

Collection and Utilization of Germplasm Resources of Myrtaceae Wild Plants in China

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Abstract: Myrtaceae is an important group of higher plants, the eighth family of angiosperms, with 134 genera, 5500-5900 species, mainly distributed in tropical America, Oceania and Asia. There are 9 genera, 126 species and 8 varieties of wild myrtle in China. South China Botanical Garden of Chinese Academy of Sciences introduced and related studies on the Myrtaceae wild plant germplasm resources since the 1930s. There are 58 species of 9 genera of Myrtaceae wild plants in China, of which there are 1 species of the genus *Acmena*, 1 species of the genus *Baeckea*, 2 species of the genus *Cleistocalyx*, 3 species of the genus *Decaspermum*, 2 species of the genus *Psidium*, 2 species of the genus *Pyrenocarp*, 1 species of the genus *Rhodamnia*, 1 species of the genus *Rhodomyrtus*, and 45 species of the genus *Syzygium* were collected. Myrtle plants have an important and far-reaching impact on the world economy in wood resources, volatile aromatic oils, industrial and pharmaceutical materials, edible spices, tropical fruits, and ecological and environmental protection. This paper studies the collection and application of wild plant germplasm resources of myrtle in China, in order to provide strategic support for China's economic development, sustainable utilization of resources and ecological environment protection.

Keywords: Myrtaceae, Wild Plants, Germplasm Resources, Collection and Utilization, China

1. Introduction

Myrtaceae is an important group of higher plants, the eighth family of angiosperms, with 134 genera, 5500-5900 species, whose are mainly distributed in tropical America, Oceania and tropical Asia [1]. There are 9 genera (*Acmena*, *Baeckea*,

Cleistocalyx, *Decaspermum*, *Psidium*, *Pyrenocarp*, *Rhodamnia*, *Rhodomyrtus*, *Syzygium*) native and domesticated in China, 126 species and 8 varieties, whose are mainly produced in Guangdong Province, Guangxi Province, Yunnan Province and other regions near the tropics [2]. In recent years, *Eucalyptus*, *Melaleuca*, *Tristania*, *Callistemon*, *Eugenia*,

Myrtus and *Feijoa* have been extensively introduced into China.

This family of Myrtaceae plants is of great significance to the world, which has great economic potential, because of the sensory characteristics which encourages their commercial exploitation plus the presence of phytochemicals which play an important role in managing several degenerative chronic diseases besides representing a hotspot of technological innovation for food, cosmetic and pharmaceutical purposes [3]. For example, *Eucalyptus* is an important commercial forest species in China, accounting for 2% of the forest area in China, providing more than 1/4 of the wood; *S. amarangense* and *P. guajava* of myrtle are popular tropical fruits in China; several species of *Callistemon* are widely used in Chinese Gardens; and myrtle is drought tolerant and poverty tolerant. Barren and adaptable, it is an excellent species for afforestation and soil and water conservation in barren mountains [4]. In this paper, the germplasm resources of wild myrtle plants in China were collected and studied in order to provide strategic support for China's economic development, sustainable utilization of resources and ecological environment protection.

2. Methods

Myrtle plants are widely collected in the south China, mainly in the north of Hainan Province, the southwest of Guangdong Province, the south of Guangxi Province and the south of Fujian Province. South China Botanical Garden of

Chinese Academy of Sciences introduced and related studies on the Myrtaceae wild plant germplasm resources since the 1930s. The community is a typical secondary shrub in hilly areas of Guangdong Province, Guangxi Province and Fujian Province [5]. Range of plants collected extends from the southeast coast to the west of Guangxi Province. Influenced by the ocean, the northernmost distribution line of myrtle communities in the coastal areas of Fujian Province has reached 26°18' north latitude. The north line of myrtle distribution is 25°18' N ~ 26°18' N, from Libo County of Guizhou Province to Lianjiang county of Fujian Province, it gradually inclines to the north and spans one latitude range [6].

