A Review: Prospective study of non-timber forest product uses in three Meranti species (Shorea spp.)

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Abstract. Meranti (Shorea spp.) is a commercial timber tree species of Indonesian forest potentially to be developed for Non-Timber Forest Products (NTFPs). We explored the NTFPs perspective of three Meranti species, Shorea hopeifolia (F. Heim) Symington, Shorea ovalis (Korth.) Blume, and Shorea balangeran Burck, by identifying the content of phytochemical compounds. Data collection methods include: exploration, identification to obtain the accuracy of the species scientific name, and analysis the phytochemical content using Gas Chromatographic Mass Spectrometer (GCMS) pyrolysis. We revealed the bark of the tree species contained phytochemical compounds potential for medicinal ingredients especially for antidiabetic, antioxidant, and anticancer. Since the exploitation of the bark is better than the trees, the potential use of non-timber forest products of the meranti supports the conservation of the species. Further research to unveil other benefits of the meranti species should be conducted.

1. Introduction

Meranti (Shorea spp.) belongs to the group of forest tree species from the Dipterocarpaceae family commonly dominated lowland forest areas in Indonesia. The number of meranti species grows naturally in Indonesia’s forest areas is around 114 species, with the highest number of species existing on Kalimantan and Sumatra Island [1]. The meranti tree is a producer of excellent tropical wood consisting of 70% of the total species in the Dipterocarpaceae family [2].

Meranti groups in Indonesia significantly contribute to high foreign exchange from timber products. Meranti is used for construction or building materials such as walls, door/window panels and floors, durable and strong wood. Over exploitation without cultivation and conservation resulting in decreasing the natural population of meranti trees in their natural habitat. In supporting meranti germplasm conservation efforts, besides conducting cultivation efforts, it is also necessary to explore the potential use of NTFPs. Since NTFPs bring economic value, it is expected to foster a conservative value towards the community around the forest area. The economic value of Shorea balangeran Burck as a medicinal material may replace the value of modern medicine so that it can indirectly foster conservation value in the society [3].

With the use of NTFPs with economic value, it is expected to grow conservative values for the communities around the forest area. The economic value of Shorea balangeran Burck as a medicinal ingredient can replace the value of the price of modern medicine so that it can indirectly foster conservation value in the society [3].
In trade, several species of meranti are already known as producing NTFPs of high economic value including damar mata kucing (*Shorea javanica* (Koord.) Valeton) and tengkawang fruit (*Shorea palembanica* Miq., *Shorea pinanga* Scheff., *Shorea stenoptera* Burck, etc.). Some research results at this time, it is known that the bark of Meranti tree has potential as a medicinal ingredient. Meranti bark is identified as containing phytochemical compounds that can respond to a disease. The Kalimantan Dayak community, in its local wisdom, utilizes bark of *Shorea balangeran* Burck for the treatment of diarrhoea, diabetes, and malaria [4]. The bark of *Shorea teysmanniana* Dyer ex Brandis reported contains active antimicrobial compounds and antioxidants potentially used as medicinal ingredients [5]. The resveratrol oligomer compounds in meranti trees have cytotoxic properties against tumour cells [6]. By apprehending the potential of medicinal ingredients in meranti trees, it brings hope that NTFPs from the meranti species group prospect to developed as medicinal ingredients. The utilization of NTFPs can appropriately support the conservation of meranti germplasm.

To explore the potential of NTFPs in meranti beside resin and tengkawang fruit, research has been conducted by to determine the phytochemical compounds of the meranti trees in its natural habitat [7-9]. The study was conducted with an exploratory method to four meranti habitat forest areas including, Bukit Barisan Selatan National Park, Lampung [7,9] and three locations in the Bangka Belitung forest area [8]. In exploration activities other than field data collection, sampling of tree branches and herbarium material were taken for screening material of phytochemical compounds and the accuracy of scientific names respectively. The results showed that three species of meranti trees grow naturally at the study site, identified as containing phytochemical compounds as potential medicinal ingredients.

2. Materials and Methods

2.1. Research Location

Exploration was carried out in four meranti habitats including the Pemerihan Forest, the Air Limau Conservation Forest, the Gunung Bantan Conservation Forest, and the Senusur Sembulu Coast Conservation Forest.

