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Detection of saponin in underutilized Indonesian Sapindaceae at Cibodas Botanic Gardens

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ABSTRACT. Cibodas Botanic Gardens (CBG) has a collection of Sapindaceae, a family known as a saponin-rich plant. Saponin is a versatile phytochemical that is commonly utilized as a surfactant, pharmaceutical, food and cosmetic additive, fodder, and pesticide. To the best of our knowledge, information regarding the saponin content and utilization of several Indonesian Sapindaceae at CBG is still limited. On the other hand, CBG as an *ex-situ* conservation institution has the great opportunity to be a frontline in researching its valuable collections. This research aims to detect the saponin content from ten species of Sapindaceae at CBG and provide recommendations for their sustainable utilization. The methods include a collection of samples from various parts of the plants, simplicia preparation, and foam test. Our results found that the leaves, pericarp, and mix of leaves-rachis-petiole of *Sapindus rarak*, leaves of *Lepisanthes rubiginosa*, *Arytera litoralis*, and *Lepisanthes amoena* were strong potential sources of saponin, while the petiole and rachis of *S. rarak*, leaves of *Mischocarpus pentapetalus*, and *Guioa diplopetala* were moderate in saponin derived. The seeds of *S. rarak*, leaves of *M. sundaicus*, *L. fruticosa*, *Alectryon corriaceus*, and rachis of *Acer laurinum* were weak in producing saponins. We conclude that ten species of Saponin collected at CBG have the potency as saponin sources. Due to their abundance, leaves can be considered renewable materials as an alternative source to substitute fruits. Leaf harvesting does not interfere with plant regeneration and does not conflict with food needs, in contrast to the utilization of seeds and fruits.

Keywords: Cibodas Botanic Gardens; foam test; plant-produced saponin; Sapindus rarak; sustainable harvesting

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INTRODUCTION

Saponin is a secondary metabolite distributed in more than one hundred families of vascular plants (Kunatsa & Katerere, 2021; Rai *et al*., 2021). The different quantities of saponin may be isolated from various parts of plants (Kunatsa & Katerere, 2021). The utilization of plant-derived saponins should be considered, as their excellence of being safe and environmentally friendly, biodegradable, and renewable, as well as their pharmaceutical effects (Wisetkomolmat *et al*., 2019).

Many saponin-rich plants known as soapbark (*Quillaja saponaria*), soapwort (*Saponaria officinalis*), soapberry (*S. saponaria*) (Wisetkomolmat *et al*., 2019), or soapnut (*S. mukorossi* and *S. rarak*) (Samal *et al*., 2017; Wisetkomolmat *et al*., 2021) have utilized as cleansing agents. The fruit, leaf, rhizome, stem, peel, flower, root, bark, or bulb of various plants are employed as shampoo, soap, detergent, gold and silver polish, hand wash, and household cleanser (Kunatsa & Katerere, 2021).

In the plant-defense mechanism, saponin is engaged (Zaynab *et al*., 2021) as an inhibitor of bacteria (Dong *et al*., 2020), fungal (Arung *et al*., 2017), and leishmania (Vermeersch *et al*., 2009). Saponins are practical in combating herbivore-specialist insects (Hussain *et al*., 2019) and molluscicides (Adomaitis & Skujienė, 2020). Saponins also eradicate undesirable fish in valuable ponds commodities (Pranggono *et al*., 2019), as well as a growth promoter, immunostimulants (Ng'ambi *et al*., 2016), and cleaners for increasing water quality (Paray *et al*., 2021).

Recently, saponins are not only involved in traditional (Balandrin, 1996) but also are approved in modern medication for humans as antibacterial (Wei *et al*., 2021), antifungal (Coleman *et al*., 2010), anticancer (Xu *et al*., 2016), antioxidant and anti-diabetic (Salahuddin *et al*., 2020), antiobesity (Marrelli *et al*., 2016), and antiviral (Pu *et al*., 2015). Nowadays, the investigation of saponin utilization as carriers in drug delivery systems were developed (Liao *et al*., 2021).

