Abstract: The genus Litsea is predominant in tropical and subtropical regions of India, China, Taiwan, and Japan. The plant possesses medicinal properties and has been traditionally used for curing various gastro-intestinal ailments (e.g., diarrhea, stomachache, indigestion, and gastroenteritis) along with diabetes, edema, cold, arthritis, asthma, and traumatic injury. Besides its medicinal properties, Litsea is known for its essential oil, which has protective action against several bacteria, possesses antioxidant and antiparasitic properties, exerts acute and genetic toxicity as well as cytotoxicity, and can even prevent several cancers. Here we summarize the ethnopharmacological properties, essentials oil, medicinal uses, and health benefits of an indigenous plant of northeast India, emphasizing the profound research to uplift the core and immense potential present in the conventional medicine of the country. This review is intended to provide insights into the gaps in our knowledge that need immediate focus on in-situ conservation strategies of Litsea due to its non-domesticated and dioecious nature, which may be the most viable approach and intense research for the long-term benefits of society and local peoples.

Keywords: human health; antimicrobial; essential oils; bioactive compound; conservation

1. Introduction

Litsea cubeba Pers., Lauraceae, consists of more than 400 species [1] and is predominant in tropical and subtropical regions of India, Southeast Asia, southern China, Taiwan, and Japan. Litsea is evergreen, fast growing, and a rare deciduous tree or shrub that attains a height of about 8 m, growing spontaneously in the eastern Himalayas, Assam, Manipur, and Arunachal Pradesh up to an altitude of 2700 m from sea level [2]. In the Assam state of India, the tree is known as “mejankari”, while it is commonly called “May Chang” or “Chinese pepper” in China. Litsea plants are the primary source for traditional medicines but they also serve as a secondary source of food for muga silk worms (Antheraea assama) [3]. The muga silk (“mejankari pat”) produced from the Litsea plant is very attractive and more expensive than the silk produced from other plants [4]. The silk cocoons fed with Litsea produce high value silk, which is creamy, glossy, and five times more expensive than silk produced from a primary source of food plant, i.e., Machilus bombycina King [3].
Litsea cubeba is a pioneer herb traditionally utilized in medicine. Different extracts from its plant parts, such as bark, leaf, root, and fruits, have been utilized in traditional Chinese medicines for curing various diseases [5,6]. The fresh green fruit is used for culinary purposes like salad preparation, chutneys, pickles, etc. [7]. The L. cubeba essential oil (LEO) extracted from fresh fruits contains about 60–90% citral content [6], and is essential oil with volatile compounds having an intense lemon-like, fresh, sweet aroma, and insoluble in water. It was found effective against Vicia faba, and weevil (Bruchus rufimanus) [8]. China is the one of the largest producers and exporter of L. cubeba oil in the world. More than 4.4 million lb of LEO has been produced per year, and three quarters of that production is exported to England, United States, France, Germany, Holland, and other countries [9]. LEO is highly aromatic in nature and extracted from the fresh fruits to exploit as an enhancer of aroma in cosmetic products besides in foods. This is employed as raw material in the production of citral, vitamin A, E, and K, ionine and methylionine, and perfumes, and also to impart antimicrobial and insecticidal properties [10–12]. Additionally, LEO is also used as an antifungal agent and bio-insecticides in the storage of grains, foods, archival documents, and/or clothing. The dried fruits are used for several medicinal purposes such as carminative (relieves flatulence), diuretic (aids urine passage), expectorant (aids secretion of sputum), stimulant, stomach ache, antiasthmatic, sedative, antidysentric, and antiseptic [6,9,13]. Some recent studies described the functional properties of L. cubeba, such as its therapeutic [9], antimicrobial [14,15], antioxidant [12,16], anti-cancerous [17,18], anti-inflammatory [19], anti-diabetic [20–22], and anti-insecticidal activities [23–25] (Figure 1).

![Figure 1](image-url). Various ethnopharmacological applications and uses of essential oil of Litsea cubeba.

2. Ethnopharmacological Uses of Litsea Species

Different species of the genus Litsea have been used as traditional herbal medicines since 600 A.D. and as sources of important secondary metabolites [26–28]. Most Litsea species produces odor active compounds while the fruits contain biologically active components that are utilized in various foods as a source of natural ingredients and for flavor [9,29]. The ethnopharmacological properties and uses of Litsea species are briefly described in Table 1.
Table 1. Ethnopharmacological properties of *Litsea* species and their uses.

| Country, Region | Species | Plant Parts | Ethnopharmacological Properties | Solvent/Ratio/Dose Administered | Reference |
|-----------------|---------|-------------|---------------------------------|---------------------------------|-----------|
| Taiwan          | *L. akoensis* Hayata | Stem bark | Cytotoxicity, antimicrobial activity | 15–30 µL of the oil dissolved in dimethylsulfoxide (DMSO) inoculated to plates with test microorganisms | [30] |
| China, Taiwan, Indochina | *L. acutivena* Hayata | Leaves and twigs | Oil for antimicrobial | 50 µL of 1 mg/mL MTT administered against A549 and HT-29 cells | [31] |
| India, China, Taiwan, Indonesia, and other parts of Southeast Asia | *L. cubeba* (Lour.) Pers. | Fruits | Pain reliever, promotes blood circulation, relieves stomach distension, asthma, demesia, diarrhea, turbid urine, and traumatic injury | - | [28,32–34] |
| | | Roots | Relieves cold, stomachache, headache, dermatophytosis, and arthralgia | - | |
| | | Leaves | Promotes blood circulation, cures maimmatis, heals hemostasis, sores furuncle, insect and snake bites, cures myocardial infarction in Wistar rats | 100 to 200 mg/kg of extract daily for a period of 21 days in rats | |
| India | *L. chinensis* (Gaertn.) Sonner. | Fruit, leaves, stem | Activates sexual behavior | 500 mg/kg of extract to male rats | [35] |
| Malaysia, Indonesia, Philippines, Taiwan | *L. garciae* S. Vidal | Fruits | Antifungal, antioxidant | Samples (0.1 g) extracted for 2 h with 80% methanol | [36] |
| Southern Korea, Japan | *L. japonica* (Thunb.) Jussieu | Leaves | Antioxidative, anti-inflammatory | Assay with IC50 values of 149 and 58 µM | [37,38] |
| India (Eastern Himalaya) | *L. laeta* (Nees) Hook. f. | Leaves | Fuelwood | - | [39] |
| Nepal, India, Bangladesh, Burma, China | *L. monopetala* (Roxb.) Pers | Barks, leaves, roots, trunk | Cures gonorrhea, skin diseases, boil, diarrhea, and dislocation, antimicrobial | Fungal growth inhibition at 150–250 µL/L with fumigation | [40–42] |
| Taiwan | *L. nakaii* Hayata | Leaves | Antimicrobial | 15-30 µL of the oil in DMSO applied to microbial plates | [43] |
| Indonesia | *L. odorifera* Val. | Leaves | - | Anti HSV-1 | - | [44] |
| India | *L. polyantha* Juss. | Barks and roots | Effective in pains, bruises, fractures, diarrhea | - | [45] |
| China | *L. rotundifolia* Hemsl. | Roots | Treating rheumatic pain | - | - | [33] |
| India, Nepal, Bhutan, Vietnam, Bangladesh, Myanmar, China | *L. salicifolia* (J. Roxb. ex Nees) Hook. f. | - | Fruits for bone fracture, stomach disorder | - | [46,47] |
| Malaysia (Sarawak) | *L. turfusa* Kosterm. | Ground barks | Antifungal, antitumor | - | [48] |
3. Essential Oils and Their Applications