2.1.1. Pemerihan Forest, Bukit Barisan Selatan National Park, Lampung, In the Ministry of Environment and Forestry administration, Pemerihan Forest is included in the Bukit Barisan Selatan National Park. Based on the government administration, it is included in the area of Peratin Village, Bangkunat Belimbing Sub District, South Lampung Regency, Lampung Province. Location of research geographically is located at coordinates of 05°34'169"-05°36'487" SL and 104°24'162"-104°24'500" EL. It is lowland forests and dry land hill, flat to steep topography, the slope of 5-55%, altitude 48-297 meters asl, podsolic red yellow and alluvial soil type, climate type A with rainfall of 2344 mm per year [10].

2.1.2. Air Limau Conservation Forest, Bangka. Based on the Ministry of Environment and Forestry, the Air Limau Conservation Forest is included in the working area of the Bangka Regency Forestry and Plantation Office, Bangka Belitung Province Forestry Service. According to the government administration, it belongs to the village of Kimak, Merawang District, Bangka Regency, Bangka Belitung Province. Geographically, the location of the study is located at 01°58'576"-01°58'641" SL and 106°03'948"-106°04'119" EL. It is lowland forest dry land, sometimes inundated by tidal, the altitude is about 10-35 meters asl, Alluvial Association and Regusol soil type, type A climate with an average rainfall of 2881 mm per year [10].

2.1.3. Gunung Bantan Conservation Forest, Belitung. Based on the Ministry of Environment and Forestry, Gunung Bantan Conservation Forest included in the working area of the East Belitung Regency Forestry Service, Bangka Belitung Province Forestry Service. In government administration, it included in the area of Nyuruk Village, Dendang District, East Belitung Regency, Bangka Belitung Province. Research location in Protected Forest of Gunung Bantan is
geographically located at 02º53'263"-02º53'443" SL and 107º46'37.5"-107º46'627" EL. It is a lowland dryland forest with flat topography to lightly undulated, the slope is about 5-10%, altitude is about 40-55 meters asl, the soil is yellowish-brown podsolic, climate B type with an average rainfall of 2637 mm per years [10].

2.1.4. Protected Forest of Senusur Sembulu Belitung. According to the Ministry Environment and Forestry administration, Senusur Sembulu Coastal Conservation Forest is included in the working area of the East Belitung Regency Forestry Service, Forestry Service of Bangka Belitung Province. The location of Senusur Sembulu Coastal Conservation Forest in the administration of the government belongs to the area of Batu Penyu Village, Gantung District, East Belitung Regency, Bangka Belitung Province. The research location of Senusur Sembulu Coastal Protected Forest is located at 03º04'327"-03º04'362" SL and 108º11'401"-108º11'431" EL. Senusur Sembulu Beach Conservation Forest is a kerangas and coastal forest, at lowland dry land or sometimes flooded with tidal water, flat topography or gentle sloping to undulating, altitude 5-30 meters asl, alluvial and regusol association (textured dust, clay and quartz sand) soil type, type B climate with an average rainfall of 2637 mm per year [10].

2.2. Methods
The research methods include exploratory, comparative identification and chromatographic analysis. Exploratory in four locations of forest areas where the natural growth of meranti (Shorea spp.), then carried out observations of the place of growth, individual morphological characteristics of meranti trees, and sampling consisting of herbarium samples and bark samples. Sampling of bark with different diameter sizes (15, 30, 75, and 94 cm), this was adjusted to the individual conditions of the meranti that were found. Branch samples were taken if available. Comparative identification by comparing herbarium samples from the field with valid herbarium specimens. Knowledge about the nature of morphology is needed to identify the species into a proper scientific name. Therefore, comparative identification of herbarium samples with valid herbarium specimens was carried out at the Forest Botanical Herbarium, Forest Research and Development Center. The analysis with GCMS pyrolysis to determine the content of phytochemical compounds was carried out in two chemical laboratories namely the Chemical Laboratory of the Indonesian Spice and Medicinal Crops Research Institute, Bogor and the Chemical Laboratory of the Center for Forest Product Research and Development, Bogor. To determine of compounds in the bark with an initial screening test, such as alkaloids, flavonoids, glycosides, phenolics, saponins, tannins, triterpenoids. The analysis of its components using GCMS pyrolysis.

3. Results and Discussion
3.1. Meranti species
Exploration results in four meranti habitats identified three species of meranti, namely Shorea hopeifolia (F.Heim) Symington, Shorea ovalis (Korth.) Blume grow in Bukit Barisan Selatan National Park, and Shorea balangeran Burk grows in the Bangka Belitung forest area.

