to 30 cm long, the crowded shrubby flower-stalk persisting; petals are white. Fruits 0.6 cm to 1.3 cm long, finely hairy, ripening

yellow, then orange, dull red, purple and finally nearly black, with thin, juicy, sweetish and slightly astringent pulp without rind.

(13) Verbenaceae

Habit: Herbs, shrubs or trees. Leaf: Opposite, simple or compound and exstipulate. Flower: Bisexual, irregular and pentamerous, usually in umbellate or paniculate cymes, mostly bracteates. Calyx is typically five-toothed. Corollas are unequally five-lobed, sometimes two-lipped. Stamens are usually four, rarely five or two. Ovary is mostly two-loculate, with two ovules in each locule; or one in each locule after septation; style one, terminal. Fruit: Drupaceous (with two to four pyrenes) or capsular. Seeds usually present without endosperm.

Vitex pubescens Vahl. (English: Malayan Teak, Chaste Tree; Malay: Halban, Leban) (**Fig. 4-C**)

Trees may up to 24 m in height, green crown, with the limbs arching out and with many small branches standing stiffly up. Barks are pale yellowish-grey or ashen, fissured and flaky in long thin pieces, the inner bark light yellow, turning green on exposure to the air. Leaves are beneath green, trifoliate or palmate. Twigs and underside of the leaves hairy, leaflets 3 to 5, sessile. The outer two are often smaller. Middle leaflet 7.5 cm to 28 cm × 3.2 cm to 10 cm elliptic, long-tipped, rather dull, shabby green, with 13 to 20 pairs of side-veins; leaf-stalk 2.5 cm to 10 cm long. Flowers are 1.5 cm long, in large, conical or flattened, terminal panicles 7.5 cm to 25 cm long, corolla violet blue, the upper lobes bluish white. Fruit 8 mm wide, green, turns dull purple and finally black; surrounded by the calyx 8 mm wide.

A **B** **C** **D**

Fig. 4 (**A**) *Clausena excavata* Burm. (Semeru, Cemumar); (**B**) *Lepisanthes rubiginosa* Roxb. (Terajan, Mertajam); (**C**) *Vitex pubescens* Vahl. (Halban, Leban); (**D**) *Musa balbisiana* Colla (Pisang Benggala).

(14) Musaceae

Habit: Tall robust herbs, with false stems may reach to 4 m in height. Leaf: Simple, large up to more than 2 m; entire, glabrous, apex obtuse, strong midrib and parallel venation, long and thick petiole, exstipulate, appearance like pinnately divided leaf. Leaves and bracts spirally arranged. Flowers: Tubular, bisexual or unisexual (often unisexual by abortion), zygomorphic, sessile or pedicellate in the axial of bracts and aggregated into spicate or compound cymose (often very large) inflorescences, subtended by spathes. Perianth segments three plus three, petaloid, split on one side. Stamens five and staminode one. Ovary inferior, three-loculate, with many ovules in each locule. Fruit: Baccate or capsular, leathery, includes one genus, *Musa.*

Musa balbisiana Colla (English: Wild Banana; Malay: Pisang Benggala) (**Fig. 4-D**)

The pseudostem is with height more than 3 m, dark green and shiny. Sap colour is milky. Suckers close to parent, at least six. Male flower compound, tepal is basically cream colour and pink pigmentation and peduncle 30 cm to 60 cm. Fruits position are curved upward; more than 17, length of fruit is less than 15 cm, fruit shape

slightly curve, pulp present and rich of seeds. Seeds are round but not completely spherical 4 mm long and dark brown.

(15) Pteridaceae

Habit: Herbaceous, mostly terrestrial, epiphytic and some are aquatic plant. The size varies from small to large. Plants grow in brackish or in coastal swamps. Leaf: Lanceolate to cordate shapes, some are peltate. Line of the margin is entire. Lamina normally has one to four or five pinnate. Spores: Sori mostly confluent along veins, where some are immersed in grooves or acrostichoid. The true indusium is absent while the marginal sori protected by false indusium that formed from lamina margin. The sporangia usually long stalked, annulus vertical or rarely oblique and interrupted by stalk. The spores are yellowish to brown.

Acrostichum aureum Linn. (English: Golden Feather Fern; Malay: Piai, Paku Laut, Piai Raya) (**Fig. 5**)

Terrestrial ferns and perennial grow in most coastal swamps. Fronds are 30 cm to greater than 100 cm, terminal stalked and narrowly oblong. The capitate is paraphyses and the apex is lobed. Sporangia scattered along veins or on whole of abaxial lamina. Leaves are pinnate, entire, thick and dark green of the mature, red brownish of the young, round lancet, leathery, apex obtuse to acuminate. Main veins structures corrugated on the abaxial and thick on the adaxial. Edge of veins is reticulated. Lamina has 1 to 3 pinnate. Fertile pinnae are smaller than sterile pinnae. Sterile pinnae rounded to retuse and shortly mucronate at apex. Rhizome stout, creeping or erect and scales dark brown to black colour.

Fig. 5. *Acrostichum aureum* Linn. (Piai, Paku Laut, Piai Raya)

Traditional knowledge of edible bitter plants in Besut

Elderly in Besut have good knowledge in traditional medicines and appreciated bitter plants as important in daily life and have their speciality; such as *Syzygium polyanthum* (Serai kayu) from Myrtaceae family, which it was well utilized for women's health, while *Rhodomyrtus tomentosa* (Kemunting) from the same family was the only species used for treating parturition-blues mother. The herb plant *Leucas zeylanica* called 'Ketumbit' in Malay was not only can be consumed as 'ulam' for treating flatulent but also the leaf paste can be applied on the stomach of the newborn baby for the same purpose. Previous research was reported women in Malaysia know better the consumption of certain species related to health of reproduction system (Norhayati *et al*., 1999; Law and Soon, 2013). *Morinda citrifolia* was found more frequently used for treating ailments such as diabetes, fever, post-partum, splenomegaly and ulcer and as supplement for anti-aging and less food appetite. This is maybe related to the bitter substance like the alkaloids; quinine, tannins, flavonoid glycosides, resin, anthraquinone and the antioxidants properties (Khairana *et al.,* 2000; Jasril *et al.,* 2003; Sequin, 2012).

Descriptions of the plants are necessary for native species of Besut area. Details may be broadened from the previous descriptions or iconographies where the accessibility to locations enabled field visit to be conducted effectively and better information can be served. Some descriptions of species from other country that had been referred for botanical confirmation were showed varieties and different characters to local plants. Thus, more effort needed, to create new record and to provide updated botanical description for better documentation of the useful edible bitter plants in Malaysia in future.

CONCLUSION

Despite of using modern medicine and undergoing social development, elders in Besut are still using bitter plants for health improvement. From their perceptions; bitter taste of the plants is special and have beneficial for healthy life. Traditional knowledge from 50 selected elders was successfully revealed, although limited and the descriptions were documented after comparison to related keys. The scientific names of edible bitter plants were confirmed and herbarium specimens were deposited in UniSZA Herbarium. There were 15 families formed by 17 species of native bitter plants consumed by Besut people, where Rubiaceae family was the highest frequency in uses. Documentation is needed as an effort to preserve the traditional medicinal knowledge related to edible bitter plants from the villages in Besut, where it is will be useful for development of sustainable drugs and products of edible bitter plants in Malaysia.

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