Basically, the essential oils (EOs) are comprised of secondary metabolites intensely present in different parts of the *Litsea cubeba*, such as root, stem, leaf, flower, and fruits. The oils are usually extracted by steam distillation processes. The EOs are chemically a complex mixture of monoterpenes, phenols, and sesquiterpenes [23]. The chemical compounds of EO from different parts of the plant vary in composition, as revealed by different peak area percentage for these compounds in leaves [49], stem bark [50], and flowers [4]. It is important to note that citral rich essential oils are present in fruits while 1,8-cineole predominate the citral content in leaves [51]. The other compounds rich in EO oil from leaves are sabinene and α-pinene [51]. Similarly, *Litsea* EO collected from the different part of the plants from a northeast location of India and analyzed by GC–MS was reported to contain sabinene in maximum proportion in leaf oils (LC1 and LC2) along with other compounds like α-pinene, terpinen-4-ol, α-terpineol, 1,8-cineole, and myrcene. Citronellol and citronellal were dominant in fruit oils (LC3 and LC4) with their respective content of 70% and 10% of the total oil composition. Similarly, geranial (c. 44%) and neral (c. 40%) were also the important components but citronellal was only found to be around 3% in one of the fruit oil samples (LC5) [52].

The chemical composition of the EO of *L. cubeba* has been seen to vary from country to country [14,50]. Despite this, the different EOs possess similar properties and exert antimicrobial, antibacterial, antioxidant, and antiparasitic activity [14,53–55]. In addition to this, *Litsea* EO has a peculiar property of insecticidal activity and acts as a repellent against several insects, e.g., cabbage looper (*Trichoplusia ni*), Japanese termite (*Reticulitermes speratus*), mosquito (*Aedes aegypti*), maize weevil (*Sitophilus zeamais*), and red flour beetle (*Tribolium castaneum*), and also possesses nematicidal activity against the pine wood nematode (*Bursaphelenchus xylophilus*) [23,24,56,57].

Various agricultural food commodities are attacked by toxigenic fungi across the world [58,59], and pose a serious threat to food safety and security by causing huge crop damages and economic loss. *Aspergillus flavus* is major fungus producing aflatoxins (AFs) that affect several crops and exert carcinogenic, mutagenic, teratogenic, hepatotoxic, and immunosuppressive properties [60,61]. Therefore, the antifungal and antimicrobial effects of *Litsea* EO against several food pathogenic microbes such as *F. verticillioides*, *F. graminearum* and *E. coli* have been investigated by several researchers [15,62,63].

4. Pharmaceutical Compounds

*Litsea cubeba* encompasses a varied number of structurally diverse biologically active compounds, and their uses in traditional medicines and their various functions are listed in Table 2. The major groups of compounds include alkaloids, monoterpenes, sesquiterpenes, diterpenes, flavonoids, amides, lignans, steroids, and fatty acids. These compounds have anticancer, anti-inflammatory, antimicrobial, antioxidant, antidiabetic, and anti-HIV properties, and therefore have immense potential for treating various diseases [64,65].

4.1. Alkaloids

Around 63 alkaloid compounds have been identified in the genus *Litsea* (few are presented in Table 2). Most of the natural aporphine alkaloids have medicinal properties like antioxidant, antitumor, anticonvulsant, and antiplasmodial properties. These alkaloid compounds and their synthetic derivatives have the potential for curing various diseases [64].

4.2. Monoterpenes

The maximum proportion of essential oils from *Litsea* species are comprised of monoterpane compounds, i.e., approximately 90% of essential oils. To date, around 20 monoterpane compounds have been extracted from the EO of *L. cubeba* but with varying structures [29,62]. These compounds exhibit a wide range of functions like antioxidant, antifungal, antiasthmatic, and antiinflammatory properties [70]. The monoterpenes can be broadly classified into two categories: menthane and cineole.
Menthane has been reported to occur in almost all species of *Litsea* except in *L. coreana* var. *sinensis* (Allen). Further, cineole is present in surplus amounts in *L. mollis* Hemsl. and *L. lancifolimaba*.

