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World Natural Therapy Assets - A Comparative Analysis Report on the Distribution, Morphology, and Active Ingredients of the Global Chamaecyparis Genus (Cupraceae).

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Chapter 1: Taxonomic Evolution and Evolutionary Biological Background of the Chamaecyparis Genus

Chamaecyparis Genus As a group of cypress with great economic and ecological value, the taxonomic status and evolutionary history of *Spach. have always been the focus of research in plant geography and phylogenetics. This genus was first formally described and named by the French botanist Édouard Spach in his book Histoire Naturelle des Végétaux in 1841 [1, 2]. The genus name " Chamaecyparis*" comes from the Greek words "chamai" (χαμαί, meaning "on the ground" or "short") and "kuparissos" (κυπάρισσος, meaning " cypress"), which largely reflects the initial impressions of some shrub-like horticultural varieties or juvenile forms of early observers.

However, in natural primary forests, Cypress species are usually giant trees that can grow to 20 to 70 meters tall [3, 4, 5].

In the framework of modern phylogenetics, the genus C. *thyoides* is classified under the subfamily Cupressoideae of the family Cupressaceae [1, 2]. According to molecular clock and genetic distance analysis, C. *thyoidesis* a relatively ancient group whose evolutionary origin can be traced back to the Late Cretaceous to the Early Paleogene. Molecular evidence shows that the genus diverged earlier than the Cretaceous-Tertiary (KT) boundary, with C. *thyoides* considered to be the most diversifying species in the genus, and its divergence point occurred around this geological period [6].

Dynamic revisions of taxonomy and extant species:

Table 1 shows that the species definition of the genus Platycladus has undergone several revisions throughout history. Currently, the widely accepted extant species mainly include six to seven species. These species exhibit a high degree of morphological similarity, but their geographical distribution shows a typical trans-Pacific discontinuous distribution pattern.

Modern scientific name	Common Names (Chinese/English)	Main distribution area	Remark
Chamaecyparis obtusa	Hinoki Cypress (Japanese Cypress)	Japan (Honshu, Shikoku, Kyushu)	A representative species within the genus, possessing extremely high economic value [2, 7]
Chamaecyparis pisifera	Japanese Sawara Cypress	Japan (Honshu, Kyushu)	Commonly used as an ornamental horticultural tree species [2, 8]
Chamaecyparis formosensis	Taiwan Red Cypress	Taiwan Central Mountain Range	The largest and longest-lived tree species in the genus [6, 9]
Chamaecyparis obtusa var. formosana	Taiwan Yellow Cypress	Mid-to-high altitude mountainous areas of Taiwan	Often considered a variant of *C. obtusa* [3, 10]
Chamaecyparis lawsoniana	Port Orford Cedar	West Coast of	It is known for its

		North America (Oregon, California)	unique chemical defense mechanisms [2, 11]
Chamaecyparis thyoides	Atlantic White Cedar	East coast of North America (Maine to Mississippi)	The earliest lineage to diverge in evolution [1, 2]
Chamaecyparis hodginsii	Fujian Cypress	Southern China, Vietnam, and Laos	Originally classified under the genus *Fokienia* [6]

It is noteworthy that several major taxonomic shifts reflect a transition from morphological characteristics to molecular evidence. For example, *C. nootkatensis, once classified in its own genus, was transferred to the genus Xanthocyparis* in the early 2000s based on strong genetic and morphological evidence, and subsequently further classified into the monotypic genus *Callitropsis* [2, 3, 6]. On the other hand, F. *hodginsii*, although morphologically different from typical C. species, has been consistently demonstrated by multiple molecular studies to be deeply embedded within the C. genus and closely related to the East Asian lineage; therefore, modern classifications often include it in *Chamaecyparis* [2, 6].

Fossil Record and Paleontological Significance

The fossil record of the genus Cypress is extremely rich, providing key clues to understanding its current discontinuous distribution pattern. † *C. eureka* was found in high-latitude regions of North America, such as Axel Heiberg Island in Canada, during the Middle Eocene, indicating that the genus was much more widely distributed then and adapted to the humid forest environment near the poles [2, 12]. Fossils of the Early Oligocene († *C. linguaefolia*) were found in Colorado, and widespread cypress forests existed in Europe during the Middle and Late Cenozoic, until global cooling during the Pliocene to Pleistocene led to their complete extinction in Europe [12]. These data suggest that the extant species are survivors of climate change and are typical Tertiary Relicts [13, 14].

