Vascular epiphytic medicinal plants as sources of therapeutic agents: Their ethnopharmacological uses, chemical composition, and biological activities

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Abstract
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Review

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

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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 pleistocene 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 exploit 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.](image)

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 Dendrobiun 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).
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).

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.

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 pamea (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 sheareri (Bak.) Ching successfully isolated several compounds and were subjected to antioxidant testing. While this was not in line with the plant’s ethnomedical uses for dysentery therapy [75], one of the isolated constituents was protocateuchic 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 deltoida* 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-hyperglycemic 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-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].
| No | Epiphyte species          | Location                  | Part of plants | Preparation route and administration | Indication (traditional)                                                                 | Pharmacological testing (modern)                                                                 |
|----|---------------------------|---------------------------|----------------|--------------------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1  | *Adiantum caudatum* 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]                                                                                                  |
| 2  | *Asplenium nidus* 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  | *Asplenium macrophyllum* Sw. | India                  | LF             | Decoction                            | As laxative, emetic, diuretic, anthelmintic agent, to treat ophthalmia, jaundice, spleen diseases [85,87] |                                                                                                                                                           |
| 4  | *Asplenium polydon* G. Foster var *bipinnatum* (Sledge) | India                  | LF             | Decoction, paste                     | Promote labor, tumor [88]                                                                                                                                 |
| 5  | *Asplenium serratum* L.  | Columbia, Peru           | na             | Not mentioned                        | Liver problem, stomachache, ovary inflammation [85,89]                                                                                             |
| 6  | *Stenochlaena palustris* (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] |
| 7  | *Davallia denticulata* (Burm. f.) Mett. ex Kuhn | Malaysia, Indonesia      | RT             | Decoction                            | Gout, pain, as tonic [82,91]                                                                                                                         |
| No. | Species                             | Origin                  | Part(s)     | Traditional Uses                                                                 | Modern Uses                                                                 |
|-----|------------------------------------|-------------------------|-------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 8   | *Araiosestia divaricata* (Blume) M. Kato | China, Taiwan           | WP          | Not mentioned                                                                  | Joint pain [92]                                                               |
|     |                                    |                         |             |                                                                                 | Anti-psoriasis [93], antioxidant (water extract, DPPH) [94]                  |
| 9   | *Davallia parvula* Wall. Ex Hook. & Grev. | na                      | WP          | Not mentioned                                                                  | Not mentioned [51,95]                                                       |
| 10  | *Davallia solida* (G. Forst.) Sw.  | Tahiti, Fiji, other Polynesian | WP          | Decoction (external and internal)                                               | Dysmenorrhea, 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-pg [101], anti-skin aging [102] |
| 11  | *Leucostegia immersa* Wall. ex C. Presl | Nepal                   | RZ          | Decoction, paste                                                                | Boils (paste), constipation (decoction), as antibacterial (paste) [103]     |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 12  | *Aeschynanthus radicans* Jack       | Malaysia                | LF          | Decoction                                                                       | Headache [52]                                                               |
| 13  | *Cyrtandra sp*                      | Indonesia               | LF          | Poultice                                                                         | Skin ailments [104]                                                         |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 14  | *Hymenophyllum polyanthos* Sw.     | Suriname                | WP          | Burnt (smoke inhaling), decoction                                               | Dizziness (insanity), pain, cramps [105]                                     |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 15  | *Hymenophyllum javanicum* Spreng.  | India                   | WP          | Smoke together with garlic and onions                                           | Headache [88]                                                               |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 16  | *Huperzia carinata* (Desv. ex Poir.) Trevis | South-East Asia       | WP          | Ointment                                                                        | Stimulate hair growth [106]                                                  |
|     |                                    |                         |             |                                                                                 | Anti-acetylcholinesterase (74,75,76, colorimetric Ellman method) [107]       |
| 17  | *Huperzia phegmaria* (L.) Rothm.    | South-East Asia, India  | WP          | Ointment                                                                        | Stimulate hair growth, skin diseases [108,109]                               |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 18  | *Huperzia megastachya* (Baker) Tardieu | Madagascar             | LF          | Decoction (infusion)                                                            | Tonic [111]                                                                  |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 19  | *Huperzia obtusifolia* (Sw.) Rothm. | Madagascar             | LF          | Decoction (infusion)                                                            | Tonic [111]                                                                  |
|     |                                    |                         |             |                                                                                 |                                                                               |
| 20  | *Nephrolepis acutifolia* (Desv.) Christ | Malaysia               | WP          | Boiled, eaten                                                                   | Food [112]                                                                   |
| No. | Species                                      | Origin                   | Parts Used   | Uses                                                                                   | Comments                                                                 |
|-----|---------------------------------------------|--------------------------|--------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 21  | *Nephrolepis biserrata* (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  | *Nephrolepis cordifolia* (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]         |
|     | **Opiglossaceae**                           |                          |              |                                                                                        |                                                                          |
| 23  | *Oleandra musifolia* (Blume) C. Presl       | Philippines, India       | ST           | Decoction Anthelmintic, emmenagogue, antidote (snake bite) [103,117]                    |                                                                          |
|     | *Botrychum lanuginosum* Wall.ex Hook & Grev.| India                    | WP           | Decoction, paste Antibacterial, anti-dysentery agents [90]                               |                                                                          |
| 24  | *Ophioglossum pendulum* L.                  | Indonesia, Philippines   | LF           | Ointment, decoction Hair treatment (crushed leaves), cough (decocotion), rid the first feces (spores), ornament [118] | Cell activator, skin whitening agent and antioxidant (patent, mixed with other *Ophioglossum* species) [119], anti-diarrhea (stipe MeOH extract, rabbit jejunum) [119] |
|     | **Polypodiaceae**                           |                          |              |                                                                                        |                                                                          |
| 26  | *Pyrosia piloselloides* (L.) M.G. Price     | Indonesia, Malaysia, China, Philippines, Pacific islands | LF           | Decoction (internal), chewed, poultice (external) Smallpox, rashes, gonorrhea, dysentery, tuberculosis, urinary tract infection, headache, cough, gum inflammation, tooth sockets, eczema, coagulate blood [120–123] | Antibacterial, anti-fungal (extracts) [124]                                |
| 27  | *Drynaria rigidula* (Sw.) Bedd.             | Indonesia, Philippines, Treasury Island | LF, RZ       | Decoction, chewing Gonorrhea, dysentery (rhizome, decoction), and seasickness (chewed) [54] | n-Hexane, dichloromethane and ethyl acetate fractions from both rhizome and leaves of *Drynaria rigidula* were screened for activity against *Plasmodium falciparum, Mycobacterium tuberculosis*, vero cells and herpes simplex virus which all extracts showed insignificant activities [125] |
| 28  | *Drynaria sparsisora* (Desv.) T. Moore      | Indonesia, Philippines, Thailand | LF, RZ       | External, decoction Rhizome: headache, fever, diarrhea, gonorrhea, swollen limbs, fever. Leaves: |                                                                          |
| No. | Species                  | Origin           | Type     | Uses                                                                 | Compounds                                                                 |
|-----|--------------------------|------------------|----------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|
| 29  | Drynaria roosii Nakaike  | China            | WP       | Decoction                                                             | Compound 230 was isolated and the biotesting showed the highest stimulation toward UMR 106 cells (osteoblast) by 42.6% at a concentration of 1 µM [127] |
| 30  | Drynaria propinqua (Wall. ex Mett.) Bedd | Bhutan, India and Nepal | ST  | Pills                                                                 | Antidote and detoxifier especially when suffering from meat poisoning and other human-made poisons (sbyar-dug) [128] |
| 31  | Drynaria quercifolia (L.) J.Sm. | Malaysia, Philippines, Indonesia, India | LF, RZ | Decoction, poultice                                                    | Compound 200 from the ethyl acetate fraction to be responsible for good antimicrobial activity [129] |
| 32  | Lepisorus contortus (Christ) Ching | Bhutan, India, China | LF   | Powder                                                                | Heals bone fracture, burns, wounds and kidney disorders [130] |
| 33  | Loxogramme involuta (D. Don) C. Presl | Indonesia | LF, WP | Smoked                                                                | Smoked with tobacco [51] |
| 34  | Loxogramme scolopendria (Bory) Presley | Indonesia | LF   | Smoked                                                                | Cigarette paper [131] |
| 35  | Microsorum fortunei (T. Moore) Ching | Indonesia | WP   | Decoction                                                             | Diuretic, promote blood circulation [82,84] |
| 36  | Microsorum punctatum (L.) Copel. | India           | LF   | Juice                                                                 | Diuretic, purgative, wounds [103] |
| 37  | Phlebodium aureum (L.) J.Sm | Mexico          | RZ   | Decoction                                                             | Cough, fever, sudorific agents [90] |
| 38  | Phymatosorus scolopendria (Burm. f.) Pic. Serm. | South-East Asia, Madagascar | RZ | Fragrance (external), poultice, decoction                             | Bronchodilator (341, in vivo) [80] | Respiratory disorder [51,80] |
| 39  | Platycerium coronarium (Mull.) Desv. | Indonesia       | LF   | Poultice (salt added)                                                 | Thyroid edema, scabies [51,132] |