### Table 2. Compounds isolated from *Litsea cubeba* and their properties.

| Compounds | Function | Reference |
|-----------|----------|-----------|
| Alkaloids  |          |           |
| (–)-8-O-Methyloblongine; (–)-Litcubine; (–)-Litcubinine; (–)-Magnocurarine; (–) Oblongine; (+)-Isoboldine β-N-Oxide; (+)-8-Methoxyisolaurenine-N-Oxide; (+)-N-(Methoxy-carbonyl)-N-(norbolide/norglaucine/norlaurocholizine/norglaucine/norbulbodione/nordicentrin/norisocorydine/norpedicentrine); Actinodaphnine; Isoboldine; Atheroline; Boldine; Castasteridme; Cassylycine; Coelaunine; Corydine; Corytuberine; Dicentrine; Dicentrinome; Glaucine; Glaziovine; Isocorydine; Isodomesticine; Juziphine; Laetanine; Laetine; Lancifoliaine; Laurelliptine; Laurolitsine; Laurotetanine; Lindarpine; Litbamidine; Litseferine; Litseglutine B; Magnoflorine; N,O-Dimethylharnovine; N-Acetyllaurolitsine; N-Allyllaurolitsine; N-Methylcoclaurine; N-Methyllaurotetanine; N-Methylcydine; Norcorydine; Nordicentrine; Norisoboldine; Norisocorydine; Norjuziphine; Oxoushinsunine; Pallidine; Phanostenine; Predicentrine; Reticuline; Sebiferine; Ushinsunine; Xanthoplanine; Butanolides and Butenolactone | Antioxidant, antiplatelet, antitumor, anticonvulsant, and antiplasmodial effects [12,13,66–69] |
| Monoterpenes | | |
| Camphene; Bornylacetate; DL-Carvone; 1,8-Cineole; Citronellal; Citronellol; p-Cymene; Geranial; Geranyl acetate; Geraniol; Limonene; Linalool; β-Myrcene; Neral; Nerol; Neryl acetate; (E)-β-Ocimene; (Z)-β-Ocimene; β-Phellandrene; α-Pinene; β-Pinene; α-Isopulegol; Sabinene; cis-Sabinene hydrate; α-Terpineol; Terpinen-4-ol; Terpinolene; α-Terpinylacacetate; Litseacubebic acid | Antibacterial activity [29,62,70] |
| Sesquiterpenes | | |
| α-Amorphene; Aphanamol II; Aromadendrene; Bulnesol; α-Cadinene; β-Cadinene; γ-Cadinene; δ-Cadinene; α-Cadinol; β-Caryophyllene; Chromolaevanedione; α-Copaene; Isocurcumol; Elemol; β-Elemene; γ-Elemene; a-Eudesmol; β-Eudesmol; γ-Eudesmol; Germacrone; α-Humulene; Humulene oxide; Indonesian; Ledene | Defensive roles [29,71–73] |
| Diterpenes | | |
| Cubelin ((þ)-6-(4-hydroxy-4-methyl-2-pentenoyl)-4,6-dimethyl-1,3-cyclohexadienecarbaldehyde);trans-Phytol | Antioxidative, antifungal, antiasthmatic, anti-anaphylactic properties [74–76] |
| Flavonoids | | |
| Flavones; flavanols; flavanones; flavanonols; anthocyanidins; chalcones; flavan-3-ols | Anti-inflammatory, antioxidant, and hepatoprotective activities [11,77–79] |
| Amides | | |
| cis-N-Ferylolyl-3-methoxytyramine; N-Ferylolyl-3-methoxytyramine; 3-Methoxy-N-sinaripityramine; N-trans-3,4-methyleneecinnamoyl-3-methoxytyramine; Cubeamine A; 1,2-dihydro-6,8-dimethoxy-7,1-(3,5-dimethoxy-4-hydroxyphenyl)-N1,N2-bis-(2-(4-hydroxyphenyl)ethyl)-1,3-naphthalene dicarboxamide; N-cis-3,4-methyleneoxycinnamoyl-3-methoxytyramine | Anticancer effects [6,68,80,81] |
| Lignans | | |
| Eugenol; syringaresinol; 9,9′-O-di-(E)-feruloyl-(+)-secoisolilicresinol; 9,9′-O-di-(E)-feruloyl- (+)-dimethyloxysecosolilicresinol; balanophonin B; (+)-1,2-dimethoxy-3-(1,3-dimethoxy-4-hydroxyphenyl)-N-N-bis-(2-(4-hydroxyphenyl)ethyl)-1,3-naphthalene dicarboxamide | Antioxidant and anticancer effects [80,82] |
| Steroids | | |
| β-sitosterone; Daucussterol; β-Sitosterol; Seppesterol, 5,6-Epoxystigmanstan-3-ol; Stigmasterol; 6-O-Palmitoyl-β-sitosteryl-D-glucoside | Antidiabetic effects [62,81,84] |
| Fatty acids | | |
| Capric acid; cis-Dec-4-enoic acid; cis-Dodec-4-enoic acid (Linderic acid); cis-Tetradec-4-enoic acid (Tszusitic acid); Hexadecenoic acid; Lignoceric acid; Lauric acid; Linoleic acid; Myristic acid; Oleic acid; Palmitic acid; Ethyl palmitate; Stearic acid; Ethyl stearate; Litseacubebic acid; 2,6-Dimethyl-6-hydroxy-2E,4E-hepta-2,4-dienal; 6,7-Dihydroxyl-3,7-dimethyl-oct-2-enolic acid | |
4.3. Sesquiterpenes

Nearly 73 sesquiterpenoid compounds (few are shown in Table 2) have been extracted from different *Litsea* species. These compounds exhibit varying structures, namely aliphatic, monocyclic, bicyclic, and tricyclic sesquiterpenes, along with their oxygenated derivatives. Most of the sesquiterpenes and their derivatives exert natural anti-HIV properties [29].

4.4. Diterpenes

This group of compounds is rare in *Litsea* species. Recently, Trisonthi et al. [74] identified and isolated a new cytotoxic diterpene, known as cubelin (235), from the fruits of *L. cubeba* using methanol extract. No other compounds have been reported to exhibit a similar molecular structure as cubelin in *L. cubeba* or any other species of *Litsea*.

4.5. Flavonoids

Flavonoids are another important and major group of compounds present in *Litsea* species. Around 39 compounds have been identified, which include mainly flavones, flavanols, flavanones, flavanones, anthocyanidins, chalcones, and flavan-3-ols (Table 2); and their glycosidic forms consisting of either glucose, galactose, or rhamnose [62,85]. These compounds are mainly present in *L. coreana*, *Litsea glutinosa*, and *L. cubeba*. However, some compounds like pinocembrinchalcone (271) and kaempferol 3,4′-di-O-L-rhamnopyranoside (258) were isolated from *L. fruticosa* (Hemsl.) [85]. Flavonoids have therapeutic properties and exhibit beneficial properties like anti-inflammatory, antioxidant, and hepatoprotective activities [11,77–79].

4.6. Amides

Approximately ten amide compounds have been identified from the genus *Litsea*, as shown in Table 2. The major *Litsea* species from where amides are obtained include *L. acutivena*, *L. auriculata*, *L. hypophaea*, *L. greenmaniana*, and *L. cubeba*. The application of amides as chemotaxonomic markers is, however, limited for individual species within the genus *Litsea* [12].

4.7. Lignans

Different types of lignans have been reported in *Litsea* species. To date, 35 lignans (few are shown in Table 2) have been extracted from various *Litsea* species: *L. acutivena*, *L. costalis*, *L. cubeba*, *L. chinpingensis*, *L. euosma*, *L. glutinosa*, *L. greenmaniana*, *L. grandis*, *L. gracilipes*, *L. hypophaea*, *L. lancifolia*, *L. lii* var. *nunkao-tahangensis*, *L. turfosa*, and *L. verticillata* [12].

4.8. Steroids

This group of compounds has limited structural diversity and only about seven steroid compounds have been reported to date from *Litsea* plants.

4.9. Fatty Acids

Fatty acids are predominant in *Litsea* species. Some of the major fatty acids present include cinnamic acid, canoic acid, octanoic acid, decenoic acid, dodecenoic acid, myristic acid, stearic acid, oleic acid, and linolenic acid [86].