Chapter Two: Causes of Global Extant and Discontinuous Distribution Patterns

The genus Platycladus exhibits a significant East Asia-North America disjunction, a highly representative biological phenomenon in phytogeography. Currently, the genus is naturally distributed on both sides of the North Pacific Ocean: the eastern coast of North America and the western coast of Asia [2, 3].

Spatial layout of the East Asian branch

In Asia, the genus C. obtusa is mainly concentrated in the Japanese archipelago and Taiwan. Japanese cypress (*C. obtusa*) and Japanese red cypress (*C. pisifera*) are important components of Japanese forests, with their distribution range extending from Fukushima Prefecture (37°10′N) to Yakushima Island (30°15′N) at the southernmost tip [14]. Japanese cypress prefers warm and humid environments and shows a certain degree of drought resistance and adaptability to poor soil, which makes it the main tree species in Japanese plantations, accounting for about 25% of the total area of plantations in the country [7].

Taiwan possesses two important relict species: Taiwan red cypress (*C. formosensis*) and Taiwan cypress (*C. obtusa* var. *formosana*, now also discussed as a separate species *C. taiwanensis*). These two are the soul of Taiwan's alpine forests, distributed in mountainous areas at altitudes of 1,300 to 2,800 meters [15, 16]. Taiwan red cypress mainly grows in mid-altitude mist forests, while Taiwan cypress is distributed in higher altitude areas, and the two often form mixed forests or pure forests. Genetic studies show that Taiwan cypress and Japanese cypress are genetically highly differentiated (*FST 0.673–0.717), and it is speculated that their ancestral populations were isolated about 1 million to 1.3 million years ago with the disappearance of* the land bridge connecting Japan and Taiwan in the early Pleistocene [13, 14].

Geographical division of the North American branch

Species of the genus Platycladus in North America are distributed at the eastern and western ends of the continent, and the two species differ greatly in evolution and ecology.

1. **Specialized evolution on the west coast: C. lawsoniana *The* natural** distribution range of C. lawsoniana is extremely narrow, mainly located in the coastal mountains of southwestern Oregon and northwestern California, with a latitudinal span of only about 40°50' to 43°35' N [17]. This species is greatly influenced by the warm Pacific current and prefers a climate with wet and cool summers and rainy winters [17, 18]. It exhibits a high degree of specialization in soil adaptation and is often associated with ultramafic rocks (such as serpentinite). This ability to survive in harsh chemical soils gives it a niche advantage in competition with other dominant conifers (such as Douglas fir) [18].

2. **East Coast Wetland Adaptation: Atlantic White Cypress (*C. thyoides*)** Atlantic white cypress is distributed along the Atlantic coastal plains of the eastern United States, extending from Maine to Florida and Mississippi.[2] Unlike West Coast species, it is a species specifically adapted to swamp, wetland and riparian environments. Its flood tolerance and excellent growth performance in acidic peat soils make it play an important role in ecological restoration in the eastern United States. [4, 19]

Biogeographical mechanisms of discontinuous distribution

The current distribution pattern of the genus Platycladus is the result of historical shifts along the Bering Land Bridge and the North Atlantic Land Bridge (NALB). During the Paleogene, the warm climate allowed the ancestors of the genus Platycladus to spread freely between Eurasia and North America via polar forests.[12] With the cooling of the climate and orogenic movements (such as the uplift of the Himalayas and Rocky Mountains) in the late Cenozoic, the originally continuous distribution area was fragmented. East Asia, due to its buffering effect from the maritime climate and the protection of its complex topography, became a refuge for many species of the genus Platycladus , which explains why the East Asian lineage has higher species diversity than the North American lineage. [13, 14]

Chapter 3: Correlation Analysis of Environmental Factors and Physiological Growth

The growth performance of plants in the genus Platycladus is closely related to the physicochemical characteristics of their environment. For forestry operators, understanding the interaction between altitude, climate conditions, and soil properties is crucial.