3. Results

The results of *Myrtaceae* wild plants collection by generations of scientists in the past 90 years show that there are 58 species of 9 genera of Myrtaceae wild plants in China (table 1), of which there are 1 species of the genus *Acmena*, 1 species of the genus *Baeckea*, 2 species of the genus *Cleistocalyx*, 3 species of the genus *Decaspermum*, 2 species of the genus *Psidium*, 2 species of the genus *Pyrenocarp*, 1 species of the genus *Rhodamnia*, 1 species of the genus *Rhodomyrtus*, and 45 species of the genus *Syzygium* were collected. The Myrtaceae wild species that have been collected have been planted in the endangered conservation base and greenhouse of the South China Botanical Garden.

Table 1. Myrtaceae wild Plants in China Have Been Collected.

Number	Specific Name	Genus Name	Florescence	Reproduction	Application Prospect
1	<i>A. acuminatissima</i> (Blume) Merr. et Perry	<i>Acmena</i>	Jul.--Oct.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
2	<i>frutescens</i> Linn.	<i>Baeckea</i>	May--Aug.	Seed Propagation	Landscape, Medicinal, Soil and Water Conservation, Indicator Plants of Acidic Soil
3	<i>C. conspersipunctatus</i> Merr. et Perry	<i>Cleistocalyx</i>	Jul.--Aug.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
4	<i>C. operculatus</i>	<i>Cleistocalyx</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation, Anti-pollution ability
5	<i>D. esquirolii</i> (Levl.) Chang et Miao	<i>Decaspermum</i>	Mar.--May	Seed Propagation	Landscape, Garden, Medicinal
6	<i>D. glabrum</i> Chang et Miao	<i>Decaspermum</i>	Mar.--May	Seed Propagation	Landscape, Garden, Medicinal
7	<i>D. gracilentum</i> (Hance) Merr.et Perry	<i>Decaspermum</i>	Mar.--May	Seed Propagation	Medicinal, Soil and Water Conservation
8	<i>P. guajava</i> Linn.	<i>Psidium</i>	Jun.--Oct.	Seed propagation, cutting propagation, circle branch propagation and grafting propagation	Landscape, Garden, Medicinal, fruitl, Soil and Water Conservation
9	<i>P. littorale</i> Raddi	<i>Psidium</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal
10	<i>P. hainanensis</i> (Merr.) Chang et Miao	<i>Pyrenocarpa</i>	Apr.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
11	<i>P. teretis</i> Chang et Miao	<i>Pyrenocarpa</i>	Jul.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
12	<i>R. dumetorum</i> (Poir.) Merr. et Perry	<i>Rhodamnia</i>	Jun.--Jul.	Seed Propagation	Garden, Medicinal, Soil and Water Conservation
13	<i>R. tomentosa</i> (Ait.) Hassk.	<i>Rhodomyrtus</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
14	<i>S. acuminatissimum</i> (Blume) DC.	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Medicinal, Soil and Water Conservation
15	<i>S. angustinii</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal,