3.1.1. Shorea hopeifolia (F.Heim) Symington. Shorea hopeifolia or locally known as meranti cengal grows in clusters in the Pemerihan forest of Bukit Barisan Selatan National Park in Lampung at an altitude of 253-297 m asl. In Indonesia, Shorea hopeifolia naturally grows in Sumatra and Kalimantan. The sample tree was in a diameter of 100 cm. Characters of Shorea hopeifolia are bole cylindrical with bark surface dark yellow to dark brown, oblong scales, often exuding brownish-yellow resin/damar, dried resin/damar black in colour, bark on young tree are smooth and sometimes lenticulated, brownish-grey in colour. Description of Shorea hopeifolia leaves are simple, alternate, petiole 0.6-1.0 cm long, slender, glabrous or pule buff pubescent, leaves papyry or leathery, elliptical or ovate 3.5-9.6 cm x 2-4.1 cm, base rounded or truncate, symmetrical or asymmetrical, apex long acuminate, acumen to 1.3 cm long, upper surface and lower surface glabrous, smooth to the touch; secondary nerves 7-11 pairs, sometimes there are domatia at the base of the leaf. Stipules a pair at
the base of the petiole or the leaf buds, elliptic or lanceolate 0.5 cm x 0.2 cm, falling early. Bole, resin/damar and leaves morphology of *S. hopeifolia* are presented in Figure 1.

![Figure 1. Shorea hopeifolia (F.Heim) Symington in Pemerihan forest, Bukit Barisan Selatan National Park, Lampung [1].](image)

3.1.2. *Shorea ovalis* (Korth.) Blume. *Shorea ovalis* is locally known as damar, kuyung merah, kuyung putih, in trading as red meranti group. Distribution of *Shorea ovalis* in Indonesia is only in Sumatera and Kalimantan. This meranti grows in a group just hardly found in the Pemerihan Forest, Bukit Barisan Selatan National Park. At the research site, *Shorea ovalis* grows in the same habitat of *Shorea hopeifolia*. Characters of *Shorea ovalis* are a large tree with diameter of bole was 220 cm, bole straight, cylindrical, slightly tapering, buttresses small, thin, bark surface regularly ditch streaked with small scaly to shallow fissured, brownish-yellowish or pale red-brown, bark surface on young tree to smooth becoming scaly, resin/damar yellow-brown or grey-brown. Characters of *S. ovalis* leaves are simple, alternate, petiole 0.7-1.0 cm long, slender, with pink-brown scabrid pubescent or long hairs, sparse or dense; leaves leathery, elliptical to oblong or obovate, 7.8-21 cm x 2.7-7.0 cm, apex acuminate with acumen to 0.9 cm long, base obtuse or truncate, upper surface with short hairs, lower surface with red-brown hairs or rough to the touch; secondary nerves 18-25 pairs, with red-brown rough hairs at lower surface. Stipules a pair at the base of the petiole or the leaf buds, triangular or ovate, acute, 1.4 cm x 0.7 cm, with red-brown scabrid hairs, sub persistent. Bole, resin/damar and leaves morphology of *Shorea ovalis* are presented in Figure 2.

3.1.3. *Shorea balangeran* Burck. Meranti *S. balangeran* locally known as belangir or belanguran, distributed in Sumatera, Bangka, Belitung, and Kalimantan. It was found growing in large groups and dominant in the observation plots in three research locations at the Air Limau Conservation Forest, Bangka, Gunung Bantan Protected Forest, Belitung, and Senusur Sembulu Coastal Conservation Forest, Belitung. The diameters of the sample trees were 53 cm (in the Air Limau Conservation Forest, Bangka), 62 cm (in Gunung Bantan Protected Forest, Belitung) and 40 cm (in Senusur Sembulu Coastal Conservation Forest, Belitung). Bole straight, cylindrical, bark surface, greyish white or light brown to blackish, fissured or v-section, regularly, deeply and scaly, buttresses straight or concave, thin to thick (Figure 3).
Figure 2. *Shorea ovalis* (Korth.) Blume in Pemerihan forest, Bukit Barisan Selatan National Park, South Lampung [1,9].

Figure 3. *Shorea balangeran* Burck in Air Limau Conservation Forest, Bangka [1].