The regulation of growth by soil physicochemical characteristics

Table 2 shows that in a study of Japanese cypress plantations conducted in South Korea, soil pH, organic matter content, and altitude were found to be **the core factors affecting its growth [20, 21].**

Environment variables	Pattern of influence on growth	Scientific observation results
Soil pH value	Positive correlation	Soil pH significantly affects the growth of diameter at breast height (DBH), and excessively acidic soils limit nutrient uptake [20, 21].
Altitude	negative correlation	With increasing altitude, the average temperature decreases, the growing season shortens, and the annual increase in DBH shows a downward trend [20].
Average annual temperature	Positive correlation	Temperature and tree height growth are positively correlated, supporting the view that climate warming may promote the spread of Cypress in some regions [20, 21].
Spacing	Competition effect	The lower the stand density (the larger the spacing), the more significant the increase in individual tree height, which is related to the allocation of photosynthetic resources [20].

In addition, plants of the genus Platycladus exhibit extremely high growth rates in their juvenile stage (before age 30), after which the growth slope tends to flatten out. This "fast at first, slow later" growth strategy helps them to rapidly occupy canopy space in the early stages of forest succession [20, 21].

habitat shifts under climate change scenarios

Climate suitability models (SDMs) predict that the potential distribution range of Platycladus species will shift significantly against the backdrop of global warming. For example, Platycladus japonicus has good environmental adaptability, but its photosynthetic efficiency may be inhibited by photorespiration if atmospheric carbon dioxide concentration exceeds 600 ppm or the frequency of extreme high temperatures increases [22]. In contrast, other conifers such as Larix japonicus are more sensitive to high temperatures, and their suitable habitats are rapidly retreating to higher altitudes. Therefore, in future forestry planning, Platycladus is often regarded as a candidate species with strong climate-resilient properties, but adaptive management strategies still need to be developed to cope with extreme climate disturbances [22].

Chapter 4: General Overview of Chemical Constituents in Plants of the Genus Platycladus

The reason why plants of the genus Platycladus can survive in nature for hundreds or even thousands of years is mainly due to their powerful secondary metabolic system. These chemical substances not only constitute the chemical defense network of plants, but also endow their wood with excellent physical qualities [7].

Chemical diversity of secondary metabolites

The main active components of the genus Platycladus can be divided into four major groups: terpenoids, phenols, cycloheptatrienolones, and lignans [7, 23].

1. **Monoterpenes and sesquiterpenes** are the most abundant components in cypress essential oil. Monoterpenes such as α-pinene*,* limonene, and sabinene are usually found in the highest concentration in the leaves, giving it a refreshing forest aroma [15, 24, 25]. Sesquiterpenes such as cadinol and eudesmol are mostly concentrated in the heartwood and are the main agents of insect repellency and preservation [26, 27, 28].

2. **Tropolones** are non-benzene aromatic compounds unique to cypress trees, the most famous of which is hinokitiol (*β* -thujaplicin). These compounds have a

strong metal ion chelating ability and can effectively inhibit fungal polyphenol oxidase, thereby preventing wood decay [23, 29, 30].

3. **Flavonoids and polyphenols** are mainly distributed in the leaves and bark. Representative components include quercitrin, amentoflavone, and hinokiflavone. These components are natural defenses of plants against ultraviolet radiation and oxidative stress [31].

Table 3. Tissue-specific chemical morphology: The distribution of chemical components in plants is extremely uneven, exhibiting a high degree of tissue specificity.

Organization Name	Advantageous chemical groups	Functions and significance
Leaf essential oil	Monoterpenoid hydrocarbons	Highly volatile, used to attract pollinators or deter herbivores [16, 24]
Heartwood extract	Oxidized sesquiterpenes, cycloheptatrienolone	High stability, giving the wood resistance to decay and termites [27, 32]
Inner bark and bark	Diterpenes, condensed tannins	Barrier function, preventing microbial invasion after mechanical damage [23, 32]
Fruit/ball	Oxidized monoterpenes (such as borneol)	Protect seeds from being eaten by pests [33, 34]

Chapter 5: Comparative Analysis of Active Ingredients from Various Species

Chemical profiling of different species in the genus Platycladus reflects their respective evolutionary paths and geographical adaptations.

Essential oil composition and geographical variation of C. *lawsoniana*

The essential oil composition of Rosen cypress is extremely complex; a study of wild populations in Oregon identified as many as 136 compounds [8, 35].