Number	Specific Name	Genus Name	Florescence	Reproduction	Application Prospect
16	<i>S. anisatum</i> (Vickery) Craven et Biffin	<i>Syzygium</i>	Apr.--May	Seed Propagation	Soil and Water Conservation Medicinal, Soil and Water Conservation
17	<i>S. araiocladum</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal
18	<i>S. australe</i> (Wendl. ex Link) Hyland	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal
19	<i>S. australe</i> (Wendl. ex Link) Hyland cv. "Elite"	<i>Syzygium</i>	Apr.--May	Seed Propagation	Garden, Medicinal, Soil and Water Conservation
20	<i>S. bullockii</i> (Hance) Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
21	<i>S. buxifolium</i> Hook. et Am.	<i>Syzygium</i>	Apr.	Seed Propagation, cutting propagation, circle branch propagation	Potted Landscape, Medicinal, Soil and Water Conservation
22	<i>S. buxifolium</i> Hook. et Am. var. austro-sinensi Merr. et Perry	<i>Syzygium</i>	May--Jul.	cutting propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
23	<i>S. championii</i> (Benth.) Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
24	<i>S. chunianum</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Soil and Water Conservation
25	<i>S. congestiflorum</i> Chang et Miao	<i>Syzygium</i>	Apr.--May	Seed Propagation	Medicinal, Soil and Water Conservation
26	<i>S. cormiflorum</i> (Muell) Hyland	<i>Syzygium</i>	Apr.	Seed Propagation	Landscape, Garden, Medicinal
27	<i>S. cumini</i> (L.) Skeels	<i>Syzygium</i>	Jun.	Seed Propagation	Landscape, Garden
28	<i>S. euonymifolium</i> (Metc.) Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
29	<i>S. euphlebium</i> (Hayata) Mori	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal,
30	<i>S. fluviatile</i> (Hemsl.) Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Soil and Water Conservation
31	<i>S. grijsii</i> (Hance) Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
32	<i>S. guangxiense</i> Chang et Miao	<i>Syzygium</i>	Jul.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
33	<i>S. grijsii</i> (Hance) Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Soil and Water Conservation
34	<i>S. hainanense</i> Chang et Miao	<i>Syzygium</i>	Apr.--May	Seed Propagation	Medicinal, Soil and Water Conservation
35	<i>S. hancei</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal
36	<i>S. jambos</i> (L.) Alston	<i>Syzygium</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal
37	<i>S. kwangtungense</i> (Merr.) Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
38	<i>S. levinei</i> Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Medicinal, Soil and Water Conservation
39	<i>S. lineatum</i> (DC.) Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Soil and Water Conservation
40	<i>S. malaccense</i> (L.) Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Garden, Medicinal, Soil and Water Conservation
41	<i>S. melanophyllum</i> Chang et Miao	<i>Syzygium</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
42	<i>S. myrsinifolium</i> (Hance) Merr. et Perry	<i>Syzygium</i>	Apr.	Seed Propagation	Landscape, Medicinal, Soil and Water Conservation
43	<i>S. oblancilimum</i> Chang et Miao	<i>Syzygium</i>	Jul.	Seed Propagation	Medicinal, Soil and Water Conservation
44	<i>S. oblatum</i> (Roxb.) Wall.	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Medicinal
45	<i>S. odoratum</i> (Lour.) DC.	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal
46	<i>S. polyanthum</i> (Wight) Walp.	<i>Syzygium</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
47	<i>S. rehderianum</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
48	<i>S. rysopodum</i> Merr. et Perry	<i>Syzygium</i>	May--Jul.	Seed Propagation	Garden, Medicinal, Soil and Water Conservation
49	<i>S. stenocladum</i> Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
50	<i>S. salwinense</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Medicinal, Soil and Water Conservation
51	<i>S. saxatile</i> Chang et Miao	<i>Syzygium</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
52	<i>S. sterrophyllum</i> Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Medicinal, Soil and Water Conservation

Number	Specific Name	Genus Name	Florescence	Reproduction	Application Prospect
53	<i>S. szechuanense</i> Chang et Miao	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Medicinal
54	<i>S. szemaense</i> Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Medicinal
55	<i>S. tetragonum</i> Wall.	<i>Syzygium</i>	May--Jun.	Seed Propagation	Landscape, Garden, Medicinal, Soil and Water Conservation
56	<i>S. tephrodes</i> (Hance) Merr. et Perry	<i>Syzygium</i>	Apr.--May	Seed Propagation	Landscape, Soil and Water Conservation
57	<i>S. thumra</i> (Roxb.) Merr. et Perry	<i>Syzygium</i>	Jul.--Aug.	Seed Propagation	Landscape, Garden, Medicinal
58	<i>S. tsoongii</i> (Merr.) Merr. et Perry	<i>Syzygium</i>	Jun.--Jul.	Seed Propagation	Landscape, Garden, Soil and Water Conservation

4. Discussion

Myrtle plants have an important and far-reaching impact on the world economy in wood resources, volatile aromatic oils, industrial and pharmaceutical materials, edible spices, tropical fruits, and ecological and environmental protection [7].