5. Functions and Potential Mechanisms of Action

5.1. Anticancer Activity

The EO extracted from the *L. cubeba* fruit has been shown to have cytotoxic effects on human lung, liver, and oral cancer cells [17]. Furthermore, the fumes of oil compounds from *L. cubeba* seeds were detrimental to human NSCLC cells (A549) through the process of cell cycle arrest and apoptosis [18].
Zhang et al. [67] showed the in vitro cytotoxic effects of the alkaloids extracted from *L. cubeba* bark against various human cancer cells, like gastric carcinoma (BGC-823), hepatocellular carcinoma (HepG2), breast cancer (MCF-7), gastric adenocarcinoma (SGC-7901), human skin cancer (SK-MEL-2), and ovarian cancer (SK-OV-3) cells. It has been revealed that the nuclear erythroid-2 related factor (Nrf2) is responsible for controlling the expression of the antioxidant response element (ARE) gene. Therefore, the Nrf2/ARE pathway is supposed to be the potential molecular target to discover chemopreventive medicines [87]. Further, Shen et al. [88] experimented with the selection of EtOH extracts of *L. glutinosa* (ZK-06), *L. monopetala* (ZK-07), and *L. garrettii* (ZK-08), employing a stable ARE luciferase reporter cell line obtained from MDA-MB-231 cells (human breast cancer). It was revealed that the ZK-08 tripled the ARE luciferase activity in comparison to the control, while ZK-06 and ZK-07 showed moderate effects, i.e., two to three times increase in ARE luciferase activity.

### 5.2. Anti-Inflammatory Activity

The compound extracted from *Litsea* species has been shown to be effective against gastroenterologia, edema, and rheumatic arthritis, and mainly the species *L. cubeba*, *L. glutinosa*, *L. akoensis*, *L. japonica*, and *L. guatemalensis* have been tested for their anti-inflammatory properties [80,89,90]. The inflammatory mediators, nitric oxide (NO) and PGE2, are produced by inducible nitric oxide synthase (iNOS) and cyclooxygenase (COX)-2 enzymes, respectively. The over expression of these two mediators destroys the target tissue during an infection. However, it has been shown that iNOS and COX-2 are not regulated in macrophages, but induce the expression of other pro-inflammatory mediators like IL-6, COX-2, and iNOS for inflammatory response [91]. Therefore, restricting the biosynthesis of prostaglandin and production of NO could potentially treat cancer [92]. The MeOH extract (0.01 mg/mL) was able to prevent the formation of NO and PGE2 in LPS-activated RAW-264.7 macrophages and further declined the release of HOCl and O2− through myeloperoxidase-catalyzed oxidation of chloride [89].

### 5.3. Antimicrobial Activity

Several compounds extracted from *Litsea* species are effective against various pathogenic strains. The EO of *L. cubeba* leaves and fruits from northeast India have shown antimicrobial properties against *S. aureus*, *L. monocytogenes*, *E. coli*, *P. aeruginosa*, *C. albicans*, and *A. niger*. However, variation in their levels of inhibition was observed, which could be due to variation in the compounds present in the leaves and fruits of *L. cubeba* [52]. Further, antimicrobial activity of the EO from *L. laevigata* was tested in Gram-positive bacteria (*S. aureus, B. subtilis, S. faecalis, S. albus*); Gram-negative bacteria (*E. coli, P. aeruginosa, P. vulgaris, and K. aerogenes*), and fungi (*C. albicans* and *A. niger*). The EO was especially effective against Gram-positive bacteria (*S. albus*) and the fungus (*A. niger*) [71].

### 5.4. Antioxidant Activity

The antioxidant activity of three flavonoids, viz., kaempferol, quercetin-3-O-β-D-glucopyranoside, and kaempferol-3-O-β-D-glucopyranoside extracted from *L. coreana* leaves revealed that the kaempferol had the highest activity while kaempferol-3-O-β-D-glucopyranoside showed the least effect [93]. Further, the antioxidant activity from leaf and bark of four different *Litsea* species from India, namely *L. glutinosa, L. monopetala, L. assamica*, and *L. laeta* showed that the bark extract of *L. glutinosa* and *L. laeta* had higher metal chelating activity with IC50 of 15.25 and 16.14 mg/mL, respectively [94]. Furthermore, the MeOH extracts of the root and stem of *L. elliptica* and *L. resinosa* depicted enhanced antioxidant activity for DPPH (2,2-Diphenyl-1-picrylhydrazyl) radicals with EC50 values of 23.99, 41.69, 11.22, and 33.48 mg/L, respectively, against the standard butylated hydroxytoluene (BHT) [95].

### 5.5. Antidiabetic Activity

The efficacy of total flavonoids of *Litsea coreana* (TFLC) was investigated for their mechanism to reduce the level of blood glucose in diabetic rats. TFLC was observed to decrease the glucose and
lipid levels in the blood and relieved the liver from oxidation stress. In addition, TFLC masked the expression of PTP1B in liver, which resulted in improving the insulin signaling pathway [20]. Similarly, TFLC was further observed to increase the insulin sensitivity, and high-density lipoprotein cholesterol (HDL-C) and superoxide dismutase (SOD) activities. On the other hand, bodyweight, serum free fatty acid, total cholesterol, triglyceride, and low-density lipoprotein cholesterol (LDL-C) content were decreased [12].

5.6. Anti-HIV Activity

Several compounds extracted from \textit{L. verticillata}, namely litseachromolaevane B (15-epi-eudesm-4(15)-ene-1β,6β-diol)(13), litseagermacran(14), litseaverticillols A–H (16–23), isolitseaneB(24),1,2,3,4-tetrahydro-2,5-dimethyl-8-(1-methylethy)-1,2-naphthalenedioli(25), oxyphyllenodiol B (26), verticillatol (15), hydroxydihydrobovolide (28), 3-epilitsenolide D2 (29), 4-hydroxy-2-methylbut-2-enolide (30), litseabutenolide (31), (+)-epiexcelsin(36), and (+)-5′-demethoxyepiexcelsin (37), have potential anti-HIV activity. These compounds showed growth inhibition of HIV in HOG.R5 cells with IC\textsubscript{50} values ranging from 2.0 to 34.5 \textmu g/mL [73,96,97], thus providing potential leads to discover medicines for HIV.

6. Conservation Strategies

The suitable growth and conservation of \textit{Litsea} plants are constrained at different stages of life. Seedling development is vital to predict the survival of plants and also to influence the forest regeneration process [14]. \textit{Litsea} seeds possess a long dormancy phase and have the potential to form long-lived seed reserves. Therefore, seed propagation is an inefficient method of propagation and needs involvement of biotechnological interventions for this potentially important medicinal plant for long-term genetic conservation.