- **Main components of wild populations:**
  - Limonene: 22.0% – 27.4%
  - Oplopanonyl acetate: 11.3% – 13.8%
  - Beyerene: 9.0% – 14.3%
  - Sabinene: 6.5% – 7.0% [8, 24, 35]

Interestingly, the leaf oil of Platycladus orientalis exhibits a striking enantiomerism characteristic. In cypress families, (+)-enantiomers are generally dominant; for example, its limonene is up to 99% pure (+)-Limonene, a stark contrast to the predominantly (-)-enantiomers found in pines [24, 35]. When this species was introduced to Europe (e.g., Spain) or North Africa (e.g., Egypt), environmental stress caused a shift in its main components, with a significant increase in the ratio of α-pinene to Δ3-geraniol, demonstrating the environmentally induced plasticity of chemotype [32, 35].

Japanese cypress (*C. obtusa*) and its Taiwanese lineage

Although Japanese cypress and Taiwan cypress are chemically similar, they differ by magnitude in the content of key defensive substances.

- **Comparison of physalis phenol content:**
  1. **Taiwan cypress:** has the highest content, with about 2.0 mg of cypressol (0.2%) per gram of dry wood [30].
  2. **Japanese cypress:** The content is significantly lower, at approximately 0.2 mg/g (0.02%) [30]. This difference explains why Taiwan cypress wood is often superior to Japanese cypress in terms of resistance to decay.
- **Composition of wood essential oil** [28]: Taiwan cypress wood essential oil contains a high proportion of **α-terpineol (19.4%)** and **borneol (16.0%),** which gives it unique pharmaceutical properties, such as significant anti-inflammatory and central nervous system sedative effects.

Characteristic chemical markers of Taiwan red cypress (*C. formosensis)*

The wood chemical profile of Taiwan red cypress contains some compounds that are rare within the genus, which is related to its longevity and large biomass defense needs.

- **Wood components:** rich in **α-eudemanol (18.06%)**, **β-guaiacene (8.0%)** and the unique **chamaecynone** [27].

- **Leaf components: α-pinene** is the dominant component (71.6% - 85%), and this high concentration of monoterpenes gives the leaves strong insect and fungal resistance [15, 27].

Chapter 6: Pharmacological Activities and Biological Functions of Plants in the Genus Platycladus

Chemical extracts from plants of the genus Platycladus have shown broad application prospects in modern biomedicine, covering multiple fields such as anti-inflammation, antibacterial, and anticancer.

Anti-inflammatory and immune-modulating mechanisms

Cypress essential oil and extracts have shown strong inhibitory effects in a variety of inflammatory models.

- **Molecular targets: Studies have confirmed that the essential oil of Taiwan cypress wood can effectively inhibit the production of TNF-α, IL-6, IL-1β** , and **NO** in macrophages [28, 36]. Its mechanism of action involves inhibition. **iNOS** and **NLRP3 inflammasome** expression, thereby blocking cytokine storm [28].
- **Respiratory protection:** In a guinea pig model, extracts of Platycladus orientalis significantly reduced tracheal constriction induced by potassium chloride (KCl) or histamine (HIS). Its active ingredients, such as **quercetin,** can relax respiratory smooth muscle by inhibiting L-type calcium channels (L-VDCC), which provides a scientific basis for the use of Platycladus orientalis in traditional medicine to treat colds and coughs [37].

Table 4. Antibacterial, antifungal and antiviral efficacy: The most famous biological activity of plants in the genus Platycladus is their strong antibacterial ability, especially their inhibition of Gram-positive bacteria.

Test microorganisms	Sensitivity (MIC/inhibition zone)	Clinical/ecological significance
Streptococcus *mutans*	MIC: 0.025 μl /ml	Effectively prevents tooth decay and is suitable for oral care products [25, 38]
Staphylococcus *aureus*	Strongly inhibits (also effective against MRSA)	It can be applied to the antibacterial finishing of hospital bed sheets and

		surgical gowns [7, 25]
Candida *albicans*	Significant antifungal effect	Treatment of oral and cutaneous candidiasis [38]
Decaying fungus (*L. sulphureus*)	Red cypermethrin has strong bactericidal properties.	This explains why the wooden structure of the ancient temple could last for thousands of years. [27]

In addition, physalisol and its derivatives have shown potential antiviral activity in recent years, and some studies have even explored their potential role in inhibiting the novel coronavirus (SARS-CoV-2) [39].

Skin Physiology and Anti-aging Applications

In the field of cosmetic science, cypress extracts are highly sought after for their outstanding antioxidant and cell-protective effects.