3.2. Phytochemical compounds and the potential of NTFPs

3.2.1. *Shorea hopeifolia*. The results of the analysis with GCMS pyrolysis showed that *Shorea hopeifolia* bark contain 25 to 32 of phytochemical compounds (Table 1).
Table 1. Number of chemical component in *Shorea hopeifolia* bark.

| No. | Sample tested                                | Total Chemical Components |
|-----|----------------------------------------------|----------------------------|
| 1.  | Bark form tree with a bole diameter of 15 cm | 32 Compounds               |
| 2.  | Bark form tree with a bole diameter of 30 cm | 25 Compounds               |
| 3.  | Bark form tree with a bole diameter of 75 cm | 25 Compounds               |
| 4.  | Bark form tree with a bole diameter of 94 cm | 32 Compounds               |

Source: [7]

The number of chemical components of *Shorea hopeifolia* bark in Table 1 shows that the diameter of the bole does not affect the component of the phytochemical content. The highest number of component found in trees with bole diameters of 15 cm and 94 cm. In this case, further research and testing are needed to determine the effect of bole diameter on the amount of phytochemical compounds. Five potential compounds as medicinal ingredients in the largest concentration order presented in Table 2.

Table 2. Phytochemical content with the five largest concentrated order.

| No. | Tested Sample | Compound Name                                               | Concentration relative (%) |
|-----|---------------|-------------------------------------------------------------|-----------------------------|
| 1.  | Bark (Ǿ= 15 cm) | 1. (E)-Hex-2en-4ynal (Monomokarbon)                       | 15.6                        |
|     |               | 2. Phenol, 2-methyl-(CAS) o-Cresol                          | 10.99                       |
|     |               | 3. Acetic acid (CAS) Ethylic acid                           | 9.48                        |
|     |               | 4. Phenol, 2,6-dimethoxy-4-(2-propenyl)                     | 5.59                        |
|     |               | 5. Phenol, 2,6-dimethoxy-(CAS) 2,6-dimethoxyphenol          | 5.45                        |
| 2.  | Bark (Ǿ= 30 cm) | 1. Phenol, 2-methyl-(CAS) 0-Cresol                          | 9.86                        |
|     |               | 2. Benzenamine (CAS) Aniline                                | 9.86                        |
|     |               | 3. Phenol, 2,6-dimethoxy-4-(2-propenyl)                     | 9.15                        |
|     |               | 4. 2,5-Dimethoxybenzyl alcohol                              | 8.46                        |
|     |               | 5. Phenol, 2,6-dimethoxy-(CAS)                              | 6.96                        |
| 3.  | Bark (Ǿ= 75 cm) | 1. 1,6-Anhydro-beta-D-gucopyranose (Lovoglucosan)           | 18.39                       |
|     |               | 2. Ethanone                                                 | 8.95                        |
|     |               | 3. Phenol (CAS)                                             | 8.85                        |
|     |               | 4. 2-Methoxy-4-methylphenol                                 | 5.11                        |
|     |               | 5. Phenol, 2,6-dimethoxy-(CAS)                              | 4.91                        |
| 4.  | Bark (Ǿ= 94 cm) | 1 (E)-Hex-2-en-4ynal                                       | 8.28                        |
|     |               | 2. Propanedioic acid (asam malonat)                         | 8.10                        |
|     |               | 3. Phenol, 2-methoxy-4-(2-propenyl) (CAS) Eugenol          | 7.76                        |
|     |               | 4. Phenol, 2,6-dimethoxy-(CAS)                              | 5.32                        |
|     |               | 5. 2-Methoxy-4-methylphenol                                 | 5.26                        |

Source: [7]

*Shorea hopeifolia* bark contains phenol compounds with relatively greater concentrations than other compounds. Phenol compounds with the greatest concentration order found in boles with a diameter of 30 cm (25.97%), 15 cm (22.03%), 75 cm (18.87%), and 94 cm (18.34%). The diameter of the bole does not provide a significant picture of the magnitude of the phenol concentration. The difference in phenol concentration in the size of the trunk diameter is not the same; it is possible that it is influenced by the physiological conditions of each individual tree. In this case, it can be assumed that the meranti tree (*Shorea hopeifolia*) with a bole diameter of 30 cm is more effective as a source of phenolic compounds.

