

Review

Vascular Epiphytic Medicinal Plants as Sources of Therapeutic Agents: Their Ethnopharmacological Uses, Chemical Composition, and Biological Activities

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Received: 17 December 2019; Accepted: 21 January 2020; Published: 24 January 2020

Abstract: This is an extensive review on epiphytic plants that have been used traditionally as medicines. It provides information on 185 epiphytes and their traditional medicinal uses, regions where Indigenous people use the plants, parts of the plants used as medicines and their preparation, and their reported phytochemical properties and pharmacological properties aligned with their traditional uses. These epiphytic medicinal plants are able to produce a range of secondary metabolites, including alkaloids, and a total of 842 phytochemicals have been identified to date. As many as 71 epiphytic medicinal plants were studied for their biological activities, showing promising pharmacological activities, including as anti-inflammatory, antimicrobial, and anticancer agents. There are several species that were not investigated for their activities and are worthy of exploration. These epiphytes have the potential to furnish drug lead compounds, especially for treating cancers, and thus warrant indepth investigations.

Keywords: epiphytes; medicinal plants; phytochemistry; pharmacology; drug leads

1. Introduction

Epiphytes are plants that grow on other plants and are often known as air plants. They are mostly found in moist tropical areas on canopy tree-tops, where they exploit the nutrients available from leaf and other organic debris. These plants exist within the plantae and fungi kingdom. The term epiphyte itself was first introduced in 1815 by Charles-François Brisseau de Mirbel in “*Eléments de physiologie végétale et de botanique*” [34]. Epiphytes can be categorized into vascular and non-vascular epiphytic plants; the latter includes the marchantiophyta (liverworts), anthocerotophyta (hornworts), and bryophyta (mosses). The common epiphytes are mosses, ferns, liverworts, lichens, and the orchids. Epiphytes fall under two major categories: As holo- and hemi-epiphytes. While orchids are a good example of holo-epiphytes, the strangler fig is a hemi-epiphyte. Although geological studies have proposed the existence of epiphytes since the pleistone epoch, an epiphyte was first depicted in “the Badianus Manuscript” by Martinus de la Cruz in 1552, which showed the *Vanilla fragrans*, a hemi-epiphytic orchid, being used by the tribal communities in latin America for fragrance and aroma, usually hung around their neck [34].

Epiphytes have been a source of food and medicine for thousands of years. Since they grow in a unique ecological environment, they produce interesting secondary metabolites that often show exciting biological activities. There are notable reviews on non-vascular epiphytes, bryophyta, regarding their phytochemical and pharmacological activities [35–38]. There are also extensive reviews on epiphytic lichens covering secondary metabolites and their pharmacological activities [39–42]. The only available review on vascular epiphytes related to medicinal uses was focused on Orchidaceae [43]. Therefore, to the best of our knowledge, there is no extensive database of vascular epiphytes regarding their medicinal contribution.

There are 27,614 recorded species of vascular epiphytes belonging to 73 families and 913 genera [44]. Vascular epiphyte species are commonly found in pteridophyta, gymnosperms, and angiosperms plant groups, which are mostly found in the moist tropical areas on canopy tree tops, where they exploits the nutrients available from leaf and other organic debris [45,46]. In this study, information on vascular epiphytic medicinal plant species was collected using search engines (Web of Science, Scifinder Scholar, prosea, prota, Google scholar), medicinal plant books (Plant Resources of South-East Asia: Medicinal and Poisonous Plants [47–49], Plant Resources of South-East Asia: Cryptogams: Ferns and Fern Allies [50], Mangrove Guide for South-East Asia [51], Medicinal Plants of the Asia-Pacific [52], Medicinal Plants of the Guiana [53], Indian Medicinal Plants [54,55], Medicinal Plants of Bhutan [56], Medicinal and aromatic plants of Indian Ocean islands: Madagascar, Comoros, Seychelles and Mascarenes [57]), and the Indonesian Medicinal Plants Database [58]. Scientific names of the epiphytic medicinal plant species were compared against the Plantlist database for accepted names to avoid redundancy [59]. The time-frame threshold for data coverage was from the earliest available data until early 2020. Nevertheless, empirical knowledge regarding traditional medicinal plants was passed through generations using verbal or written communication, with verbal communication highly practiced by remote tribes [60,61]. It is possible that some oral traditional medical knowledge may not be reported and therefore not captured in this review. In this current study, we collected and reviewed 185 epiphytic medicinal plants reported in the literature, covering ethnomedicinal uses of epiphytes, their phytochemical studies and the pharmacological activities. The data collection approach used is presented in Figure 1.

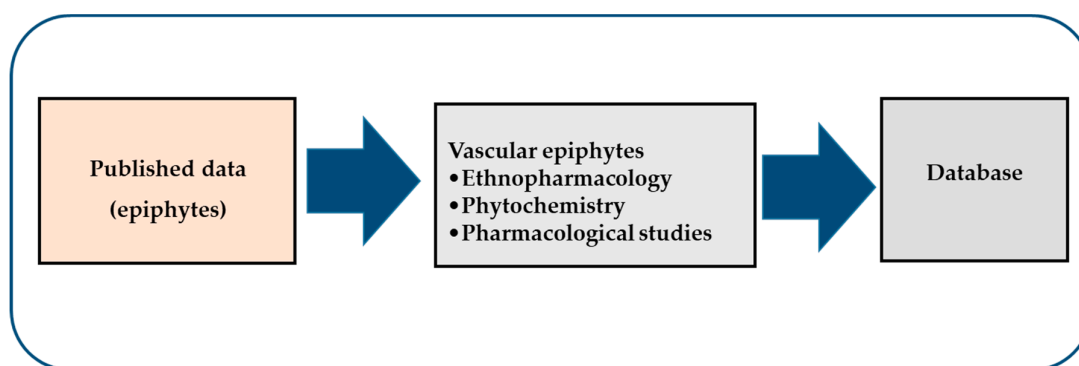


Figure 1. Schematic data collection approach.

2. Ethnopharmacological Information of Vascular Epiphytic Medicinal Plants

2.1. Vascular Epiphytic Medicinal Plant Species Distribution within Plant Families

In this component of the study, we collated and analysed 185 of the medicinally used epiphytic plants species using ethnopharmacological information. This data (Table 1) includes the name of species, plant family, areas where the epiphytes are used in traditional medicines, part(s) of the plant being used in medication, how the medicine was prepared, and indications. Of the 185 medicinally used epiphytes, 53 species were ferns (mostly polipodiaceae), with 132 species belonging to the non-fern category. The Orchidaceae family contains the *Dendrobium* genus that contains the highest number of medicinal epiphytes, including 64 orchid species and 20 *Dendrobium* species. The

Orchidaceae epiphytes were the majority of non-fern epiphytes. *Cassytha filiformis* L., *Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall., *Cymbidium goeringii* Rchb.f.) Rchb.f., *Acrostichum aureum* Limme, and *Ficus natalensis* Hochst. were the five most popular vascular epiphytic medicinal plants used (Figure 2).



Figure 2. Five most popular medicinal epiphytes. (A) *C. filiformis* L. (B) *B. odoratissimum* (Sm.) Lindl. ex Wall. (C) *C. goeringii* (Rchb.f.) Rchb.f. (D) *A. aureum* Limme. (E) *F. natalensis* Hochst.

2.2. Distribution of Vascular Epiphytic Medicinal Plant Species by Country

Based on the available records, the data curation and analysis revealed that the Indigenous Indonesians have used 58 diverse epiphytic medicinal plant species throughout the archipelago and have the highest record compared to other tropical countries (Figure 3). China is second and is well known for its traditional medicine, including the use of epiphytes in medicament preparation. This is followed by the Indigenous Indians, with the well-established Ayurveda as a formal record of Indian medicinal plants. The traditional medicinal plant knowledge of Indonesia has been heavily influenced by Indian culture and enriched by Chinese and Arabian traders since the kingdom era [60].



Figure 3. Density map showing a number of epiphytic medicinal plant species used by different countries. The number of species used is proportional to colour intensity.

2.3. Parts of Vascular Epiphytic Medicinal Plant Species Used in Traditional Medicines

This review determined that leaves were the main plant components used in the traditional medicines (Figure 4). This was expected given they are more easily harvested (without excessive

tools) and processed compared to other plant parts, e.g., the root and stem. As some epiphytes have a small biomass compared to higher trees, the whole plant is commonly harvested in medicament preparation. Interestingly, almost half of epiphytic medicinal plants were ferns, in which the stem-like stipe is prepared for medicine. Without haustoria (a specialised absorbing structure of a parasitic plant), the root and rhizome of epiphytic medicinal plants are easily harvested and prepared.

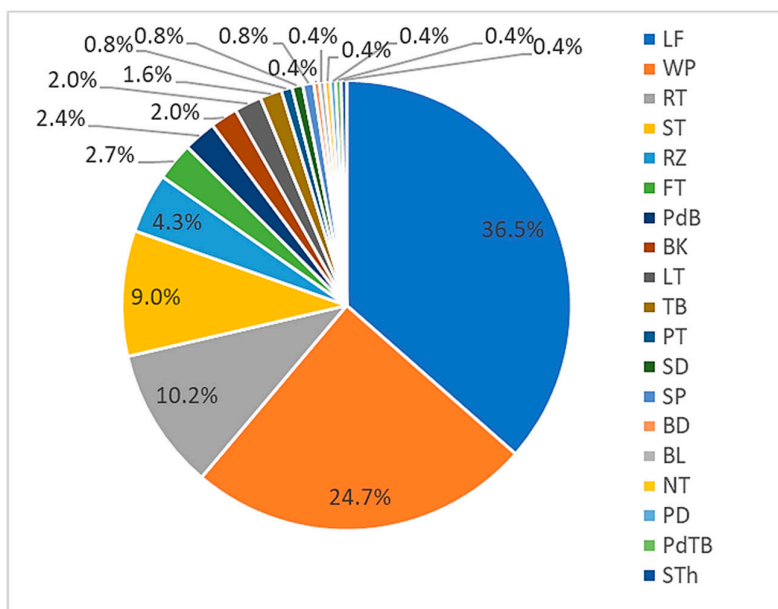


Figure 4. Components of epiphytic plants used in medicinal preparations (represented in percentages). LF: leaf; WP: whole; RT: root; ST: stem, RZ: rhizome; FT: fruit; PdB: pseudobulbs; BK: bark; LT: latex; TB: tuber; PT: pith; SD: seed; SP: spore; BD: buds; BL: bulbs; NT: nutmeg; PD: pedi; PdTB: pseudotuber; STh: sheath.

2.4. Modes of Preparation and Dosage of Administration of Vascular Epiphytic Medicinal Plant Species in Traditional Medicines

Generally, medicinally active secondary metabolites have a water solubility problem likely related to the lipophilic moieties in their structures [62]. Using boiling water, decoctions are able to increase the yield of secondary metabolites extracted from medicinal plants. Therefore, it is not surprising that decoctions are commonly used in traditional medicine preparations from plants (Figure 5). External applications are also commonly practiced in traditional medicinal therapies, including poultice (moist mass of material), raw, or less processed medicine. Poultices were commonly prepared for skin diseases while a decoction was ingested for internal infectious diseases (i.e., fever).

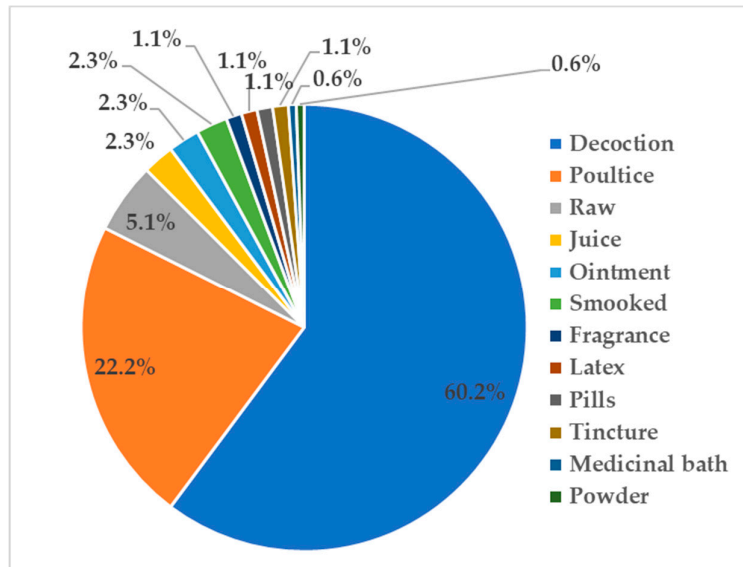


Figure 5. Modes of preparation and administration of epiphytic medicinal plants (represented in percentages).

2.5. Category of Diseases Treated by Vascular Epiphytic Medicinal Plant Species

Interestingly, epiphytes have been used for treating various ailments, including both infectious and non-infectious diseases. Traditional communities described infectious diseases related to skin diseases (wounds, boils, ulcers, abscesses, smallpox) and non-skin diseases (fever, diarrhoea, ulcers, colds, worm infections, and malaria). A total of 54 epiphytic medicinal plant species were prescribed to treat skin diseases while 81 species to treat non-skin infectious diseases (Figure 6).

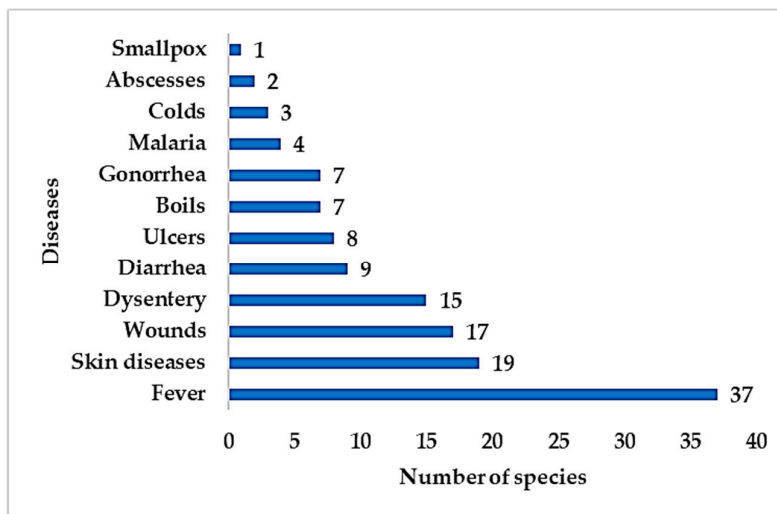


Figure 6. Number of epiphytic medicinal plant species used traditionally to treat infectious diseases.

Hygiene has been a serious issue in traditional communities as it gives rise to infectious diseases. Fever is a common symptom of pathogenic infection and has been treated using medicinal plants, including epiphytes. Hygiene issues are also a common cause of skin disease, wounds, dysentery, and diarrhoea in traditional communities.

3. Phytochemical Composition of Vascular Epiphytic Medicinal Plants

Epiphytes belong to a distinctive plant class as they do not survive in soil and this influences the secondary metabolites present. Epiphytes are physically removed from the terrestrial soil nutrient pool and grow upon other plants in canopy habitats, shaping epiphyte morphologies by the method in which they acquire nutrients [63]. Nutrients, such as nitrogen and phosphorus, are obtained from different sources, including canopy debris (through fall) and host tree foliar leaching [63], the latter influencing canopy soil nutrient cycling [64,65]. In the conversion of sunlight into chemical energy, the epiphyte often uses a specific carbon fixation pathway (CAM: Crassulacean acid metabolism) as a result of harsh environmental conditions [66], making them unique and thus worthwhile for scientific studies.

In the early 20th century, laboratory-based research on epiphytes studied the plant's production of alkaloids, cyanogenetic, and organic sulfur compounds, with the plants producing limited quantities of these compounds [67]. Common plant steroids, e.g., β -sitosterol, have been shown to be present in 22 different epiphytic medicinal plants (Figure 7). This is possibly due to the function of the steroids as structural cell wall components, giving rise to a wide distribution across plant families and species. A further example of a common plant steroid present is stigmasterol.