4.1. Garden Value

Myrtle (myrtle family) is one of the rare species of discolored flowers in China [8]. Its flowers first turn white, then red and purple, and then gradually become light. Its flowering period is long, up to 3 to 4 months. Evergreen, compact tree, gorgeous design and color, both considerable flowers and fruit; Strong trunk toughness, can also make bonsai; In the garden for greenbelt, road greening, but also as a hedge, flower platform. As an ornamental flower and garden plant, myrtle is gradually introduced into the city. The myrtle is graceful in shape, with reddish brown young leaves and soft and graceful adult leaves. It is also a good kind of fruit tree, suitable for cultivation as garden tree or road tree. *S. buxifolium* is an excellent bonsai tree species with local characteristics.

Rose-wood of myrtle family belongs to broad-leaved tree species, whose wood is hard, uniform in structure, clear in texture, natural and resistant to rot [9]. The bug eat by moth. In the western developed countries often used to make high-grade solid wood furniture, villa building materials, outdoor floors. It is also often used to make violin, guitar and other high-end instruments. Rose-wood has passed the international green organization environmental protection certification (FSC certification), is widely advocated and recommended green pollution-free tree species.

Myrtle (myrtle family) grows rapidly, bears barren and has strong resistance to stress [10]. The myrtle is compact and evergreen in all seasons. The flowers are first white and then red. The fruit color bright red turns to sauce red, the branch toughness is strong, may make the bonsai, in the garden afforestation may use its cluster plant, the piece plant or the isolated plant embellishes the green space, may receive the better effect, is has the good afforestation beautification effect wild flowers, has been gradually listed in the garden plant ornamental flowers list by the Chinese part city.

4.2. Edible Value

Forests and woodland ecosystems are a hugely important natural resource, easily overlooked and often undervalued.

Globally, one in six people is estimated to rely on forests for food [11], and many more depend on forests for other critical ecosystem services, such as climate regulation, carbon storage, human health, and the genetic resources that underpin important wood and wood products-based industries.

At present, the research on fruit nutrition processing of myrtle is mainly about storage, health drinks and wine making [12]. Myrtle fruit is rich in mineral elements, sugar and other nutrients. Fruit contains 18 kinds of amino acids, including 8 kinds of essential amino acids for human body. The total content is 13.47 mg/g, and glutamate is the highest, which plays an important role in human metabolism. Myrtle fresh fruit is rich in vitamins, with up to 28.8 mg of vitamin C per 100 g fresh fruit, 0.19 mg of vitamin B1 and 0.39 mg of beta-carotene. Myrtle fruit is also rich in a variety of amino acids and organic acids required by the human body. It is a kind of high-quality fruit wine resource, with the characteristics of high juice, high soluble solid content, moderate sweet and sour, rich fruit flavor, good color, little pollution and rich resources.

Myrtle is a pure natural wild fruit, free from chemical fertilizer and pesticide pollution [13], and belongs to the first generation of developed fruit, which meets the psychological requirements of current consumers to "return to nature" to develop and consume green food. It is relatively complete in nutrients, rich in protein, sugar, vitamins, amino acids these nutrients, but also contains strong antioxidant active substances, such as anthocyanins, flavonoids, these bioactive substances have antioxidant, anti-aging effect.

Myrtle is a highly manganese rich plant with high health care value [14]. Its stem can also be used for medicinal purposes, with the effect of promoting blood circulation and clearing collaterals, astringent and stopping diarrhea, and filling the empty hemostasis. Its root contains phenols, tannins and so on, and has the effect of treating chronic dysentery, rheumatism, hepatitis and lowering blood fat.

4.3. Medicinal Value

Myrtle has anti-fungal and antibacteria (especially gram-positive bacteria) properties and it can be used in internal and external applications [15-18]. Many kinds of myrtle have medicinal value. *S. legatii*, *S. masukuense*, and *Syzygium* species A had the best activities against Gram-negative and Gram-positive bacteria values [19]. *E. erythrophylla* had the best against *Bacillus cereus*. Many extracts had relatively low cytotoxicity leading to reasonable selectivity indices. Three leaf extracts (*S. masukuense*,

Syzygium species A, and *E. natalitia*) were moderately cytotoxic. The plant extracts had a good capacity to reduce biofilm formation and good to poor potential to destroy pre-formed biofilms.