The potential of NTFPs from *Shorea hopeifolia* trees is that the tree contains 32 of phytochemical compounds that can be developed as medicinal or cosmetic ingredients and relatively large concentrations of phenol compounds. Phenol compounds are useful as natural antioxidants and play...
a role in inhibiting cancer cell growth. The compounds do not bring carcinogenesis risk [9]. The cytotoxic properties of phytochemical compounds from the bark of *Shorea hopefolia* isolated and evaluated against human hepatoma (HepG2) and liver cells, showed that hopeaphenol compounds were the most cytotoxic to HepG2 cells with a CC50 value of 4.5 mg ml⁻¹ [11].

3.2.2. *Shorea ovalis*. Phytochemical screening results showed *Shorea ovalis* contain seven alkaloid compounds, saponins, tannins, phenolics, flavonoids, triterpenoids, and glycosides (Table 3).

**Table 3.** Phytochemical screening of *Shorea ovalis* bark from the Pemerihan Forest, Bukit Barisan Selatan National Park, Lampung.

| Phytochemical content | 70     | 88     | 104    | 132    |
|-----------------------|--------|--------|--------|--------|
| Alkaloid              | +      | +      | +      | +      |
| Saponin               | +      | +      | +      | +      |
| Tanin                 | -      | -      | -      | +      |
| Fenolik               | +      | +      | +      | +      |
| Flavonoid             | +      | +      | +      | +      |
| Triterpenoids         | +      | +      | +      | +      |
| Steroid               | -      | -      | -      | -      |
| Glikosida             | +      | +      | +      | +      |

Annotation: + (identified), - (not identified), Source: [9]

*Shorea ovalis* bark from bole diameters of 70, 88, and 104 cm contains six alkaloids, saponin, phenolic, flavonoid, triterpenoids, and glycoside groups. Meanwhile, the bark from a bole diameter of 132 cm contains seven phytochemical compounds due to the presents of tannins. Results of GCMS Pyrolysis analysis on *Shorea ovalis* trees from four different bole diameter sizes showed similar chemical compounds but different in concentrations. Variations in the phytochemical content of *Shorea ovalis* bark as a result of GCMS Pyrolysis analysis presented in Table 4.

**Table 4.** Variations in phytochemical content of *Shorea ovalis* bark based on the results of GCMS pyrolysis analysis.

| Phytochemical Compound                                      | Concentration (%) |
|-------------------------------------------------------------|-------------------|
|                                                             | 70    | 88.3  | 104   | 132   | 136   |
| Guaiacol                                                    | 2.20  | -     | 3.40  | 2.92  | 5.37  |
| 2-methoxy 4-methylphenol                                   | 5.79  | 4.09  | 5.83  | 4.05  | 4.25  |
| Phenol, 4-ethenyl-2 methoxy                                | 3.44  | -     | -     | -     | 4.53  |
| Vanillin                                                    | 2.13  | -     | 1.23  | 1.67  | 1.73  |
| 2,6 dimethoxyphenol                                         | -     | 4.14  | 5.71  | 2.89  | 4.75  |
| 1,2,4 trimethoxybenzene                                     | 4.08  | 4.65  | -     | 3.65  | -     |
| Levogluconosan                                              | 5.95  | 3.75  | 10.62 | -     | -     |
| Eugenol                                                     | -     | 1.13  | 1.44  | -     | 1.01  |
| 2-propanone,1-(4-hydroxy-3-methoxyphenyl)                   | 5.73  | 3.49  | -     | -     | -     |
| Cyclopentanetrione 3-(2-pentenyl)                          | 12.41 | -     | -     | 13.73 | -     |
| Cyclopropa[5,6] stigmast-22-en-3-one                        | -     | 6.13  | -     | -     | -     |
| Lupene 3-one                                                | -     | 8.46  | -     | -     | -     |
| 4-methoxy-3-(methoxymethyl) phenol                          | -     | -     | 5.77  | -     | -     |
| Benzene,1,2,3-trimethoxy-5-methyl                           | -     | -     | 9.52  | -     | -     |
| 4-allyl-2,6-dimethoxyphenol                                 | -     | -     | -     | 2.64  | -     |
| 5-allyl-4-hydroxy-2-mercapto-6-methylpirimidine             | -     | -     | -     | -     | 11.79 |

Source: [9]