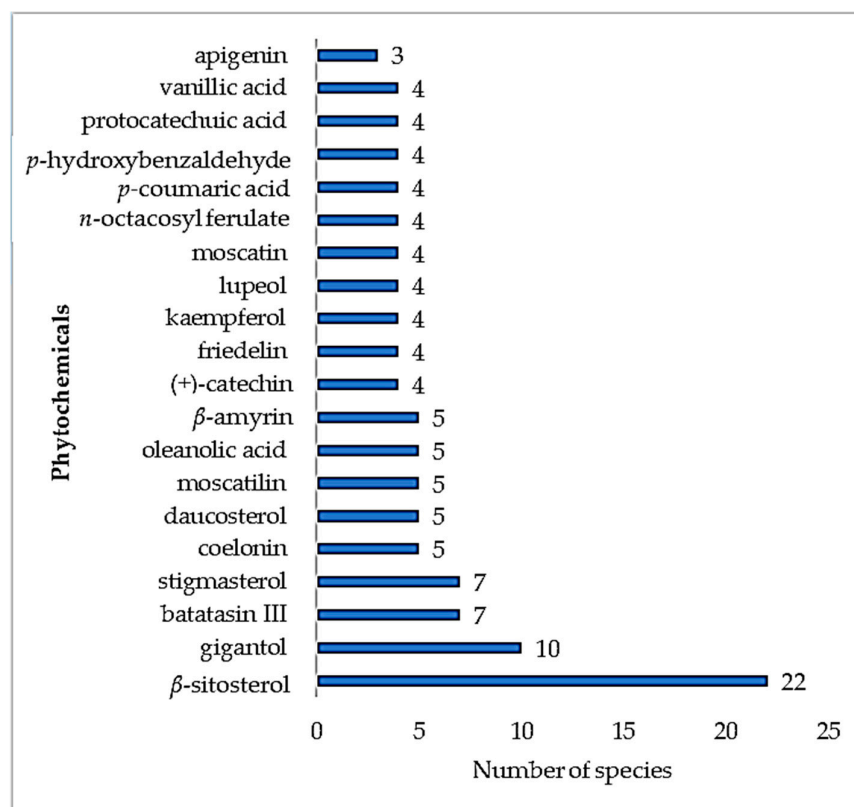


Figure 7. Number of epiphytic medicinal plant species producing the same secondary metabolites.

Table 2 lists the secondary metabolites identified in epiphytic medicinal plants and details the species, isolated compounds, and provides references. Currently, only 69 species have been phytochemically studied (23 fern and 46 non-fern epiphytes) and 842 molecules have been isolated from these epiphytic plants. Analysis of the literature showed epiphytes were able to produce a range of secondary metabolites, including terpenes and flavonoids, with no alkaloids being isolated from epiphytic fern medicinal plants thus far. β -Sitosterol, a common phytosterol in higher plants, was reported across fern genera. Interestingly, there is one unique terpene produced, hopane, which is commonly called fern sterol. Common flavonoids, such as kaempferol, quercetin, and flavan-3-ol derivatives (catechin), were also reported across the epiphytic ferns. Epiphytic pteridaceae,

Acrostichum aureum Limme, is rich in quercetin [68]. Further analysis showed there were more secondary metabolites reported from non-fern epiphytic medicinal plants than from fern epiphytic medicinal plants, including terpene derivatives, flavonoids, and alkaloids. Included were flavanone, flavone, and flavonol derivatives but no flavan-3-ols were reported in these epiphytes so far. In the non-fern epiphytes, there were more phytochemical studies on orchid genera with additional classes of compounds reported, including penantrene derivatives (flavanthrinin, nudol, fimbriol B) [69,70] from the *Bulbophyllum* genus and the alkaloid dendrobine from the *Dendrobium* genus [71].

Therefore, while epiphytes may have limitations in accessing nutrients, adaptation has enabled them to successfully survive these environments. Studies on numerous medicinal epiphytes show that the unique environment does not constrain the plants from producing different types of secondary metabolites. These include terpenes, flavonoids, and alkaloids, especially the non-fern epiphytic medicinal plants.

4. Pharmacological Activities of Vascular Epiphytic Medicinal Plants

The pharmacological activities of medicinal epiphytes are summarised in Table 1, including the plant species, ethnopharmacological indication, and pharmacological test results. The ethnopharmacological uses of each plant are also present for a correlation and comparison with the pharmacological activities. There are a large number of phytochemical studies on the four fern-epiphytes (*Stenochlaena palustris* (Burm. F.) Bedd., *Botrychum lanuginosum* Wall.ex Hook & Grev., *Pyrrosia petiolosa* (Christ) Ching, *Psilotum nudum* (L.) P. Beauv) without any biological activity testing reported. This occurred to four non-fern epiphytes (*Bulbophyllum vaginatum* (Lindl.) Rchb.f, *Mycaranthes pannea* (Lindl.) S.C.Chen & J.J.Wood, *Pholidota articulata* Lindl., *Viscum ovalifolium* DC) and non-fern epiphytic medicinal plants. This lack of pharmacological testing limits scientific support for the traditional uses of these plants.

From the 191 collected records of epiphytic medicinal plants, around 71 species were subjected to bioactivity testing, with 25 of these species using crude extract samples. Although this testing represents almost 50% of the species examined, only a few of the pharmacological tests were related to ethnopharmacological claims. Here, we discuss selected species where the outcomes indicated a coherent relationship between bioactivities and traditional claims.

4.1. Infectious Disease Therapy

Research on epiphytes that have been used in infectious disease therapy include in wound healing, dysentery, and skin infections. A study on the methanol extract of *Adiantum caudatum* L., Mant showed anti-fungal activity against common fungi found in wounds (*Aspergillus* and *Candida* species) [72], including *Aspergillus flavus*, *A. spinulosus*, *A. nidulans*, and *Candida albicans*, with minimum inhibitory concentration (MIC) values of 15.6, 15.6, 31.2, and 3.9 µg/mL, respectively. Gallic acid was one of the bioactive constituents [73]. The methanol extract of *Ficus natalensis* Hochst (a semi-epiphytic plant) showed anti-malarial activity against *Plasmodium falciparum*, with an half maximal inhibitory concentration (IC₅₀) value of 41.7 µg/mL, and weak bactericidal activity against *Staphylococcus aureus*, with an MIC value of 99 µg/mL [74]. These results became preliminary data for confirming its traditional uses as malarial fever therapy and wound healing. Phytochemical studies on *Pyrrosia shearereri* (Bak.) Ching successfully isolated several compounds and were subjected to anti-oxidant testing. While this was not in line with the plant's ethnomedical uses for dysentery therapy [75], one of the isolated constituents was protocatechic acid, which is known to possess anti-bacterial activity. It implies that the traditional uses of the epiphyte were for bacillary dysentery therapy.

4.2. Non-Infectious/Degenerative Disease-Related Therapy

An exploration on *Drynaria* species, highly prescribed in bone fracture therapy, successfully isolated flavonoid constituents that induce osteoblast proliferation [76]. Previous studies on *Acrostichum aureum* Limme failed to show its anti-bacterial activities [77] contrary to its traditional claims in wound management. However, patriscabratine **257** was isolated from the defatted

methanol extract of whole plant of *A. aureum*, and subsequent testing showed it possessed anti-cancer activity in gastric cells and this supported the traditional use of the plant in peptic ulcer therapy [68]. A decoction from the epiphyte *Ficus deltoidea* has been used to treat diabetes. A study on the hot aqueous extract of this plant revealed anti-hyperglycemic activity by stimulating insulin secretion up to seven-fold. Furthermore, its activity mechanism was related to both the K^+ -ATP-dependant and -non-dependant insulin secretion pathway [78]. However, further studies are required to identify the constituents responsible for the anti-hyperglycaemic activity.

The Indigenous people of Paraguay have used *Catasetum barbatum* Lindley to topically treat inflammation. Four bioactive compounds were isolated from this species and 2,7-dihydroxy-3,4,8-trimethoxyphenanthrene (confusarin) **595** showed the highest anti-inflammatory activity [79]. The study also revealed the compound to be a non-competitive inhibitor of the H_1 -receptor.

From the polypodiaceae family, the rhizome of *Phymatodes scolopendria* (burm.) Ching has been used to treat respiratory disorders. A bioassay-guided phytochemical study on *Phymatodes scolopendria* (Burm. f.) Pic. Serm. isolated 1,2-benzopyrone (coumarin) **209** as a bronchodilator [80].

5. Epiphytic Plant–Host Interactions on Secondary Metabolite Tapping

Secondary metabolite tapping has been an interesting study to reveal the molecular interactions between epiphytes and their host. This interaction was more visible when a physical channel between the two were developed. This channel (haustorium) made an epiphytic plant act as a parasite that enabled the plant to harvest molecular components from the host plant. A study on *Scurulla oortiana* (Korth.) Danser growth in three different host species (*Citrus maxima*, *Persea Americana*, and *Camellia sinensis*) identified three secondary metabolites (quercitrin, isoquercitrin, and rutin) in the *S. oortiana* (Korth.) Danser epiphyte growing on the three hosts [81]. Interestingly, extensive chromatographic and spectroscopic studies discovered that the flavonoids found in the *S. oortiana* (Korth.) Danser were independent of the host plants [81]. Secondary metabolite production in a host plant can also be triggered by the existence of a parasite, as discussed in a study on *Tapirira guianensis* infested by *Phoradendron perrottetii*, in which infested branches produced more tannin compare to non-infested branches, with infestation inducing a systemic response [81].

Table 1. Ethnopharmacological database of epiphytic medicinal plants.

| No | Epiphyte species | Location | Part of plants | Preparation and route of administration | Indication (traditional) | Pharmacological testing (modern) |
|---------------------|---|---|----------------|---|--|---|
| Fern species | | | | | | |
| Adiantaceae | | | | | | |
| 1 | <i>Adiantum caudatum</i> L. | India, Indonesia, Malaysia | LF | Decoction | Cough, heal wound, cold, tumors of spleen, liver and other viscera, skin diseases, bronchitis, and inflammatory diseases [73,82,83] | Antimicrobial (MeOH extract, gram +, -, fungi) [73] |
| Aspleneaceae | | | | | | |
| 2 | <i>Asplenium nidus</i> L. | Tahiti, Malaysia, Philippines, Vanuatu, Indonesia | LF, WP | Ointment, decoction, eaten | Headache, hair loss (pounded leaves mixed with coconut oil), ease labor, fever (decoction), contraceptive, depurative, sedative agents. edible food (young leaves), ornament, anti-inflammation, promote blood circulation [84–86] | Antioxidative (MeOH extract, DPPH), tyrosinase inhibiting (MeOH extract, microtitre), antibacterial (MeOH extract) [77] |
| 3 | <i>Asplenium macrophyllum</i> Sw. | India | LF | Decoction | As laxative, emetic, diuretic, anthelmintic agent, to treat ophthalmia, jaundice, spleen diseases [85,87] | |
| 4 | <i>Asplenium polydon</i> G. Foster var <i>bipinnatum</i> (Sledge) | India | LF | Decoction, paste | Promote labor, tumor [88] | |
| 5 | <i>Asplenium serratum</i> L. | Columbia, Peru | na | Not mentioned | Liver problem, stomachache, ovary inflammation [85,89] | |
| Blechnaceae | | | | | | |
| 6 | <i>Stenochlaena palustris</i> (Burm. F.) Bedd. | Indonesia, India | LF, RZ | Eaten, decoction, poultice | Young reddish leaves are used as food, leaves are used to treat fever, skin diseases, throat, and gastric ulcer, as antibacterial, rhizome and leaves are used to treat burns and ulcers, as cooling agent [51,90] | |
| Davalliaceae | | | | | | |
| 7 | <i>Davallia denticulata</i> (Burm. f.) Mett. ex Kuhn | Malaysia, Indonesia | RT | Decoction | Gout, pain, as tonic [82,91] | |

| | | | | | | | |
|-------------------------|--|--------------------------------|----|---------------------------------------|--|--|--|
| 8 | <i>Araiostegia divaricata</i> (Blume) M. Kato | China, Taiwan | WP | Not mentioned | Joint pain [92] | Anti-psoriasis [93], antioxidant (water extract, DPPH) [94] | |
| 9 | <i>Davallia parvula</i> Wall. Ex Hook. & Grev. | | na | Not mentioned | Not mentioned [51,95] | | |
| 10 | <i>Davallia solida</i> (G. Forst.) Sw. | Tahiti, Fiji, other Polynesian | WP | Decoction (external and internal) | Dysmennorrhoea, luochorea, uterine hemorrhage, sore throat, asthma, constipation, fracture, fish sting, promote health pregnancy, as a bath for newborn, anti-microbial [86,96–98] | Antioxidant (extract, ABTS) [94], antioxidant (DPPH, all isolates) [99], anti-neurotoxicity (extract, (Neuro-2a cells, ATCC CCL-131) [100], C-terminal cytosolic domain of P-gp [101], anti-skin aging [102] | |
| 11 | <i>Leucostegia immersa</i> Wall. ex C. Presl | Nepal | RZ | Decoction, paste | Boils (paste), constipation (decoction), as antibacterial (paste) [103] | | |
| Gesneriaceae | | | | | | | |
| 12 | <i>Aeschynanthus radicans</i> Jack | Malaysia | LF | Decoction | Headache [52] | | |
| 13 | <i>Cyrtandra sp</i> | Indonesia | LF | Poultice | Skin ailments [104] | | |
| Hymenophyllaceae | | | | | | | |
| 14 | <i>Hymenophyllum polyanthos</i> Sw. | Suriname | WP | Burnt (smoke inhaling), decoction | Dizziness (insanity), pain, cramps [105] | | |
| 15 | <i>Hymenophyllum javanicum</i> Spreng. | India | WP | Smoke together with garlic and onions | Headache [88] | | |
| Lycopodiaceae | | | | | | | |
| 16 | <i>Huperzia carinata</i> (Desv. ex Poir.) Trevis | South-East Asia | WP | Ointment | Stimulate hair growth [106] | Anti-acetylcholinesterase (74,75,76, colorimetric Ellman method) [107] | |
| 17 | <i>Huperzia phlegmaria</i> (L.) Rothm | South-East Asia, India | WP | Ointment | Stimulate hair growth, skin diseases [108,109] | Cytotoxic activities against HuCCA-1, A-549, HepG2, and MOLT-3 cancer cell lines (81, 79, 77) [110] | |
| 18 | <i>Huperzia megastachya</i> (Baker) Tardieu | Madagascar | LF | Decoction (infusion) | Tonic [111] | | |
| 19 | <i>Huperzia obtusifolia</i> (Sw.) Rothm. | Madagascar | LF | Decoction (infusion) | Tonic [111] | | |
| Nephrolepidaceae | | | | | | | |
| 20 | <i>Nephrolepis acutifolia</i> (Desv.) Christ | Malaysia | WP | Boiled, eaten | Food [112] | | |

| | | | | | | |
|------------------------|---|--|------------|---|---|---|
| 21 | <i>Nephrolepis biserrata</i> (Sw.) Schott | Malaysia, Indonesia, Ivory Coast, New Guinea | LF, RZ, WP | Decoction, cooked | Leaves are used to treat boils, blister, abscesses, sores, and cough. Rhizomes are used as edible food [113,114] | Antibacterial (extract) [115] |
| Oleandraceae | | | | | | |
| 22 | <i>Nephrolepis cordifolia</i> (L.) C. Presl | India | RZ | Decoction (fresh leaves) | Cough, rheumatism, chest congestion, nose blockage, loss appetites, infection (antibacterial), pinnae is used to treat cough, wounds, jaundice, anti-fungal, styptic, anti-tussive [90] | Antibacterial, anti-fungal (extract fractions aerial part) [116] |
| 23 | <i>Oleandra musifolia</i> (Blume) C. Presl | Philippines, India | ST | Decoction | Anthelmintic, emmenagogue, antidote (snake bite) [103,117] | |
| Ophioglossaceae | | | | | | |
| 24 | <i>Botrychum lanuginosum</i> Wall.ex Hook & Grev. | India | WP | Decoction, paste | Antibacterial, anti-dysentery agents [90] | |
| 25 | <i>Ophioglossum pendulum</i> L. | Indonesia, Philippines | LF | Ointment, decoction. | Hair treatment (crushed leaves), cough (decoction), rid the first feces (spores), ornament [118] | Cell activator, skin whitening agent and antioxidant (patent, mixed with other <i>Ophioglossum</i> species) [119], anti-diarrhea (stipe MeOH extract, rabbit jejunum) [119] |
| Polypodiaceae | | | | | | |
| 26 | <i>Pyrrosia piloselloides</i> (L.) M.G. Price | Indonesia, Malaysia, China, Philippines, Pacific islands | LF | Decoction (internal), chewed, poultice (external) | Smallpox, rashes, gonorrhoea, dysentery, tuberculosis, urinary tract infection, headache, cough, gum inflammation, tooth sockets, eczema, coagulate blood [120–123] | Antibacterial, anti-fungal (extracts) [124] |
| 27 | <i>Drynaria rigidula</i> (Sw.) Bedd. | Indonesia, Philippines, Treasury Island | LF, RZ | Decoction, chewing | Gonorrhoea, dysentery (rhizome, decoction), and seasickness (chewed) [54] | <i>n</i> -Hexane, dichloromethane and ethyl acetate fractions from both rhizome and leaves of <i>Drynaria rigidula</i> were screened for activity against <i>Plasmodium falciparum</i> , <i>Mycobacterium tuberculosis</i> , vero cells and herpes simplex virus which all extracts showed insignificant activities [125] |
| 28 | <i>Drynaria sparsisora</i> (Desv.) T. Moore | Indonesia, Philippines, Thailand | LF, RZ | External, decoction | Rhizome: headache, fever, diarrhea, gonorrhoea, swollen limbs, fever. Leaves: | |