The ecosystem studies have shown that the regeneration of forests depends mainly on two factors, namely the seed rain and the soil seed bank [98–101]. Seed rain is the result of seed production from several plants within the same community as well as addition of seeds from other neighboring communities [102]. Therefore, seed rain has a significant role in generating new plants and determining the structure, dynamics, and regeneration of any forest community [101,103,104]. The soil seed bank, on the other hand, represents the current and past plant community. It prevents the extinction of local species and aids in the regeneration of the forest [105,106]. Furthermore, the soil seed bank functions as a source of colonizing species and accelerates the process of forest succession [107,108]. In addition, the concept of in situ conservation includes the establishment of different types of nature protection areas. These valuable plants can be conserved in the form of ex situ conservation by creating botanical gardens and arboretums. As an alternative, the germplasm resources storehouse could be restored for the long-term preservation of seeds, pollen, and/or asexual propagules [109]. A rapid clonal propagation system for the conservation of various explant sources (shoot tip, node, leaf, and petiole) of \textit{Litsea cubeba} was developed [110]. Furthermore, in-vitro rooting without growth-regulator is possible and over 100 plantlets have been successfully developed in the glasshouse.

7. Conclusions and Future Prospects

The present review has discussed the ethnopharmacological properties of \textit{Litsea cubeba} compounds having the potential to cure various ailments because of inherent anticancer, antimicrobial, anti-inflammatory, antioxidant, antidiabetic, and anti-HIV properties. However, the underlying mechanism and their mode of action are not well researched and established. Further in vitro and in vivo genotoxic experiments of \textit{Litsea} need to be evaluated to entitle its ethnomedical values. The in-depth exploration of \textit{Litsea cubeba} for its various withstanding pharmacological properties can potentially be employed as an initiative to discover new drugs to treat serious diseases like cancer and HIV. Furthermore, it is also considered high time to combine biological research activity with clinical applications to gain insights into the mechanisms of action, drug reactions, and other health related
issues associated with the consumption of crude extracts of the plant. Therefore, research involving clinical evaluation along with conservation strategies is imperative for long term benefits to society.

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**References**

1. Mabberley, D.J. *The Plant-Book: A Portable Dictionary of the Higher Plants*; Cambridge University Press: Cambridge, UK, 1993; Volume 581.
2. Kapoor, L. *Handbook of Ayurvedic Medicinal Plants: Herbal Reference Library*; Routledge: London, UK, 2017.
3. Yadav, G.; Goswami, B. Studies on the foliar constituents of food plants of muga silkworm (*Antheraea assama* Westwood). *J. Ecolobiol.* 1990, 2, 222–228.
4. Choudhury, S.; Ahmed, R.; Barthel, A.; Leclercq, P.A. Composition of the stem, flower and fruit oils of *Litsea cubeba* Pers. from two locations of Assam, India. *J. Essent. Oil Res.* 1998, 10, 381–386. [CrossRef]
5. Duke, J.A.; Ayensu, E.S. *Medicinal Plants of China*; Reference Publications: Cambridge, MA, USA, 1985; Volume 2.
6. Chen, Z.; Bi, H.; Fan, C.; Bao, C. Chemical constituents from the branch of *Litsea cubeba* (Lour.) Pers. *Chem. Ind. For. Prod.* 2013, 33, 133–136.
7. Mao, A. Preliminary report on the folklore botany of Mao Nagas of Manipur India. *Ethnobotany* 1993, 5, 143–147.
8. Yao, K.; Yang, C. Using pheasant pepper seed oil for controlling the broad bean weevil *Bruchus rufimanus*. *Acta Ecol. Sin.* 1984, 27, 173–181.
9. Chen, S.-L.; Yu, H.; Luo, H.-M.; Wu, Q.; Li, C.-F.; Steinmetz, A. Conservation and sustainable use of medicinal plants: Problems, progress, and prospects. *Chin. Med.* 2016, 11, 37. [CrossRef]
10. Budavari, S.; O’Neil, M.J.; Smith, A.; Heckelman, P.E. *The Merck Index*; Merck: Rahway, NJ, USA, 1989; Volume 11.
11. Wang, J.-Q.; Li, J.; Zou, Y.-H.; Cheng, W.-M.; Lu, C.; Zhang, L.; Ge, J.-F.; Huang, C.; Jin, Y.; Lv, X.-W. Preventive effects of total flavonoids of *Litsea coreana* leaf on hepatic steatosis in rats fed with high fat diet. *J. Ethnopharmacol.* 2009, 121, 54–60. [CrossRef] [PubMed]
12. Wang, Y.-S.; Wen, Z.-Q.; Li, B.-T.; Zhang, H.-B.; Yang, J.-H. Ethnobotany, phytochemistry, and pharmacology of the genus *Litsea*: An update. *J. Ethnopharmacol.* 2016, 181, 66–107. [CrossRef] [PubMed]
13. Feng, T.; Zhang, R.-T.; Tan, Q.-G.; Liu, Y.-P.; Cai, X.-H.; Luo, X.-D. Two new isoquinoline alkaloids from *Litsea cubeba*. *Z. Naturforsch. B* 2009, 64, 871–874. [CrossRef]
14. Wang, H.; Liu, Y. Chemical composition and antibacterial activity of essential oils from different parts of *Litsea cubeba*. *Chem. Biodivers.* 2010, 7, 229–235. [CrossRef]
15. Liu, T.-T.; Yang, T.-S. Antimicrobial impact of the components of essential oil of *Litsea cubeba* from Taiwan and antimicrobial activity of the oil in food systems. *Int. J. Food Microbiol.* 2012, 156, 68–75. [CrossRef]
16. Hwang, J.-K.; Choi, E.-M.; Lee, J.H. Antioxidant activity of *Litsea cubeba*. *Fitoterapia* 2005, 76, 684–686. [CrossRef] [PubMed]
17. Ho, C.-L.; Jie-Ping, O.; Liu, Y.-C.; Hung, C.-P.; Tsai, M.-C.; Liao, P.-C.; Wang, E.I.-C.; Chen, Y.-L.; Su, Y.-C. Compositions and in vitro anticancer activities of the leaf and fruit oils of *Litsea cubeba* from Taiwan. *Nat. Prod. Commun.* 2010, 5, 617–620. [CrossRef]
18. Seal, S.; Chatterjee, P.; Bhattacharya, S.; Pal, D.; Dasgupta, S.; Kundu, R.; Mukherjee, S.; Bhattacharya, S.; Bhuyan, M.; Bhattacharyya, P.R. Vapor of volatile oils from *Litsea cubeba* seed induces apoptosis and causes cell cycle arrest in lung cancer cells. *PLoS ONE* 2012, 7, 47014. [CrossRef]
19. Liao, P.-C.; Yang, T.-S.; Chou, J.-C.; Chen, J.; Lee, S.-C.; Kuo, Y.-H.; Ho, C.-L.; Chao, L.K.-P. Anti-inflammatory activity of neral and geranial isolated from fruits of Litsea cubeba Lour. *J. Funct. Foods* 2015, 19, 248–258. [CrossRef]

20. Sun, Y.-X.; Lu, Y.-X.; Wang, L.-Y. Study on the mechanism of action of total flavonoids of Litsea coreana for reducing blood glucose level in rat with type 2 diabetes mellitus. *Chin. J. Integr. Med.* 2010, 30, 617–621.