- **Drynaria roosii** Nakaiké: Deficient kidney, invigorate blood, heal wound, stop bleeding [54].
- **Drynaria propinqua**: Antidote and detoxifier especially when suffering from meat poisoning and other human-made poisons (sbyar-dug) [128].
- **Drynaria quercifolia**: Swelling, fever (poultice leaves), haemoptysis, typhoid fever, ulcers, dyspepsia, arthralgia, diarrhea (decoced rhizome), inflammation, anthelmitic, cough, fever, phthisis, poultice of rhizome mixed with *Lannea coromandelica* (Houtt.) Merr. to treat headache, hepatoprotective agent [21, 22, 96].
- **Lepisorus contortus**: Heals bone fracture, burns, wounds and kidney disorders [130].
- **Loxogramme involuta**: Smoked with tobacco [51].
- **Loxogramme scolopendria**: Cigarette paper [131].
- **Microsorum fortunei**: Diuretic, promote blood circulation [82,84].
- **Microsorum punctatum**: Diuretic, purgative, wounds [103].
- **Phlebodium aureum**: Cough, fever, sudorific agents [90].
- **Phymatosorus scolopendria**: Bronchodilator (341, in vivo) [80].
- **Platycerium coronarium**: Thyroid edema, scabies [51,132].
| No. | Species                        | Origin                          | Usage/Preparation                  | Uses/Properties                                                                 |
|-----|--------------------------------|---------------------------------|------------------------------------|---------------------------------------------------------------------------------|
| 40  | *Platycerium bifurcatum* (Cav.) C. Chr. | Indonesia                       | LF Poultice (salt added)           | Thyroid edema, scabies, fever, swelling [100, 101]                               |
| 41  | *Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf. | South-Africa, Mexico, Guatemala | LF, RZ Decoction                   | Sore throat, itches, cough, febrifuge [103,133]                                 |
| 42  | *Pyroecia heterophylla* (L.) M.G. Price | India                           | WP Poultice                        | Swelling, sprain, pain (cooling agent) [134]                                    |
| 43  | *Pyroecia lanceolata* (L.) Farw.   | Malaysia, South-Africa, Mexico   | LF, WP Juice, poultice, decoction  | Dysentery, headache, colds, sore throats, itch guard [88,120]                   |
| 44  | *Pyroecia lingua* (Thunb.) Farw.   | Japan, China, Indonesia, Pacific Islands | LF, WP Decoction                   | Diuretic, anti-inflammation, analgesic, cough, stomachache, urinary disorder (diuretic agent) [120,135–137] |
| 45  | *Pyroecia longifolia* (Burm.f.) C.V. Morton | Indonesia, Pacific Islands      | LF Poultice (cold water)           | Ease pains in labor [51,120]                                                    |
| 46  | *Pyroecia petiolosa* (Christ) Ching | China                           | WP Decoction                       | Urinary tract infections, as diuretic [139]                                      |
| 47  | *Pyroecia sheareri* (Baker) Ching   | China                           | LF Decoction                       | Bacillary dysentery, rheumatism [120,140]                                        |
| 48  | *Psilotum nudum* (L.) P. Beauv.     | India                           | LF, SP Fresh, decoction            | Diarrhea (infants), antibacterial, purgative [88]                                |
| 49  | *Acrostichum aureum* 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] |
| 50  | *Acrostichum speciosum* Wild.      | South-East Asia                 | Thatch                            | 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], antitumor ((gastric: AGS; colon: HT-29 and breast: MDA-MB-435S) using the MTT assay) [144] |
| 51  | *Taenitis blechnoides* (Willd.) Sw. | Malaysia                        | LF Decoction                       | Postnatal protection [145]                                                       |
| No. | Species                        | Origin/Location                  | Usage/Preparation          | Uses/Activities                                                                 |
|-----|--------------------------------|---------------------------------|----------------------------|--------------------------------------------------------------------------------|
| 52  | Selaginella tamariscina         | 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] |
|     |                                |                                 |                            |                                                                                   |
| 53  | Vittaria elongata 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] |
|     |                                |                                 |                            |                                                                                   |
|     |                                |                                 |                            |                                                                                   |
| 54  | Philodendron fragrantissinum    | Guyana, Suriname, Brazil        | LF, RT Decoction, external (leaves) | Inflammation, aphrodisiac, demulcent, diuretic [105]                               |
|     |                                |                                 |                            |                                                                                   |
| 56  | Schefflera caudata (Vidal)      | Philippines WP                  | Decoction                   | Tonic for women after birth [150]                                                  |
|     |                                |                                 |                            |                                                                                   |
| 57  | Schefflera elliptica (Blume)    | South-East Asia, China, India   | BK, LF, RT Decoction, chewed, external | Bechic, vulnerary, toothache, aromatic bath, dropsy [150]. Antimicrobial [151] |
|     |                                |                                 |                            |                                                                                   |
| 59  | Schefflera elliptifoliola Merr. | Philippines                     | LF Decoction               | Tonic for woman after birth [150]                                                  |
|     |                                |                                 |                            |                                                                                   |
| 60  | Schefflera simulans Craib       | Thailand, Malaysia              | LF, RT Decoction           | Stomach problem, protective medicine after birth [150]                            |
|     |                                |                                 |                            |                                                                                   |
| 61  | Asclepiadaceae                 | Indonesia                       | LF, RT Decoction           | Promote blood circulation [104]                                                    |
|     |                                |                                 |                            |                                                                                   |
| 62  | Dischidia acuminata Constantin | Vietnam WP                     | Decoction                  | Blenorrhoea, promote urination [52]                                                |
|     |                                |                                 |                            |                                                                                   |
| 63  | Dischidia bengalensis Colebr.   | Thailand LT, RT                 | Latex (external), decoction (tonic) | Anthemintic (ringworm), tonic [152]                                               |
|     |                                |                                 |                            |                                                                                   |
| 64  | Dischidia imbricata (Blume)     | Indonesia                       | LF Poultice                | Gonorrhoea, burns and wounds [58,153]                                             |
|     | Steud.                         |                                 |                            |                                                                                   |
| 65  | Dischidia major (Vahl) Merr.    | India, Thailand, Philippines    | LF, RT, crusped (external), | Peptic ulcer, liver dysfunction (decoked leaves mixed with Hoya kerii Craib leaves and Vanilla aphylla Blume stem), fever |
|     |                                |                                 |                            |                                                                                   |
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66  **Dischidia nummularia** R.Br.  
Malaysia, Brunei  
Decoction, latex (external)  
Chewed with areca catechu (root), goiter (crushed leaves mixed with salt), cough (root mixed betel quid), wound and injuries, stomache [52,154,155]
Wound, gonorrhea, sprue in children, cirrhosis [156]

67  **Dischidia platyphylla** Schltr.  
Philippines  
Decoction  
Putrefaction [52]

68  **Dischidia purpurea** Merr.  
Philippines  
Crushed leaves mixed with coconut oil applied as external poultice  
Eczema, herpes [52,157]

69  **Toxocarpus sp.**  
Indonesia  
Decoction  
Headache, fever, nervous system problem [104]

70  **Impatiens niamniamensis** Gilg (semi epiphytic)  
Congo  
Poultice  
Wounds, sores, pain [158]  
Anti-hyperglicemic (Rat) [159]

71  **Convolvulaceae** (parasite)  

72  **Cassytha filiformis** L  
India, Taiwan, China, Vietnam, Malaysia, Philippines, Indonesia, Fiji, Africa, Central America.  
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 α1-adrenoceptor antagonist (Rat thoracic aorta) [163], antiplatelet and vasorelaxing actions (Rabbit platelet, aortic contraction) [164], anti-trypanosomal, citotoxicity [165], antioxidant [166]

73  **Cuscuta australis** R.Br.  
Indonesia, Vietnam, China  
Decoction, poultice  
Whole plant: emollient, sedative, sudorific and tonic agents, urinary complaint. The seeds: sedative agent, diuretic, 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  **Cuscuta reflexa** Roxb.  
India  
Decoction, poultice  
Mixed with the twigs of *Vitex negundo* L. applied as fomentation on the abdomen of kwarsikor 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]

| Clusiaceae | | | |
|---|---|---|---|
| 75 | Clusia grandiflora Splitg. (hemi epiphyte) | Guyana, Suriname | RT | Decoction | Aphrodisiac [105] | Antibacterial [176] |
| 76 | Clusia fockeana Miq. (hemi epiphyte) | Guyana, Suriname | ST(Exudate) | Poultice | Snake bites, ulcers [105] |

| Gesneriaceae | | | |
|---|---|---|---|
| 77 | Columnea nicaraguensis Oerst. | Panama | ST, LF, WP | Decoction, maceration | Fever [177] |
| 78 | Columnea sanguinolenta (Klotzsch ex Oerst.) Hanst. | Panama | ST, LF | Decoction | Dysmenorrhea [177] |
| 79 | Columnea tulae Urb. var. tomentulosa (C.V. Morton) B.D. Morley | Panama | ST | Decoction | Fever [177] |

| Loganiaceae | | | |
|---|---|---|---|
| 80 | Drymonia serrulata (Jacq.) Mart. | Amazon | na | Not mentioned | Eczema [178] |
| 81 | Drymonia coriacea (Oerst. ex Hanst.) Wiehler | Amazon | na | Not mentioned | Toothache [178] |

| Loranthaceae (parasite) | | | |
|---|---|---|---|
| 82 | Fagraea auriculata Jack. (semi epiphyte) | Indonesia | ST | Stem for stick [58] | Anti-inflammatory [180] |