- **Anti-wrinkle mechanism:** 70% ethanol extract of Japanese cypress leaves can inhibit the activity of elastase and collagenase. By upregulating the expression of **SOD1** gene, it can effectively remove reactive oxygen species (ROS) in cells and prevent skin aging and wrinkle formation caused by ultraviolet radiation [31].
- **Wound healing:** Extracts from the leaves of Taiwan red cypress can regulate the expression of matrix metalloproteinases **MMP-2** and **MMP-9.** Since these enzymes are involved in tissue remodeling and metastasis, precise regulation can promote wound repair and reduce scar formation [9].

Chapter 7: The Scientific Basis of Chemical Ecology and Wood Durability

Secondary metabolites of the genus Platycladus are not only sources of medicinal substances, but also competitive strategies for survival in complex ecosystems.

Insect repellency and insecticidal activity

Certain components in the heartwood have excellent insecticidal and mosquito-repellent effects.

- **Nootkatone:** This is a key component of the heartwood of Rosen cypress (and Alaskan cypress). It has been shown to be highly toxic to a variety of arthropods, including the black-legged tick (*Ixodes scapularis), which transmits Lyme disease, the flea (Xenopsylla cheopis)*, which transmits plague, and the mosquito (Aedes aegypti). [32] Nootkatone is currently being developed as a new generation of biopesticides and natural insect repellents.
- **Carvacrol:** Also found in cypress, it has a significant inhibitory effect on tick populations in forest litter [32].

Antifungal and wood preservative

The wood of the genus Platycladus is known as "immortal for a thousand years," and its core mechanism lies in the synergistic effect of cycloheptatrienolones and sesquiterpenes.

1. **Chelation effect:** Pine phenol can bind to metal ions such as iron and zinc in fungi, blocking the metabolic process of their key enzymes [23, 29].
2. **Physicochemical barriers:** Tree age is positively correlated with the content of sesquiterpenes in heartwood. As the tree ages, these compounds accumulate in large quantities in the heartwood, giving the wood a near-immune defense against brown rot fungi, white rot fungi, and termites [16, 26].

Chapter 8: Conservation, Management and Future Prospects of Chamaecyparis Genus Resources

Faced with increasingly severe climate challenges and resource depletion pressures, the sustainable utilization of cypress resources has become an urgent priority for forestry science.

Conservation strategies for genetic diversity

Genetic analysis shows that species of the genus Platycladus, such as Platycladus japonicus, have retained extremely high genetic uniqueness in Pleistocene refuges [13, 14]. To cope with future environmental changes, conservation efforts should not be limited to establishing nature reserves, but should also include ex-situ conservation and gene bank preservation for threatened species. In particular, long-lived tree species such as Taiwan red cypress have growth cycles of up to a thousand years, making them extremely difficult to recover quickly after drastic environmental changes [6, 10].

Industrialization and Biorefining

Traditionally, the exploitation of cypress resources has focused primarily on log construction and furniture manufacturing. Future development should move towards a "whole-tree utilization" biorefining model.

- **Forestry residue recycling:** Extract essential oils from branches and wood chips removed during afforestation and thinning, and extract high-value raw materials such as cypressin and quercetin [7, 34].
- **Functional textiles and building materials**: Incorporate cypress essential oil into fibers or coatings to develop home furnishings with natural antibacterial and stress-relieving functions [7].

Chapter 9: Conclusion

The genus *Chamaecyparis*, a relict group spanning Eurasia and North America, profoundly reflects the art of adaptation of organisms to dramatic changes in the Earth's environment through its evolutionary trajectory and chemical characteristics. From the Rosen cypress of the west coast of North America challenging serpentine soils to the unwavering presence of the giant Taiwan red cypress in the high-altitude mist forests of Taiwan, the genus Chamaecyparis demonstrates remarkable resilience across both spatial and temporal dimensions.

Through comparative analysis, we discovered significant interspecific and tissue-specific differences in the chemical defense systems of this genus: the East Asian lineage excels in the accumulation of cypressin, while the North American lineage is unique in its evolution of specialized insecticidal compounds (such as nucadone). These chemicals not only contribute to the high durability of wood but also demonstrate enormous economic value in modern pharmacology, cosmetic science, and the development of biopesticides.