| | | | | | | |
|----|--|---|--------|---|--|---|
| 29 | <i>Drynaria roosii</i> Nakaike | China | WP | Decoction | anti-vomiting, snake bite, eye infection [54,104,126] Deficient kidney, invigorate blood, heal wound, stop bleeding [54] | Compound 230 was isolated and the biotesting showed the highest stimulation toward UMR 106 cells (osteoblast) by 42.6% at a concentration of 1 μ M [127] |
| 30 | <i>Drynaria propinqua</i> (Wall. ex Mett.) Bedd | Bhutan, India and Nepal | ST | Pills | Antidote and detoxifier especially when suffering from meat poisoning and other human-made poisons (<i>sbyar-dug</i>) [128] | |
| 31 | <i>Drynaria quercifolia</i> (L.) J.Sm. | Malaysia, Philippines, Indonesia, India | LF, RZ | Decoction, poultice | Swelling, fever (poultice leaves), haemoptysis, typhoid fever, ulcers, dyspepsia, arthralgia, diarrhea (decocted rhizome), inflammation, anthelmintic, cough, fever, phthisis, poultice of rhizome mixed with <i>Lannea coromandelica</i> (Houtt.) Merr.) to treat headache, hepatoprotective agent [21, 22, 96] | Compound 200 from the ethyl acetate fraction to be responsible for good antimicrobial activity [129] |
| 32 | <i>Lepisorus contortus</i> (Christ) Ching | Bhutan, India, China | LF | Powder | Heals bone fracture, burns, wounds and kidney disorders [130] | |
| 33 | <i>Loxogramme involuta</i> (D. Don) C. Presl | Indonesia | LF, WP | Smoked | Smoked with tobacco [51] | |
| 34 | <i>Loxogramme scolopendria</i> (Bory) Presley | Indonesia | LF | Smoked | Cigarette paper [131] | |
| 35 | <i>Microsorium fortunei</i> (T. Moore) Ching | Indonesia | WP | Decoction | Diuretic, promote blood circulation [82,84] | |
| 36 | <i>Microsorium punctatum</i> (L.) Copel. | India | LF | Juice | Diuretic, purgative, wounds [103] | |
| 37 | <i>Phlebodium aureum</i> (L.) J.Sm | Mexico | RZ | Decoction | Cough, fever, sudorific agents [90] | |
| 38 | <i>Phymatosorus scolopendria</i> (Burm. f.) Pic. Serm. | South-East Asia, Madagascar | RZ | Fragrance (external), poultice, decoction | Fragrance, gecko bites, accelerate childbirth Respiratory disorder [51,80] | Bronchodilator (341 , in vivo) [80] |
| 39 | <i>Platyserium coronarium</i> (Mull.) Desv. | Indonesia | LF | Poultice (salt added) | Thyroid edema, scabies [51,132] | |

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| 40 | <i>Platyserium bifurcatum</i> (Cav.) C. Chr. | Indonesia | LF | Poultice (salt added) | Thyroid edema, scabies, fever, swelling [100, 101] | |
| 41 | <i>Pleopeltis macrocarpa</i> (Bory de Saigey) Kaulf. | South-Africa, Mexico, Guatemala | LF, RZ | Decoction | Sore throat, itches, cough, febrifuge [103,133] | |
| 42 | <i>Pyrrosia heterophylla</i> (L.) M.G. Price | India | WP | Poultice | Swelling, sprain, pain (cooling agent) [134] | |
| 43 | <i>Pyrrosia lanceolata</i> (L.) Farw. | Malaysia, South-Africa, Mexico | LF, WP | Juice, poultice, decoction | Dysentery, headache, colds, sore throats, itch guard [88,120] | |
| 44 | <i>Pyrrosia lingua</i> (Thunb.) Farw. | Japan, China, Indonesia, Pacific Islands | LF, WP | Decoction | Diuretic, anti-inflammation, analgesic, cough, stomachache, urinary disorder (diuretic agent) [120,135–137] | Antioxidant [137], inhibition effects on virus-induced CPE when SARS-CoV strain BJ001 [138] |
| 45 | <i>Pyrrosia longifolia</i> (Burm. f.) C.V. Morton | Indonesia, Pacific Islands | LF | Poultice (cold water) | Ease pains in labor [51,120] | |
| 46 | <i>Pyrrosia petiolosa</i> (Christ) Ching | China | WP | Decoction | Urinary tract infections, as diuretic [139] | |
| 47 | <i>Pyrrosia sheareri</i> (Baker) Ching | China | LF | Decoction | Bacillary dysentery, rheumatism [120,140] | Antioxidant [140] |
| Psilotaceae | | | | | | |
| 48 | <i>Psilotum nudum</i> (L.) P. Beauv. | India | LF, SP | Fresh, decoction | Diarrhea (infants), antibacterial, purgative [88] | |
| Pteridaceae | | | | | | |
| 49 | <i>Acrostichum aureum</i> L. | South-East Asia, Bangladesh, Fiji, China, Panama | LF, RZ | Eaten, decoction | Wounds, peptic ulcers and boils, worm infections, asthma, constipation, elephantiasis, febrifuge, chest pain, emollients [51,68] | Anti-implantation (EtOH extract, albino rats) [141], Anti-tumour (hella cells, MTT assay) [142], Antioxidant (DPPH), tyrosine inhibition (96-well microtitre), antibacterial activity [77,143], anti-cancer ((gastric: AGS; colon: HT-29 and breast: MDA-MB-435S) using the MTT assay) [144] |
| 50 | <i>Acrostichum speciosum</i> Willd. | South-East Asia | | | Thatch [51] | |
| 51 | <i>Taenitis blechnoides</i> (Willd.) Sw. | Malaysia | LF | Decoction | Postnatal protection [145] | |
| Selaginellaceae | | | | | | |

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| 52 | <i>Selaginella tamariscina</i> (P.Beauv.) Spring | Nepal | WP, SP | Fresh (spore), decoction | Vermilion powder, prolapsed rectum, cough, bleeding piles, amenorrhea, antibacterial [90,146] | Anti-acne [147], thymus growth-stimulatory activity in adult mice (reversal of involution of thymus) and remarkable anti-lipid peroxidation activity [148] |
| Vittariaceae | | | | | | |
| 53 | <i>Vittaria elongata</i> Sw. | South-East Asia, Andaman | LF | Decoction | Rheumatism [90] | Cytotoxicity against two human cancer cell lines, lung carcinoma (NCI-H460) and central nervous system carcinoma (SF-268), antioxidant (DPPH) [149] |
| Non-Fern | | | | | | |
| Araceae | | | | | | |
| 54 | <i>Philodendron fragrantissimum</i> (Hook.) G.Don | Guyana, Suriname, Brazil | LF, RT | Decoction, external (leaves) | Inflammation, aphrodisiac, demulcent, diuretic [105] | |
| Aralliaceae | | | | | | |
| 56 | <i>Schefflera caudata</i> (Vidal) Merr. & Rolfe | Philippines | WP | Decoction | Tonic for women after birth [150] | |
| 57 | <i>Schefflera elliptica</i> (Blume) Harms. | South-East Asia, China, India | BK, LF, RT | Decoction, chewed, external | Bechic, vulnerary, toothache, aromatic bath, dropsy [150]. | Antibacterial [151] |
| 58 | <i>Schefflera elliptifoliola</i> Merr. | Philippines | LF | Decoction | Tonic for woman after birth [150] | |
| 59 | <i>Schefflera oxyphylla</i> (Miq.) R.Vig. | Thailand, Malaysia, Indonesia | RT | Decoction | Sedative for frightened child, externally to treat fevers [150] | |
| 60 | <i>Schefflera simulans</i> Craib | Thailand, Malaysia | LF, RT | Decoction | Stomach problem, protective medicine after birth [150] | |
| Asclepiadaceae | | | | | | |
| 61 | <i>Asclepiadaceae sp.</i> | Indonesia | LF, RT | Decoction | Promote blood circulation [104] | |
| 62 | <i>Dischidia acuminata</i> Costantin | Vietnam | WP | Decoction | Blenorrhoea, promote urination [52] | |
| 63 | <i>Dischidia bengalensis</i> Colebr. | Thailand | LT, RT | Latex (external), decoction (tonic) | Anthelmintic (ringworm), tonic [152] | |
| 64 | <i>Dischidia imbricata</i> (Blume) Steud. | Indonesia | LF | Poultice | Gonorrhoea, burns and wounds [58,153] | |
| 65 | <i>Dischidia major</i> (Vahl) Merr. | India, Thailand, Philippines, | LF, RT, WP | Decoction, chrused (external), | Peptic ulcer, liver dysfunction (decocted leaves mixed with <i>Hoya kerii</i> Craib leaves and <i>Vanilla aphylla</i> Blume stem), fever | |

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| | | Malaysia, Brunei | | chewed with areca catechu | (root), goiter (crushed leaves mixed with salt), cough (root mixed betel quid), wound and injuries, stomache [52,154,155] | |
| 66 | <i>Dischidia nummularia</i> R.Br. | Thailand, Indonesia | LF, LT, WP | Decoction, (external) | latex | Wound, gonorrhea, sprue in children, cirrhosis [156] |
| 67 | <i>Dischidia platyphylla</i> Schltr | Philippines | LF | Decoction | | Putrefaction [52] |
| 68 | <i>Dischidia purpurea</i> Merr. | Philippines | LF | Crushed mixed with coconut oil applied as external poultice | leaves | Eczema, herpes [52,157] |
| 69 | <i>Toxocarpus sp.</i> | Indonesia | LF | Decoction | | Headache, fever, nervous system problem [104] |
| Balsaminaceae | | | | | | |
| 70 | <i>Impatiens niammiamensis</i> Gilg (semi epiphytic) | Congo | LF | Poultice | | Wounds, sores, pain [158] Anti-hyperglycemic (Rat) [159] |
| Convolvulaceae <i>(parasite)</i> | | | | | | |
| 72 | <i>Cassytha filiformis</i> L | India, Taiwan, China, Vietnam, Malaysia, Philippines, Indonesia, Fiji, Africa, Central America. | WP, NT | Decoction | | Cough, dysentery, diarrhea, intestinal problems, headache, malaria fever, nephritis, edema, hepatitis, sinusitis, gonorrhea, syphilis, skin ulcer, eczema, prevent haemoptysis. Parasite skin and scalp. Induce lactation (after still birth), promote hair growth, diuretic, vermifuge, laxative agent, saliva blood removal (childbirth) [52,160–162] An α 1-adrenoceptor antagonist (Rat thoracic aorta) [163], antiplatelet and vasorelaxing actions (Rabbit platelet, aortic contraction) [164], anti-trypanosomal, cytotoxicity [165], antioxidant [166] |
| 73 | <i>Cuscuta australis</i> R.Br. | Indonesia, Vietnam, China | WP, SD | Decoction, poultice | | Whole plant: emollient, sedative, sudorific and tonic agents, urinary complaint. The seeds: sedative agent, diabetes, cornea opacity, acne, dandruff [167] Cytotoxicity, antioxidant activity, and inhibitory effects on tyrosinase activity and melanin biosynthesis were estd. by using melanoma Clone M-3 [168] |
| 74 | <i>Cuscuta reflexa</i> Roxb. | India | WP | Decoction, poultice | | Mixed with the twigs of <i>Vitex negundo</i> L. applied as fomentation on the abdomen of kwarsiokor children, fever, itchy [139, 140] Anti-viral [141, 142], anti-HIV [169], analgesic, relaxant (ether extract) [170], antisteroidogenic activity (MeOH extract) [171], antibacterial activity [172], |

hair growth activity in androgen-induced alopecia [173], anti-inflammatory (murine macrophage cell line RAW264.7), anti-cancer (Hep3B cells by MTT assay) [174], antioxidant (etOAc extract, DPPH), anti-obesity (EtOAc extract) [175]

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| Clusiaceae | | | | | | |
| 75 | <i>Clusia grandiflora</i> Splitg. (hemi epiphyte) | Guyana, Suriname | RT | Decoction | Aphrodisiac [105] | Antibacterial [176] |
| 76 | <i>Clusia fockeana</i> Miq. (hemi epiphyte) | Guyana, Suriname | ST(Exu date) | Poultice | Snake bites, ulcers [105] | |
| Gesneriaceae | | | | | | |
| 77 | <i>Columnnea nicaraguensis</i> Oerst. | Panama | ST, LF, WP | Decoction, maceration | Fever [177] | |
| 78 | <i>Columnnea sanguinolenta</i> (Klotzsch ex Oerst.) Hanst. | Panama | ST, LF | Decoction | Dysmenorrhea [177] | |
| 79 | <i>Columnnea tulae</i> Urb. var. <i>tomentulosa</i> (C.V. Morton) B.D. Morley | Panama | ST | Decoction | Fever [177] | |
| 80 | <i>Drymonia serrulata</i> (Jacq.) Mart. | Amazon | na | Not mentioned | Eczema [178] | Analgesic, anti-inflammatory [179] |
| 81 | <i>Drymonia coriacea</i> (Oerst. ex Hanst.) Wiehler | Amazon | na | Not mentioned | Toothache [178] | |
| Loganiaceae | | | | | | |
| 82 | <i>Fagraea auriculata</i> Jack. (semi epiphyte) | Indonesia | ST | | Stem for stick [58] | Anti-inflammatory [180] |
| Loranthaceae (parasite) | | | | | | |
| 83 | <i>Amyema bifurcata</i> (Benth.) Tiegh. | Australia | ST, LF | Decoction | Colds, fever, sores [181] | |
| 84 | <i>Amyema quandang</i> (Lindl.) Tiegh. | Australia | LF | Decoction | Fever [182] | |
| 85 | <i>Amyema maidenii</i> (Blakely) Barlow | Australia | FT | Decoction | Inflammation in the genital regions [183] | |
| 86 | <i>Dendrophthoe falcata</i> (L.f.) Ettingsh | India | WP | Decoction | Pulmonary tuberculosis, asthma, menstrual disorders, swellings, wounds, ulcers, strangury, renal and vesical calculi, | Wound healing activity was studied, antimicrobial activity and antioxidant activity [185] |

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| | | | | | | aphrodisiac, astringent, narcotic, diuretic [184]. | |
| 87 | <i>Dendrophthoe frutescens</i> L. | Indonesia | LF, WP | Drink (decoction) | | Anti-inflammation, antibacterial [84] | |
| 88 | <i>Dendrophthoe incarnata</i> (Jack) Miq. | Malaysia | LF | Poultice | | Mixed with <i>Curcuma longa</i> L and rice to make poultice to treat ringworm [186] | |
| 89 | <i>Dendrophthoe pentandra</i> (L.) Miq. | Indonesia, Malaysia, Thailand, Vietnam | LF, WP | Poultice, decoction | | Sores, ulcers, other skins infections, protective medicine after childbirth, cough, hypertension, cancer, diabetes, tonsil problem [51,58,186,187] | Antioxidant (MeOH extract, DPPH), Tyrosinase activity [187] |
| 90 | <i>Taxillus umbellifer</i> (Schult. f.) Danser | Indonesia, Malaysia, Vietnam | RT, LF | Decoction drink, poultice | | Fever, headache, wounds [186] | |
| 91 | <i>Erianthemum dregei</i> (Eckl. & Zeyh.) Tiegh. | Southern & Eastern Africa | BK | Mixed with milk | | Powdered mixed with milk to treat stomach problems in children [188] | |
| 92 | <i>Loranthus globosus</i> Roxb | Malaysia, Indo-China | LF, ST, FT | Poultice (leaves), juice | | Headache, expel afterbirth, cough [189] | Antimicrobial, cytotoxicity (brine shrimp) [190], toxicity (Evan's rat) [191] |
| 93 | <i>Loranthus spec div.</i> | Indonesia | WP | Poultice, decoction | | Ariola, varicella, diarrhea, ankylostomiasis, morbilli (gabag), cancer [58] | |
| 94 | <i>Macrosolen robinsonii</i> (Gamble) Danser | Vietnam | LF | Decoction | | Enlarged abdomen (diuretic tea) [192] | |
| 95 | <i>Macrosolen cochinchinensis</i> (Lour.) Tiegh. | Malaysia, Indo-China | ST, LF | Decoction, poultice | juice, | Expel after birth, headache, cough [192] | |
| 96 | <i>Scurrula atropurpurea</i> (Blume) Danser | Indonesia, Philippines | LF, ST, WP | Decoction | | Mouthwash (gargled), cancer (breast, throat cancer), cowpox, chickenpox, diarrhea, hookworm, measles, hepatitis, and cancer [193–195] | Cancer cell invasion inhibitory effects [196,197] |
| 97 | <i>Scurrula ferruginea</i> (Jack) Danser | Malaysia | LF, WP | Decoction, poultice | | Decocted whole plant (mixed with <i>Millettia sericea</i> (Vent.) Wight & Arnott) is used as bathing to relieve malaria, decocted leaves as protective medicine after childbirth, pounded leaves to treat wounds, snake bites [193] | Antiviral (HSV-1 and poliovirus) and cytotoxic activities on murine and human cancer lines (3LL, L1210, K562, U251, DU145, MCF-7) [198] |
| 98 | <i>Scurrula parasitica</i> L. | China, Vietnam | WP | Decoction | | Swelling, back pains, numbness, soreness of limbs, hypertension, galactagogue, quieting uterus (no contraction), reducing lumbago, bone strengthening. [193] | Anti-cancer (flavonoids extract, Leukimia cell line HL-60) [199], NF-κB inhibition [199], recovery of cisplatin-induced nephrotoxicity [200], Antioxidant (extracts, DPPH) [201] anti- |