| Loranthaceae (parasite) | | | |
|---|---|---|---|
| 83 | Amyema bifurcata (Benth.) Tieg. | Australia | ST, LF | Decoction | Colds, fever, sores [181] |
| 84 | Amyema quandang (Lindl.) Tieg. | Australia | LF | Decoction | Fever [182] |
| 85 | Amyema maidenii (Blakely) Barlow | Australia | FT | Decoction | Inflammation in the genital regions [183] |
| 86 | Dendrophthoe falcata (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] |
| No. | Species                                      | Country                      | Application/Side Effects                                                                 | Additional Information/Notes          |
|-----|---------------------------------------------|------------------------------|------------------------------------------------------------------------------------------|---------------------------------------|
| 87  | *Dendrophthoe frutescens* L.                | Indonesia                    | Drink (decoction)                                                                        | Anti-inflammation, antibacterial [84]  |
| 88  | *Dendrophthoe incarnata* (Jack) Miq.        | Malaysia                     | Poultice                                                                                 | Mixed with *Curcuma longa* L. and rice to make poultice to treat ringworm [186] |
| 89  | *Dendrophthoe pentandra* (L.) Miq.          | Indonesia, Malaysia, Thailand | Poultice, decoction                                                                       | Sores, ulcers, other skin infections, protective medicine after childbirth, cough, hypertension, cancer, diabetes, tonsil problem [51,58,186,187] |
| 90  | *Taxillus umbellifer* (Schult. f.) Danser   | Indonesia, Malaysia, Vietnam  | Decoction drink, poultice                                                                | Antioxidant (MeOH extract, DPPH), Tyrosinase activity [187] |
| 91  | *Erianthemum dregei* (Eckl. & Zeyh.) Tiegh. | Southern & Eastern Africa     | Mixed with milk                                                                          | Powdered mixed with milk to treat stomach problems in children [188] |
| 92  | *Loranthus globosus* Roxb.                 | Malaysia, Indo-China          | Poultice (leaves), juice                                                                 | Headache, expel afterbirth, cough [189] |
| 93  | *Loranthus spec div.*                      | Indonesia                    | Poultice, decoction                                                                       | Ariola, varicella, diarrhea, ankylostomiasis, morbilli (gagbag), cancer [58] |
| 94  | *Macrosolen robinsonii* (Gamble) Danser     | Vietnam                      | Decoction                                                                                | Enlarged abdomen (diuretic tea) [192]  |
| 95  | *Macrosolen cochinchinensis* (Lour.) Tiegh. | Malaysia, Indo-China          | Decoction, juice, poultice                                                              | Expel after birth, headache, cough [192] |
| 96  | *Scurrula atropurpurea* (Blume) Danser      | Indonesia, Philippines        | Decoction                                                                                | Mouthwash (gargled), cancer (breast, throat cancer), cowpox, chickenpox, diarrhea, hookworm, measles, hepatitis, and cancer [193–195] |
| 97  | *Scurrula ferruginea* (Jack) Danser         | Malaysia                      | Decoction, poultice                                                                      | Decocted whole plant (mixed with *Milletta sericea* (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] |
| 98  | *Scurrula parasitica* L.                    | China, Vietnam                | Decoction                                                                                | Swelling, back pains, numbness, soreness of limbs, hypertension, galactagogue, quieting uterus (no contraction), reducing lumbago, bone strengthening, [193] |

**Note:** The listed applications and side effects are based on traditional uses and may not be scientifically verified. Always consult a healthcare professional before using any natural remedies.
| No. | Species                     | Origin                        | Part(s) | Use(s)                                                                 | Additional Information                                                                 |
|-----|-----------------------------|-------------------------------|---------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 99  | Viscum aethiopicum [sic]    | Southern & Eastern Africa     | LF      | Decoction (tea)                                                         | Diarrhea [188]                                                                          |
| 100 | Viscum capense L.f.         | Southern & Eastern Africa     | ST, FT  | Decoction, external                                                    | Wart, asthma, irregular menstruation, hemorrhage [188]                                  |
| 101 | Viscum pauciflorum L.f.     | Southern & Eastern Africa     | WP      | Decoction                                                             | Astringent [188]                                                                        |
| 102 | Viscum rotundifolium L.f.   | Southern & Eastern Africa     | WP      | External                                                               | Wart [188]                                                                              |
|     | Melastomataceae             |                               |         |                                                                         |                                                                                          |
| 103 | Medinilla radicans 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 | Pachycentria constricta (Bl) | Indonesia                    | TB      | Tubers are boiled and eaten                                           | Hemorrhoids [51,104]                                                                    |
|     | Moraceae                    |                               |         |                                                                         |                                                                                          |
| 105 | Ficus annulata Blume        | Indonesia                     | LF, RT  | Leaves decoction to treat fever, the root to treat Hansen diseases    | Fever and Hansen diseases [195]                                                          |
| 106 | Ficus deltoidea Jack        | Indonesia, Malaysia, Thailand | LF, RT, FT | Drink (decoction), ointment                                           | Leucorrhea, headache, fever, diabetes, high blood pressure, skin infection, aphrodisiac agent, ornament [104,208–210] |

**Additional Information:**
- 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, H2O2-induced oxidative damage in NG108-15 cells)[204], antibacterial (EtOH extract, MRSA) [205]
- Antimicrobial activity (stems extract), Anticonvulsant activity (MeOH extract, albino mice) [206]
- Immunoassay (stem, aqueous extracts, T cell activity in ruminants) [207]
scavenging, xanthine oxidase (XOD), nitric oxide (NO) 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]

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] Antimicrobial, 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]

107  *Ficus lacor* Buch.-Ham. India BK, LT, BD, SD Decoction, poultice Decoked stem bark to treat gastric and ulcer, latex to treat boils (external), typhoid and fever (internal), decocted bud to treat ulcer, leukorrhoea, Seed as tonic for stomach disorder [184,218–220]

108  *Ficus natalensis* Hochst. Uganda, Tanzania, Senegal, West Africa, South Africa, (semi epiphytic, secondary terrestrial) 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]

109  *Ficus parietalis* Blume Vietnam, Thailand, Malaysia, Indonesia RT Decoction Stomach-ache [210]

110  *Ficus pumila* L. Vietnam FT, LF, LT Drink (decoction) Diarrhea, hemorloid, rheumatic, anemia, haematuria, dysentery, dropsy, galactoge, tonic for impotence, lumbago, anthelmintic agent, externally used to treat carbuncles [210]

111  *Poikilospermum suaveolens* (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]

**Orchidaceae**

112  *Acampe carinata* (Griff.) Panigrahi Himalaya, Nepal WP Decoction Rheumatism, sciatica, neuralgia, beneficial in secondary syphilis and uterine diseases [228]
| **113** | *Acriopsis liliifolia* (J.Koenig) Seidenf. | Malaysia | LF, RT | Decoction of the roots and leaves | Fever [229] |
|---|---|---|---|---|---|
| **114** | *Anoectochilus formosanus* Hayata | Taiwan | WP | Decoction | Fever, anti-inflammatory agent, diabetes, liver disorder, chest and abdominal pain [230] |
| &nbsp; | &nbsp; | &nbsp; | &nbsp; | &nbsp; | Anti-inflammatory (water extract, rat paw), hepatoprotective (water extract, rat, SGOT-OPT) [231], anti-hyperliposis (414, rat induced) [232], ameliorative effect (water extract, ovariecotmised 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, CCl4 induced rat) anti-inflammatory (414, lps stimulate mice) [239,240], anti-cancer (polysaccharide water extract, protate cancer cell lin PC3) [241] |
| **115** | *Anoectochilus roxburghii* (Wall.) Lindl. | Taiwan, China, Japan | WP | Decoction | Fever, snake bite, lung and liver diseases, hypertension, child malnutrition [242] |
| &nbsp; | &nbsp; | &nbsp; | &nbsp; | &nbsp; | Hypoglycemic effect (414, streptozotocin (STZ) diabetic rats) [243], hypoglycemic and antioxidant effects (water extract, alloxan-induced diabetic mice, DPPH) [244] |
| **116** | *Ansellia africana* Lindl. | Southern & Eastern Africa | PD, ST, RT | Decoction | Pedi is used to treat cough, the stem is used as aphrodisiac, used as emetic agent [188] |
| **117** | *Bulbophyllum kwangtungense* Schltr. | China, Japan | TB | Tonic | To treat pulmonary tuberculosis, promote body liquid production, reduce fever, hemostatic agent [245] |
| **118** | *Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall. | China, Burma, Vietnam, Thailand, Laos, Nepal, Bhutan, India | WP | Decoction | To treat pulmonary tuberculosis, chronic inflammation and fracture [247] |
| &nbsp; | &nbsp; | &nbsp; | &nbsp; | &nbsp; | Anti-tumor activities (456, 457, 458, against HeLa and K562 human tumor cell line) [246], 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 |
| 119 | Bulbophyllum vaginatum (Lindl.) Rchb.f. | Malaysia | WP | Juice | Juice of the plant is instilled in the ear to cure earache [160] |
| 120 | Catasetum barbatum (Lindl.) Lindl. | Japan, Guiana, Paraguayan | WP | Decoction | Febrifuge, anti-inflammatory [79] |
| 121 | Coelogyne sp | Indonesia | RT | Decoction | Headache, fever [104] |
| 122 | Cymbidium aloifolium (L.) Sw. | Thailand, Vietnam | LF | Decoction (internal), juice from heated or crushed leaves. | Otitis media, colds, irregular periods, arthritis, sores, burns, tonic [252] |
| 123 | Cymbidium canaliculatum R.Br | Australia | PdB | Chewed, poultice | Dysentery, boils, sores, wounds, itchy skin, fractured arms over the break [181,254] |
| 124 | Cymbidium ensifolium (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 | Cymbidium goeringii (Rchb.f.) Rchb.f. | Japan, China, Korea, Thailand, Vietnam, India | WP | Decoction | Hypertension, diuretic agent [255] |
| 126 | Cymbidium madidum Lindl. | Australia | PdB | Chewed | Dysentery [181] |
| 127 | Dendrobium affine (Decne.) Steud. | Australia | PdB | Poultice, external | Crushed pseudobulbs (sticky) is applied to itchy skins, boils, infected skin lesion, minor burns [181] |
| 128 | Dendrobium aloifolium (Blume) Rchb.f. | South East Asia | LF | Poultice | Headache [51] |
| 129 | Dendrobium amoenum Wall. ex Lindl. | China | LF | Dried and ground | Skin diseases [257] |
| 130 | Dendrobium chrysium Rolfe | Australia | LF | Decoction | Diabetes [258] |
| 131 | *Dendrobium candidum* | China | LF | Decoction | Diabetes [260] |
|     | Wall. ex Lindl.       |       |     |           |              |