Against the backdrop of climate change and sustainable resource utilization, in-depth research on the genus Platycladus will no longer be limited to the traditional field of forestry, but will combine genomics, chemical ecology, and biotechnology to open up entirely new research and industrial pathways. Protecting these "kings of the forest" is protecting the precious chemical assets and ecological memories accumulated by the Earth over tens of millions of years of evolution.

References

1. Chamaecyparis Spach | Plants of the World Online | Kew Science, https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:11633-1
2. Chamaecyparis - Wikipedia, https://en.wikipedia.org/wiki/Chamaecyparis
3. Conifer Database - Chamaecyparis, https://conifersociety.org/conifers/chamaecyparis
4. Chamaecyparis (Cypress, False-cypress) | North Carolina Extension Gardener Plant Toolbox, https://plants.ces.ncsu.edu/plants/chamaecyparis/
5. Chamaecyparis | Landscape Plants | Oregon State University, https://landscapeplants.oregonstate.edu/chamaecyparis
6. Chamaecyparis (false-cypress) description, https://www.conifers.org/cu/Chamaecyparis.php
7. The Precious Potential of the Sacred Tree Chamaecyparis obtusa..., https://www.mdpi.com/1422-0067/25/5/2723
8. Chemical Compositions and Enantiomeric Distributions of Foliar Essential Oils of Chamaecyparis lawsoniana (A. Murray bis) Parl, Thuja plicata Donn ex D. Don, and Tsuga heterophylla Sarg - PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC11126146/
9. New Terpenoids from Chamaecyparis formosensis (Cupressaceae..., https://pmc.ncbi.nlm.nih.gov/articles/PMC6017238/

10. Chamaecyparis obtusa (ヒノキhinoki) description - The Gymnosperm Database, https://www.conifers.org/cu/Chamaecyparis_obtusa.php

11. Chamaecyparis lawsoniana Leaf Essential Oil as a Potential Anticancer Agent: Experimental and Computational Studies - PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC10346282/

12. Historical biogeography of the genus Chamaecyparis (Cupressaceae, Coniferales) based on its fossil record - ResearchGate, https://www.researchgate.net/publication/225677966_Historical_biogeography_of_the_genus_Chamaecyparis_Cupressaceae_Coniferales_based_on_its_fossil_record

13. (PDF) The Historical Biogeography of Divergence in the Relict Cypress Chamaecyparis obtusa, and the Implications for Conservation and Management in East Asia - ResearchGate, https://www.researchgate.net/publication/396033076_The_Historical_Biogeography_of_Divergence_in_the_Relict_Cypress_Chamaecyparis_obtusa_and_the_Implications_for_Conservation_and_Management_in_East_Asia

14. The Historical Biogeography of Divergence in the Relict Cypress Chamaecyparis obtusa, and the Implications for Conservation and Management in East Asia - PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC12483943/

15. Analysis of leaf essential oils from the indigenous five conifers of Taiwan, https://for.nchu.edu.tw/en/uploads/file/thesis/3081c0da-7c01-400b-9502-de25eed9608e.pdf

16. (PDF) Antifungal Potential and Chemical Composition of Chamaecyparis formosensis and Chamaecyparis obtusa var. formosana Essential Oils in Liquid and Vapor Phases Against 4 Fungal Species - ResearchGate, https://www.researchgate.net/publication/375143443_Antifungal_Potential_and_Chemical_Composition_of_Chamaecyparis_formosensis_and_Chamaecyparis_obtusa_var_formosana_Essential_Oils_in_Liquid_and_Vapor_Phases_Against_4_Fungal_Species

17. Chamaecyparis lawsoniana (A - Southern Research Station - USDA, https://www.srs.fs.usda.gov/pubs/misc/ag_654/volume_1/chamaecyparis/lawsoniana.htm

18. The Environment of Chamaecyparis lawsoniana - Forest Science Labs, https://www.fsl.orst.edu/rna/Documents/publications/The%20environment%20of%20Chamaecyparis%20lawsoniana%201980.pdf

19. Chamaecyparis thyoides Fact Sheet, https://web.uri.edu/wp-content/uploads/sites/2078/Chamaecyparis-thyoides.pdf

20. The Growth Pattern of Chamaecyparis obtuse Stand along Longevity in Gyeongnam Province, South Korea - SciRP.org, https://www.scirp.org/journal/paperinformation?paperid=102816