21. Chhetri, D.; Parajuli, P.; Subba, G. Antidiabetic plants used by Sikkim and Darjeeling Himalayan tribes, India. *J. Ethnopharmacol.* 2005, 99, 199–202. [CrossRef]

22. Yadav, M. Herbal drugs and phytoconstituents useful for the management of diabetes. *Int. J. Green Pharm.* 2017, 11, S21.

23. Jiang, Z.; Akhtar, Y.; Bradbury, R.; Zhang, X.; Isman, M.B. Comparative toxicity of essential oils of *Litsea pungens* and *Litsea cubeba* and blends of their major constituents against the cabbage looper, *Trichoplusia ni*. *J. Agric. Food Chem.* 2009, 57, 4833–4837. [CrossRef]

24. Seo, S.-M.; Kim, J.; Lee, S.-G.; Shin, C.-H.; Shin, S.-C.; Park, I.-K. Fumigant antitermitic activity of plant essential oils and components from ajowan (*Trachyspermum ammi*), allspice (*Pimenta dioica*), caraway (*Carum carvi*), dill (*Anethum graveolens*), geranium (*Pelargonium graveolens*), and litsea (*Litsea cubeba*) oils against Japanese termite (*Reticulitermes speratus* Kolbe). *J. Agric. Food Chem.* 2009, 57, 6596–6602.

25. Zhang, H.J.; Zheng, L.H.; Zhao, K.; Chen, Y.; Yi, Z. Insecticidal activities of constituents of *Litsea cubeba* fruit extracts effective against the maize weevil (*Coleoptera: Curculionidae*). *J. Insect Sci.* 2017, 17, 103. [CrossRef]

26. Mohanan, N.; Kumar, E.S. A new species of *Litsea* (Lauraceae) from India. *Nord. J. Bot.* 2003, 23, 611–613. [CrossRef]

27. Guzmán-Gutiérrez, S.; Gómez-Cansino, R.; García-Zebadúa, J.; Jiménez-Pérez, N.; Reyes-Chilpa, R. Antidepressant activity of *Litsea glaucescens* essential oil: Identification of β-pinene and linalool as active principles. *J. Ethnopharmacol.* 2012, 143, 673–679. [CrossRef] [PubMed]

28. Kong, D.-G.; Zhao, Y.; Li, G.-H.; Chen, B.-J.; Wang, X.-N.; Zhou, H.-L.; Lou, H.-X.; Ren, D.-M.; Shen, T. The genus *Litsea* in traditional Chinese medicine: An ethnomedical, phytochemical and pharmacological review. *J. Ethnopharmacol.* 2015, 164, 256–264. [CrossRef]

29. Agrawal, N.; Choudhary, A.S.; Sharma, M.C.; Dobbal, M.P. Chemical constituents of plants from the genus *Litsea*. *Chem. Biodivers.* 2011, 8, 223–243. [CrossRef]

30. Ho, C.-L.; Lin, C.-Y.; Wang, E.I.-C.; Su, Y.-C. Composition, antioxidant and antimicrobial activities of leaf and twig essential oils of *Litsea akokensis* from Taiwan. *Nat. Prod. Commun.* 2011, 6, 901–904. [CrossRef]

31. Cheng, H.-I.; Lin, W.-Y.; Duh, C.-Y.; Lee, K.-H.; Tsai, I.-L.; Chen, I.-S. New cytotoxic butanolides from *Litsea acutivena*. *J. Nat. Prod.* 2001, 64, 1502–1505. [CrossRef]

32. Normile, D. The new face of traditional Chinese medicine. *Science* 2003, 299, 188–190. [CrossRef]

33. Xie, Z.; Yu, Y. The Guide of National Chinese Herbal Medicine (I); People’s Medical Publishing House: Beijing, China, 1996.

34. Kumar, P.B.; Kannan, M.M.; Quine, S.D. *Litsea deccanensis* ameliorates myocardial infarction in wistar rats: Evidence from biochemical histological studies. *J. Young Pharm.* 2017, 11, 399–409. [CrossRef]

35. Ageel, A.; Islam, M.; Ginawi, O.; Al-Yahya, M. Evaluation of the aphrodisiac activity of *Litsea chinensis* (Lauraceae) and *Orchis malculta* (Orchidaceae) extracts in rats. *Phytother. Res.* 1994, 8, 103–105. [CrossRef]

36. Hassan, S.H.A.; Fry, J.R.; Bakar, M.F.A. Antioxidant and phytochemical study on pengolaban (*Litsea garciae*), an edible underutilized fruit endemic to Borneo. *Food Sci. Biotechnol.* 2013, 22, 1–7. [CrossRef]

37. Min, B.S.; Lee, S.Y.; Kim, J.H.; Kwon, O.K.; Park, B.Y.; An, R.B.; Lee, J.K.; Moon, H.I.; Kim, T.J.; Kim, Y.H. Lactones from the Leaves of *Litsea japonica* and Their Anti-complement Activity. *J. Nat. Prod.* 2003, 66, 1388–1390. [CrossRef] [PubMed]

38. Yoon, W.-J.; Kang, S.C.; Ham, Y.-M.; Kim, K.-N.; Yang, W.H.; Kim, H.-J.; Park, S.-Y.; Jung, Y.-H. Antioxidative and anti-inflammatory activities of *Litsea japonica* leaves. *J. Korean Soc. Appl. Biol.* 2010, 53, 27–32. [CrossRef]

39. Bhatt, B.; Lemtur, M.; Changkija, S.; Sarkar, B. Fuelwood characteristics of important trees and shrubs of Eastern Himalaya. *Enery. Sources Part A Recovery Util. Environ. Eff.* 2017, 39, 47–50. [CrossRef]