The full recognition of the commercial potency of raw material saponins from a crude plant extract or high-purity saponin led to the development of feasible processes that can address the consumer demand for saponins. The process includes the exploration of new materials along with information on their properties and protocols optimization as the key elements of successful extraction (Güçlü-Üstündağ & Mazza, 2007). The exploration of new sources is carried out to provide alternative materials, coupled with prevent the overexploitation of particular sources.

Cibodas Botanic Gardens (CBG) curated thousands of living plant collections, supported by botanical expertise to be a frontline to research on them (Sharrock, 2019). The collections consist of many unique plants, but their potency is overlooked. The investigation about the potency of plant collections can encourage their visibility (Hudson *et al*., 2021). Research on plant biological capacity, cultivation, and sustainable harvesting can be a reference for contributing to ecological and human well-being (Sharrock, 2019).

In Indonesia, the fruit of *Sapindus rarak* (Sapindaceae) is the most popular saponin-rich source that is recognized as a natural detergent for washing batik or shampoo (Nia *et al*., 2018; Muttafaq *et al*., 2019). But, reports regarding the utilization of its leaves as detergents as well as pharmaceutical purposes have not been found. Whereas several plants are rich in saponins in their leaves (Kunatsa & Katerere, 2021). Furthermore, leaves are abundant plant organs. Its harvesting does not interfere with plant regeneration and does not conflict with food needs (Chen *et al*., 2016).

To the best of our knowledge, information regarding the saponin content and utilization of several Indonesian Sapindaceae at CBG is still limited. On the other hand, CBG has uniqueness in altitude and temperature which may affect the secondary metabolite profile produced by plants. This research aims to explore the saponin content of various parts of the Sapindaceae of CBG's collection. The most important part of this research is to build reference on the potency of leaves and other parts of Sapindaceae to substitute its fruit for saponin sources.

MATERIALS AND METHODS

Study area. Our research was conducted at Cibodas Botanic Gardens (CBG) that located at Cianjur, West Java, Indonesia. CBG is a botanic garden managed by the National Research and Innovation Agency (BRIN), formerly the Indonesian Institute of Sciences (LIPI). The gardens were established at the foot of Mount Gede and Pangrango, at an altitude of approximately 1,300-1,425 meters above sea level. The average annual temperature was 19.3 °C, rainfall was 2.129 mm/year, air humidity was 89.5%, solar irradiation was 6.6 hours/day, and wind speed was 2.8 km/hour, and the soil in CBG is relatively acidic with a soil pH of about 5.6 (Junaedi *et al*., 2021). The environmental condition mentioned above becomes important data because of its effect on saponins from plants (Szakiel *et al*., 2011).

Materials preparation and saponin detection. All plant materials were obtained from CBG. The list of Sapindaceae collection of CBG obtained from the Unit of Registration and Collection CBG per December 2021 that can be accessed online through Sistem Informasi Data Tanaman (SINDATA) (https://sindata.krcibodas.lipi.go.id, https://krcibodas.brin.go.id) or Makoyana Indonesia (http://makoyana.brin.go.id). We inventoried eighteen species of Sapindaceae that grow in CBG. Regarding the abundance of material and the possibility to access plant locations, we selected only ten species for saponin detection. The materials include leaves, seed, pericarp, petiole, and rachis from 1) *Sapindus rarak* DC, and leaves of 2) *Lepisanthes rubiginosa* (Roxb.) Leenh., 3) *Arytera litoralis* Blume, 4) *Mischocarpus pentapetalus* (Roxb.) Radlk., 5) *Lepisanthes amoena* (Hassk.) Leenh., 6) *Lepisanthes fruticosa* (Roxb.) Leenh., 7) *Guioa diplopetala* (Hassk.) Radlk, 8) *Mischocarpus sundaicus* Blume, 9) *Acer laurinum* Hassk., and 10) *Alectryon coriaceus* (Benth.) Radlk. The materials were collected from December 2021 to March 2022. The sample preservation protocol follows previous research with modification (Borokini *et al*., 2022). Each fresh material was cut into small pieces, washed under a running tap, and blotted in different bamboo trays. The samples were dried inside the oven at 40 °C for 5 - 7 days, except one of the samples from leaves of *S. rarak* that were air dried for 13 days, until gained constant weight. The completely dried material was pulverized into fine powder using an electrical blender. Each sample in fine powder form was sieved through a 40 mesh sieve, kept in air-tight plastic clips, and labeled for further analysis. Saponin detection was carried out by foam test. About 1 gram of the fine powdered sample was extracted with 10 ml of sterile distilled water and boiled for 5 minutes. After cooling, the mixture was filtered with Whatman paper number 1. About 2.5 ml of the filtrate was added to 10 ml of sterile distilled water in a glass test tube and shaken vigorously to foam for about 30 seconds. Then it was allowed to stand for 10 minutes and the foam height are measured with a digital caliper.