*Shorea ovalis* bark contains many phenol compounds and tended to dominate as indicated by the presence of 2,6 dimethoxyphenol, 2-methoxy 4-methylphenol, phenol, 4-ethenyl-2-methoxy. Phenol compounds are known to have antioxidant activity, showing barrier activity to free radical
propagation that can trigger cancer. *Shorea ovalis* is rich in chemical compounds, their results of the research concluded that almost every sample of bark found compounds: 2,6-dimethoxyphenol, eugenol, guaiacol, 2-methoxy 4-methylphenol, vanillin, and phenolic 2-methoxy 4-methylphenol is a compound detected in all *Shorea ovalis* bark analyses with a concentration of 4-5% [9]. Compounds contained in *Shorea ovalis* bark potential as a medicinal ingredient include eugenol compounds known as an analgesic for reducing pain. Guaiacol derivatives are for flavoring in food or as an expectorant in cough medicines and stimulate expectoration. Vanillin compound as a pharmaceutical additive is for enhancing the aroma or taste. The cyclopentanetrione compound use for a medicinal ingredient to control the secretion of diarrohea and inflammatory diseases. Pyrimidine compounds in the pharmacopeia often use for antibacterial drug source. Therefore, the potential for NTFPs *Shorea ovalis* is as cancer drug ingredients.

3.2.3. *Shorea balangeran*. The results of phytochemical screening on *Shorea balangeran* originated from three research sites (Air Limau Conservation Forest in Bangka, Gunung Bantan Conservation Forest, and Senusur Sembulu Coastal Conservation Forest in East Belitung) contains alkaloid, saponin, tannin, phenolic, flavonoid, triterfenoid, steroid, and glycoside (Table 5).

| Table 5. Bark phytochemical screening of *Shorea balangeran* from Bangka Belitung. |
|---|---|---|
| No. | Phytochemical Content | Location of Sample Origin |
| | | Air Limau Conservation Forest, Bangka | Senusur Sembulu Coastal Conservation Forest, Belitung | Gunung Bantan Conservation Forest, Belitung |
| | | Bole Diameter (cm) | 20 | 31 | 46 | 21 | 31 | 40 | 20 | 32 | 41 |
| 1. | Alkaloids | + | + | + | + | + | + | + | + | + |
| 2. | Saponins | + | + | + | + | + | + | + | + | + |
| 3. | Tannins | + | + | + | + | + | + | + | + | + |
| 4. | Phenolic | + | + | + | + | + | + | + | + | + |
| 5. | Flavonoids | + | + | + | + | + | + | + | + | + |
| 6. | Triterfenoid | + | + | + | + | + | + | + | + | + |
| 7. | Steroids | + | - | - | + | - | - | - | - | - |
| 8. | Glicosids | + | + | + | + | + | + | + | + | + |

Annotation: + (present), - (absent); Source: [8]

Table 5 showed that the bole diameter size and the location where it grows can be taken into consideration for sampling bark as phytochemical screening material. *Shorea balangeran* bark from bole diameter of 20 cm and 21 cm from the origin of Air Limau Conservation Forest (Bangka) and Senusur Sembulu Coastal Conservation Forest (Belitung) holds eight phytochemical compounds namely alkaloids, saponins, tannins, phenolics, flavonoids, triterpenoids, glycosides, and steroids. *Shorea balangeran* bark from a bole diameter of 20 cm from the Gunung Bantan Protected Forest (Belitung) holds seven phytochemical compounds as no steroid.

Potential of NTFPs Meranti *Shorea balangeran* with the identification of seven to eight phytochemical groups as potential medicinal ingredients allegedly is an active compound as antidiabetic, antioxidant, and anticancer. The methanol extract of *Shorea balangeran* bark had a low IC50 value (0.816 ppm) indicated as potential antidiabetic [12]. The tannin compound as one of the active compounds with antioxidant activity inhibits tumor growth [13].
The potential of NTFPs *Shorea balangeran* as medicinal material is not only from the bark but also from twigs and leaves. The research result revealed that the branches and leaves of *Shorea balangeran* were contained seven to eight classes of phytochemical compounds (Table 6 and 7) [8].