Inhibitory effect of atropine on salivary secretion (extracts, rabbit) [261], anti-hyperglycemic (extract, streptozotocin-induced diabetic (STZ-DM) rats) [260], antioxidant (polysaccharide, 10-phenanthroline-Fe²⁺-H₂O₂ systems and ammonium peroxydisulfate/N,N,N',N'-tetra-methylethanediamine systems) [262] antioxidant (555, 556, DPPH) [263], antioxidant (558, 559, 560, DPPH) [264], anti-tumor (soluble polysacharride, human neuroblastoma (SH2SY5Y) induced by SPD was observed and analyzed by Hoechst stain method) [265]

| 132 | *Dendrobium canaliculatum* var. foelschei (F.Muell.) | Australia | PdB | Poultice, external | Crushed pseudobulbs (sticky) is applied to infected skin and cuts [181] |
|     | Rupp & T.E.Hunt  |       |     |           |              |

| 133 | *Dendrobium crumenatum* 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 | *Dendrobium chrysanthum* Wall. ex Lindl. | China | LF | Dried and ground | Skin diseases, immune regulator, anti-pyretic, improve eyesight [269,268] |

Anti-inflammation (590, macrophages were harvested from 2-month-old male C57BL/6J mice) [268]

| 135 | *Dendrobium densiflorum* Lindl. | China | LF | Tonic | Promote body fluid production [270] |

| 136 | *Dendrobium faciferum* J.J.Sm | Indonesia | ST | Dried | For twist work (craft) [271] |

| 137 | *Dendrobium fimbriatum* Hook. | Japan, China | LF | Decoction, paste | Promote body fluid production, set fractured bone (paste) [272] |

Antioxidant (water-soluble crude polysaccharide (DFHP), DPPH) [273] 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 |

| 138 | *Dendrobium lodigesii* Rolfe | China | LF | Decoction | Promote body fluid production, reduce fever, nourish the stomach, anti-cancer agent [274] |
| No. | Species | Country | Part | Description |
|-----|---------|---------|------|-------------|
| 139 | *Dendrobium moniliforme* (L.) Sw. | China, Taiwan | ST Decocted dried stem | Anti-pyretic, analgesic, aphrodisiac, stomachic, tonic agents [278] Anti-inflammatory (RAW264.7) [277] Hypoglicemic (polisaccharide, mice) [280], antioxidant (polisaccharide) [281] |
| 140 | *Dendrobium moschatum* (Buch.-Ham) S.w | Nepal | LF Juice | Cure earache [282] |
| 141 | *Dendrobium nobile* Lindl. | China, Indonesia | WP Tonic | Fever, reduce mouth dryness, aphrodisiac, promote body fluid production, nourish stomach, anorexia, lumbago, impotence [266,283-286] Immunomodulatory activity (lymphocyte proliferation test MTT test) [287,288], antioxidant (water-soluble polysaccharide, DPPH) [290], antimicrobial (Extracts), antitumour (extracts, Dalton's lymphoma ascites (DLA) cells w), induction of in vitro lipid peroxidation (extracts, TBARS) [291], NO inhibition (murine macrophage RAW 264.7 cells) [292], anti-tumor (polysaccharide extracts, sarcoma 180 in vivo and HL-60)[293] |
| 142 | *Dendrobium pachyphyllum* (Kuntze) Bakh.f. | Indonesia | WP Decoction | Hydropsy [271] |
| 143 | *Dendrobium purpureum* Roxb. | Indonesia, Malaysia | LF Crushed and heated to make poultice | Nail fungal infection [266] |
| 144 | *Dendrobium salaccense* (Blume) Lindl. | Indonesia | LF Fragrance | Fragrance [271] |
| 145 | *Dendrobium teretifolium* R.Br. | South-Pacific Island | LF Decoction | Severe headache, other pains [294,295] |
| 146 | *Dendrobium catenatum* Lindl. | China | LF Decoction | Anxiety and panic [296] |
| 147 | *Dendrobium utile* J.J.Sm. | Indonesia | ST Dried | Twist work [271] |
148  *Dichaea muricata* (Sw.) Lindl.  
Central, South American  
Decoction (wash)  
Eye infection [285]

149  *Eulophia speciosa* (R.Br.) Bolus  
Indonesia  
Decoction  
Analgesic [271]

150  *Epidendrum strobiliferum* Rchb.f.  
China, Korea  
Infusion, decoction  
Analgesic [297]

151  *Epidendrum rigidum* Jacq.  
Mexico, North Sudamerica, Antilles  
Infusion, decoction  
Replenish body fluid [299]

152  *Mycaranthes panna* (Lindl.) S.C.Chen & J.J.Wood  
Vietnam, Malaysia  
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  *Eriopsis biloba* Lindl.  
America  
Poultice  
Sore gums and mouth membranes [285]

154  *Grammatophyllum scriptum* (L.) Blume  
Indonesia, Thailand  
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  *Jumellea fragrans* (Thouars) Schltr.  
Madagascar  
Decoction  
Anti-spasmodic, anti-asthmatic agents, mixed leaves of *Ziziphus mauritiana, Mussaenda arcuate* to treat eczema (decocition), mixed with *Eugenia uniflora* to treat diarrhea [57]

156  *Liparis condylobulbon* Rchb.f.  
Indonesia  
Chewing, external  
Intestinal complaints and constipation. (eastern Sulawesi, ambon), tormina, abscess [271,303]

157  *Liparis nervosa* (Thunb.) Lindl.  
China, Thailand, Malaysia  
Decoction, external  
Stop internal/external bleeding, treat snake bites [303]
| No. | Species/Genus                          | Country/Region          | Formulate | Use                                                                 | Additional Properties                                                                 |
|-----|---------------------------------------|-------------------------|-----------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 158 | Neottia ovata (L.) Bluff & Fingerh.  | Spain TB                | Tincture  | Stomach diseases [304]                                              | Anti-viral (extract, SARS-CoV Frankfurt 1 strain [305])                                 |
| 159 | Masdevallia uniflora Ruiz & Pav.      | Mexico, south America WP| Decoction | Facilitate urination (pregnant women), reduce bladder inflammation [285] | Spasmolytic activity (667, 690, 693, 694, 695, Wistar rat) [70], antinociceptive activity (extract, mice) [306] |
| 160 | Camaridium densum (Lindl.) M.A.Blanco | Mexico WP               | Decoction | Analgesic, relaxant agents [306]                                    |                                                                                       |
| 161 | Neotena boothii (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 | Oberonia lycopodioides (J.Koenig) Ormerod & Seidenf. | Malaysia LF | Poultice | Boils [153,308]                                                      |                                                                                       |
| 163 | Oberonia mucronata (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 | Erycina pusilla (L.) N.H.Williams & M.W.Chase | Mali WP                | Decoction | Lacerations [285]                                                   |                                                                                       |
| 165 | Otochilus lancilabius Seidenf.        | Bhutan, Nepal, India, China (Tibet), Laos and Vietnam WP | Pills | Antiemetic, febrifuge for stomach inflammation (bad-tshad), and allays hyperdipsia and dehydration [56] |                                                                                       |
| 166 | Phragmipedium pearcei (Rchb.f.) Rauh & Senghas | South America WP | Decoction | Stomachache [285]                                                   |                                                                                       |
| 167 | Pholidota articulata Lindl.           | Himalaya, Nepal WP      | Decoction | Whole plant: bone fractures [228]                                    |                                                                                       |
| 168 | Pholidota chinensis 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
| No. | Species                                      | Origin/Location                          | Use/Curative Property                                                                 |
|-----|---------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------|
| 169 | *Renanthera moluccana* Blume                | Indonesia                                | Ornament [271]                                                                        |
| 170 | *Rhynchostylis retusa* (L.) Blume           | Himalaya, Nepal, India                    | Rheumatic, hepaoprotective agent [312,228]                                           |
| 171 | *Scaphyglottis livida* (Lindl.) Schltr.     | Mexico                                   | Analgesic, anti-inflammatory agents [306,313]                                         |
| 172 | *Vanda tessellata* (Roxb.) Hook. ex G.Don | India, Sri Lanka, Burma                   | 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]                                      |
| 173 | *Papilinanthe teres* (Roxb.) Schltr.        | Indonesia                                | Ornamental [318]                                                                     |
| 174 | *Vanilla griffithii* Rchb.f.                | Indonesia                                | Edible [318]                                                                         |
| 175 | *Vanilla planifolia* Jacks. ex Andrews      | Indonesia, Mexico                        | Fever, rheumatism, hysteria, increase energy and muscular system [58,284,318]        |
| 176 | *Peperomia galioides* Kunth                 | Peru                                     | Poultice (external), drink (internal)                                                |
| 177 | *Piper retrofractum* Vahl                   | Indonesia                                | Anticonvulsion, antivomiting, diarrhea, dysentery, constipation, headache [324]       |
| 178 | *Hydnophytum formicarum* Jack               | Indonesia, Philippines, Thailand          | Poultice to treat swelling, headache, decoction to treat liver, intestinal complaints,|
|     |                                             |                                          | powder as anthelmintic, heart                                                         |