21. The Growth Pattern of Chamaecyparis obtusa Stand along Longevity in Gyeongnam Province, South Korea - Scirp.org., https://www.scirp.org/pdf/ojf_2020091114272585.pdf

22. Exploring the Climate-Suitable Forestation Area Under Species Distribution and Growth Modeling for Larix kaempferi and Chamaecyparis obtusa in the Republic of Korea - MDPI, https://www.mdpi.com/1999-4907/16/3/530

23. BIOLOGICAL ACTIVITIES OF TROPOLONE AND HINOKITIOL: THE TOOLS IN PLANT PHYSIOLOGY AND THEIR PRACTICAL USE | Request PDF - ResearchGate, https://www.researchgate.net/publication/282674423_Biological_activities_of_tropolone_and_hinokitiol_The_tools_in_plant_physiology_and_their_practical_use

24. Chemical Compositions and Enantiomeric Distributions of Foliar Essential Oils of Chamaecyparis lawsoniana (A. Murray bi… - OUCI, https://ouci.dntb.gov.ua/en/works/4563KPvl/

25. (PDF) Chemical composition and antimicrobial activity of ..., https://www.researchgate.net/publication/6637721_Chemical_composition_and_antimicrobial_activity_of_Chamaecyparis_obtusa_leaf_essential_oil

26. Identification and variation analysis of the composition and content of essential oil and fragrance compounds in Phoebe zhennan wood at different tree ages - Frontiers, https://www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2024.1368894/full

27. Chemical composition and antifungal activity of essential oil isolated from Chamaecyparis formosensis Matsum. Wood - ResearchGate, https://www.researchgate.net/publication/239554365_Chemical_composition_and_antifungal_activity_of_essential_oil_isolated_from_Chamaecyparis_formosensis_Matsum_Wood

28. Chemical Composition and Anti-inflammatory Activity of Chamaecyparis obtusa f. formosana Wood Essential Oil from Taiwan ResearchGate, https://www.researchgate.net/publication/263972279_Chemical_Composition_and_Anti-inflammatory_Activity_of_Chamaecyparis_obtusa_f_formosana_Wood_Essential_Oil_from_Taiwan

29. BIOLOGICAL ACTIVITIES OF TROPOLONE AND HINOKITIOL: THE TOOLS IN PLANT PHYSIOLOGY AND THEIR PRACTICAL USE - ishs, https://ishs.org/ishs-article/755_17/

30. Hinokitiol - Wikipedia, https://en.wikipedia.org/wiki/Hinokitiol

31. Biological Activity and Component Analyses of Chamaecyparis obtusa Leaf Extract: Evaluation of Antiwrinkle and Cell Protection Effects in UVA-Irradiated Cells - PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC10146071/

32. Yellow-Cedar, Callitropsis (Chamaecyparis) nootkatensis, Secondary Metabolites, Biological Activities, and Chemical Ecology - USDA Forest Service, https://www.fs.usda.gov/pnw/pubs/journals/pnw_2018_karchesy001.pdf

33. Essential Oils Composition and Biological Activity of Chamaecyparis obtusa, Chrysopogon nigritanus and Lavandula coronopifolia Grown Wild in Sudan - PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC9921792/

34. Essential Oils Composition and Biological Activity of Chamaecyparis obtusa, Chrysopogon nigritanus and Lavandula coronopifolia Grown Wild in Sudan - MDPI, https://www.mdpi.com/1420-3049/28/3/1005

35. Chemical Compositions and Enantiomeric ... - Semantic Scholar, https://pdfs.semanticscholar.org/003e/3fa8fd8aebe5622e205305811506a159e3fd.pdf

36. Chemical composition and anti-inflammatory activity of Chamaecyparis obtusa f.formosana wood essential oil from Taiwan - PubMed, https://pubmed.ncbi.nlm.nih.gov/25026733/

37. Chamaecyparis lawsoniana and Its Active Compound Quercetin as Ca2+ Inhibitors in the Contraction of Airway Smooth Muscle - PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC11123793/

38. Evaluation of Antioxidant and Antifungal Activity of Chamaecyparis obtuse Extract for Use in Oral Herbal Medicine - MDPI, https://www.mdpi.com/2076-3417/13/18/10236

39. Hinoki Cypress (Chamaecyparis Obtusa) Leaf Oil, https://www.stayjapan.jp/ZAO/RES/hygiene/Hinoki%20cypress%20Leaf%20Oil(english).pdf