The main components of *P. guajava* leaves are triterpenoids, flavonoids, tannins and other components, which have major pharmacological effects on lowering blood glucose, blood lipid, blood pressure, antiviral and anti-inflammatory effects [20]. The leaves of *B. frutescens* contain fennel, etc., which can be used medically to treat jaundice, cystitis, dermatitis and eczema. Root and *Melastoma dodecandrum* And may *Artemisia vulgaris*. Combined treatment of functional uterine bleeding. The flower and leaves of *C. operculatus* for medicinal, containing phenolic and flavonoid glycosides, to treat colds; The root can cure xanthrax hepatitis. Leaves of *D. gracilentum* have the effect of dispelling wind, dehumidifying, killing insects, relieving itching, clearing heat and stopping dysentery. The roots *D. esquirolii* used in dysentery, hepatitis, epigastric pain, lumbar muscle strain, irregular menstruation. Leaves are used for rheumatism, numbness, and fall injuries.

Myrtle can be extracted from a variety of medicinal ingredients. Three flavonoid glycosides and one hydrolyzable tannin were isolated from myrtle leaves [21]. There were 9 kinds of hydrolyzed tannins in myrtle leaves and roots, 3 of which were c-glucoside hydrolyzed tannins. The volatile oil of rhodomyrti was extracted by ethyl ether ultrasonic extraction and 33 chemical constituents were identified. It was found that the volatile oil of rhodomyrti contained 3-methyl-alpha-pinene, anti-carylidene, citronene, cubedene and other components with pharmacological activities. Standard myrtle oil enteric capsule is the standard extract of myrtle leaves. The main components are standard myrtle oil, oil essence, limonene and other single mushrooms. It is a mucilaginous solvent containing volatile oil.

Myrtle in root, leaf, fruit, medicine has deeper medicinal value, folk has a long history of medicine in our country, its taste sweet, acerbity, flat, can root functions of loose, convergence anti-diarrhea, clinical indications of acute or chronic gastroenteritis, stomach indigestion, hepatitis, dysentery disease, rheumatoid arthritis, strain of lumbar muscles, functional uterine bleeding, prolapse, etc; Leaf has astringency, diarrhea and hemostasis, clinical indications acute and chronic gastritis, dyspepsia, dysentery external use to treat traumatic bleeding [22]. It has the effects of nourishing blood and nourishing fetus, improving eyesight, and clinical indications for asthenia and spermatorrhea after anemia.

In recent years, the natural products chemical biology research group of South China Botanical Garden, Chinese Academy of Sciences, carried out a systematic study on the chemical constituents of myrtle [23-28]. we found a series of new structure phloroglucinol derivatives, mainly the heterodimeric products of phloroglucinol, monoterpenes and sesquiterpenes, which were analyzed by multiple spectra, e the chemical structure and absolute configuration of these compounds were determined by CD calculation, X-ray single crystal diffraction and total synthesis. It was also found that compounds such as tomentoanol A and tomentosone C had

good activity against gram-positive drug resistance.

4.4. Ecological and Environmental Protection

The Myrtaceous species could mitigate the threat of microbial contamination of soil, while producing valuable biomass for fuel, essential oils or honey. Concerns that land application of organic waste may introduce microbial contaminants into the environment could be mitigated by growing plants with antiseptic properties in waste-amended soil. Prosser investigated the potential for two myrtaceous plants, manuka (*Leptospermum scoparium*) and kanuka (*Kunzea robusta*) with antiseptic properties to reduce numbers of the pathogen indicator *Escherichia coli* in soil [29]. Pots containing perennial ryegrass (*Lolium perenne*), manuka and kanuka, were spiked with *Escherichia coli* and a rainfall event was simulated. Decimal reduction times (DRT) showed *E. coli* numbers were reduced under kanuka and manuka compared to a pasture control (8, 5 and 93 days respectively).