Data analysis. The data of saponin content were classified as follows: no foam = negative; foam less than 1 cm = weakly positive; foam 1.2 – 2 cm high = positive; and foam higher than 2 cm high = strongly positive (Mojab *et al*., 2003; Dahiru *et al*., 2006). Microsoft® Excel 2013 spreadsheet software was employed to analyzed the data. The significance of the difference in foam height produced by ten species was carried out by One-Way ANOVA statistical analysis followed by a post hoc test of the Least Significant Different (LSD).

RESULTS AND DISCUSSION

Our research found the ten collections of Sapindaceae at CBG had various levels of saponin content. Ten Sapindaceae at CBG addressed the saponin with classification as follows: the leaves, pericarp, and mixed of leaves-rachis-petiole of *S. rarak*, leaves of *L. rubiginosa*, *A. litoralis*, and *L. amoena* were strong potential sources of saponin, while the petiole and rachis of *S. rarak,* leaves of *M. pentapetalus* and *G. diplopetala* were moderate in saponin derived. The seeds of *S. rarak*, leaves of *M. sundaicus*, *L. fruticosa*, *A. coriaceus,* and rachis of *A. laurinum* were weak in producing saponins (Table 1).

Table 1. Categorization of saponin content from Sapindaceae CBG collection based on foam test

Plant	Part	Foam height (cm)	Category
S. rarak	Fruits	6.45 ± 0.04a	Strong
L. amoena	Leaves	4.35 ± 0.33b	
S. rarak	Mix leaves, rachis, petioles	2.89 ± 0.29c	
L. rubiginosa	Leaves	2.87 ± 0.23c	
S. rarak	Leaves (air-dried)	2.38 ± 0.37d	
A. litoralis	Leaves	2.05 ± 0.59de	
G. diplopetala	Leaves	1.95 ± 0.19ef	Moderate
S. rarak	Leaves (oven-dried)	1.84 ± 0.19ef	
M. pentapetalus	Leaves	1.55 ± 0.27f	
S. rarak	Rachis	1.26 ± 0.20g	
S. rarak	Petioles	1.12 ± 0.13g	
A. coriaceus	Leaves	0.35 ± 0.06h	Low
L. fruticosa	Leaves	0.35 ± 0.07h	
M. sundaicus	Leaves	0.33 ± 0.14h	
A. laurinum	Rachis	0.25 ± 0.06h	
S. rarak	Seeds	0.14 ± 0.07h	

Note: a-h = The means on the same column with different letter are significantly different (p>0.05)

Detection of saponin and utilization of Sapindaceae at CBG. Sapindaceae are economically important family as resources and sustenance. Several species of Sapindaceae produce popular fruit crops in Indonesia, such as leci (*Litchi sinensis*), longan (*Dimocarpus longan*), rambutan (*Nephelium lappaceum*), matoa (*Pometia pinnata*), buah sobo (*L. amoena*), katilayu (*L. rubiginosa*), rambutan pucat (*Mischocarpus pentapetalus*), and rambutan hutan (*Nephelium cuspidatum*) (Angio & Irawanto, 2019). Many species of Sapindaceae are formulated as fish poison and cultivated as ornamental plants (Acevedo-Rodríguez *et al*., 2010). On the other hand, the ten species of Sapindaceae at CBG are considered as minor economically valuable plants because of their minimal information of utilization. Many Indonesian people are not familiar with them although they are indigenous to Indonesia. Therefore, it is important to describe the utilization of Sapindaceae collected at CBG below.