*activated macrophages-like cell line, RAW 264.7* [310]
| Code | Species                                      | Origin         | Part     | Preparation     | Use                                                                 |
|------|---------------------------------------------|----------------|----------|-----------------|----------------------------------------------------------------------|
| 179  | *Myrmecodia tuberosa* Jack                  | Indonesia      | PT       | Drink (decocted)| Swelling, headache [51,104,338]                                      |
| 180  | *Myrmecodia pendens* Merr. & L.M.Perry      | Papua          | PT       | Decoction       | Rheumatism, headache, renal problems, tumor [340]                    |
| 181  | *Scaphium macropodum* (Miq.) Beumée ex K.Heyne ex K.Heyne (hemi-epiphyte)| Indonesia | RT       | Drink (decoction) | Nervous system problem [104]                                       |
| 182  | *Premna parasitica* Blume                   | Indonesia      | LF       | Drink (decoction)| Fever [58]                                                           |
| 183  | *Viscum articulatum* Burm.f.                | Cambodia, India, Taiwan, China | WP | Poultice, decocction | Decoction to treat bronchitis, skin tumour, neuralgia, arthritis and as tonic, sedative, febrifuge, crushed plant to treat cut [341] |
|      |                                             |                |          |                 | 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], Immunomodulatory effect (EtOH fractions) [339], 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-1-IIIIB-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... |
| No. | Species                          | Origin          | Parts  | Uses                                                                 |
|-----|---------------------------------|-----------------|--------|----------------------------------------------------------------------|
| 184 | *Viscum ovalifolium* 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] |
| 185 | *Hedychium ongi cornutum* 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 |
|----|------------------|--------------|
| 1  | Adiantum caudatum L., Mant | 16-hentriacontanone 1, 19α-hydroxyferna-7,9(11)-diene 2, 29-norhopan-22-ol 3, 3α-hydroxy-4α-methoxyflicane 4, 8α-hydroxyferran-25,7β-olide 5, adiantone 6, flic-3-ene 7, hentriacontane 8, isoadiantone 9, quercetin-3-O-glucoside 10, β-sitosterol 11, β-sitosterol 11, β-sitosterol glucoside 12 [354–356] |
| 2  | Asplenium nidus L. Blechnaceae | (-)-epiafzelechin 3-O-β-D-allopyranoside 13, homoserine 14 [357] |
| 3  | Davallia solida (Blume) M. Kato | 1-Oβ-D-glucopyranosyl-(2S,3R*,4E,8Z)-2-N-[(2R)-hydroxytetrasanoyl]octadescaphasinga 4,8-diene 15, 3-formylindole 16, 3-oxo-4,5-dihydro-α-ionyl-β-D-lucopyranoside 17, kaempferol 3-O-β-D-glucopyranoside 18, kaempferol 3-O-(3',6'-di-O-E-p-coumaroyl)-β-D-glucopyranoside 19, kaempferol 3-O-(3',6'-di-O-E-p-coumaroyl)-(6'-O-E-feruloyl)-β-D-glucopyranoside 20, kaempferol 3-O-(3',6'-di-O-E-p-coumaroyl)-β-D-glucopyranoside 21, kaempferol 3-O-(6'-O-E-p-coumaroyl)-β-D-glucopyranoside 22, lutein 23, stenopaluside 24, stenopalustrosides A–E 25–29, β-sitosterol-3-O-β-D-glucopyranoside 30 [358,359] |
| 4  | Araucaria diversicolor (Blume) M. Kato | (-)-epicatechin 3-O-β-D-(2″-O-vanillyl)allopyranoside 31, (-)-epicatechin 3-O-β-D-(2″-trans-cinnamoyl)allopyranoside 32, (-)-epicatechin 3-O-β-D-(3″-O-vanillyl)allopyranoside 33, (-)-epicatechin 3-O-β-D-(3″-trans-cinnamoyl)allopyranoside 34, (-)-epicatechin 3-O-β-D-allopyranoside 35, (-)-epicatechin 3-O-β-D-allopyranoside 36, 24-norferna-4 (23) 37, 4β-carboxymethyl(-)-epicatechin 38, 4β-carboxymethyl(-)-epicatechin methyl ester 39, 4β-carboxymethyl(-)-epicatechin potassium 40, 9(11)-diene 41, cyanin 42, davallic acid 43, epiafzelechin-(4β→8)-epicatechin 3-O-β-D-allopyranoside 44, epicatechin-(4β→6)-epicatechin-(4β→8)-epicatechin-(4β→6)-epicatechin-D-glucouctono-β-lactone endiol 45, epicatechin-(4β→8)-4β-carboxymethylpyrroline 46, hop-21-ene 47, monardein 48, pelargomin 49, procyanidin B-2 3″-O-β-D-allopyranoside 50, sodium salts 51 [92,93,360–364] |
| 5  | Davallia solida (G. Forst.) Sw. | 18-diene 52, 18-diene 52, 19α-hydroxyfermenes 53, 19α-hydroxyflicic-3-ene 54, 2-C-β-D-glucopyranosyl-1,3,6,7-tetrahydroxyxanthone 55, 2-C-β-D-glucopyranosyl-1,3,6,7-tetrahydroxyxanthone 56, 2-C-β-D-glucopyranosyl-1,3,6,7-tetrahydroxyxanthone 56, 30-O-P-hydroxybenzoylmangiferin 57, 3-O-P-hydroxybenzoylmangiferin 58, 40-O-phydroxybenzoylmanfigerin 59, 4-O-β-D-glucopyranosyl-2,6,4-trihydroxybenzophenone 60, 4β-carboxymethyl(-)-epicatechin 38, 4β-carboxymethyl(-)-epicatechin methyl ester 39, 60-O-P-hydroxybenzoylmanfigerin 61, eriodictyol 62, eriodictyol-8-C-β-D-glucopyranoside 63, fena-(9(11)) 64, fern-7-en-19α-ol 65, fern-9(11)-en-19α-ol 66, ferna-7 67, filic-3-en-19α-ol 68, filica-3,18,20-triene 69, flic-3,18-diene 70, icariside E3 71, icariside E5 72, mangiferin 73 [99,101,362,365,366] |
| 6  | Huperzia carinata (Desv. ex Poir.) Trevis | carinatums A, B, and C 74, 75, 76 [107] |
| 7  | Huperzia phlegmaria (L.) Rothm | 14β,21α,29-trihydroxyserran-3β-y1 dihydrocaffeate (lycophlegmarial D) 77, 21α,24-dihydroxyserrat-14-en-3β-y1 4-hydroxyccinamate (lycophlegmarial C) 78, 21β,24,29-trihydroxyserrat-14-en-3β-y1 dihydrocaffeate (lycophlegmarial B) 79, 21β,29-dihydroxyserrat-14-en-3α-y1 dihydrocaffeate (lycophlegmarial A) 80, 21β-hydroxy-serat-14-en-3α-ol 81, 21β-hydroxy-serat-14-en-3α-y1 acetate 82, 8,11,13-abietatriene-3β,12-dihydroxy-7-one (margocinil) 83, 8-deoxy-13-dehydroseratinine 84, 8-deoxyseratinidine 85, acrifoline 86, annotine 87, annotinine 88, ... |
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8 Huperzia megastachya (Baker) Tardieu
Huperzia megastachya (Baker) Tardieu
Nephrolepis biserata (Sw.) Schott
Nephrolepis cordifolia (L.) C. Presl
Oleandraceae
Opioglossaceae
Polypodiaceae
Bolttigium lanuginosum Wall.ex Hook & Grev.

B. lanuginosum: 6'-O-palmitoyl-sitosterol-3-O-β-D-glucoside 129, 1-O-β-D-glucopyranosyl-(2S,3R,4E,8Z)-2-[(2R-hydroxy hexadecanoyl) amino]-4,8-octadecadiene-1, 3-diol 130, 30-nor-21β-hopan-22-one 131, apigenin 132, β-sitosterol 133, daucosterol 134, luteolin 135, luteolin-7-O-glucoside 136, thunbergol A 137 [378].

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12 Drynaria roosii Nakaike
Drynaria roosii Nakaike

Drynaria roosii: kaempferol 3-O-β-D-glucopyranoside-7-O-α-L-arabinoside 138, (2R)-naringin 139, (2S)-naringenin-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-cafeoyl-12-hydroxydodecanolic acid 145, xanthohalogenol 146, naringenin 147, kushennol F 148, sporafallone G 149, kuraminone 150, leachianone A 151, 8-phenylkaempferol 152, kaempferol 153, chitratone 154, fern-(9(11)-ene 155, hop-22(29)-ene 156, isoglucanone 157, dryocarposol 158, dryocarposyl acetate 159, (-)-azefelechin-3-O-β-D-allopyranoside 160, (-)-azefelechin-6-C-β-α-glucopyranoside 161, 4α-carboxymethyl-(-)-catechin methyl ester 162, (-)-epiafzelechin-(4β→8)-(-)-epiafzelechin-(4β→8)-4β-carboxymethyl(-)-epiafzelechin methyl ester 163, (-)-epiafzelechin-(4β→8)-4β-carboxymethyl(-)-epicatechin methyl ester 164, (-)-epiafzelechin-(4β→8)-4α-carboxymethyl(-)-epiafzelechin ethyl ester 165, (-)-epiafzelechin-3-β-O-β-D-allopyranoside 166, (-)-epicatechin-3-O-β-α-D-allopyranoside 167, (-)-catechin 168, 4β-carboxymethyl(-)-epiafzelechin methyl ester 169, 4β-carboxymethyl(-)-epiafzelechin 170, (-)-epiafzelechin-(4β→8)-(-)-epiafzelechin 171, (-)-epiafzelechin 172, (-)-epiafzelechin (4β→8)-4β-carboxymethyl-epiafzelechin methyl ester 173, epicatechin-(4β→8)-epicatechin 174, (-)-azefelechin 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, forntubolin A, curcumin B, demethoxycurcumin B, bisdemethoxycurcumin, 183, 184, bacchanine 185, isobavachalcone, 186, (-)-epicatechin 144, liquiritigenin 187, bakuchiol 188, protocatechuic acid 189, (R)-5,7,3′,5′-tetrahydroxyflavonone 7-O-neohesperidoside 190, (2S)-5,7,3′,5′-tetrahydroxyflavonone 7-O-β-D-glucopyranoside 191, 5,7,3′,5′-tetrahydroxyflavanone 192, 3′-lavadulyl-4-methoxy-2,2′,4′,6′-tetrahydroxyflavonone 193, 5,7-dihydroxycromene-7-O-β-D-glucopyranoside 194, 5,7-dihydroxycromene-7-O-neohesperidosyl 195 [76,379-383].
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15 **Drynaria rigidula** (Sw.) Bedd. fern-9(11)ene 202, hop-22(29)-ene 156, \( \gamma \)-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-\( \beta \)-rhamnopyranosyl-4\’-O-\( \beta \)-glucopyranoside 208 [125,386]