R. tomentosa are evergreen shrubs and community building plants prevalent in tropical and subtropical areas. Investigating the status quo of community distribution and analyzing the relationship between climate factors and community distribution can provide a strong basis for climate change research. Myrtle is a tropical shrub that is sensitive to temperature change, spreads rapidly and has a role of climate indicator. It is a tropical indicator plant and can be used as a monitoring climate in tropical and subtropical regions.

Myrtle is a pioneer tree species. It prefers warm and humid climates, but it can also adapt to dry air. Myrtle is quite resistant to drought, barren, not resistant to water and humidity, and has no harsh requirements on soil. It also grows well on arid soil, but it must be acidic soil. Therefore, myrtle is one of the common indicator plants of acidic soil in south China, and plays an important role in vegetation restoration of degraded mountain areas in south China. Myrtle is an excellent tree species for afforestation and soil and water conservation in barren mountains in south China. Understanding the characteristics of myrtle's diffusion and distribution is of great importance to the restoration of vegetation and ecological protection of water sources and woodlands in degraded mountainous areas of south China.

The branches, leaves and other parts of several Myrtle plants in Zhanjiang area were collected, and the extraction solution of myrtle plants was obtained by reflux extraction method, and was diluted to 1000 times, 600 times and 300 times solution respectively and sprayed on the cabbage heart damaged by yellow flea beetle [20]. The results showed that the ethanol extracts of myrtle, *Eucalyptus citri*, guava, Putao and red fruit had obvious avoidance effect on the beetle.

5. Conclusion

Myrtaceae plants, as a wild resource, have unique plant advantages, and have a broad development prospect in landscape gardening, food processing, development of health

care products, research on medical drugs and ecological environment protection, etc. With the improvement of people's living standard and the development of resources, Myrtaceae plants will become the focus of the fruit industry, food processing and mountain area development due to its remarkable therapeutic value, novel flavor, extensive functions, natural, pollution-free and nutrient-rich unique advantages. Myrtle is easy to cultivate and easy to manage. It is suitable for ornamental cultivation. But for now, myrtle is basically in a primitive state of low recognition and low utilization. Although myrtle is widely distributed in China, most of them are scattered in nature without large-scale artificial cultivation. The natural community area is small and the density is small, the growth environment is poor, and the human damage is serious, which severely restricts the development of myrtle. Therefore, it is necessary to make full use of myrtle's resource advantages, strengthen the scientific protection of myrtle's existing resources, expand the artificial cultivation area, and have a broad application prospect in medical care and modern urban gardens. In order to accelerate the development of myrtle planting industry and give full play to its economic and ecological value, the following aspects of research should be strengthened:

- 1) Strengthen the study on the biological and ecological characteristics of myrtle. Make a general survey of its natural areas, master its distribution range of longitude, latitude and altitude, and understand its suitable environmental conditions; The growth characteristics and phenological law were studied.
- 2) Myrtle fruit has high economic value and wide application, and its development and utilization have a good market prospect. The research on chemical composition, pharmacological value and edible value of myrtle should be strengthened to further develop a series of nutritional health care and medicinal products.
- 3) Collect the germplasm resources of myrtle for ornamental, medicinal, nutritional and health care purposes, carry out genetic improvement respectively, carry out directional cultivation, and improve its utilization value.
- 4) Strengthen the research on strong seedling cultivation and cultivation technology of myrtle, especially the research on asexual propagation technology such as cutting and tissue culture, as well as cultivation technology such as planting density, fertilization and nurturing management, so as to provide technical guarantee for accelerating the scale development of myrtle.