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| | | | | | | cancer (Polysaccharide fraction, S180, K562 and HL-60 cell lines, MTT assay) [202], anti-obesity activity using porcine pancreatic lipase assay (EtOH extract, PPL; triacylglycerol lipase, EC 3.1.1.3)[203], neuroprotective activity (168, H ₂ O ₂ -induced oxidative damage in NG108-15 cells)[204], antibacterial (EtOH extract, MRSA) [205] |
| 99 | <i>Viscum aethiopicum</i> [sic] | Southern & Eastern Africa | LF | Decoction (tea) | Diarrhea [188] | |
| 100 | <i>Viscum capense</i> L.f. | Southern & Eastern Africa | ST, FT | Decoction, external | Wart, asthma, irregular menstruation, hemorrhage [188] | Antimicrobial activity (stems extract), Anticonvulsant activity (MeOH extract, albino mice) [206] |
| 101 | <i>Viscum pauciflorum</i> L.f. | Southern & Eastern Africa | WP | Decoction | Astringent [188] | |
| 102 | <i>Viscum rotundifolium</i> L.f. | Southern & Eastern Africa | WP | External | Wart [188] | Immunoassay (stem, aqueous extracts, T cell activity in ruminants) [207] |
| Melastomataceae | | | | | | |
| 103 | <i>Medinilla radicans</i> Blume | | LF, RT | Leaves eaten to treat dysentery, adventitious roots applied as poultice to wound, young leaves to skin disorders | Dysentery, wound and skin disorders [153] | |
| 104 | <i>Pachycentria constricta</i> (Bl) Blume | Indonesia | TB | Tubers are boiled and eaten | Hemorrhoids [51,104] | |
| Moraceae | | | | | | |
| 105 | <i>Ficus annulata</i> Blume | Indonesia | LF, RT | Leaves decoction to treat fever, the root to treat Hansen diseases | Fever and Hansen diseases [195] | |
| 106 | <i>Ficus deltoidea</i> Jack | Indonesia, Malaysia, Thailand | LF, RT, FT | Drink (decoction), ointment | Leucorrhoea, headache, fever, diabetes, high blood pressure, skin infection, aphrodisiac agent, ornament [104,208–210] | Toxicity (aqueous extract, rats) [211], anti-nociceptive [212], antioxidant (leaves aqueous extracts, redn. power of iron (III), superoxide anion (O ₂ -) |

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| | | | | | | scavenging, xanthine oxidase (XOD), nitric oxide (NO \cdot) and lipid peroxidn [213], anti-melanogenic effect (extract, B16F1 melanoma cells, MTT assay) [214], anti-cancer [215], hypoglycemic activity (extract, rodents) [78,214] antimicrobial activity (extract) [216], Anti-inflammatory [217] |
| 107 | <i>Ficus lacor</i> Buch.-Ham. | India | BK, LT, BD, SD | Decoction, poultice | Decocted stem bark to treat gastric and ulcer, latex to treat boils (external), typhoid and fever (internal), decocted bud to treat ulcer, leucorrhoea, Seed as tonic for stomach disorder [184,218–220] | The medicated liquor has effects of relaxing muscles and tendons, activating collateral flow, promoting blood circulation, dispelling blood stasis, expelling wind, removing dampness, and relieving pain [221] |
| 108 | <i>Ficus natalensis</i> Hochst. (semi epiphytic, secondary terrestrial) | Uganda, Tanzania, Senegal, West Africa, South Africa, | LF, LT, RT, BK | Decoction, poultice | Root was used to treat lumbago, headache, arthritis, cataract and cough, Leaves were used to treat snakes bite, malaria, dysentery, ulcers, wounds and used as septic ears [222] | Antibacterial, antimalarial, and/or antileishmania activities were obsd. in some crude extracts., and five of these exts. showed a significant cytotoxicity against human tumor cells [74] |
| 109 | <i>Ficus parietalis</i> Blume | Vietnam, Thailand, Malaysia, Indonesia | RT | Decoction | Stomach-ache [210] | |
| 110 | <i>Ficus pumila</i> L. | Vietnam | FT, LF, LT | Drink (decoction) | Diarrhea, hemaroid, rheumatic, anemia, haematura, dysentery, dropsy, galactoge, tonic for impotence, lumbago, anthelmintic agent, externally used to treat carbuncles [210] | Against T-cell leukemia [223], antimicrobial [224] |
| 111 | <i>Poikilospermum suaveolens</i> (Blume) Merr. | Indonesia, Thailand | BK | Decoction | Water from the stem for drink, aide the secretion of waste products from the vagina, pain, numbness, stomach ulcer [58,225,226] | Anti-viral (MeOH extract) [227] |
| Orchidaceae | | | | | | |
| 112 | <i>Acampe carinata</i> (Griff.) Panigrahi | Himalaya, Nepal | WP | Decoction | Rheumatism, sciatica, neuralgia, beneficial in secondary syphilis and uterine diseases [228] | |

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| 113 | <i>Acriopsis liliifolia</i> (J.Koenig) Seidenf. | Malaysia | LF, RT | Decoction of the roots and leaves | Fever [229] | |
| 114 | <i>Anoectochilus formosanus</i> Hayata | Taiwan | WP | Decoction | Fever, anti-inflammatory agent, diabetes, liver disorder, chest and abdominal pain [230] | Anti-inflammatory (water extract, rat paw), hepatoprotective (water extract, rat, SGOT-OPT) [231], anti-hyperliposis (414, rat induced) [232], ameliorative effect (water extract, ovariectomised rat) [233], antioxidant (water extract, DPPH) [234], anti-hyperglycemic (water extract, diabetic rats induced by streptozotocin) [235], anti-cancer (extracts, breast cancer MCF-7 cell) [236], liver regeneration (extract, rat) [237,238], Hepatoprotective (414, CCl ₄ induced rat) anti-inflammatory (414, lps stimulate mice) [239,240], anti-cancer (polysaccharide water extract, protate cancer cell lin PC3) [241] |
| 115 | <i>Anoectochilus roxburghii</i> (Wall.) Lindl. | Taiwan, China, Japan | WP | Decoction | Fever, snake bite, lung and liver diseases, hypertension, child malnutrition [242] | Hypoglycemic effect (414, streptozotocin (STZ) diabetic rats) [243], hypoglycemic and antioxidant effects (water extract, alloxan-induced diabetic mice, DPPH) [244] |
| 116 | <i>Ansellia africana</i> Lindl. | Southern & Eastern Africa | PD, ST, ST, RT | Decoction | Pedi is used to treat cough, the stem is used as aphrodisiac, used as emetic agent [188] | |
| 117 | <i>Bulbophyllum kwangtungense</i> Schltr. | China, Japan | TB | Tonic | To treat pulmonary tuberculosis, promote body liquid production, reduce fever, hemostatic agent [245] | Anti-tumor activities (456, 457, 458, against HeLa and K562 human tumor cell line) [246] |
| 118 | <i>Bulbophyllum odoratissimum</i> (Sm.) Lindl. ex Wall. | China, Burma, Vietnam, Thailand, Laos, Nepal, Bhutan, India | WP | Decoction | To treat pulmonary tuberculosis, chronic inflammation and fracture [247] | Anti-tumor (bibenzyl, inhibiting NO microphage) [247,248], anti-cancer (225,470, 471, 475, 476, 478, 479, 482, 484, human leukaemia cell lines K562 and HL-60, human lung adenocarcinoma A549, human hepatoma BEL-7402 and human stomach cancer SGC-790) [249], anti-cancer (human leukemia cell lines K562 and HL-60, human lung |

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| | | | | | | | | adenocarcinoma A549, human hepatoma BEL-7402 and human stomach cancer cell lines SGC-7901) Anti-cancer (473 and 474, human leukemia cell lines K562 and HL-60, human lung adenocarcinoma A549, human hepatoma BEL-7402 and human stomach cancer SGC-7901) [250] |
| 119 | <i>Bulbophyllum vaginatum</i> (Lindl.) Rchb.f. | Malaysia | WP | Juice | Juice of the plant is instilled in the ear to cure earache [160] | | | |
| 120 | <i>Catasetum barbatum</i> (Lindl.) Lindl. | Japan, Guiana, Paraguayan | WP | Decoction | Febrifuge, anti-inflammatory [79] | | | Anti-inflammatory (505, rat) [251] |
| 121 | <i>Coelogyne sp</i> | Indonesia | RT | Decoction | Headache, fever [104] | | | |
| 122 | <i>Cymbidium aloifolium</i> (L.) Sw. | Thailand, Vietnam | LF | Decoction (internal), juice from heated or crushed leaves. | Otitis media, colds, irregular periods, arthritis, sores, burns, tonic [252] | | | Antinociceptive, anti-inflammatory (EtOH extract, mice) [253] |
| 123 | <i>Cymbidium canaliculatum</i> R.Br | Australia | PdB | Chewed, poultice | Dysentery, boils, sores, wounds, itchy skin, fractured arms over the break [181,254] | | | |
| 124 | <i>Cymbidium ensifolium</i> (L.) Sw | Taiwan, Vietnam | LF, RT, FL, WP, RT | Decoction | Diuretic agent (leaves), pectoral agent (root), eye problem (flower), cough, lung, gastrointestinal problems and sedative [252] | | | |
| 125 | <i>Cymbidium goeringii</i> (Rchb.f.) Rchb.f. | Japan, China, Korea, Thailand, Vietnam, India | WP | Decoction | Hypertension, diuretic agent [255] | | | Anti-inflammatory (478, RAW 264.7 cells) [256], anti-hypertensive (515, rat), diuretic activity (515, rats) [255] |
| 126 | <i>Cymbidium madidum</i> Lindl. | Australia | PdB | Chewed | Dysentery [181] | | | |
| 127 | <i>Dendrobium affine</i> (Decne.) Steud. | Australia | PdB | Poultice, external | Crushed pseudobulbs (sticky) is applied to itchy skins, boils, infected skin lesion, minor burns [181] | | | |
| 128 | <i>Dendrobium aloifolium</i> (Blume) Rchb.f. | South East Asia | LF | Poultice | Headache [51] | | | |
| 129 | <i>Dendrobium amoenum</i> Wall. ex Lindl. | China | LF | Dried and ground | Skin diseases [257] | | | Antioxidant (519, NBT), antibacterial (519, diffusion) [257] |
| 130 | <i>Dendrobium chryseum</i> Rolfe | Australia | LF | Decoction | Diabetes [258] | | | Antioxidant (526, 530, 532, DPPH) [259] |

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| 131 | <i>Dendrobium candidum</i> Wall. ex Lindl. | China | LF | Decoction | Diabetes [260] | Inhibitory effect of atropine on salivary secretion (extracts, rabbit) [261], anti-hyperglycemic (extract, streptozotocin-induced diabetic (STZ-DM) rats) [260], antioxidant (polysaccharide, 10-phenanthroline-Fe ²⁺ -H ₂ O ₂ systems and ammonium peroxydisulfate/ <i>N,N,N',N'</i> -tetra-methylethanediamine systems) [262] antioxidant (555, 556, DPPH) [263], antioxidant (558, 559, 560, DPPH) [264], anti-tumor (soluble polysaccharide, human neuroblastoma (SH2SY5Y) induced by SPD was observed and analyzed by Hoechst stain method) [265] |
| 132 | <i>Dendrobium canaliculatum</i> var. <i>foelschei</i> (F.Muell.) Rupp & T.E.Hunt | Australia | PdB | Poultice, external | Crushed pseudobulbs (sticky) is applied to infected skin and cuts [181] | |
| 133 | <i>Dendrobium crumenatum</i> Sw. | Malaysia, Indonesia | LF, PdTB | Leaves pounded, bulbs heated to produce juice and applied as external uses | Acne (leaves), infected ears (pseudotubers) [266,267] | Antimicrobial [268] |
| 134 | <i>Dendrobium chrysanthum</i> Wall. ex Lindl. | China | LF | Dried and ground | Skin diseases, immune regulator, antipyretic, improve eyesight [269,268] | Anti-inflammation (590, macrophages were harvested from 2-month-old male C57BL/6J mice) [268] |
| 135 | <i>Dendrobium densiflorum</i> Lindl. | China | LF | Tonic | Promote body fluid production [270] | |
| 136 | <i>Dendrobium faciferum</i> J.J.Sm | Indonesia | ST | Dried | For twist work (craft) [271] | |
| 137 | <i>Dendrobium fimbriatum</i> Hook. | Japan, China | LF | Decoction, paste | Promote body fluid production, set fractured bone (paste) [272] | Antioxidant (water-soluble crude polysaccharide (DFHP), DPPH) [273] |
| 138 | <i>Dendrobium loddigesii</i> Rolfe | China | LF | Decoction | Promote body fluid production, reduce fever, nourish the stomach., anti-cancer agent [274] | Inhibitors of Na ⁺ , K ⁺ -ATPase of rat kidney (607, 608) [275], antiplatelet aggregation activity (479, 523, 606, rabbit platelet) [276], antioxidant (DPPH), anti NO production (activated |

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| | | | | | | | | | macrophages-like cell line, RAW264.7) [277] |
| 139 | <i>Dendrobium moniliforme</i> (L.) Sw. | China, Taiwan | ST | Decocted stem | dried | Anti-pyretic, analgesic, aphrodisiac, stomachic, tonic agents [278] | | | Anti-inflammatory (552, RAW 264.7 cells) [279], hypoglycemic (polysaccharide, mice) [280], antioxidant (polysaccharide) [281] |
| 140 | <i>Dendrobium moschatum</i> (Buch.-Ham) S.w | Nepal | LF | Juice | | Cure earache [282] | | | |
| 141 | <i>Dendrobium nobile</i> Lindl. | China, Indonesia | WP | Tonic | | Fever, reduce mouth dryness, aphrodisiac, promote body fluid production, nourish stomach, anorexia, lumbago, impotence [266,283–286] | | | Immunomodulatory activity (656, 660, 661, 662, 663, lymphocyte proliferation test MTT test) [287,288], antioxidant (478, 523, 524, 528, 584, 641, 672, 673, 674, DPPH) anti-NO (478, 523, 524, 528, 584, 641, 672, 673, 674, murine macrophage-like cell line RAW 264.7) [289], antioxidant (water-soluble polysaccharide (DNP), DPPH) [290], antimicrobial (Extracts), antitumour (extracts, Dalton's lymphoma ascites (DLA) cells w), induction of in vitro lipid peroxidation (extracts, TBARS) [291], NO inhibition (475, 523, 542, 632, 633, 634, 665–671, murine macrophage RAW 264.7 cells) [292], anti-tumor (polysaccharide extracts, sarcoma 180 in vivo and HL-60)[293] |
| 142 | <i>Dendrobium pachyphyllum</i> (Kuntze) Bakh.f. | Indonesia | WP | Decoction | | Hydropsy [271] | | | |
| 143 | <i>Dendrobium purpureum</i> Roxb. | Indonesia, Malaysia | LF | Crushed and heated to poultice | and make | Nail fungal infection [266] | | | |
| 144 | <i>Dendrobium salaccense</i> (Blume) Lindl. | Indonesia | LF | Fragrance | | Fragrance [271] | | | |
| 145 | <i>Dendrobium teretifolium</i> R.Br. | South-Pacific Island | LF | Decoction | | Severe headache, other pains [294,295] | | | |
| 146 | <i>Dendrobium catenatum</i> Lindl. | China | LF | Decoction | | Anxiety and panic [296] | | | |
| 147 | <i>Dendrobium utile</i> J.J.Sm. | Indonesia | ST | Dried | | Twist work [271] | | | |