Sapindus rarak **DC**. This species is known as *lerak* by the Indonesian people. It is native to Assam, Bangladesh, Cambodia, Chad, East Himalaya, India, Jawa, Laos, Lesser Sunda Island, Malaya, Myanmar, Sri Lanka, Sumatra, Taiwan, Thailand, and Vietnam (POWO, 2022). *S. rarak* is often recognized as *S. saponaria* due to its morphological similarity. However, *S. rarak* is different from *S. saponaria*. The leaves of *S. rarak* are in pairs, consisting of 7, 9, or 13 pairs, the petal is four strands with the same size and shape, scaly. The flower disks are arranged in semi-circles. The fruit is 1.8-2 cm in diameter and has a keel and the seeds about 1.2-1.5 cm in diameter (Fig. 1). Whereas paired leaves of *S. saponaria* consist of one to five pairs. Its corolla consists of five petals, hairy with circular flower disks. Its fruit has a diameter of 0.8 - 1.2 cm and does not have a keel, and its seeds are 0.8 - 1.2 cm in diameter (Adema *et al*., 1994). If only referring to the size of seeds, *S. rarak* of CBG's collection might be misidentified as *S. saponaria* because of its smaller size (Fig. 1). The environmental condition may affect the growth and phytochemical composition of plants (Szakiel *et al*., 2011).

The phytochemical content of the leaves has not been revealed (so their utilization), in contrast to the fruit that has been widely harvested and studied as saponin-rich sources. The fruit of *S. rarak* is sold as soaps and detergents, both in raw materials and processed products form that are more practical to use. Fresh fruit can be squeezed in water to directly produce foam without complicated processing. This short process can reduce a high carbon footprint, unlike in the general detergent industry (de Koning *et al*., 2010). Saponins extracted from fruit are utilized as anti-hyperlipidemic (Asao *et al*., 2009) and goat feed supplements that safe for short-term and long-term administration (Wina *et al*., 2006).

Due to Table 1, the leaves of air-dried *S. rarak* are very potent to produce saponins, as strong as a mixture of rachis, petiole, and oven-dried leaves. But, if rachis, petiole, and oven-dried leaves are separated, they only have a low level of saponins. *S. rarak* has a compound leaf structure. Harvesting leaves will produce an abundance of rachis and petiole waste. Considering the content of saponins which is quite good in rachis and petiole, these two parts can be utilized. On the other hand, seeds are included in the practice of selling *S. rarak* fruit. However, seeds were not significant in producing saponins. The seeds should be separated and returned to their role for plant reproduction. While the fruit can used as a detergent because the fruit of *S. rarak* is non-edible.

The processing of simplicia can affect the saponin content (Pangestu, 2019). Air drying depends on room temperature while oven drying needs a higher temperature and more cost. Saponins are phytochemicals that are resistant to temperature but may be affected to some extent. The use of an oven with electrical power can be considered if faster drying times are required.