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References

- [1] Angiosperm Phylogeny Group (2016), An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG IV. *Botanical Journal of the Linnean Society*, 181 (1), 1–20.
- [2] Editorial Committee of Chinese Flora (1984). *Chinese Flora*. Beijing: Science Press, 53 (1), 1-28.
- [3] Liu Xiaoping, Zhou Yonghui, Luo Sumei, Guo Chengyun, and Chen Bilu (2019). Development and Application Prospect of Permplasm Resources of Local Flower Myrtle. *Modern Horticulture*, 373 (1), 61-62.
- [4] Han Fei, and Huang Xiaochun (2017). Garden Rookie Myrtle. *Modern Horticulture*, 19 (10), 53-54.
- [5] Liu Zexin, Wu Yuehong, and Xioa Zexin (2018). Investigation and Research on Forest Germplasm Resources in Chaoshan Area. *Forestry and Environmental Science*, 34 (2), 101-106.
- [6] Si Shubin, Cao Fuxiang, Peng Jiqing, and Xu Ruoxian (2012). Delineation of the North Line of Myrtle Community Distribution in China and Its Relationship with Climate Factors. *Journal of Central South University of Forestry and Technology*, 32 (3), 162-165.
- [7] Zheng Shufang, Zhao Daxuan, and Qiu Wenwu (2013). Exploitation and Utilization of Wild Plant Myrtle. *Tropical Agriculture in Guangxi*, 131, 53-54.
- [8] Ye Caihua, Yan Xiaoxia, and Wang Zhunian (2015). Development and Utilization of *Rhodomyrtus tomentosa* and Its Cultivation Management Techniques. *Chinese Journal of Tropical Agriculture*, 35 (1), 22-25.
- [9] Liu Wei, Xie Bin, and Deng Guanghua (2009). Research Progress of *Syzygium buxifolium*-a Typical Plant for Potted Landscape. *Journal of Anhui Agriculture Science*, 37 (30), 14678-14681.
- [10] Tan Fengjie (2011). Research Status and Development Prospect of *Rhodomyrtus tomentosa*. *China Tropical Agriculture*, 39, 63-64.
- [11] M J. Wingfield, E. G. Brockerhoff, B. D. Wingfield and B. Slippers (2015). Planted Forest Health: The Need for a Global Strategy. *Science*, 349 (6250), 832-836.
- [12] Li Wu-guo, Su Qiao, Wei Jieshu, Liao Qiwen, Liu Cuiting, Zhu Yeyan, Zhao Guangyin, Li Wenwen, Huang Haoji, Li Wenying, Cao Weiji, and Zhan Ruoting (2018). GC-MS Analysis of Volatile Oils from Leaves of Two Myrtaceae Species and Their Anti-proliferation Activity Against Lung Cancer A549 and H460 Cells. *Science and Technology of Food Industry*, 39 (15), 260-265.
- [13] Qiu Wenwu (2011). Analysis and Evaluation of Nutritional Components of Wild Myrtle Fruits. *Fruit Trees in South China*, 2, 15-16.
- [14] Liu Chun, Mei Le, and Li Xin (2013). Overview of Pharmaceutical Research on Guava Fruit. *Anhui Agricultural Science*, 41, 7460-7462.