40. Baul, T.K.; Hossain, M.M.; Mezbahuddin, M.; Mohiuddin, M. Vegetative propagation of *Litsea monopetala*, a wild tropical medicinal plant: Effects of indole-3-butyric acid (IBA) on stem cuttings. *J. For. Res.* 2011, 22, 409–416. [CrossRef]

41. Hua, H.; Xing, F.; Selvaraj, J.N.; Wang, Y.; Zhao, Y.; Zhou, L.; Liu, X.; Liu, Y. Inhibitory effect of essential oils on *Aspergillus ochraceus* growth and ochratoxin A production. *PLoS ONE* 2014, 9, 108285. [CrossRef]
66. Lee, S.-S.; Chen, C.-K.; Huang, F.-M.; Chen, C.-H. Two dibenzopyrrocoline alkaloids from *Litsea cubeba*. *J. Nat. Prod.* 1996, 59, 80–82. [CrossRef]

67. Zhang, W.; Hu, J.-F.; Lv, W.-W.; Zhao, Q.-C.; Shi, G.-B. Antibacterial, antifungal and cytotoxic isoquinoline alkaloids from *Litsea cubeba*. *Molecules* 2012, 17, 12950–12960. [CrossRef]

68. Tanaka, H.; Yatsuhashi, S.; Yasuda, T.; Sato, M.; Sakai, E.; Xiao, C.; Murata, H.; Murata, J. A new amide from the leaves and twigs of *Litsea auriculata*. *J. Nat. Med.* 2009, 63, 331–334. [CrossRef] [PubMed]

69. Huang, C.-H.; Huang, W.-J.; Wang, S.-J.; Wu, P.-H.; Wu, W.-B. Litebamine, a phenanthrene alkaloid from the wood of *Litsea cubeba*, inhibits rat smooth muscle cell adhesion and migration on collagen. *Eur. J. Pharmacol.* 2008, 596, 25–31. [CrossRef] [PubMed]

70. Chen, C.-J.; Tseng, Y.-H.; Chu, F.-H.; Wen, T.-Y.; Cheng, W.-W.; Chen, Y.-T.; Tsao, N.-W.; Wang, S.-Y. Composition and antimicrobial analysis of the essential oil of *Litsea cubeba* Persoon. *J. Wood Sci.* 2012, 58, 538–543. [CrossRef]

71. Muhammed, A.M.; Subbu, R.M.; Jirovetz, L.; Mohamed, S.P. Composition and antimicrobial analysis of the essential oil of *Litsea laevigata* nees (Lauraceae). *Nat. Prod. Commun.* 2008, 3, 1069–1072. [CrossRef]

72. Ahmad, F.B.; bin Jantan, I.; Bakar, B.A.; Ahmad, A.S.B. A comparative study of the composition of the leaf oils of three *Litsea* species from Borneo. *J. Essent. Oil Res.* 2005, 17, 323–326. [CrossRef]

73. Zhang, H.-J.; Van Hung, N.; Cuong, N.M.; Soejarto, D.D.; Pezzuto, J.M.; Fong, H.H.; Tan, G.T. Sesquiterpenes and butenolides, natural anti-HIV constituents from *Litsea verticillata*. *Planta Med.* 2005, 71, 452–457. [CrossRef] [PubMed]

74. Trisonthi, P.; Sato, A.; Nishiwaki, H.; Tamura, H. A new diterpene from *Litsea cubeba* fruits: Structure elucidation and capability to induce apoptosis in HeLa cells. *Molecules* 2014, 19, 6838–6850. [CrossRef]

75. Cheng, M.-J.; Wang, T.-A.; Lee, S.-J.; Chen, I.-S. A new butanolide and a new secobutanolide from *Litsea lili* var. nunkao-tahangensis. *Nat. Prod. Res.* 2010, 24, 647–656. [CrossRef]

76. Chowdhury, J.U.; Bhiuyan, M.N.I.; Nandi, N.C. Aromatic plants of Bangladesh: Essential oils of leaves and fruits of *Litsea glutinosa* (Lour.) CB Robinson. *Bangladesh J. Bot.* 2008, 37, 81–83. [CrossRef]

77. Chen, L.; Cheng, W.; Hu, C.; Jin, Y.; Li, R.; Li, J. Study on anti-inflammatory effects of total flavonoids of *Litsea coraeana* Leve. Var. *Anhui Nongye Daxue Xuebao* 2004, 39, 439–442.

78. Ye, H.; Jin, L.; Yu, J.; Wu, J. Research on the mechanism of antioxidation of flavonoids from leaves of *Litsea coraeana*. *J. Wenzhou Med. Coll.* 2006, 36, 424–427.

79. Tang, W.J.; Zhang, Y.L.; Xiao, Q.P.; Huang, C.; Jin, Y.; Li, J. Four flavanocoumarins from the leaves of *Litsea coraeana* LEVL. *Chem. Biodivers.* 2013, 10, 1128–1132. [CrossRef] [PubMed]

80. Guo, Q.; Zeng, K.; Gao, X.; Zhu, Z.; Zhang, S.; Chai, X.; Tu, P. Chemical constituents with NO production inhibitory and cytotoxic activities from *Litsea cubeba*. *J. Nat. Med.* 2015, 69, 94–99. [CrossRef] [PubMed]

81. Chen, J.; Zhu, C.; Hu, H.; Ni, X.; Yang, P. Study on chemical constituents of the root of *Litsea cubeba* II chloroform portion and ethyl acetate portion from methanol extract. *Chin. J. Pharm.* 2010, 7, 504–508.

82. Agrawal, N.; Pareek, D.; Dobhal, S.; Sharma, M.C.; Joshi, Y.C.; Dobhal, M.P. Butanolides from methanolic extract of *Litsea glutinosa*. *Chem. Biodivers.* 2013, 10, 394–400. [CrossRef]

83. Tsai, I.L.; Cheng, M.J.; Hung, H.W.; Cheng, H.I.; Chen, I.S. Chemical constituents from the leaves of *Litsea acutivena*. *J. Clin. Chem. Soc.* 2007, 54, 503–506. [CrossRef]

84. Hata, T. Studies on the formosan plant seed oils XVI oil of *Litsea cubeba* pers. *Nippon Kagaku Kaishi* 1939, 60, 122–125. [CrossRef]

85. Liu, R.; Zhang, H.-C.; Zhou, F.; Wang, R.-M.; Tu, Q.; Wang, J.-Y. Flavonoids and alkaloids from the leaves of *Litsea fruticosa*. *Biochem. Syst. Ecol.* 2013, 50, 293–295. [CrossRef]

86. Yan, X.; Wei, X.; Xie, H.; Liu, M.; Zhang, F. Aporphine alkaloids of *Litsea rotundifolia* and *L. rotundifolia* var. oblongifolia. *J. Trop. Subtrop. Bot.* 2000, 8, 324–328.