Fig. 1. Fruits of *Sapindus rarak* found at Cibodas Botanic Gardens

Lepisanthes amoena **(Hassk.) Leenh**. The plant is known as *buah sobo* (Palembang), *langir* (Sundanese), and *selekop* or *kokang* (Dayak; East Kalimantan) and native to Indonesia with distribution areas in Borneo, Jawa, Lesser Sunda Island, Malaya, and Sumatra (POWO, 2022). This monoecious shrub or tree can grow up to 7 m tall. Its leaves consist of 15 - 31 leaflets, inflorescence up to 60 cm (Pusdatin-BRIN, 2022), lobed-berry fruits, orange-brown in color, and 2 - 3 cm in diameter (Jansen, 1991a). The plant is wildly growing in the forest and uncultivated. The leaves have been utilized but rarely as traditional cosmetics such as skin cleansers, sunscreen, shampoo, and soap. The fruit and nut are edible but little known as astringent. Whereas previous research reveals the ethanol extract of the seeds and fruits of this plant contains flavonoids, saponins, and tannins. The seeds and fruits also contain alkaloids and triterpenoids and act as strong antioxidants (Salusu *et al*., 2017). The mature leaves of ethanol extract contain higher phenolic content than young and semi-mature leaves and inhibit the growth of *Streptococcus mutans*, *Propionibacterium acnes* (acne-causing bacteria), and *Candida albicans* (Arung *et al*., 2017; Purnamasari *et al*., 2021). The study of this plant usability is limited to its raw material and crude extract. The use of pure saponins from this plant is still not investigated. From Table 1, this species is categorized as a strong candidate for saponin source, as well as its seed and pericarp. Based on the efficacious fact above, it is better to choose as ethanol as a solvent in the extraction of CBG's collection than water to extract more saponin.

Lepisanthes rubiginosa **(Roxb.) Leenh.** The plant is known as *daun jelavat*. It is utilized by the people of East Kalimantan for open wounds treatment and skin ailments (Mujahid *et al*., 2019). In folk medicine, the decoction of leaves and roots is formulated for headaches and fever treatment. The young leaves are edible as a fresh vegetable. The leaf extract has antioxidant, analgesic, antihyperglycemia, neuropharmacological, and antidiarrheal activity. The essential oils extracted from the flower exhibited anticancer activity against small cell lung cancer and antioxidant activity, whereas the essential oil of fruit did not show anticancer activity and possessed low antioxidant activity. Both essential oils of flower and fruit against *Trichophyton mentagophyte*, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans* (Chuangbunyat *et al*., 2011). The saponins isolated from leaves and twigs are abundant, consisting of an oleanane glycoside lepisantheside A, farnesyl glycoside lepisantheside B, acutoside A, and 3-O-[b-D-xylopyranosyl-(1->3)-b-D-glucopyranosyl-]-oleanolic acid. The four compounds are exhibited anticancer activity against human cancer cell lines (KB, HepG2, SK-LU-1, and MCF7) (Tran *et al*., 2022).

The native range of *L. rubiginosa* is Andaman Island, Assam, Bangladesh, Borneo, Cambodia, China Southeast, East Himalaya, Hainan, India, Jawa, Laos, Lesser Sunda Island, Malaya, Maluku, Myanmar, Nepal, New Guinea, Nicobar Island, Philippines, Sulawesi, Sumatra, Thailand, Vietnam, and Western Australia (POWO, 2022). This plant grows as a shrub or small tree up to 16 m high. Leaves velvety when young, has stiff and paper-like texture, above greyish green to grey, beneath yellowish green to reddish brown, dense, and short-hairy. Flowers are sweet-scented with green sepals and white to yellowish petals (Adema *et al*., 1994). Considering the interesting findings of phytochemical research, the *L. rubiginosa* that grows at CBG has high value as a potential reference for in-depth analysis and maybe a chemotype compared with other regions.

Arytera litoralis **Blume**. The plant is known as *ki lalayu* or *emping bidara* and native to Andaman Island, Bangladesh, Bismarck Archipelago, Borneo, Cambodia, Caroline Island, China Southeast, Hainan, India, Jawa, Laos, Lesser Sunda Island, Malaya, Maluku, Myanmar, New Guinea, Nicobar Island, Philippines, Solomon Island, Sulawesi, Sumatra, Thailand, and Vietnam (POWO, 2022). It has small fruits; young fruits are orange and ripe fruits are dark red (Lailati & Ekasari, 2015). Its seeds are oval, shiny black with yellowish aril (Lailati & Ekasari, 2015). In Indonesia, this plant is often utilized as an ornamental plant in parks and recreation areas. Its wood can be used for fences (Lailati & Ekasari, 2015). In Malaysia, this small evergreen shrub is traditionally used for making a rough basket and grown as a shade tree in parks. Methanol and ethyl acetate crude extract of leaves have antibacterial properties against *Bacillus subtilis*, but water extract cannot. Saponin can be extracted in water but is not the best in efficiency (Arifullah, 2014). Research on the use of saponins extracted from this plant is still limited. As a plant whose leaves contain relatively abundant saponins, *A. litoralis* needs to be investigated further, especially regarding its benefits that have not been widely researched.