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| 148 | <i>Dichaea muricata</i> (Sw.) Lindl. | Central, South American | LF | Decoction (wash) | Eye infection [285] | |
| 149 | <i>Eulophia speciosa</i> (R.Br.) Bolus | Indonesia | RT | Decoction | Analgesic [271] | |
| 150 | <i>Epidendrum strobiliferum</i> Rchb.f. | China, Korea | ST | Infusion, decoction | Analgesic [297] | Analgesic (676, 677 exhibited notable analgesic action at 3 mg/kg, causing 86 and 83% inhibition of abdominal constriction, respectively [297], antinociceptive effect (MeOH extract, methanolic ext. (ME) [298] |
| 151 | <i>Epidendrum rigidum</i> Jacq. | Mexico, North America, Antilles | ST | Infusion, decoction | Replenish body fluid [299] | Phytotoxin (chloroform-methanol extract) [299] |
| 152 | <i>Mycaranthes pannea</i> (Lindl.) S.C.Chen & J.J.Wood | Vietnam, Malaysia | WP | External, medicinal bath | Medicinal bath to treat ague and malaria fever, fractures, bruises, skin complaints, dislocated joint to relieve severe pain, swelling, dislocation and fracture [153,300,301] | |
| 153 | <i>Eriopsis biloba</i> Lindl. | America | ST | Poultice | Sore gums and mouth membranes [285] | |
| 154 | <i>Grammatophyllum scriptum</i> (L.) Blume | Indonesia, Thailand | BL, SD, ST | Poultice | Pseudo bulb mixed with curcuma and salt applied to sores and abdomen to expel worms, to treat dropsy and aphthae, seeds mixed with food to treat dysentery, aphthae, crushed plant mixed with rice liquor to treat snake bite, scorpions' and centipedes' stings [271,302] | |
| 155 | <i>Jumellea fragrans</i> (Thouars) Schltr. | Madagascar | LF, ST | Decoction | Anti-spasmodic, anti-asthmatic agents, mixed leaves of <i>Ziziphus mauritana</i> , <i>Mussaenda arcuate</i> to treat eczema (decoction), mixed with <i>Eugenia uniflora</i> to treat diarrhea [57] | |
| 156 | <i>Liparis condylobulbon</i> Rchb.f. | Indonesia | PdB, LF | Chewing, external | Intestinal complaints and constipation. (eastern Sulawesi, ambon), tormina, abscess [271,303] | |
| 157 | <i>Liparis nervosa</i> (Thunb.) Lindl. | China, Thailand, Malaysia | WP | Decoction, external | Stop internal/external bleeding, treat snake bites [303] | |

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| 158 | <i>Neottia ovata</i> (L.) Bluff & Fingerh. | Spain | TB | Tincture | Stomach diseases [304] | Anti-viral (extract, SARS-CoV Frankfurt 1 strain [305]) |
| 159 | <i>Masdevallia uniflora</i> Ruiz & Pav. | Mexico, south America | WP | Decoction | Facilitate urination (pregnant women), reduce bladder inflammation [285] | |
| 160 | <i>Camaridium densum</i> (Lindl.) M.A.Blanco | Mexico | WP | Decoction | Analgesic, relaxant agents [306] | Spasmolytic activity (667,690, 693, 694, 695, Wistar rat) [70], antinociceptive activity (extract, mice) [306] |
| 161 | <i>Nidema boothii</i> (Lindl.) Schltr. | Malaysia | WP | Decoction | Relaxant agent [307] | Spasmolytic effects (471, 478, 488, 508, 671, 696, 697, 699, 700, 702, guinea ileum pig model) [307] |
| 162 | <i>Oberonia lycopodioides</i> (J.Koenig) Ormerod | Malaysia | LF | Poultice | Boils [153,308] | |
| 163 | <i>Oberonia mucronata</i> (D.Don) Ormerod & Seidenf. | China, Vietnam | WP | Decoction | Rheumatism, promote blood circulation, inflammation of the bladder/ureter, bruises and fractures, detoxicant, diuretic agent [309] | |
| 164 | <i>Erycina pusilla</i> (L.) N.H.Williams & M.W.Chase | Mali | WP | Decoction | Lacerations [285] | |
| 165 | <i>Otochilus lancilabius</i> Seidenf. | Bhutan, Nepal, India, China (Tibet), Laos and Vietnam | WP | Pills | Antiemetic, febrifuge for stomach inflammation (<i>bad-tshad</i>), and allays hyperdipsia and dehydration [56] | |
| 166 | <i>Phragmipedium pearcei</i> (Rchb.f.) Rauh & Senghas | South America | WP | Decoction | Stomachache [285] | |
| 167 | <i>Pholidota articulata</i> Lindl. | Himalaya, Nepal | WP | | Whole plant: bone fractures [228] | |
| 168 | <i>Pholidota chinensis</i> Lindl. | China, India | PdB | Tincture | Scrofula, toothache, stomachache, chronic bronchitis, duodenal ulcer [310] | Antioxidant (475, 539, 667, 670, 671, 711, 712, 717, 722, 723, 726, DPPH), anti-inflammatory (475, 539, 667, 670, 671, 711, 712, 717, 722, 723, 726, inhibitory activity on NO production from activated macrophage-like cell line, RAW 264.7)[311], antioxidant (715, 741, 742, 746, 747, 749, 750, DPPH), anti-inflammatory (as above, inhibitory activity on NO production from |

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| | | | | | | | activated macrophages-like cell line, RAW 264.7) [310] |
| 169 | <i>Renanthera moluccana</i> Blume | Indonesia | WP | Ornament | Ornament [271] | | |
| 170 | <i>Rhynchosyilis retusa</i> (L.) Blume | Himalaya, Nepal, India | LF | | Rheumatic, hepaoprotective agent [312,228] | | |
| 171 | <i>Scaphyglottis livida</i> (Lindl.) Schltr. | Mexico | WP | Decoction | Analgesic, anti-inflammatory agents [306,313] | | Spasmolytic (471, 475, 714, 754,755, rat ileum rings) [314], antinociceptive (extracts, male mice ICR) [306], acute toxicity (extract, male mice ICR) [313] |
| 172 | <i>Vanda tessellata</i> (Roxb.) Hook. ex G.Don | India, Sri Lanka, Burma | LF, RT, FL | Leaves pounded to make juice, paste, extract (alcoholic) of the root and flower | Fever (as paste), otitis (dropped juice), the root to treat bronchitis, rheumatic, dyspepsia, sciatica, inflammation, otitis, nervous problem, fever and as aphrodisiac, laxative, tonic (for liver) agent [140,289-291] | | Cholinergic activity (glycoside fraction), anti-arthritic (extract, albino rat) [315], anti-inflammatory (extract), antidiabetic (extract, rat) [316,317] |
| 173 | <i>Papilionanthe teres</i> (Roxb.) Schltr. | Indonesia | WP | Ornament | Ornamental [318] | | Anti-aging (758, 759, HaCaT cytochrome C oxidase) [319] |
| 174 | <i>Vanilla griffithii</i> Rchb.f. | Indonesia | WP | Eaten | Edible [318] | | |
| 175 | <i>Vanilla planifolia</i> Jacks. ex Andrews | Indonesia, Mexico | FT, STh | Decoction | Fever, rheumatism, hysteria, increase energy and muscular system [58,284,318] | | Antimicrobial activity (extract) [320] |
| Piperaceae | | | | | | | |
| 176 | <i>Peperomia galioides</i> Kunth | Peru | WP | Poultice (external), drink (internal) | Chrused plant is used to treat wounds, cuts, plant juice is used to treat gastric ulcers [321] | | Antibacterial (oil) [322,323] |
| 177 | <i>Piper retrofractum</i> Vahl | Indonesia | FT, RT | Drink (decoction) | Anticonvulsion, antivomiting, diarrhea, dysentery, constipation, headache [324] | | Anti-convulsan (776, mice) [325], cytotoxicity (extract, 779) [326], anti-platelet aggregation (extract) [327], anti-vector (extract, mosquito larvae) [328,329], antioxidant (228, 283, 334, 574, 771, 772, 782, 783, DPPH) [330], antileishmanial activity (extracts, leishmania donovani) [331], anti-obesity (776, 777, C57BL/6] mice) [332] |
| Rubiaceae | | | | | | | |
| 178 | <i>Hydnophytum formicarum</i> Jack | Indonesia, Philippines, Thailand | TB | Poultice, decoction, powder | Poultice to treat swelling, headache, decoction to treat liver, intestinal complaints, powder as anthelmintic, heart | | Anti-tumor (extracts, against human tumor cell lines, HeLa and A549) [333], xanthine oxidase inhibitory (MeOH |

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| | | | | | tonic, antidiabetic agent and to treat skin, bone, knee, ankle, lung diseases [303] | extract, assayed spectrophotometrically under aerobic conditions [334], antimicrobial, cytotoxicity (226, 786, 787, against HuCCA-1 and KB cell lines) [335], trigger cytochrome C release in treated MCF-7 cell (786, ELISA) [336], anti-cancer (786, the human breast carcinoma cell line MCF-7) [337] |
| 179 | <i>Myrmecodia tuberosa</i> Jack | Indonesia | PT | Drink (decocted) | Swelling, headache [51,104,338] | Immunomodulatory effect (EtOH fractions) [339] |
| 180 | <i>Myrmecodia pendens</i> Merr. & L.M.Perry | Papua | PT | Decoction | Rheumatism, headache, renal problems, tumor [340] | |
| Sterculiaceae | | | | | | |
| 181 | <i>Scaphium macropodium</i> (Miq.) Beumée ex K.Heyne (hemi-epiphyte) | Indonesia | RT | Drink (decoction) | Nervous system problem [104] | |
| Verbenaceae | | | | | | |
| 182 | <i>Premna parasitica</i> Blume | Indonesia | LF | Drink (decoction) | Fever [58] | |
| Viscaceae | | | | | | |
| 183 | <i>Viscum articulatum</i> Burm.f. | Cambodia, India, Taiwan, China | WP | Poultice, decoction | Decoction to treat bronchitis, skin tumour, neuralgia, arthritis and as tonic, sedative, febrifuge, crushed plant to treat cut [341] | Toxicity (extract, mice) [342], anti-tumor (820, MTT assay) [343], anti-inflammatory (1234718, superoxide inhibition) [344], cytotoxicity and anti-HIV-1 activity (shown by isolated compounds including 801, 804, 803, 813, 814, 815, 824, 828); MDAMB-435 and HeLa cells, HIV-1IIIIB-infected C8166 cells) [345], anti-nephrotoxic (127, gentamicin-induced renal damage in Wistar rats) [346], antioxidant, anti-inflammatory (810, 811, 812, 822, 825, 829, 830, 831, 832, 833, 834, DPPH, NO production and cell viability assay. The murine macrophage cell line RAW264.7) [347], diuretic activity (MeOH extract, male rats) [348], antiepileptic activity (MeOH extract, rat) [349], anti-hypertension (glucocorticoid-induced |

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|----------------------|---------------------------------------|-----------------------|--------|--------------------|---|--|
| 184 | <i>Viscum ovalifolium</i> DC. | Cambodia, Malaysia | LF, WP | Poultice, external | Leaves (poultice) to treat neuralgia, as herbal bath to treat fever in children, ash mixed with sulphur, coconut oil to treat pustular itches [353] | hypertension, <i>N</i> ω -nitro-L-arginine methyl in rats) [350,351], antioxidant (polysaccharide fraction, DPPH) [352] |
| Zingiberaceae | | | | | | |
| 185 | <i>Hedychium ongi cornotum</i> Griff. | Indonesia | RZ, RT | Drink (decoction) | Rhizome is used to treat syphilis; root is used to treat worm [58] | |

Note: na: not mentioned; ST: stem; PT: pith; TB: tuber; SP: spore; BK: bark; LT: latex; NT: nutmeg; SD: seed; FT: fruit; BD: buds; PD: pedi; PdB: pseudobulbs; FL: flower; PdTB: pseudotuber; BL: bulbs; STh: sheath; WP: whole; LF: leaf; RT: root; RZ: rhizome.

Table 2. Phytochemical constituents of epiphytic medicinal plants.

| No | Epiphyte species | Constituents |
|----------------------|--|---|
| Fern species | | |
| Adiantaceae | | |
| 1 | <i>Adiantum caudatum</i> L., Mant | 16-hentriacontanone 1 , 19 α -hydroxyferna-7,9(11)-diene 2 , 29-norhopan-22-ol 3 , 3 α -hydroxy-4 α -methoxyfilicane 4 , 8 α -hydroxyfernan-25,7 β -olide 5 , adiantone 6 , filic-3-ene 7 , hentriacontane 8 , isoadiantone 9 , quercetin-3- <i>O</i> -glucoside 10 , β -sitosterol 11 , β -sitosterol 11 , β -sitosterol glucoside 12 [354–356] |
| Aspleanceae | | |
| 2 | <i>Asplenium nidus</i> L. | (-)-epiafzelechin 3- <i>O</i> - β -D-allopyranoside 13 , homoserine 14 [357] |
| Blechnaceae | | |
| 3 | <i>Stenochlaena palustris</i> (Burm. F.) Bedd. | 1- <i>O</i> - β -D-glucopyranosyl-(2 <i>S</i> *,3 <i>R</i> *,4 <i>E</i> ,8 <i>Z</i>)-2- <i>N</i> -[(2 <i>R</i>)-hydroxytetraacosanoyl]octadecaspingha 4,8-dienine 15 , 3-formylindole 16 , 3-oxo-4,5-dihydro- α -ionyl- β -D-lucopyranoside 17 , kaempferol 3- <i>O</i> - β -D-glucopyranoside 18 , kaempferol 3- <i>O</i> -(3',6'-di- <i>O</i> - <i>E</i> - <i>p</i> -coumaroyl)- β -D-glucopyranoside 19 , kaempferol 3- <i>O</i> -(3'- <i>O</i> - <i>E</i> - <i>p</i> -coumaroyl)-(6'- <i>O</i> - <i>E</i> -feruloyl)- β -D-glucopyranoside 20 , kaempferol 3- <i>O</i> -(3'- <i>O</i> - <i>E</i> - <i>p</i> -coumaroyl)- β -D-glucopyranoside 21 , kaempferol 3- <i>O</i> -(6'- <i>O</i> - <i>E</i> - <i>p</i> -coumaroyl)- β -D-glucopyranoside 22 , lutein 23 , stenopaluside 24 , stenopalustrosides A–E 25–29 , β -sitosterol-3- <i>O</i> - β -D-glucopyranoside 30 [358,359] |
| Davalliaceae | | |
| 4 | <i>Araiostegia divaricata</i> (Blume) M. Kato | (-)-epicatechin 3- <i>O</i> - β -D-(2''- <i>O</i> -vanillyl)allopyranoside 31 , (-)-epicatechin 3- <i>O</i> - β -D-(2'- <i>trans</i> -cinnamoyl)allopyranoside 32 , (-)-epicatechin 3- <i>O</i> - β -D-(3''- <i>O</i> -vanillyl)allopyranoside 33 , (-)-epicatechin 3- <i>O</i> - β -D-(3'- <i>trans</i> -cinnamoyl)allopyranoside 34 , (-)-epicatechin 3- <i>O</i> - β -D-allopyranoside 35 , (-)-epicatechin 3- <i>O</i> - β -D-allopyranoside 35 , (+)-catechin 3- <i>O</i> - β -allopyranoside 36 , 24-norferna-4 (23) 37 , 4 β -carboxymethyl(-)-epicatechin 38 , 4 β -carboxymethyl(-)-epicatechin methyl ester 39 , 4 β -carboxymethyl(-)-epicatechin potassium 40 , 9(11)-diene 41 , cyanin 42 , davallic acid 43 , epiafzelechin-(4 β →8)-epicatechin 3- <i>O</i> - β -D-allopyranoside 44 , epicatechin-(4 β →6)-epicatechin-(4 β →8)-epicatechin-(4 β →6)-epicatechin-D-glucocotono- δ -lactone enediol 45 , epicatechin-(4 β →8)-4 β -carboxymethylpicatechin 46 , hop-21-ene 47 , monardein 48 , pelargonin 49 , procyanidin B-2 3''- <i>O</i> - β -D-allopyranoside 50 , sodium salts 51 [92,93,360–364] |
| 5 | <i>Davallia solida</i> (G. Forst.) Sw. | 18-diene 52 , 18-diene 52 , 19 α -hydroxyfernenes 53 , 19 α -hydroxyfilic-3-ene 54 , 2- <i>C</i> - β -D-glucopyranosyl-1,3,6,7-tetrahydroxyxanthone 55 , 2- <i>C</i> - β -D-xylopyranosyl-1,3,6,7-tetrahydroxyxanthone 56 , 2- <i>C</i> - β -D-xylopyranosyl-1,3,6,7-tetrahydroxyxanthone 56 , 30- <i>O</i> - <i>p</i> -hydroxybenzoylmangiferin 57 , 3- <i>O</i> - <i>p</i> -hydroxybenzoylmangiferin 58 , 40- <i>O</i> -phydroxybenzoylmangiferin 59 , 4- <i>O</i> - β -D-glucopyranosyl-2,6,4'-trihydroxybenzophenone 60 , 4 β -carboxymethyl(-)-epicatechin 38 , 4 β -carboxymethyl(-)-epicatechin methyl ester 39 , 60- <i>O</i> - <i>p</i> -hydroxybenzoylmangiferin 61 , eriodictyol 62 , eriodictyol-8- <i>C</i> - β -D-glucopyranoside 63 , fena-9(11) 64 , fern-7-en-19 α -ol 65 , fern-9(11)-en-19 α -ol 66 , ferna-7 67 , filic-3-en-19 α -ol 68 , filica-3,18,20-triene 69 , filica-3,18-diene 70 , icariside E3 71 , icariside E5 72 , mangiferin 73 [99,101,362,365,366] |
| Lycopodiaceae | | |
| 6 | <i>Huperzia carinata</i> (Desv. ex Poir.) Trevis | carinatamins A, B, and C 74 , 75 , 76 [107] |
| 7 | <i>Huperzia phlegmaria</i> (L.) Rothm | 14 β ,21 α ,29-trihydroxyserrat-3 β -yl dihydrocaffeate (lycophlegmariol D) 77 , 21 α ,24-dihydroxyserrat-14-en-3 β -yl 4-hydroxycinnamate (lycophlegmariol C) 78 , 21 β ,24,29-trihydroxyserrat-14-en-3 β -yl dihydrocaffeate (lycophlegmariol B) 79 , 21 β ,29-dihydroxyserrat-14-en-3 α -yl dihydrocaffeate (lycophlegmariol A) 80 , 21 β -hydroxy-serrat-14-en-3 α -ol 81 , 21 β -hydroxy-serrat-14-en-3 α -yl acetate 82 , 8,11,13-abietatriene-3 β ,12-dihydroxy-7-one (margocilin) 83 , 8-deoxy-13-dehydroserratidine 84 , 8-deoxyserratidine 85 , acrifoline 86 , annotine 87 , annotinine 88 , |