87. Jeong, W.-S.; Jun, M.; Kong, A.-N.T. Nrf2: A potential molecular target for cancer chemoprevention by natural compounds. *Antioxid. Redox Signal.* 2006, 8, 99–106. [CrossRef] [PubMed]

88. Shen, T.; Chen, X.-M.; Harder, B.; Long, M.; Wang, X.-N.; Lou, H.-X.; Wondrak, G.T.; Ren, D.-M.; Zhang, D.D. Plant extracts of the family Lauraceae: A potential resource for chemopreventive agents that activate the nuclear factor-erythroid 2-related factor 2/antioxidant response element pathway. *Planta Med.* 2014, 80, 426–434. [PubMed]

89. Choi, E.-M.; Hwang, J.-K. Effects of methanolic extract and fractions from *Litsea cubeba* bark on the production of inflammatory mediators in RAW264. 7 cells. *Fitoterapia* 2004, 75, 141–148. [CrossRef]
90. Gogoi, D.; Bezbaruah, R.L.; Bordoloi, M.; Sarmah, R.; Bora, T.C. Insights from the docking analysis of biologically active compounds from plant *Litsea* Genus as potential COX-2 inhibitors. *Bioinformation* 2012, 8, 812. [CrossRef] [PubMed]

91. Kim, S.S.; Oh, O.-J.; Min, H.-Y.; Park, E.-J.; Kim, Y.; Park, H.J.; Han, Y.N.; Lee, S.K. Eugenol suppresses cyclooxygenase-2 expression in lipopolysaccharide-stimulated mouse macrophage RAW264. 7 cells. *Life Sci.* 2003, 73, 337–348. [CrossRef]

92. Hong, C.H.; Hur, S.K.; Oh, O.-J.; Kim, S.S.; Nam, K.A.; Lee, S.K. Evaluation of natural products on inhibition of inducible cyclooxygenase (COX-2) and nitric oxide synthase (iNOS) in cultured mouse macrophage cells. *J. Ethnopharmacol.* 2002, 83, 153–159. [CrossRef]

93. Ye, H.; Yu, J. The preliminary studies on antioxidation of three kinds of flavonoids from *Litsea coreana*. *Zhang Yao Cai* 2004, 27, 113–115. [PubMed]

94. Choudhury, D.; Ghosal, M.; Das, A.P.; Mandal, P. In vitro antioxidant activity of methanolic leaves and barks extracts of four *Litsea* plants. *Asian J. Plant Sci. Res.* 2013, 3, 99–107.

95. Wong, M.-H.; Lim, L.-F.; bin Ahmad, F.; bin Assim, Z. Antioxidant and antimicrobial properties of *Litsea elliptica* Blume and *Litsea resinoso* Blume (Lauraceae). *Asian Pac. J. Trop. Biomed.* 2014, 4, 386–392. [CrossRef] [PubMed]

96. Hoang, V.D.; Tan, G.T.; Zhang, H.-J.; Tamez, P.A.; Van Hung, N.; Cuong, N.M.; Soejarto, D.D.; Fong, H.H.; Pezzuto, J.M. Natural anti-HIV agents—Part I: (+)-demethoxyepiexcelsin and verticillatol from *Litsea verticillata*. *Phytochemistry* 2002, 59, 325–329. [CrossRef]

97. Zhang, H.-J.; Tan, G.T.; Hoang, V.D.; Van Hung, N.; Cuong, N.M.; Soejarto, D.D.; Pezzuto, J.M.; Fong, H.H. Natural anti-HIV agents. Part 3: *Litseaverticillols* A–H, novel sesquiterpenes from *Litsea verticillata*. *Tetrahedron* 2003, 59, 141–148. [CrossRef]

98. McClanahan, T.R. The effect of a seed source on primary succession in a forest ecosystem. *Vegetatio* 1986, 65, 175–178. [CrossRef]

99. Urbanska, K.M.; Erdt, S.; Fattorini, M. Seed rain in natural grassland and adjacent ski run in the Swiss Alps: A preliminary report. *Restor. Ecol.* 1998, 6, 159–165. [CrossRef]

100. Bossuyt, B.; Hermy, M. Seed bank assembly follows vegetation succession in dune slacks. *J. Veg. Sci.* 2004, 15, 449–456. [CrossRef]

101. Pakeman, R.; Small, J. The role of the seed bank, seed rain and the timing of disturbance in gap regeneration. *J. Veg. Sci.* 2005, 16, 121–130. [CrossRef]

102. Booth, B.D.; Larson, D.W. The role of seed rain in determining the assembly of a cliff community. *J. Veg. Sci.* 1999, 9, 657–668. [CrossRef]

103. Fuller, R.; Del Moral, R. The role of refugia and dispersal in primary succession on Mount St. Helens, Washington. *J. Veg. Sci.* 2003, 14, 637–644. [CrossRef]

104. Tackenberg, O.; Stöcklin, J. Wind dispersal of alpine plant species: A comparison with lowland species. *J. Veg. Sci.* 2008, 19, 109–118. [CrossRef]

105. Olano, J.; Caballero, I.; Laskurain, N.; Loidi, J.; Escudero, A. Seed bank spatial pattern in a temperate secondary forest. *J. Veg. Sci.* 2002, 13, 775–784. [CrossRef]

106. Auld, T.D.; Denham, A.J.; Turner, K. Dispersal and recruitment dynamics in the fleshy-fruited *Persoonia lanceolata* (Proteaceae). *J. Veg. Sci.* 2007, 18, 903–910. [CrossRef]

107. Augusto, L.; Dupouey, J.-L.; Picard, J.-F.; Ranger, J. Potential contribution of the seed bank in coniferous plantations to the restoration of native deciduous forest vegetation. *Acta Oecol.* 2001, 22, 87–98. [CrossRef]

108. Luzuriaga, A.L.; Escudero, A.; Olano, J.M.; Loidi, J. Regenerative role of seed banks following an intense soil disturbance. *Acta Oecol.* 2005, 27, 57–66. [CrossRef]

109. Xie, G.; Li, X.; Li, L.; Jiang, Y.; Zheng, Y.; Wang, W. Wild Energy Plant Resources, Conservation and Sustainable Use of Sanqingshan in Eastern China. *IERI Procedia* 2013, 5, 10–13. [CrossRef]

110. Mao, A.; Wetten, A.; Fay, M.; Caligari, P. In vitro propagation of *Litsea cubeba* (Lours.) Pers., a multipurpose tree. *Plant Cell Rep.* 2000, 19, 263–267. [CrossRef] [PubMed]