**Table 6.** Phytochemical screening of *Shorea balangeran* branches from Bangka and Belitung forests.

| No. | Phytochemical content of branches | Location of Sample |
|-----|----------------------------------|--------------------|
|     |                                  | Air Limau Conservation Forest, Bangka | Senusur Sembulu Coastal Conservation Forest, Belitung | Gunung Bantan Conservation Forest, Belitung |
| 20  | 31 | 46 | 21 | 31 | 40 | 20 | 32 | 41 |
| 1.  | Alkaloids                        | + | + | + | + | + | + | + | + |
| 2.  | Saponins                         | + | + | + | + | + | + | + | + |
| 3.  | Tannins                          | + | + | + | + | + | + | + | + |
| 4.  | Phenolic                         | + | + | + | + | + | + | + | + |
| 5.  | Flavonoids                       | + | + | + | + | + | + | + | + |
| 6.  | Triterphenoid                    | + | + | + | + | + | + | + | + |
| 7.  | Steroids                         | + | - | - | - | - | + | - | - |
| 8.  | Glicosides                       | + | + | + | + | + | + | + | + |

Annotation: + (detected), - (undetected); Source: [8].

**Table 7.** Phytochemical screening of *Shorea balangeran* leaves from the forests of Bangka and Belitung.

| No. | Phytochemical content of leaves | Location of Sample |
|-----|---------------------------------|--------------------|
|     |                                  | Air Limau Conservation Forest, Bangka | Senusur Sembulu Coastal Conservation Forest, Belitung | Gunung Bantan Conservation Forest, Belitung |
| 20  | 31 | 46 | 21 | 31 | 40 | 20 | 32 | 41 |
| 1.  | Alkaloids                        | + | + | + | + | + | + | + | + |
| 2.  | Saponins                         | + | + | + | + | + | + | + | + |
| 3.  | Tannins                          | + | + | + | + | + | + | + | + |
| 4.  | Phenolic                         | + | + | + | + | + | + | + | + |
| 5.  | Flavonoids                       | + | + | + | + | + | + | + | + |
| 6.  | Triterphenoid                    | + | + | + | + | + | + | + | + |
| 7.  | Steroids                         | + | - | - | - | - | + | - | - |
| 8.  | Glicosides                       | + | + | + | + | + | + | + | + |

Annotation: + (detected), - (undetected); Source: [8].

The bark, twigs, and leaves of *Shorea balangeran* as shown in Table 5, 6 and 7 identified to hold similar phytochemical compounds. Therefore, utilizing NTFPs *Shorea balangeran* as medicinal material could come from twigs or leaves.
3.3. Conservation efforts
One of the conservation aims is to save the population or the existence of the germplasm of a species. To support the conservation of *Shorea* spp. one of the breakthroughs is to explore the potential of NTFPs and predicted to hold high economic value. The use of *Shorea* spp. as a medicinal ingredient is one of the potential uses of the NTFPs of *Shorea*. By utilizing NTFPs, it is expected to provide economic and conservation benefits. Further research on various aspects is still needed to achieve it.

The utilization technique is one of the basic knowledge that needs to be researched and studied. The utilization of NTFPs of *Shorea* leaves is more conservative than wood utilization. Similarly, the use of twigs and leaves is more conservative than the use of bark. Branches and leaves are available continuously, with proper sampling techniques guarantee its sustainability.

Phytochemical screening on *Shorea hopeifolia* and *Shorea ovalis* twigs and leaves need to be conducted. By knowing the phytochemical compounds in the branches and leaves of the three species of meranti, it is hoped that the utilization of NTFPs Meranti will be more optimal and more conservative. The use of NTFPs Meranti that is effective, indirectly greatly supports efforts to conserve species germplasm.

4. Conclusion
Three meranti species were identified at four research sites, *Shorea hopeifolia* (F.Heim) Symington and *Shorea ovalis* (Korth.) Blume grows naturally in the Pemerihan Forest, Bukit Barisan Selatan National Park, Lampung. *Shorea balangeran* Burck grows in the Air Limau Conservation Forest, Bangka, Gunung Bantan Conservation Forest, and Senusur Sembulu Coastal Conservation Forest, East Belitung.

The bark of *Shorea hopeifolia, Shorea ovalis* and *Shorea balangeran* contain phytochemical compounds as potential medicinal ingredients. The potential of NTFPs in *Shorea* trees as medicinal ingredients is an active compound as antidiabetic, antioxidant, and anticancer.

The utilization of NTFPs of *Shorea* appropriately supports efforts to conserve species germplasm. In this case, research is still needed from various aspects of the utilization of NTFPs of *Shorea* optimally, economically and sustainably.

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