- dihydrolycopodine **89**, epidihydrofawcettidine **90**, fawcettidine **91**, huperzine A **92**, lycododine **93**, lycoflexine **94**, lycophlegmarin **95**, lycophlegmarin **95**, lycophlegmarine **96**, lycophlegmine **97**, lycopodine **98**, malycorin A **99**, malycorins B, C **100, 101**, *N,N*-dimethylphlegmarine **102**, phlegmanol A–E **103–107**, phlegmaric acid **108**, α -obscurine **109**, β -obscurine **110** [110,367–372]
- 8 *Huperzia megastachya* (Baker) Tardieu 21-*epi*-serratenediol **111**, 21-*epi*-serratenediol-3-acetate **112**, lycoclavanol **113**, megastachine **114**, phlegmanol-D **115**, serratenediol **116**, serratenediol-3-acetate **117**, serratenonediol diacetate **118**, tohogenol diacetate **119** [373,374]
- 9 *Nephrolepis biserrata* (Sw.) Schott 1 β ,11 α -diacetoxy-11,12-epoxydrim-7-ene **120**, 1 β ,3 β ,11 α -triacetoxy-11,12-epoxydrim-7-ene **121**, 1 β ,6 α ,11 α -triacetoxy-11,12-epoxydrim-7-ene **122**, sequoyitol **123** [363,375]
- Oleandraceae**
- 10 *Nephrolepis cordifolia* (L.) C. Presl fern-9(11)-ene **124**, hentriacontanoic acid **125**, myristic acid octadecylester **126**, oleanolic acid **127**, sequoyitol (patent) **123**, triacontanol **128**, β -sitosterol **11** [376,377]
- Opioglossaceae**
- 11 *Botrychum lanuginosum* Wall.ex Hook & Grev. (6'-*O*-palmitoyl)-sitosterol-3-*O*- β -D-glucoside **129**, 1-*O*- β -D-glucopyranosyl-(2*S*,3*R*,4*E*,8*Z*)-2-[(2*R*-hydroxy hexadecanoyl) amino]-4,8-octadecadiene-1, 3-diol **130**, 30-nor-21 β -hopan-22-one **131**, apigenin **132**, β -sitosterol **133**, daucosterol **134**, luteolin **135**, luteolin-7-*O*-glucoside **136**, thunberginol A **137** [378]
- Polypodiaceae**
- 12 *Drynaria roosii* Nakaike kaempferol 3-*O*- β -D-glucopyranoside-7-*O*- α -L-arabinoside **138**, (2*R*)-naringin **139**, (2*S*)-narigenin-7-*O*- β -D-glucoside **140**, kaempferol 3-*O*- α -L-rhamnosyl-7-*O*- β -D-glucoside **141**, luteolin-7-*O*- β -D-neohesperidoside **142**, maltol glucoside **143**, (-)-epicatechin **144**, 12-*O*-caffeoyl-12-hydroxyldodecanoic acid **145**, xanthogalenol **146**, naringenin **147**, kushenol F **148**, sporaflavone G **149**, kurarinone **150**, leachianone A **151**, 8-phenylkaempferol **152**, kaempferol **153**, chiratone **154**, fern-9(11)-ene **155**, hop-22(29)-ene **156**, isoglaucanone **157**, dryocrassol **158**, dryocrassol acetate **159**, (+)-afzelechin-3-*O*- β -allopyranoside **160**, (+)-afzelechin-6-*C*- β -glucopyranoside **161**, 4 α -carboxymethyl-(+)-catechin methyl ester **162**, (-)-epiafzelechin-(4 β \rightarrow 8)-(-)-epiafzelechin-(4 β \rightarrow 8)-4 β -carboxymethyl(-)-epiafzelechin methyl ester **163**, (-)-epiafzelechin-(4 β \rightarrow 8)-4 β -carboxymethyl(-)-epicatechin methyl ester **164**, (-)-epiafzelechin-(4 β \rightarrow 8)-4 α -carboxymethyl(-)-epiafzelechin ethyl ester **165**, (-)-epiafzelechin-3-*O*- β -D-allopyranoside **166**, (-)-epicatechin-3-*O*- β -D-allopyranoside **167**, (+)-catechin **168**, 4 β -carboxymethyl(-)-epiafzelechin methyl ester **169**, 4 β -carboxymethyl(-)-epiafzelechin **170**, (-)-epiafzelechin-(4 β \rightarrow 8 \rightarrow O \rightarrow 7)-epiafzelechin-(4 β \rightarrow 8)-epiafzelechin **171**, (-)-epiafzelechin **172**, (-)-epiafzelechin-(4 β \rightarrow 8)-4 β -carboxymethyl-epiafzelechin methyl ester **173**, epicatechin-(4 β \rightarrow 8)-epicatechin **174**, (+)-afzelechin **175**, (+)-epicatechin-3-*O*- β -D-allopyranoside **176**, (-)-epicatechin-8-*C*- β -D-glucopyranoside **177**, (-)-epiafzelechin-5-*O*- β -D-allopyranoside **178**, drynachromoside A **179**, drynachromoside B **180**, fortunamide **181**, curcumine **182**, demethoxycurcumine **183**, bisdemethoxycurcumine **184**, bavachinine **185**, isobavachalcone **186**, (-)-epicatechin **144**, liquiritine **187**, bakuchiol **188**, protocatechuic acid **189**, (*R*)-5,7,3',5'-tetrahydroxy-flavonone 7-*O*-neohesperidoside **190**, (2*S*)-5,7,3',5'-tetrahydroxyflavonone 7-*O*- β -D-glucopyranoside **191**, 5,7,3',5'-tetrahydroxyflavonone **192**, 3'-lavandulyl-4-methoxy-2,2',4',6'-tetrahydroxyylcalcone **193**, 5,7-dihydroxychromone-7-*O*- β -D-glucopyranoside **194**, 5,7-dyhydroxychromone-7-*O*-neohesperidosyl **195** [76,379–383]
- 13 *Drynaria propinqua* (Wall. ex Mett.) Bedd (-)-epiafzelechin 3-*O*- β -D-allopyranoside **13** [384]
- 14 *Drynaria quercifolia* (L.) J.Sm. friedelin **196**, epifriedelinol **197**, β -amyrin **198**, β -sitosterol **11**, 3- β -D-glucopyranoside **199**, 3,4-dihydroxybenzoic acid **200**, acetylulpeol **201** [129,385]

- 15 *Drynaria rigidula* (Sw.) Bedd. fern-9(11)ene **202**, hop-22(29)-ene **156**, γ -sitosterol **203**, 3,4-dihydroxybenzoic acid **200**, 4-hydroxybenzoic acid **204**, 4-hydroxyphenyl-1-(2-arabinopyranosyl)-tetrahydro-2H-pyran-3,4,5-triol **205**, 4-hydroxyphenyl-1-tetrahydro-2H-pyran-3,4,5-triol **206**, kaempferitrin **207**, 3,5-dihydroxy-flavone-7-O- β -rhamnopyranosyl-4'-O- β -glucopyranoside **208** [125,386]
- 16 *Phymatosorus scolopendria* (Burm. f.) Pic. Serm. 1,2-benzopyrone (coumarin) **209** [80]
- 17 *Pyrrisia lingua* (Thunb.) Farw. diploptene **210**, β -sitosterol **11**, octanordammarane **211**, dammara-18(28),21-diene **212**, (18S)-18-hydroxydammar-21-en **213**, (18R)-18-hydroxydammar-21-ene **214**, (18S)-pyrrosialactone **215**, (18R)-pyrrosialactone **216**, (18S)-pyrrosialactol **217**, 3-deoxyocotillol **218**, dammara-18(28),21-diene **212**, cyclohopanol **219**, cyclohopanediol **220**, hop-22(29)-en-28-al **221** [387–389]
- 18 *Pyrrisia petiolosa* (Christ) Ching α -tocopherol **222**, diploptene **210**, 24-methylene-9,19-cyclolanost-3 β -yl acetate **223**, cycloeucalenol **224**, β -sitosterol **11**, daucosterol **134**, vanillic acid **225**, protocatechualdehyde **226**, hydrocaffeic acid **227**, caffeic acid **228**, 7-O-[6-O-(α -L-arabinofuranosyl)- β -D-glucopyranosyl]gossypetin **229**, kaempferol-3-O- β -D-glucopyranoside-7-O- α -L-arabinofuranoside **230** [389,390]
- 19 *Pyrrisia sheareri* (Baker) Ching diploptene **210**, β -sitosterol **11**, vanillic acid **225**, protocatechuic acid **189**, mangiferin **73**, fumaric acid **231**, sucrose **232** [75]
- Psilotaceae**
- 20 *Psilotum nudum* (L.) P. Beauv apigenin di-C-glycoside **233**, 7,4',4'-tri-O- β -D-glucopyranoside **234**, 4',4'-di-O- β -D-glucopyranoside **235**, 7,4'-di-O- β -D-glucopyranoside **236**, 3'-hydroxypsilotin (6-[4'-(β -D-glucopyranosyloxy)-3'-hydroxyphenyl]-5,6-dihydro-2-oxo-2H-pyran) **237**, 24-methylene-5 α -lanost-8-en-3 β -ol **238**, 24 β -methyl-25-dehydrolophenol **239**, codisterol **240**, isofucosterol **241**, 24-methylene-25-hydroxyphenol **242**, avenasterol **243**, psilotin **244** [391–394]
- Pteridaceae**
- 21 *Acrostichum aureum* L. quercetin 3-O- β -D-glucoside **245**, ponasterone A **246**, lupeol **247**, friedelin **196**, β -sitosterol **11**, stigmaterol **248**, campesterol **249**, tetracosanoic acid **250**, ursolic acid **251**, gallic acid **252**, (2R,3S)-sulfated pterosin C **253**, (2S,3S)-sulfated pterosin C **254**, (2S,3S)-pterosin C **255**, (2R)-pterosin P **256**, patriscabratine **257**, tetracosane **258**, quercetin-3-O- β -D-glucoside **259**, quercetin-3-O- β -D-glucosyl-(6 \rightarrow 1)- α -L-rhamnoside **260**, quercetin-3-O- α -L-rhamnoside **261**, quercetin-3-O- α -L-rhamnosyl-7-O- β -D-glucoside **262**, kaempferol **153** [68,395–397]
- 22 *Selaginella involvens* (P.Beauv.) Spring hexadecanoic acid **263**, stearic acid **264**, β -sitosterol **11**, stigmaterol **248**, amentoflavone **265**, β -D-glucopyranoside **266**, (3 β)-cholest-5-en-3yl **267**, β -amyrin **198** [398]
- Vittariaceae**
- 23 *Vittaria elongate* Sw. vittarin-A-F **268–273**, 3-O-acetylinduloic acid **274**, ethyl 3-O-acetylinduloate **275**, methyl 4-O-coumaroylquininate **276**, vittarilide-A, B **277, 278**, vittariflavone **279**, methyl 4-O-caffeoylquininate **280**, ethyl 4-O-caffeoylquininate **281**, methyl 5-O-caffeoylquininate **282**, apigenin **132**, vitexin **283**, 5,7-dihydroxy-3',4',5'-trimethoxyflavone **284**, amentoflavone **265**, *trans-p*-coumaric acid **285**, methyl *trans-p*-coumarate **286**, methyl caffeate **287**, ferulic acid **288**, *p*-cresol **289**, 4-hydroxybenzaldehyde **290**, 4-hydroxybenzoic acid **204**, methyl 4-hydroxybenzoate **291**, protocatechualdehyde **226**, protocatechuic acid **189**, methyl protocatechuate **292**, vanillin **293**, vanillic acid **225** [149]
- Non-Fern**
- Balsaminaceae**
- 24 *Impatiens niarniamensis* Gilg (semi epiphytic) α -N,N,N-trimethyltryptophan betaine **294** [159]

- 25 Convolvulaceae
(parasite)
- 26 *Cassytha filiformis* L. *N*-(3,4-dimethoxyphenethyl)-4,5-methylenedioxy-2-nitrophenylacetamide 295, actinodaphnine 296, cassythine 297, isoboldine 298, cassameridine 299, cassamedine 300, lysicamine 301, cathafiline 302, cathaformine 303, actinodaphnine 304, *N*-methylactinodaphnine 305, cathafiline 306, cathaformine 307, predicentrine 308, ocoteine 309, filiformine 310, (+)-diasyringaresinol 311, cathafiline 312, cathaformine 313, actinodaphnine 314, *N*-methylactinodaphnine 315, predicentrine 308, ocoteine 316, neolitsine 317, dicentrine 318, cassythine (cassyfiline) 319, actinodaphnine 320, 4-*O*-methylbalanophonin 321, cassyformin 322, isofiliformine 323, cassythic acid 324, cassythic acid 324, cassythine 325, neolitsine 326, dicentrine 318, 1,2-methylenedioxy-3,10,11-trimethoxyaporphine 327, (-)-*O*-methylflavinatine 328, (-)-salutaridine 329, isohamnetin-3-*O*- β -glucoside 330, isohamnetin-3-*O*-rutinoside 331 [164,378,399–403]
- 27 *Cuscuta australis* R.Br. 4-oic acid-7-oxo-kaurene-6 α -*O*- β -D-glucoside 332, thymidine 333, caffeic acid 228, *p*-coumaric acid 334, caffeic- β -D-glucoside 335, kaempferol 153, quercetin 336, astragalol 337, hyperoside 338, astragalol 339, kaempferol 153, quercetin 336, β -sitosterol 11, β -sitosterol 3-*O*- β -D-xylopyranoside 340 [404–406]
- 28 *Cuscuta reflexa* Roxb. coumarin 341, α -amyrin 342, β -amyrin 198, α -amyrin acetate 343, β -amyrin acetate 344, oleanolic acetate 345, oleanolic acid 127, stigmasteryl 248, lupeol 247, stigmast-5-en-3-*O*- β -D-glucopyranoside tetraacetate 346, stigmast-5-en-3-*O*- β -D-glucopyranoside 347, stigmast-5-en-3-yl-acetate 348, β -sitosterol 11, 3,5,7,3'-pentahydroxyflavanone (taxifolin) 349, 3,5,7,4'-tetrahydroxyflavanone (aromadendrin) 350 [169,407,408]
- Clusiaceae**
- 29 *Clusia grandiflora* Splitg. (hemi epiphyte) friedelin 196, β -amyrin 198, β -sitosterol 11, lupeol 247, chamone I 351, chamone II 352 [176,409]
- Loganiaceae**
- 30 *Fagraea auriculata* Jack. (semi epiphyte) di-*O*-methylcrenatin 353, potalioside B 354, adoxosidic acid 355, adoxoside 356, (*p*)-pinoresinol 357, salicifoliol 358 [180]
- Loranthaceae (parasite)**
- 31 *Dendrophthoe falcata* (L.f.) Ettingsh 3 β -acetoxy-1 β -(2-hydroxy-2-propoxy)-11 α -hydroxy-olean-12-ene 359, 3 β -acetoxy-11 α -ethoxy-1 β -hydroxy-olean-12-ene 360, 3 β -acetoxy-1 β -hydroxy-11 α -methoxy-olean-12-ene 361, 3 β -acetoxy-1 β ,11 α -dihydroxy-olean-12-ene 362, 3 β -acetoxy-1 β ,11 α -dihydroxy-urs-12-ene 363, 3 β -acetoxy-urs-12-ene-11-one 364, 3 β -acetoxy-lup-20(29)-ene 365, 30-nor-lup-3 β -acetoxy-20-one 366, (20S)-3 β -acetoxy-lup-29-oic acid 367, kaempferol-3-*O*- α -L-rhamnopyranoside 368, quercetin-3-*O*- α -L-rhamnopyranoside 369, gallic acid 252 [410]
- 32 *Loranthus globosus* Roxb (+)-catechin 168, 3,4-dimethoxycinnamyl alcohol 370, 3,4,5-trimethoxycinnamylalcohol 371 [190]
- 33 *Macrosolen cochinchinensis* (Lour.) Tiegh. quercetin 336, gallic acid 252, orientin 372, rutin 373, quercetin-3-*O*-apiosyl(1 \rightarrow 2)-[rhamnosyl(1 \rightarrow 6)]-glucoside 374, vicenin 375 [411]
- 34 *Scurrula atropurpurea* (Blume) Danser octadeca-8,10,12-triynoic acid 376, hexadec-8-ynoic acid 377, hexadec-10-ynoic acid 378, hexadeca-8,10-diyynoic acid 379, hexadeca-6,8,10-triynoic acid 380, hexadeca-8,10,12-triynoic acid 381, (*Z*)-9-octadecenoic acid 382, (*Z,Z*)-octadeca-9,12-dienoic acid 383, (*Z,Z,Z*)-octadeca-9,12,15-trienoic acid 384, octadeca-8,10-diyynoic acid 385, (*Z*)-octadec-12-ene-8,10-diyynoic acid 386, octadeca-8,10,12-triynoic acid 376, theobromine 387,