Guioa diplopetala **(Hassk.) Radlk.** *G. diplopetala* is known by the people of Sumba as *kapehu* or *ki bayawak* (Sundanese) (Van Welzen, 1998). Information regarding the use of this plant as traditional medicine is still limited. Boiled roots are believed to be anti-inflammation on mucous membranes (Adema *et al*., 1994). Methanol extract of leaves contains alkaloids, flavonoids, terpenoids/steroids, tannins, saponins, and anthraquinones and performs antioxidant and antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* (Kristiani *et al*, 2018). The native range of *G. diplopetala* is Borneo, Cambodia, Jawa, Laos, Lesser Sunda Island, Malaya, Myanmar, Sulawesi, Sumatra, Thailand, and Vietnam (POWO, 2022). The habitus is a shrub or tree that can grows up to 1-1.85 m high. The outer bark is smooth, grey-brown to grey-white, the inner bark is pink to pale brown, and the sapwood is yellowish white. The leaflets are opposite to alternate, asymmetrical at basal, and leathery. Sepals are green with white petals and pink stamens. Fruit are red when fresh but blackish when dry. Seeds are black and 0.802 mm long (Adema *et al*., 1994). The documentation regarding fruit, flower, and leaves are limited, as well as the potential and role of saponins derived from this plant.

Mischocarpus pentapetalus **(Roxb.)**. This evergreen tree is native to Andaman Island, Assam, Bangladesh, Borneo, Cambodia, China South-Central, China Southeast, Jawa, Laos, Lesser Sunda Island, Malaya, Myanmar, Philippines, Sumatra, Thailand, and Vietnam (POWO, 2022). The medicinal properties of this plant known as *rambutan pucat* or *ki hoe* have not been explored comprehensively. The habitus of this species is a shrub or tree up to 15-25 m tall (Hidayat & Suhendri, 2020). Its leaves consist of 2-12 leaflets, inflorescence up to 40 cm long, fruit are almost globe-shaped to an ellipsoid capsule, reddish, about 3 mm in diameter (Jansen, 1991b) with seed enveloped by thin fleshy orange arillode (Hidayat & Suhendri, 2020). The utilization is limited to harvesting its edible fruit and nut, its stem wood as a tonic after childbirth (Hidayat & Suhendri, 2020), and its heavy, straight, and durable wood as a construction material (Hong, 2017).

Alectryon coriaceus **(Benth.) Radlk.** This species is non-native to Indonesia but indigenous to New South Wales and Queensland (POWO, 2022). However, because of its presence at CBG, it becomes important to be checked. This species is known as *the beach bird's eye* based on its eye-like fruit (Pusdatin-BRIN, 2022). They are specifically named *coriaceus* because of the leathery thick leaves. The habitus is a small tree that can grows up to 11 m high (Floyd, 2008). Information regarding the phytochemical content and utilization of this plant other than ornamental plants is still not available. This is a great opportunity for CBG to be a front-liner in researching their valuable collections.