16 **Phymatosorus scolopendria** (Burm. f.) Pic. Serm. diploptene 210, \( \beta \)-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-deoxycoptilol 218, dammara-18(28),21-diene 212, cyclohexopene 219, cyclohexopanediol 220, hop-22(29)-en-28-al 221 [387–389]

17 **Pyroisa lingua** (Thunb.) Farw. diploptene 210, \( \beta \)-sitosterol 11, octanordammarane 211, dammara-18(28),21-diene 212, cyclohexopene 219, cyclohexopanediol 220, hop-22(29)-en-28-al 221 [387–389]

18 **Pyroisa petiolosa** (Christ) Ching diploptene 210, \( \beta \)-sitosterol 11, octanordammarane 211, dammara-18(28),21-diene 212, cyclohexopene 219, cyclohexopanediol 220, hop-22(29)-en-28-al 221 [387–389]

19 **Pyroisa showert** (Baker) Ching diploptene 210, \( \beta \)-sitosterol 11, octanordammarane 211, dammara-18(28),21-diene 212, cyclohexopene 219, cyclohexopanediol 220, hop-22(29)-en-28-al 221 [387–389]

**Pilostates**

20 **Psilotum nudum** (L.) P. Beauv apigenin di-C-glucoside 233, 7,4',4'-tri-O-\( \beta \)-D-glucopyranoside 234, 4',4'-di-O-\( \beta \)-D-glucopyranosides 235, 7,4'-di-O-\( \beta \)-D-glucopyranoside 236, 3'-hydroxyprosolin (6-{[\( \beta \)-D-glucopyranosyloxy]-3'-hydroxyphenyl}-5,6-dihydro-2-oxo-2H-pyran) 237, 24-methylene-5a-lanost-8-en-3\'-ol 238, 24\'-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-\( \beta \)-D-glucoside 245, ponasterone A 246, lupeol 247, friedelin 196, \( \beta \)-sitosterol 11, stigmasterol 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,3R)-pterosin C 255, (2R)-pterotonin P 256, patriscabratine 257, tetracosane 258, quercetin-3-O-\( \beta \)-D-glucoside 259, quercetin-3-O-\( \beta \)-D-glucosyl-(6\’-1)-\( \alpha \)-L-rhamnoside 260, quercetin-3-O-\( \alpha \)-D-glucoside 261, quercetin-3-O-\( \beta \)-L-rhamnoside 262, kaempferol 153 [68,395–397]

22 **Selaginella involvens** (P. Beauv.) Spring hexadecanoic acid 263, stearic acid 264, \( \beta \)-sitosterol 11, stigmasterol 248, amentoflavone 265, \( \beta \)-D-glucopyranoside 266, (3\'-cholest-5-en-3-yl) \( \beta \)-amyrin 198 [398]

**Vittariaceae**

23 **Vittaria elongate** Sw. vittarin-A-F 268–273, 3-O-acetylindoloidic acid 274, ethyl 3-O-acetylindololactone 275, methyl 4-O-coumaroylquinone 276, vittarilide-A, B 277, 278, vittarilflavone 279, methyl 4-O-cafeoylquinone 280, ethyl 4-O-cafeoylquinone 281, methyl 5-O-cafeoylquinone 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 protocatechuete 292, vanillin 293, vanillic acid 225 [149]

**Non-Fern**

24 **Impatiens niamniensis** Gilg (semi epiphytic) \( \alpha \)-N,N,N-trimethyltryptophan betaine 294 [159]
25. Convolvulaceae (parasite)  
26. Cuscuta filiformis L.  

N-(3,4-dimethoxyphenethyl)-4,5-methylenedioxy-2-nitrophenylacetamide 295, actinodaphnine 296, cassythine 297, isoboldine 298, cassamiderine 299, cassamedine 300, lyciscamine 301, cathafiline 302, cathaformine 303, actinodaphnine 304, N-methylactinodaphnine 305, cathafiline 306, cathaformine 307, predicentrine 308, oceleine 309, filiformine 310, (+)-diisoyringaresinol 311, cassythine 312, cathaformine 313, actinodaphnine 314, N-methylactinodaphnine 315, predicentrine 308, oceleine 316, neoistigmaster 317, dichentrace 318, cassythine (cassamyl) 319, actinodaphnine 320, 4-O-methylbalanopphonin 321, cassyformedrine 322, cassythine acid 323, cassythine acid 324, cassythine 325, neoistigmaster 326, dichentrace 318, 1,2-methylenedioxy-3,10,11-trimethoxyaporphine 327, (+)-O-methylflavinatine 328, (-)-salutaridine 329, isohamnetin-3-O-glucoside 330, isohamnetin-3-O-rutinoside 331 [164,378,399-403]

27. Cuscuta australis (Blume) Danser  

Roxb.  
Cuscata reflexa Roxb.  
Coumarin 341, α-amyrin 342, β-amyrin 198, α-amyrin acetate 343, β-amyrin acetate 344, oleanolic acid 345, oleanolic acid 127, stigmastanol 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]

28. Cuscuta australis (Blume) Danser  

Roxb.  
Cuscata reflexa Roxb.  
Coumarin 341, α-amyrin 342, β-amyrin 198, α-amyrin acetate 343, β-amyrin acetate 344, oleanolic acid 345, oleanolic acid 127, stigmastanol 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]

29. Clusia grandiflora Splittg. (parasite)  

(hemi epiphyte)  
Clusia grandiflora Splittg. (parasite)  
(hemi epiphyte)  
Loranthaceae (parasite)  

30. Fagraea auriculata Jack. (semi epiphyte)  

Loranthaceae (parasite)  

31. Dendrophthoe falcata (L.f.) Ettingsh  

parasite)  

32. Loranthus globosus Roxb  

(+) catechin 168, 3,4-dimethoxycinnamyl alcohol 370, 3,4,5-trimethoxycinnamylalcohol 371 [190]

33. Macrosolen cochinchenensis (Lour.) Tiegh.  

Scirrula atropurpurea (Blume) Danser  

404-406]

34. octadeca-8,10,12-triynoic acid 376, hexadec-8-yanoic acid 377, hexadec-10-yanoic acid 378, hexadec-8,10-diyanoic acid 379, hexadec-6,8,10-triynoic acid 380, hexadec-8,10,12-triynoic acid 381, (Z)-9-octadecenoic acid 382, (Z,Z)-octadec-9,12-dienoic acid 383, (Z,Z)-octadec-9,12,15-trienoic acid 384, octadeca-8,10-diyanoic acid 385, (Z)-octadec-12-ene-8,10-diyanoic acid 386, octadeca-8,10,12-triynoic acid 376, theobromine 387,
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caffeine 388, quercitrin 389, rutin 373, icariside 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

Bulbophyllum roxburghii Lindl. ex Wall.
go-odoratissimum noectochilus

36 Scurrula parasitica L. Moraceae

(+)-catechin 168 [204]

Orchidaceae

37 Ficus pumila L.

(1S,4S,5R,6R,7S,10S)-1,4,6-trihydroxyudesmane 6-O-β-D-glucopyranoside 39, (1S,4S,5R,6R,7S,10S)-1,4-dihydroxyamaliane 1-O-β-D-glucopyranoside 396, (23Z)-3β-acetoxyacycloart-23-en-25-ol 39, (23Z)-3β-acetoxeyupha-7,23-dien-25-ol 39, (24RS)-3β-acetoxyacycloart-23-en-24-ol 39, (2S)-24-hydroxystigmast-4-en-3-one 400, (24S)-stigmast-5-ene-3β,24-diol 401, 1α,11-dihydroxyacin-4-ene 11-0-β-D-glucopyranoside 402, 3β-acetoxy-(20R,22E,24RS)-20,24-dimethoxydammaran-22-en-25-ol 403, 3β-acetoxy-(20S,22E,24RS)-20,24-dimethoxydammaran-22-en-25-ol 404, 3β-acetoxy-20,21,22,23,24,25,26,27-octanordammaran-17β-ol 405, 3β-acetoxy-22,23,24,25,26,27-hexanordammaran-20-one 406, cycloartane-type triterpenoids 407, triterpenoids 408 [413-415]