- caffeine **388**, quercitrin **389**, rutin **373**, icarisiside B2 **390**, aviculin **391**, (+)-catechin **168**, (-)-epicatechin **144**, (-)-epicatechin-3-*O*-gallate **392**, (-)-epigallocatechin-3-*O*-gallate **393** [196,197]
- 35 *Scurrula ferruginea* (Jack) Danser glycoside 4'-*O*-acetyl-quercitrin **394** [412]
- 36 *Scurrula parasitica* L. (+)-catechin **168** [204]
- Moraceae**
- 37 *Ficus pumila* L. (1*S*,4*S*,5*R*,6*R*,7*S*,10*S*)-1,4,6-trihydroxyeudesmane 6-*O*- β -D-glucopyranoside **39**, (1*S*,4*S*,5*S*,6*R*,7*R*,10*S*)-1,4-dihydroxymaaliene 1-*O*- β -D-glucopyranoside **396**, (2*S*,3*Z*)-3 β -acetoxycycloart-23-en-25-ol **39**, (2*S*,3*Z*)-3 β -acetoxyeupha-7,23-dien-25-ol **39**, (2*S*,4*R*)-3 β -acetoxycycloart-25-en-24-ol **39**, (2*S*,4*S*)-24-hydroxystigmast-4-en-3-one **400**, (2*S*,4*S*)-stigmast-5-ene-3 β ,24-diol **401**, 10 α ,11-dihydroxycadin-4-ene 11-*O*- β -D-glucopyranoside **402**, 3 β -acetoxo-(20*R*,22*E*,24*R*)-20,24-dimethoxydammaran-22-en-25-ol **403**, 3 β -acetoxo-(20*S*,22*E*,24*R*)-20,24-dimethoxydammaran-22-en-25-ol **404**, 3 β -acetoxo-20,21,22,23,24,25,26,27-octanordammaran-17 β -ol **405**, 3 β -acetoxo-22,23,24,25,26,27-hexanordammaran-20-one **406**, cycloartane-type triterpenoids **407**, triterpenoid **408** [413–415]
- Orchidaceae**
- 38 *Anoectochilus formosanus* Hayata (6*R*,9*S*)-9-hydroxy-megastigma-4,7-dien-3-one-9-*O*- β -D-glucopyranoside **409**, (R)-(+)-3,4-dihydroxybutanoic acid γ -lactone **410**, 1-*O*-isopropyl- β -D-glucopyranoside **411**, 2-(β -D-glucopyranosyloxymethyl)-5-hydroxymethylfuran **412**, 3-(*R*)-3- β -D-glucopyranosyloxy-4-hydroxybutanoic acid **413**, 3-(*R*)-3- β -D-glucopyranosyloxybutanolide (kinsenoside) **414**, 4-(β -D-glucopyranosyloxy)benzyl alcohol **415**, corchoionoside C **416** [416]
- 39 *Anoectochilus roxburghii* (Blume) 24 ξ -isopropenylcholesterol **417**, 5-hydroxy-3',4',7-trimethoxyflavonol-3-*O*- β -D-rutinoside **418**, 7-*O*- β -D-diglucoside **419**, 8-*C*- β -hydroxybenzylquercetin **420**, 8-*p*-hydroxybenzyl quercetin, **421**, anoectosterol **422**, campesterol **249**, cirsilineol **423**, daucosterol **134**, ferulic acid **288**, isorhamnetin **424**, isorhamnetin-3 **425**, isorhamnetin-3, 4'-*O*- β -D-diglucoside **426**, isorhamnetin-3-*O*- β -D-rutinoside **427**, isorhamnetin-7-*O*- β -D-glucopyranoside **428**, isorhamnetin-7-*O*- β -D-diglucoside **429**, kaempferol-3-*O*- β -D-glucopyranoside **430**, kaempferol-7-*O*- β -D-glucopyranoside **431**, *p*-coumaric acid **334**, *p*-hydroxybenzaldehyde **432**, quercetin **336**, quercetin 3'-*O*- β -D-glucopyranoside **433**, quercetin 3-*O*- β -D-glucopyranoside **434**, quercetin 3-*O*- β -D-rutinoside **435**, quercetin 7-*O*- β -glucoside **436**, quercetin-7-*O*- β -D-[6'-*O*-(*trans*-feruloyl)]-glucopyranoside **437**, sitosterol **438**, stigmasterol **248**, succinic acid **439**, 3',4',7-trimethoxy-3,5-dihydroxyflavone **440**, 3-methoxyl-*p*-hydroxybenzaldehyde **441**, daucosterol **134**, daucosterol **134**, ferulic acid **288**, isorhamnetin-3-*O*- β -D-glucopyranoside **442**, isorhamnetin-3-*O*- β -D-rutinoside **443**, lanosterol **444**, methyl 4- β -D-glucopyranosyl-butanoate **445**, *o*-hydroxy phenol **446**, oleanolic acid **127**, palmitic acid **447**, *p*-hydroxy benzaldehyde **448**, *p*-hydroxy cinnamic acid **449**, *p*-hydroxybenzaldehyde **432**, rutin **373**, sorghumol 3-*O*-*E*-*p*-coumarate **450**, sorghumol 3-*O*-*Z*-*p*-coumarate **451**, stearic acid **264**, succinic acid **452**, β -D-glucopyranosyl-(3*R*)-hydroxybutanolide **453**, β -sitosterol **11** [395-403]
- 40 *Bulbophyllum kwangtungense* Schltr. 10,11-dihydro-2,7-dimethoxy-3,4-methylenedioxydibenzo[*b,f*]oxepine **454**, 5-(2,3-dimethoxyphenethyl)-6-methylbenzo[*d*][3,4,3,6]dioxole **455**, 7,8-dihydro-3-hydroxy-12,13-methylenedioxy-11-methoxyldibenz[*b,f*]oxepin **456**, 7,8-dihydro-4-hydroxy-12,13-methylenedioxy-11-methoxyldibenz[*b,f*]oxepin **457**, 7,8-dihydro-5-hydroxy-12,13-methylenedioxy-11-methoxyldibenz [b,f]oxepin, **458**, cumulatin **459**, densiflorol A **460**, plicatol B **461** [245,417]
- 41 *Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall. (+)-lyoniresinol-3a-*O*- β -D-glucopyranoside **462**, 3,5-dimethoxyphenethyl alcohol **463**, 3,7-dihydroxy-2,4,6-trimethoxyphenanthren **464**, 3-hydroxyphenethyl 4-*O*-(6'-*O*- β -apiofuranosyl)- β -D-glucopyranoside **465**, 3-methoxy-4-hydroxycinnamic aldehyde **466**, 3-methoxyphenethyl alc. 4-*O*- β -D-glucopyranoside **467**, 4-hydroxy-3,5-dimethoxybenzaldehyde **468**, 4-*O*- β -D-glucopyranoside **469**, 7-hydroxy-2,3,4-trimethoxy-9,10-dihydrophenanthrene **470**, batatasin III **471**, Bulbophyllanthrone **472**, bulbophythrins A, B **473**, **474**, Coelonin **475**, densiflorol B **476**, ethyl orsellinat **477**, gigantol **478**, moscatin **479**, *p*-hydroxyphenylpropionic acid **480**, *p*-hydroxyphenylpropionic methyl ester **481**, syringaldehyde **482**, syringin **483**, tristin **484**, vanillic acid **225** [249,250,418–421]

- 42 *Bulbophyllum vaginatum* (Lindl.) Rchb.f. (±)-syringaresinol **485**, (2*R**,3*S**)-3-hydroxymethyl-9-methoxy-2-(4'-hydroxy-3',5'-dimethoxyphenyl)-2,3,6,7-tetrahydrophenanthro [4,3-*b*]furan-5,11-diol **486**, 2,4-dimethoxyphenanthrene-3,7-diol **487**, 3,4,6-trimethoxyphenanthrene-2,7-diol **488**, 3,4,6-trimethoxy-9,10-dihydrophenanthrene-2,7-diol **489**, 3,4',5-trihydroxy-3'-methoxybibenzyl (tristin) **490**, 3,4'-dihydroxy-5,5'-dimethoxybibenzyl **491**, 3,4-dihydroxybenzoic acid **200**, 3,4-dimethoxy-9,10-dihydrophenanthrene-2,7-diol (erianthridin) **492**, 3,4-dimethoxyphenanthrene-2,7-diol (nudol) **493**, 3,5-dimethoxy-9,10-dihydrophenanthrene-2,7-diol (6-methoxycoelonin) **494**, 3,5-dimethoxyphenanthrene-2,7-diol **495**, 3'-dihydroxy-5-methoxybibenzyl **496**, 4,4',6,6'-tetramethoxy-[1,1'-biphenanthrene]-2,2',3,3',7,7'-hexol **497**, 4,6-dimethoxy-9,10-dihydrophenanthrene-2,3,7-triol **498**, 4,6-dimethoxyphenanthrene-2,3,7-triol **499**, 4-methoxy-9,10-dihydrophenanthrene-2,7-diol (coelonin) **500**, 4-methoxyphenanthrene-2,7-diol (flavanthrinin) **501**, 4-methoxyphenanthrene-2,3,5-triol (fimbriol B) **502**, 9,10-dihydrophenanthrenes **503**, dihydroferulic acid **504**, Friedelin **196**, *p*-coumaric acid, **334** [69,422,423]
- 43 *Catasetum barbatum* (Lindl.) Lindl. 2,7-dihydroxy-3,4,8-trimethoxyphenanthrene **505** [251]
- 44 *Cymbidium aloifolium* (L.) Sw. aloifol I **506**, aloifol II **507**, 6-*O*-methylcoelonin **508**, batatasin III **471**, coelonin **475**, gigantol, **478**, 1-(4'-hydroxy-3',5'-dimethoxyphenyl)-2-(3'-hydroxyphenyl)ethane **509**, 1-(4'-hydroxy-3',5'-dimethoxyphenyl)-2-(4''-hydroxy-3''-methoxyphenyl)ethane **510**, 2,7-dihydroxy-4,6-dimethoxy-9,10-dihydrophenanthrene **511**, cymbinodin-A **512**, cymbinodin B **513** [424–426]
- 45 *Cymbidium goeringii* (Rchb.f.) Rchb.f. β-sitosterol **11**, daucosterol **134**, ergosterol **514**, gigantol **478**, cymbidine A **515** [255,256,427]
- 46 *Dendrobium amoenum* Wall. ex Lindl. amotin **516**, amoenin **517**, amoenumin **518**, amoenylin, isoamoenylin **519**, 3,4'-dihydroxy-5-methoxybibenzyl, **520**, 4,4'-dihydroxy-3,3',5-trimethoxybibenzyl (moscatilin) **521** [428–430]
- 47 *Dendrobium chryseum* Rolfe araxerol **522**, coumarin **341**, moscatilin **523**, chrysotobibenzyl **524**, chrysotoxin **525**, gigantol **478**, kaempferol **153**, *cis*-melilotoside **526**, defuscin **527**, dendroflorin **528**, dengibsin **529**, dihydromelilotoside **530**, naringenin **147**, *n*-octacosyl ferulate **531**, *trans*-melilotoside **532** [259,431]
- 48 *Dendrobium candidum* Wall. Ex Lindl. (-)-loliolide **533**, (-)-secoisolariciresinol **534**, (-)-syringaresinol **535**, (+)-lyoniresinol-3*a*-*O*-β-*D*-glucopyranoside **462**, (+)-syringaresinol-4-β-*D*-monoglucoside **536**, (1*R*)-1'-(4-hydroxy-3,5-dimethoxyphenyl) propan-1'-ol 4-*O*-β-*D*-glucopyranoside **537**, (*E*)-*p*-Hydroxycinnamic acid **538**, 2,4,7-trihydroxy-9,10-dihydrophenanthrene **539**, 2-methoxyphenol-*O*-β-*D*-apiofuromosyl-(1→2)-β-*D*-glucopyranoside **540**, 3,4-dihydroxy-5,4'-dimethoxybibenzyl **541**, 3-*O*-methylgigantol **542**, 4,4'-dihydroxy-3,5-dimethoxybibenzyl **543**, 4',5-dihydroxy-3,3'-dimethoxybibenzyl **544**, 4-allyl-2,6-dimethoxyphenylglucoside **545**, 4'-dihydroxy-5-methoxybibenzyl **546**, 5-hydroxymethyl-furaldehyde **547**, Adenosine **548**, Aduncin **549**, *cis*-feruloyl-*p*-hydroxybenzenethylamine **550**, coniferyl alcohol **551**, daucosterol **134**, defuscin **527**, denbinobin, **552**, dendrocandin A **553**, dendrocandin B **554**, dendrocandin C **555**, dendrocandin D **556**, dendrocandin E **557**, dendrocandins F–I **558–561**, dendromonilioside E **562**, dendrophenol **563**, dihydroresveratrol **564**, gigantol **478**, guanosine **565**, hentriacontane **8**, heptadecanoic acid **566**, hexadecanoic acid **263**, icariol A 2-4-*O*-β-*D*-glucopyranoside **567**, khaephuoside **568**, leonurioside A **569**, naringenin **147**, *n*-octacosyl ferulate **531**, *N*-*trans*-feruloyl tyramine **570**, *n*-triacontyl *cis*-*p*-coumarate **571**, *p*-hydroxy-phenylpropionic acid **480**, sucrose **232**, syringaresinol **572**, syringaresinol-4,4'-*O*-bis-β-*D*-glucoside **573**, *trans*-cinnamoyl-*p*-hydroxybenzenethylamine **574**, uridine **575**, vanillyl alcohol **576**, β-sitosterol **11** [237-239,419-421]
- 49 *Dendrobium chrysanthum* Wall. Ex Lindl. (2*S*)-*N*-*cis*-cinnamoyl-2-oxopropylpyrrolidine **577**, (2*S*)-*N*-*trans*-cinnamoyl-2-oxopropylpyrrolidine **578**, (*b*)-lyoniresinol **579**, 2,5-dihydroxy-4,9-dimethoxyphenanthrene **580**, 4,4'-dihydroxy-3,3',5-trimethoxybibenzyl **581**, 7,70-bis-(4-hydroxy-3,5-dimethoxyphenyl)-8,80-dihydroxymethyl-tetrahydrofuran-4-β-*D*-glucoside **582**, chrysophanol **583**, chrysotobibenzyl **524**, chrysotobibenzyl **524**, chrysotoxin **525**, crepidatin **584**, dehydrodiconiferyl alcohol-4-β-*D*-glucoside **585**, denchrysans A, B **586**, **587**, denchryside A **588**, denchryside B **589**, dendrochrysanene **590**, dendroflorin **528**, dengibsin **529**, dengibsin **529**, emodin **591**, gigantol **478**, moscatilin **523**, moscatilin **523**, moscatin **479**, physcion **592**, β-sitosterol **11** [226,418,422-425]