Lepisanthes fruticosa **(Roxb.) Leenh.** *L. fruticosa* or known as *terengganu cherry* or *mojowontu* is traditionally used as folk medicine although its publication about pharmacognostic, physicochemical, phytochemical, and nutraceutical value are limited. Its seeds are consumed by roasting. Its roots are eaten in a compound poultice to relieve itching and fever or infused as a tea against rheumatism, backache, or impotence, and believed to be effective as an aphrodisiac (Tarmizi *et al*., 2022). In southern Thailand, the young leaves are eaten as a vegetable and utilized in the pre-harvest rice ritual. Its fruits are edible and sweet when ripe, but still not popular yet. Unripe fruits comprise phenolic and flavonoids at their highest level compared to mature, ripe, and overripe fruit. The aqueous extract of the unripe fruit act as an excellent inhibitor of α-glucosidase. The ethanolic crude extract and its fraction perhaps be a strong antioxidant and anti-diabetic (Salahuddin *et al*., 2020). This plant is cultivated as an ornamental plant, firewood, and material for house building is native to Borneo, Cambodia, Jawa, Laos, Lesser Sunda Is., Malaya, Maluku, Myanmar, Philippines, Sulawesi, Sumatera, Thailand, and Vietnam (POWO, 2022). This plant grows as a shrub or tree up to 10 m tall with paripinnate leaves. Its fruits are almost globe-shaped to ellipsoid berries, up to 4 cm in diameter with dark red to black color (Jansen, 1991c).

Mischocarpus sundaicus **Blume.** Its native range is Andaman Island, Assam, Borneo, Cambodia, China Southeast, Hainan, Jawa, Laos, Lesser Sunda Island, Malaya, Maluku, Myanmar, New Guinea, Philippines, Sulawesi, Sumatra, Thailand, and Vietnam (POWO, 2022). The habitus is a shrub or tree that grows up to 10-30 m high. Twigs are usually reddish brown. Leaflets ovate (shaped like an egg) to elliptic, the base is rounded or angular, and the inflorescence is long, located axillary and pseudoterminal. *M. sundaicus* and *M. pentapetalus* are not distinguished sharply for some characters and presumably can be hybridized (Adema *et al*., 1994). Roots and leaves are utilized as traditional herbs to treat cough, malaria, and diabetes in Way Kambas National Park, Lampung (Denny *et al*., 2021). This plant is a source of pollen for stingless honey bees *Heterotrigona itama* dan *Tetragonula laeviceps* in Belitung (Priambudi *et al*., 2021). Apart from this potential, the role of saponins from this plant has not been explored.

Acer laurinum **Hassk.** This species is native to Assam, Borneo, Cambodia, China South-Central, China Southeast, East Himalaya, Hainan, Jawa, Laos, Lesser Sunda Is., Malaya, Myanmar, Philippines, Sulawesi, Sumatera, Thailand, Tibet, Vietnam (POWO, 2022) and known locally as *maple* (English), *huru kappas* (Sundanese), or *wuru kembang* (Javanese) (Nasution, 1998). *A. laurinum* have yellow flower and winged red or purplish fruit (Pusdatin-BRIN, 2022). The conspicuous glaucous lower leaf surface and interesting fruit allow it to be an ornamental plant. The woods are not so valuable timber because of their scarcity and the absence of heartwood. The utilization of wood is only on a local scale for small objects like household utensils or frames (Nasution, 1998). Roots, twigs, barks, and leaves contain triterpene saponin and showed interesting anti-leishmania activity (Vermeersch *et al*., 2009).

CONCLUSION

The ten species of Sapidanceae from the CBG's collection have potential as saponin sources, ranging from strong (leaves, pericarp, and mixed of leaves-rachis-petiole of *Sapindus rarak*, leaves of *Lepisanthes rubiginosa*, *Arytera litoralis*, and *Lepisanthes amoena*), moderate (petiole and rachis of *S. rarak*, leaves of *Mischocarpus pentapetalus* and *Guioa diplopetala*), to weak (Seeds of *S. rarak*, leaves of *M. sundaicus, L. fruticosa*, *Alectryon corriaceum* and rachis of *Acer laurinum*). Due to their abundance, utilization of leaves should be considered as promising alternative than harvesting fruit. Furthermore, quantitative measurement of the saponin content in all parts of plants is required, as important as research on the bioactivity of saponins extracted from these plants.

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