38 Anoectochilus formosanus Hayata

(6R,9S)-9-hydroxy-megastigma-4,7-dien-3-one-9-O-β-D-glucopyranoside 409, (R)-(+)3,4-dihydroxybutanoic acid ϒ-lactone 410, 1-O-isopropyl-β-D-glucopyranoside 411, 2-(β-D-glucopyranosyloxy)methyl-5-hydroxymethylfuran 412, 3-(R)-3-β-D-glucopyranosyloxybutanolide (kinesinolide) 414, 4-(β-D-glucopyranosyl)benzyl alcohol 415, corchoinoside C 416 [416]

39 Anoectochilus roxburghii (Blume)

24α-isopropenylcholesterol 417, 5-hydroxy-3',4'-7-trimethoxyflavonol-3-O-β-D-rutinoside 418, 7-O-β-D-diglucoside 419, 8-C-β-hydroxybenzyloxyquinocerin 420, 8-p-hydroxybenzyloxy quercetin, 421, anochocerin 422, campesterol 249, cirsilolin 423, daucosterol 134, ferulic acid 288, isorhamnetin 424, isorhamnetin-3-β-D-glucoside 426, isorhamnetin-3-O-β-D-rutinoside 427, isorhamnetin-7-O-β-D-glucopyranoside 428, isorhamnetin-7-O-β-D-diglucoside 429, kaempferol-3-β-D-glucopyranoside 430, kaempferol-7-O-β-D-glucopyranoside 431, p-coumaric acid 334, p-hydroxybenzaldehyde 432, quercetin 336, quercetin 3-0-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-methoxy-p-β-hydroxybenzaldehyde 441, daucosterol 134, daucosterol 134, ferulic acid 288, isorhamnetin-3-O-β-D-rutinoside 443, lanosterol 444, methyl 4-β-D-glucopyranosyl-butanoate 445, o-hydroxy phenol 446, oleandric acid 127, palmitic acid 447, p-hydroxy benzaldehyde 448, p-hydroxy cinnamic acid 449, p-hydrobenzaldehyde 452, rutin 373, sorphumol 3-O-E-p-coumarate 450, sorgumol 3-O-Z-p-coumarate 451, stearic acid 264, succinic acid 452, β-D-glucopyranosyl-(3R)-3-hydroxybutanoic acid 453, β-sitosterol 11 [395-403]

40 Bulbophyllum kwangtungense Schltr.

10,11-dihydro-2,7-dimethoxy-3,4-methylenedioxydibenzof[b,f]oxepine 454, 5-(2,3-dimethoxyphenethyl)-6-methylbenzo[d][3,4]dioxole 455, 7,8-dihydro-3-hydroxy-12,13-methylenedioxy-11-methylenidibenz[b,f]oxepine 456, 7,8-dihydro-4-hydroxy-12,13-methylenedioxy-11-methylenidibenz[b,f]oxepine 457, 7,8-dihydro-5-hydroxy-12,13-methylenedioxy-11-methylenidibenz[b,f]oxepine, cumulatin 459, densiflorol A 460, plicatol B 461 [245,417]

41 Bulbophyllum odoratissimum (Sm.) Lindl. ex Wall.

(+)-lyoniresinol-3α-O-β-D-glucopyranoside 462, 3,5-dimethoxyphenethyl alcohol 463, 3,7-dihydroxy-2,4,6-trimethoxyphenanthrene 464, 3,7-dihydroxy-6'-O-(6''-O-β-apiofuranosyl)-β-D-glucopyranoside 465, 3-methoxy-4-hydroxyccinnamic 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, bulbothyrins A, B 473, 474, Coelenin 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 [245,250,418-421]
Bulbophyllum vaginatum (Lindl.) Rchb.f. (±)-syringaresinol 485, (2R*,3S*)-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-trimethoxyanthrone-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 (erianthrin) 492, 3,4-dimethoxyphenanthrene-2,7-diol (nudol) 493, 3,5-di-methoxy-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′,7′,7′-hexol 497, 4,6-dimethoxy-9,10-di-hydrophenanthrene-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-2,3,7-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]

Catasetum barbatum (Lindl.) Lindl. 2,7-dihydroxy-3,4,8-trimethoxyphenanthrene 505 [251]

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 479, 2,4-dimethoxy-4,6-dimethoxy-9,10-dihydrophenanthrene 511, cymbinadin-A 512, cymbinadin B 513 [424–426]

Cymbidium goeringii (Rchb.f.) Rchb.f. β-sitosterol 11, daucosterol 134, ergosterol 514, gigantol 478, cymbidine A 515 [255,256,427]

Dendrobium amoenum Wall. ex Lindl. amotin 516, amoenin 517, amoenumin 518, amoeylin, isoamoeylin 519, 3,4′-dihydroxy-5-methoxybibenzyl 520, 4,4′-dihydroxy-3,3′,5-trimethoxybibenzyl (moscatinin) 521 [428–430]

Dendrobium chryseum Rolfe araxerol 522, coumarin 531, moscatilin 523, chrysotobibenzyl 524, chrysotocin 525, gigantol 478, kaempferol 153, cis-melilotoside 526, defuscin 527, dendroforrin 528, dengibsin 529, dihydrodesmiletoside 530, naringenin 147, n-octacosyl ferulate 531, trans-melilotoside 532 [259,431]

Dendrobium candidum Wall. Ex Lindl. (-)-lophilide 533, (-)-secosolariciresinol 534, (-)-syringaresinol 535, (+)-lyoniresinol-3a-O-β-D-glucopyranoside 462, (+)-syringaresinol-4,4′-dimethoxy-5,4′-dimethoxy-3,5-dimethoxy-1′-O-methylbibenzyl 541, 3-O-methylgigantol 542, 4,4′-dihydroxy-3,5-dimethoxybibenzyl 543, 4′,5-dihydroxy-3,3′-dimethoxybibenzyl 544, 4-allyl-2,6-dimethoxyphenylglycoside 545, 4′-dihydroxy-5-methoxybibenzyl 546, 5-hydroxymethyl-furaldehyde 547, Adenosine 548, Aduncin 549, cisorufiyol-p-hydroxybenzenethylamine 550, coniferyl alcohol 551, daucosterol 134, defuscin 527, denbinbinol, 552, dendrocanadin A 553, dendrocanadin B 554, dendrocanadin C 555, dendrocanadin D 556, dendrocanadin E 557, dendrocanadins F–I 558–561, dromenoniliside E 562, dromophenol 563, dihydroresveratrol 564, gigantol 478, guanosine 565, hentriacontane 8, heptadecanoic acid 566, hexadecanoic acid 263, icaril A 2,4-O-β-D-glucopyranoside 567, khaephuoside 568, leonuriside A 569, naringenin 147, n-octacosyl ferulate 531, N-trans-feruloyl tyramine 570, n-triacetyl 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 567, β-sitosterol 11 [237,239,419,421]

Dendrobium chrysanthum (Spreng.) Blume (2S)-N-cis-cinnamoyl-2-oxoppyrrolidine 577, (2S)-trans-cinnamoyl-2-oxoppyrrolidine 578, (β)-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)-8,8-dihydroxymethyl-tetrahydrofurane-4,4′-d-glucoside 582, chrysophanol 583, chrysotobibenzyl 524, chrysotobibenzyl 524, chrysotoxin 525, crepidatin 584, crepidatin 584, dihydrodicoumaroyl alcohol 4,4′-d-glucoside 585, dencrysans A, B 586, 587, dencrysides A 588, dencrysides B 589, dencrychosane 590, dencroflorin 528, dengibsin 529, emodin 591, gigantol 478, moscatilin 523, moscatilin 523, moscatin 479, phoscin 592, β-sitosterol 11 [226,418,422,425]
50 *Dendrobium fimbriatum* Hook.

2-hydroxyethyl caffeate 593, ayaipin 594, chrysocephalin 583, chrysotobenzyl (l) 595, confusarin 596, crepidatin 584, defuscin 527, denhydroshizukanolide 597, fimbriatone 598, *n*-drotiaconoic 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

dendropholen (4,4′-dihydroxy-3,3′,5-trimethoxybenzoyl) 563, loddisegisins A-D 602-605, moscatilin 523, moscatilin diacetate 606, moscatin 479, shihunidine 607, shihunone 608, stilbenes 609 [275-277]

52 *Dendrobium moniliforme* (L.) Sw.

heptacosane 610, 3,4-dihydroxy-4,5-dimethoxy benzyl 611, 3,4-dihydroxy-5,4′-dimethoxy benzyl 612, 4-methoxybenzaldehyde 613, a known alkaloid 6-hydroxybenzyl 614, alkyl 4′-hydroxy-cis-cinnamates 615, alkyl ferulates 616, daucosterol 134, denbinbin 552, denbinbin, alkyl 4′-hydroxy-trans-cinnamates 617, dromerausiside E 562, ethyl linolenates 618, heptatriacontaneic acid 619, linoleic acid 620, methyl linolenates 621, monilin 622, monilin 623, *n*-nonacosane 624, *n*-octacosyl ferulate 531, *n*-triacontyl *p*-hydroxy-cis-cinnamate 625, octacosyl hexadecanoate 626, phytosterols 627, stigmat-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-dihydroxycarboxylate 630, 10,12,13,14-tetrahydroxyalloaromadendrane 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, 6α,10,12-trihydroxycarboxylate 637, 7,12-dihydroxy-5-hydroxymethyl-11-isopropyl-6-methyl-9-oxatriacyclo[6.2.1.0]undecan-10-one-15-O-β-D-glucopyranoside 638, batatasin III 471, bullantanol 639, chrysotobenzyl 524, coelenon 475, crepidatin 584, denbinbin 552, dendrobane A 640, dendrobine A,7,7′ chrysoxotone 641, dendrobine 642, dendrobiumane 643, dendrofensilfuran 644, dendroflorin 528, dendronobiolin A 645-653, dendronobiolin J 654, dendronobilone A 655, dendronobilosides A, B 656, 657, dendronophenol A-B 658, 659, dromonoside A 660, dendroxine E-G 661-663, dromoxine 664, ephemerosinthol A 665, ephemerosinthol C 666, ephemerosinth B 668, flavantheridin 669, gigantol 478, hircinol 670, luosathanidin 671, moscatilin 523, moscatilin 523, moscatin, 479, gigantol 478, nabilin D-E 672, 673, nobilone 674, nobilenione 675, stigmasteryl 248, β-sitosterol 11, β-sitosterol glucoside 12 [71,286-289,292,439-444]

55 *Epidendrum strobiliferum* Rchb.f.