- [15] Mahboubi, M (2016). *Myrtus communis* L. And Its Application in Treatment of Recurrent *Apthous Stomatitis*. *Journal Ethnopharmacology*, 193, 481–489.
- [16] Mandegary, A., Soodi, M., Sharififar, and F., Ahmadi, S (2014). Anticholinesterase, Antioxidant, and Neuroprotective Effects of *Tripleurospermum Disciforme* and *Dracocephalum Multicaule*. *Journal of Ayurveda and Integrative Medicine*, 5, 162.
- [17] Raeiszadeh, M., Esmaeili-Tarzi, M., Bahrapour-Juybari, K., Nematollahi-mahani, S., Pardakhty, A., Nematollahi, M., and Mehrabani, M (2018). Evaluation the Effect of *Myrtus communis* L. Extract on Several Underlying Mechanisms Involved in Wound healing: an in-vitro Study. *South African Journal of Botany*. 118, 144–150.
- [18] Samareh Fekri, M., Mandegary, A., Sharififar, F., Poursalehi, H. R., Nematollahi, M. H., Izadi, A., Mehdipour, M., Asadi, A., and Samareh Fekri, M (2018). Protective Effect of Standardized Extract of *Myrtus communis* L. (myrtle) on Experimentally Bleomycininduced Pulmonary Fibrosis: Biochemical and Histopathological Study. *Drug Chemical Toxicology*, 41, 1–7.
- [19] Ibukun M. Famuyide, Abimbola O. Aro, Folurunso O. Fasina, Jacobus N. Eloff, and Lyndy J. McGaw (2019). Antibacterial and Antibiofilm Activity of Acetone Leaf Extracts of Nine Under Investigated South African *Eugenia* and *Syzygium* (Myrtaceae) Species and Their Selectivity Indices. *Complementary and Alternative Medicine*, 19, 141.
- [20] Sabira Begum, Syed Ali, Saima Tauseef, and Syed Tahir Ali (2014). Chemical Constituents and Antioxidant Activity of Fresh Leaves of *Psidium guajava* Cultivated in Pakistan. *Journal Chemical Society of Pakistan*, 36 (1): 119-122.
- [21] Fu Chunli, Peng Yan, Chen Ziyun, Xiao Shenghong, and Chen Huaxu (2016). Chemical Constituents from *Psidium guajava* Leaves. *Journal of Chinese Medicinal Materials*, 39 (12), 2781-2784.
- [22] Chen Jialing, Guo Wei, Peng Wei, and Su Weiwei (2013). Volatile Components in Leaves of Myrtaceous Plants by SPME-GC-MS. *Journal of Tropical and Subtropical Botany*, 21 (2), 189-192.
- [23] Liu Hongxin, Chen Kai, Yuan Yao, Xu Zhifang, Tan Haibo, and Qiu Shengxiang (2016). Rhodomentones A and B, Novel Meroterpenoids with an Unique NMR Characteristics from *Rhodomyrtus tomentosa*. *Organic & Biomolecular Chemistry*, 14, 7354-7360.
- [24] Liu Hongxin, Zhang Weimin, Xu Zhifang, Tan Haibo, and Qiu Shengxiang (2016). Isolation, Synthesis, and Biological Activity of Tementosenol A from the Leaves of *Rhodomyrtus tomentosa*. *RSC Advances*, 6, 25882-25886.
- [25] Xiang Yuqing, Liu Hongxin, Zhao Liyun, Xu Zhifang, Tan Haibo, and Qiu Shengxiang (2017). Viminone A, A Novel Dearomatic Dibenzofuran-type Acylphloroglucinol with Antimicrobial Activity from *Callistemon viminalis*. *Scientific Reports*, 7, 2363-2368.
- [26] Zhao Liyun, Liu Hongxin, Huo Luqiong, Wang Miaomiao, Yang Bao, Zhang Weimin, Xu Zhifan, Tan Haibo, and Qiu Shengxiang (2018). Structural Optimization and Antibacterial Evaluation of Rhodomyrtosone B analogues Against MRSA Strains. *Medicinal Chemistry Communication*, 9, 1698-1707.
- [27] Liu Hongxin, Tan Haibo, Li Saini, Chen Yuan, Li Haohua, Qiu Shengxiang, and Zhang Weimin (2019). Two New 12-membered Macrolides from the Endophytic Fungal Strain *Cladosporium colocasiae* A801 of *Callistemon viminalis*. *Journal of Asian Natural Products Research*, 21 (7), 696-701.
- [28] Zhao Liyun, Liu Hongxin, Wang lei, Xu Zhifang, Tan Haibo, and Qiu Shengxiang (2019). Rhodomyrtosone B, A Membrane-targeting Anti-MRSA Natural Acylphloroglucinol from *Rhodomyrtus tomentosa*. *Journal of Ethnopharmacology*, 228, 50-57.
- [29] J. A. Prosser, R. R. Woods, J. Horswella, and B. H. Robinson (2016). The Potential in-situ Antimicrobial Ability of Myrtaceae Plant Species on Pathogens in Soil. *Soil Biology & Biochemistry*, 96, 1-3.
- [30] Wang Jing, Liu Xianwu, Li runtang, Xie Qiulan, and Zhang Yu (2018). Preliminary Study on the Effect of Several Plant Extracts of Myrtle Family on the Avoidance of Yellow Kojima. *South China Agriculture*, 12 (30), 37-38.