- 50 *Dendrobium fimbriatum* Hook. 2-hydroxyethyl caffeate 593, ayapin 594, chrysophanol 583, chrysotobibenzyl (I) 595, confusarin 596, crepidatin 584, defuscin 527, denhydroshizukanolide 597, fimbriatone 598, *n*-dotriacontanoic acid 599, *n*-octacosyl ferulate 531, *n*-triacontyl *cis-p*-coumarate 571, physcion 592, rhein 600, scopolin methyl ether 601, β -sitosterol 11 [432,433]
- 51 *Dendrobium loddigesii* Rolfe dendrophenol (4,4'-dihydroxy-3,3',5-trimethoxybibenzyl) 563, loddigesiinols A-D 602-605, moscatilin 523, moscatilin diacetate 606, moscatin 479, shihunidine 607, shihunine 608, stilbenes 609 [275-277]
- 52 *Dendrobium moniliforme* (L.) Sw. heptacosane 610, 3,4-dihydroxy-4',5-dimethoxy bibenzyl 611, 3,4-dihydroxy-5,4'-dimethoxy bibenzyl 612, 4-methoxybenzaldehyde 613, a known alkaloid 6-hydroxynobiline 614, alkyl 4'-hydroxy-*cis*-cinnamates 615, alkyl ferulates 616, daucosterol 134, denbinobin 552, denbinobin, alkyl 4'-hydroxy-*trans*-cinnamates 617, dendromonilide E 562, ethyl linolenates 618, heptatriaconsanoic acid 619, linoleic acid 620, methyl linolenates 621, moniliformin 622, moniline 623, *n*-nonacosane 624, *n*-octacosyl ferulate 531, *n*-triacontyl *p*-hydroxy-*cis*-cinnamate 625, octacosanyl hexadecanoate 626, phytosterols 627, stigmast-4-en-3-one 628, vanillin 293, α -dihydropicrotoxinin 629, β -sitosterol 11 [285,434-438]
- 53 *Dendrobium moschatum* (Buch.-Ham) S.w. moscatin 479, moscatilin 523 [254,428-432]
- 54 *Dendrobium nobile* Lindl. 10,12-dihydroxypicrotoxane 630, 10 β ,13,14-trihydroxyalloaromadendrane 631, 3,4,8-trimethoxyphenanthrene-2,5-diol 632, 3,4'-dihydroxy-5,5'-dimethoxydihydrostilbene 633, 3-*O*-methylgigantol 542, 5,7-dimethoxyphenanthrene-2,6-diol 634, 6-hydroxy-dendrobine (dendramine) 635, 6-hydroxy-dendroxine 636, 6 α ,10,12-trihydroxypicrotoxane 637, 7,12-dihydroxy-5-hydroxymethyl-11-isopropyl-6-methyl-9-oxatricyclo [6.2.1.0^{2,6}]undecan-10-one-15-*O*- β -D-glucopyranoside 638, batatasin III 471, bullatantirolo 639, chrysotobibenzyl 524, coelonin 475, crepidatin 584, denbinobin 552, dendrobane A 640, dendrobin A,7 chrysotoxine 641, dendrobine 642, dendrobiumane 643, dendrodensiflorol, 644, dendroflorin 528, dendronobiline A-I 645-653, dendronobiline J 654, dendronobiline A 655, dendronobilosides A, B 656, 657, dendronophenol A-B 658, 659, dendroside A 660, dendroside E-G 661-663, dendroxineo 664, ephemeranthal A 665, ephemeranthal C 666, erianthridin 667, fimbriol-B 668, flavanthridin 669, gigantol 478, hircinol 670, lusianthridin 671, moscatilin 523, moscatilin 523, moscatin, 479, gigantol 478, nobilin D-E 672, 673, nobilone 674, nobilonine 675, stigmasterol 248, β -sitosterol 11, β -sitosterol glucoside 12 [71,286-289,292,439-444]
- 55 *Epidendrum strobiliferum* Rchb.f. 24-methylenecycloartanol 676, campesterol 249, pholidotin 677, stigmasterol 248, β -sitosterol 11 [297]
- 56 *Epidendrum rigidum* Jacq. 2,3-dimethoxy-9,10-dihydrophenanthrene-4,7-diol 678, 24-methyl-9,19-cyclolanostane-25-en-3 β -ol 679, 3,4,9-trimethoxyphenanthrene-2,5-diol 680, apigenin 132, batatasin III 471, gigantol 478, isovitexin 681, stilbenoids I-IV 682-685, triterterpenoids 24,24-dimethyl-9,19-cyclolanostane-25-en-3 β -ol 686, vitexin 283 [299]
- 57 *Mycaranthes pannea* (Lindl.) S.C.Chen & J.J.Wood Acervatol 687, acervatone 688, flavanthridin 669, flavanthrinin 689 [301]
- 58 *Camaridium densum* (Lindl.) M.A.Blanco 2,5-dihydroxy-3,4-dimethoxyphenanthrene 690, 2,5-dihydroxy-3,4-dimethoxyphenanthrene 690, 9,10-dihydro-2,5-dihydroxy-3,4-dimethoxyphenanthrene 691, 9,10-dihydro-2,7-dihydroxy-3,4-dimethoxyphenanthrene 692, erianthridin 667, fimbriol-A 693, gymnopusin 694, nudol 695 [70,445]
- 59 *Nidema boothii* (Lindl.) Schltr. 1,5,7-trimethoxy-9,10-dihydrophenanthrene-2,6-diol, 696, 1,5,7-trimethoxyphenanthrene-2,6-diol 697, 2,4-dimethoxyphenanthrene-3,7-diol 488, 9,19-cyclolanosta-24,24-dimethyl-25-en-3 β -yl *trans-p*-hydroxycinnamate 698, aloifol II 507, batatasin III 471, ephemeranthal B 699, ephemeranthaloquinone 700, gigantol 478, lusianthridin 671, nidemin 701, nidemone 702 [307,446]
- 60 *Pholidota articulata* Lindl. 2,7-dihydroxy-3,4,6-trimethoxy-9, 10-dihydrophenanthrene flavidin 703, 2,7-dihydroxyl-methoxy-9,10-dihydrophenanthrene (coelonin) 704, 9, 10-dihydrophenanthrenes 705, coelogin 706, coeloginin 707, flavidin 708, flavidin 709, oxoflavidin 710 [447]

- 61 *Pholidota chinensis* Lindl. (*E*)-2',3,3'-trihydroxy-5-methoxystilbene (pholidotol C) **711**, (*Z*)-3,3'-hydroxy-5-methoxystilbene (pholidotol D) **712**, 2,4,7-trihydroxy-9,10-dihydrophenanthrene **539**, 2,5-dimethoxy-3,4,3',4'-bis(dimethylenedioxy)bibenzyl **713**, 3,4'-dihydroxy-3',5'-dimethoxybibenzyl **714**, 3,4'-dihydroxy-4-methoxydihydrostilbene **715**, 4,4'-dihydroxydiphenylmethane **716**, 4,5-dihydroxy-2-methoxy-9,10-dihydrophenanthrene **717**, 5,3'-dihydroxy-2,3-(methylenedioxy)bibenzyl **718**, 9,10-dihydro-2,4-dihydroxy-7-methoxyphenanthrene **719**, batatasin III **471**, blestrinol A **720**, blestrin A **721**, bulbophylol B **722**, cannabidiol **723**, coelonin **475**, coelonin **475**, cyclopholidone **724**, cyclopholidone **724**, cyclopholidonol **725**, cyclopholidonol **725**, erianthridin **667**, eulophiol **726**, flavanthrin **727**, flavanthrin **727**, gymconpin C **728**, hircinol **670**, lusianthridin **671**, lusianthridin, **671**, phochinenins A – F **729–734**, phochinenins G-L **735–740**, pholidotols A-B **741**, **742**, 3,4'-dihydroxy-5-methoxydihydrostilbene **743**, phoyunnanin D **744**, *p*-hydroxybenzaldehyde **432**, *p*-hydroxybenzyl alcohol **745**, protocatechuic aldehyde **746**, resveratrol **747**, thunalbene **748**, thunalbene **749**, *trans*-3-3-dihydroxy-2,5-dimethoxystilbene **750**, *trans*-3-hydroxy-2,3,5-trimethoxystilbene **751**, β -daucosterol **752** [310,311,434,435,448,449]
- 62 *Scaphyglottis livida* (Lindl.) Schltr. 24,24-dimethyl-9,19-cyclolanosta-9(11),25-dien-3-one (cyclobalanone) **753**, 3,4'-dihydroxy-3',4,5-trimethoxybibenzyl **754**, 3,4'-dihydroxy-3',5'-dimethoxybibenzyl **714**, 3,7-dihydroxy-2,4,8-trimethoxyphenanthrene **755**, 3,7-dihydroxy-2,4-dimethoxyphenanthrene **756**, 5 α -lanosta-24,24-dimethyl-9(11),25-dien-3 β -ol **757**, batatasin III **471**, coelonin **475**, gigantol **478**, nidemin **701** [313,314,446]
- 63 *Papilionanthe teres* (Roxb.) Schltr. eucomic acid **758**, vandaterosides I-III **759–761** [319]
- 64 *Vanda tessellate* (Roxb.) Hook. ex G. Don. Oxotessallatin **762** [436]
- Piperaceae**
- 65 *Peperomia galioides* Kunth (+)-*epi*- α -bisabolol **763**, galopiperone **764**, grifolic acid **765**, grifolin **766**, hydropiperone **767**, piperogalin **768**, piperogalone **769** [437,438,450]
- 66 *Piper retrofractum* Vahl 28-methylnonacos-27-en-1-oic acid **770**, 3-methyl-5-decanoylpyridine **771**, caffeic acid **228**, di-methyl 3,4-bis(4-hydroxyphenyl)-1,2-cyclobutanedicarboxylate **772**, esculetin **773**, methyl piperate **774**, *N*-isobutyleicosa-2,4-dienamide **775**, *p*-coumaric acid **334**, pipereicosalidine **776**, piperine **777**, piperine **777**, pipernonaline **778**, piperoctadecalidine **779**, retrofractamide-D **780**, retrofractamides A, C **781**, **782**, uracil **783**, uridine **575**, vitexin **283**, vitexin 2'-*O*- β -glucopyranoside **784**, β -D-glucopyranoside **266**, β -sitosterol **11** [325,330,451–454]
- Rubiaceae**
- 67 *Hydnophytum formicarum* Jack 4-aminophenyl acetate **785**, 7,3',5'-trihydroxyflavone **786**, butein **787**, butin **788**, Isoliquiritigenin **789**, protocatechualdehyde **226**, stigmast-4-en-3-one **628**, stigmasterol **248**, β -sitosterol **11** [337,386]
- Viscaceae**
- 68 *Viscum articulatum* Burm.f. (2*S*)-5,3,4-trihydroxyflavanone 7-*O*- β -D-glucoside **790**, (2*S*)-homoeriodictyol **791**, (2*S*)-homoeriodictyol 7-*O*- β -D-glucoside **792**, (2*S*)-naringenin 7-*O*- β -D-glucoside **793**, (2*S*)-pinocembrin 7-*O*-[cinnamoyl(1 \rightarrow 5)- β -D-*apiosyl*(1 \rightarrow 2)]- β -D-glucoside **794**, (2*S*)-pinocembrin 7-*O*-[β -D-*apiosyl*(1 \rightarrow 2)]- β -D-glucoside (1) **795**, (2*S*)-pinocembrin 7-*O*- β -D-glucoside **796**, (4'-hydroxy-2',3',6',3''-tetramethoxy-1,3-diphenylpropane)-4''-*O*- β -D-glucopyranoside **797**, 1-*O*-benzyl-[5-*O*-benzoyl- β -D-*apiofuranosyl*(1 \rightarrow 2)]- β -D-glucopyranoside **798**, 2-deoxy-*epi*-inositol **799**, 2-phenylethanol **800**, 4- β -D-glucosyloxy-3-hydroxy-benzoic acid **801**, 4'-hydroxy-7,3'-dimethoxyflavan-5-*O*- β -D-glucopyranoside **802**, 4-*O*-cinnamoyl quinic acid **803**, 5,3',4'-trihydroxyflavanone-7-*O*- β -D-glucopyranoside **804**, 5,4'-dihydroxyflavanone-7-*O*- β -D-glucopyranoside **805**, 7-*O*- β -D-glucopyranoside **806**, betulin **808**, betulinic acid **809**, cinnamic acid methyl ester **810**, diphenylpropane glycoside **811**, eriodictyol 7-*O*- β -D-glucopyranoside **812**, homoeriodictyol 7-*O*- β -D-glucopyranoside **813**, homoeriodictyol-7-*O*- β -D-glucopyranoside **814**, homoeriodictyol-7-*O*- β -D-glucopyranoside-4'-*O*- β -D-(5''-cinnamoyl)apiofuranoside **815**, homoeriodictyol-7-*O*- β -D-glucopyranoside-4'-*O*- β -D-*apiofuranoside* **816**, lupenyl

| | | |
|----|---------------------------------|---|
| | | acetate 817 , lupeol 247 , lupeol acetate 818 , lupeol palmitate 819 , lupeol stearate 820 , lycorin 821 , methylparaben 822 , naringenin 7- <i>O</i> - β -D-glucopyranoside 823 , Oleanolic acid 127 , <i>p</i> -hydroxybenzaldehyde 432 , <i>p</i> -hydroxy-benzoic acid 824 , pinocembrin 825 , pinocembrin 7- <i>O</i> - β -D-glucopyranoside 826 , pinocembrin-7- <i>O</i> -[cinnamoyl (1 \rightarrow 5)- β -D-apiofuranosyl (1 \rightarrow 2)]- β -D-glucopyranoside 827 , pinocembrin-7- <i>O</i> - β -D-apiofuranosyl(1 \rightarrow 2)- β -D-glucopyranoside 828 , pinocembrin-7- <i>O</i> - β -D-apiofuranosyl-(1 \rightarrow 5)- β -D-apiofuranosyl-(1 \rightarrow 2)- β -D-glucopyranoside 829 , protocatechuic acid 189 , vanillin 293 , visartisides A-C 830, 831, 832 , visartisides D-F (4–6) 833, 834, 835 , viscumitol 836 , α -amyrin 342 , β -amyrin acetate 837 , β -sitosterol 11 [343–347,455–457] |
| 69 | <i>Viscum ovalifolium</i> DC | 3- <i>O</i> - α -L-arabinopyranoyl-hederagenin-28- <i>O</i> - β -D-glucopyranosyl-(1 \rightarrow 6)- β -D-glucopyranoside 838 , gypsogenic acid 839 , hederagenin 840 , hederagenin-3- <i>O</i> - α -L-arabinopyranoside 841 , hederagenin-3- <i>O</i> - α -L-arabinopyranoyl-(2 \rightarrow 1)- <i>O</i> - β -D-glucopyranoside 842 , lupeol acetate 818 , lupeol palmitate 819 , oleanolic acid 127 , lupeol stearate 820 , β -amyrin 198 , β -amyrin acetate 344 [458,459] |

6. Conclusions

Epiphytes are the most beautiful vascular plants and contain interesting phytochemicals and possess exciting pharmacological activities. An analysis of the literature revealed 185 epiphytes that are used in traditional medicine, in which phytochemical studies identified a total of 842 secondary metabolites. Only 71 epiphytic medicinal plants were studied for their pharmacological activities and showed promising pharmacological activities, including anti-inflammatory, antimicrobial, and anticancer. Several species were not investigated for their activities and are worthy of exploration, including epiphytes from the Araceae (*P. fragrantissimum*), Aralliaceae (*S. caudata*, *S. elliptica*, *S. elliptifoliola*, *S. oxyphylla*, *S. simulans*), and Asclepidaceae (*Asclepiadaceae sp.*, *D. acuminata*, *D. benghalensis*, *D. imbricate*, *D. major*, *D. nummularia*, *D. platyphylla*, *D. purpurea*, *Toxocarpus sp.*) families, in which no phytochemical and pharmacological studies had been reported. These species have been used by Indigenous populations to treat both degenerative and nondegenerative diseases. It is known that there are examples of Indigenous populations living in protected forest reserves (e.g., in Indonesia) where epiphytes are used in their medicine, e.g., some species of *Dischidia* are used to treat fever, eczema, herpes etc.; these plants have not yet been studied. Therefore, the possibility of responsible bioprospecting exists (in compliance with the Nagoya protocol), which would be invaluable in biodiversity knowledge as well as in mutual benefit sharing agreements.

Author Contributions: Conceptualization, A.S.N., P.W., P.A.K.; data curation and analysis, A.S.N.; making and editing of the figures, A.S.N.; writing—original draft preparation, A.S.N., P.W., P.A.K.; writing—review and editing, A.S.N., B.T., P.W., P.A.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: ASN thanks to University of Jember and University of Wollongong for research support. Authors thank to Frank Zich (Australian Tropical Herbarium & National Research Collections Australia) for providing taxonomy consultation.

Conflicts of Interest: The authors declare no conflict of interest

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