24-methylenecycloartanol 676, campesterol 249, pholidin 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-cycloolanostane-25-en-3β-ol 679, 3,4,9-trimethoxyphenanthrene-2,5-diol 680, apigenin 132, batatasin III 471, gigantol 478, isovitexin 681, stilbenoids I-IV 682-685, triterpenoids 24,24-dimethyl-9,19-cyclopanostane-25-en-3β-ol 686, vitexin 283 [299]

57 *Myrcarathus pannae* (Lindl.) S.C.Chen & J.J.Wood

Acervatol 687, acervatone 688, flavantheridin 669, flavantherin 689 [301]

58 *Camariaium densum* (Lindl.) M.A.Blanco

2,3-dihydroxy-3,4-dimethoxyphenanthrene 690, 2,3-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, ephemerosinth B 693, ephemerosinthone 700, gigantol 478, limonanthin 671, moscatin 523, moscatin 523, moscatin, 479, gigantol 478, nabilin D-E 701, nobile 709 [307,446]

59 *Niema bohtheii* (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-cyclopanoate-24,24-dimethyl-25-en-3β-ol trans-p-hydroxycinnamate 698, aloifol I 507, batatasin III 471, ephemerosinthol B 699, ephemerosinthone 700, gigantol 478, limonanthin 671, nidiman 701, nidemone 702 [307,446]

60 *Pholidota articulata* Lindl.

2,7-dihydroxy-3,4,6-trimethoxy 9, 10-dihydrophenanthrene flavidin 703, 2,7-dihydroxy-7-methoxy-9,10-dihydrophenanthrene (coelenin) 704, 9, 10-dihydrophenanthrenes 705, coelaquin 706, coelogenin 707, flavidin 708, flavidin 709, oxoflavidin 710 [447]
61 Pholidota chinensis Lindl. (E)-2',3',3'-trihydroxy-5-methoxy stilbene (pholidotol C) 711, (Z)-3',3'-hydroxy-5-methoxy stilbene (pholidotol D) 712, 2,4,7-trihydroxy-9,10-dihydrophenanthrene 539, 2,5-dimethoxy-3,4,5'-bis(dimethylenedioxy)benzyl 713, 3',4'-dihydroxy-3',5'-dimethoxybenzyl 714, 3,4-dihydroxy-4'-methoxydihydrocannabinol 715, 4',4'-dihydroxydiphenylmethane 716, 4,5-dihydroxy-2-methoxy-9,10-dihydrophenanthrene 717, 5,3'-dihydroxy-2,3-(methylenedioxy)benzyl 718, 9,10-dihydro-2,4-dihydroxy-7-methoxyphenanthrene 719, batatasin III 471, blestrin A 720, blestrin A 721, bulbophyll B 722, cannabidiol 723, coelolin 475, coelolin 476, cyclopholidone 724, cyclopholidone 725, cyclopholidone 725, erianthridin 667, euphol 726, flavantherin 727, flavantherin 727, gynocpin C 728, hircinol 670, lusianthridin 671, lusianthridin 671, phochinenins A – F 719–724, pholidotols A–B 741, 742, 3,4-dihydroxy-5-methoxydihydrostilbene 743, phyanunnarin D 744, p-hydroxybenzaldehyde 432, p-hydroxybenzyl alcohol 745, proteacechmal aldehyde 746, resveratrol 477, thunabale 748, thunabale 749, trans-3,3-dihydroxy-2,5-dimethoxybenzene 750, 3,4-dihydroxy-2,3,5-trimethoxybenzene 751, β-daucosterol 752 [310,311,434,435,448,449]

62 Scaphyglottis livida (Lindl.) Schltr. 24,24-dimethyl-9,19-cyclooctanosta-11(9),25-dien-3-one (cyclobalanone) 753, 3,4'-dihydroxy-3',4'-trimetoxybenzene 754, 3,4'-dihydroxy-3',5'-dimethoxybenzene 714, 3,4-dihydroxy-2,4,8-trimethoxybenzene 755, 3,4-dihydroxy-2,4,4-dimethoxyphenanthrene 756, 5α-lanosta-24,24-dimethyl-9(11),25-dien-3β-ol 757, batatasin III 471, coelolin 475, gigantol 478, nideolin 701 [313,314,446]

63 Papilionanthe teres (Roxb.) Schltr. Eucomin acid 758, vandasteroids I-III 759–761 [319]

64 Vanda tessellate (Roxb.) Hook. ex G. Don. Oxotessallatin 762 [436]

Piperaceae

65 Peperomia galoides Kunth (+)-epi-α-bisabolol 763, galapiperone 764, grifolic acid 765, grifolin 766, hydropiperone 767, piperogalin 768, piperogalone 769 [437,438,440]

66 Piper retrofractum Vahl 28-methylmiconacos-27-en-1-oic acid 770, 3-methyl-5-decanoylpyridine 771, caffeeic acid 228, di-methyl 3,4-bis(4-hydroxyphenyl)-1,2-cyclobutanedicarboxylate 772, esculetin 773, methyl piperate 774, N-isobutylecicosa-2,4-dienamide 775, p-coumaric acid 334, piperiecosalidene 776, piperine 777, piperonine 778, piperocatalcalidene 779, retroflectamide-D 780, retroflectamides A, C 781, 782, uracil 783, uridine 575, vetixin 283, vetixin 2′-O-β-glucopyranoside 784, β-D-glucopyranoside 266, β-sitosterol 11 [325,330,451–454]

Rubiaceae

67 Hydnophytum formicarium Jack 4-aminophenyl acetate 785, 7,3',5'-trihydroxyflavone 786, butein 787, butin 788, Isoliquiritigenin 789, protocatechaldehyde 226, stigmasterol 11 [337,386]

Viscaceae

68 Viscum articulatum Burm.f. (2S)-5,3,4-trihydroxyflavanone 7-O-β-D-glucoside 790, (2S)-homoeorictodyl 791, (2S)-homoeorictodyl 7-O-β-D-glucoside 792, (2S)-naringenin 7-O-β-D-glucoside 793, (2S)-pinocembrin 7-O-[cinnamoyl(1′)]-β-D-glucoside 794, (2S)-pinocembrin 7-O-[β-D-apiosyl(1′)]-β-D-glucoside (1′) 795, (2S)-pinocembrin 7-O-β-D-glucoside 796, (4′-hydroxy-2′,3′,5′-tetramethoxy-1,3-diphenylpropane)-4″-O-β-Dglucopyranoside 797, 1-O-benzyl-[5-O-benzyl]-β-D-glucopyranosyl(1′→2′)-β-D-glucopyranoside 798, 2-deoxy-α-L-rhamnose 800, 4-β-D-glucosyl-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-7-0-β-D-glucopyranoside 804, 5,4′-dihydroxyflavanone-7-O-β-D-lucopyranoside 805, 7-O-β-D-glucopyranoside 806, butin 807, butin 808, butinolic acid 809, cinnamic acid methyl ester 810, diphenylpropane glycoside 811, eriodictyol 7-O-β-D-glucopyranoside 812, homoeorictodyl 7-O-β-D-glucopyranoside 813, homoeorictodyl 7-O-β-D-glucopyranoside 814, homoeorictodyl 7-O-β-D-glucopyranoside 815, homoeorictodyl 7-O-β-D-glucopyranoside 816, lupenyl
acetate 817, lupeol 247, lupeol acetate 818, lupeol palmitate 819, lupeol stearate 820, lycorin 821, methylparaben 822, naringenin 7-O-β-D-glucopyranoside 823, Oleanolic acid 127, p-hydroxybenzaldehyde 432, p-hydroxy-benzoic acid 824, pinocembrin 825, pinocembrin 7-O-β-D-glucopyranoside 826, pinocembrin-7-O-[cinnamoyl (1→5)-β-D-apiofuranosyl (1→2)]-β-D-glucopyranoside 827, pinocembrin-7-O-β-D-apiofuranosyl(1→2)-β-D-glucopyranoside 828, pinocembrin-7-O-β-D-apiofuranosyl-(1→5)-β-D-apiofuranosyl-(1→2)-β-D-glucopyranoside 829, protocatechuic acid 189, vanillin 293, visartisides A-C 830, 831, 832, visartisides D-F (4–6) 833, 834, 835, viscumtol 836, α-amyrin 342, β-amyrin acetate 837, β-sitosterol 11 [343–347,455–457]

*Viscum ovalifolium* DC 3-O-α-L-arabinopyranoyl-hederagenin-28-O-β-D-glucopyranosyl(1→6)-β-D-glucopyranoside 838, gypsogenic acid 839, hederagenin 840, hederagenin-3-O-α-L-arabinopyranoside 841, hederagenin-3-O-α-L-arabinopyranoyl-(2→1)-O-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. fragantissimum), Aralliaceae (S. caudata, S. elliptica, S. elliptifoliola, S. oxyphylla, S. simulans), and Asclepidaceae (Asclepias sp., D. acuminata, D. benghalensis, D. imbricate, D. nunnularia, 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 biodiscovery knowledge as well as in mutual benefit sharing agreements.

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