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## The development status, problems and countermeasures of Eucommia industry

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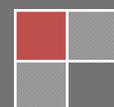
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### ABSTRACT

Firstly, the foreign Eucommia industrial distribution and research overview were introduced in the paper, and the situation of domestic breeding cultivation techniques and integrated development and utilization were described. For the problems of Eucommia industry, the following series of suggestions were put forward, such as strengthening policy support, developing Eucommia picking standards and management regulations, increasing research promotion and transformation, strengthening the training of the managers and the gatherers of Eucommia, establishing the new industrial demonstration zone, and cultivating leading enterprises.

### KEYWORDS

Eucommia industry; Development status; Research progress; Problems; Countermeasures.



## INTRODUCTION

Eucommia is an endemic economic species in China. Having treasure all over the whole plant, it is not only a precious Chinese medicine resource, but also an important national strategic resource. It can provide high-quality wood as well as increase carbon sinks and improve the ecological environment. The active component of Eucommia can be used to produce a variety of biological health care and pharmaceutical products. Eucommia rubber extracted from the fruit, leaves, and bark of Eucommia can serve as a substitute for natural rubber, which is a scarce resource. Its uniqueness and versatile functions bring it more and more attention. Currently, China has approximately 350,000 hectares of Eucommia, accounting for over 95% of the world's total Eucommia resources. In recent years, as the further development of Eucommia rubber resources, the cultivation area of Eucommia will be greatly increased, therefore, the industrialization of Eucommia resources has a bright future. Literature studies show that there is only a few research results, which mainly focus on seeds breeding, cultivation techniques and the status of comprehensive development and utilization. Therefore, this research plans to generalize the Eucommia industry research status at home and abroad, the problems and suggestions of the solutions to promote healthy and sustainable development of Eucommia industry.

### GENERAL SITUATION OF FOREIGN EUCOMMIA INDUSTRY DISTRIBUTION AND RESEARCH

#### Foreign Eucommia industrial distribution

In 1896, Europe introduced Eucommia from China. Eucommia has been planted in the botanical gardens in French and Britain and are growing well. In 1899, Japan introduced Eucommia from central China and thus becoming the country with the largest cultivation scale of introduced Eucommia. Japan mainly used Eucommia as raw material for producing Medicine & Health Products, and that's why they introduced them<sup>[1]</sup>. In 1906, Russia successfully introduced Eucommia to solve the problem of a shortage of domestic hard rubber. In 1952, the US introduced Eucommia, mainly using them as ornamental trees on roads and in gardens. In recent years, North Korea and South Korea also started to introduce Eucommia<sup>[2]</sup>. South Korea mainly uses Eucommia for producing Eucommia health care products. In addition to these countries, India and Canada, etc., also introduced Eucommia from China.

In short, the cultivation and production scale of Eucommia in foreign countries is relatively small, the total number being less than 5 percent of the total Eucommia resources, and the main purpose of cultivating Eucommia is to produce Eucommia-based health care products.

#### Research of Eucommia industry in foreign countries

In the early 1950s, Russia, the United States, Japan and other countries found that Eucommia plays a very special role in human health, and also gives new ideas to health. What's more, it is especially beneficial for nourish the liver and kidney and can make waist and knees stronger. The national professional medical research community in Russia, the United States, Japan and other countries have done a far better job than China in terms of doing research on the Eucommia's medicinal health performance<sup>[3]</sup>.

Russia pays high attention to develop and utilize natural plant resources. In 1955, a Russian scholar published his research finding that says Eucommia can relieve hypertension. The study aroused the attention of the scientists all over the world<sup>[4]</sup>.

In 1976, scholars from University of Wisconsin and Harvard University believed that Eucommia is now the world's highest quality natural anti-hypertensive drugs<sup>[5]</sup>.

Currently, foreign countries have more studies on the medicinal properties of Eucommia and Japan has more researches on the health effects of Eucommia. Many of the research results have been used in production. Japanese scientists believe that Eucommia can be used for health care in space<sup>[6]</sup>.

Japan found that Eucommia leaf can promote and maintain health, and now Eucommia leaf has been attracting people's attention as it is used as new material for a healthy tea. In Nagano, the Eucommia cultivation with the purpose of producing leaves enjoys rapid development and has entered the commercialization stage. Currently, we can see Eucommia tea, Eucommia noodles, and other Eucommia-based health care products everywhere in the Japanese domestic market. These products have also been exported to Southeast Asia and Europe and the United States.

### STATUS OF EUCOMMIA INDUSTRY RESEARCH IN CHINA

#### Eucommia fine seed breeding

Eucommia has a long history of cultivation in China, but the fine seed breeding in China started relatively late and we still cultivate Eucommia forest by young Eucommia. In the 1990s, the domestic Luoyang Forestry Bureau and other units, with a decade's research and experiment, finally bred the fine Eucommia seeds-the "Huazhong No.1-No.5", for the first time. And the seed has also been cultivated in the Eucommia central area and the main producing areas in Hunan, Henan, Sichuan, etc.<sup>[2,8]</sup>

In recent years, with the increasing technical needs of our Eucommia emerging industry and industrial development of Chinese medicine, the research team represented by Du Hongyan from Chinese Academy of Forest Research Center chose a total of six new fine breeds for fruit Eucommia, including “Huazhong No.6-No.10” and “Daguo No.1”, etc. As a result, Eucommia yield has been increased by 163.8% to 236.1 %<sup>[7]</sup>. In terms of molecular breeding, Wuyuntana, one of the group members, has made important progress on early trait judgment, breed quality innovation and other aspects.<sup>[1]</sup>

In fine seed breeding, although the Chinese Academy of Forest Research and Development Center has bred 16 fine Eucommia species, because of the cultivation customs and other reasons, the national fine seed breeding rate is lower than five percent. In the meantime, as there is a lack of Natural Rubber resource, there is a urgent need for the fine seed of natural Eucommia. Therefore, we should, based on the former studies, collect and preserve Eucommia seed, combine the traditional breeding methods and modern breeding methods to breed new varieties which are suitable to be cultivated in different areas, and therefore to meet the demand for rapid industrial development.

## **Eucommia comprehensive development and utilization conditions**

### **The development of Eucommia medicine**

"Compendium of Materia Medica", written by Li Shizhen, recoded that the new leaves, flowers and fruits of Eucommia can be used as medicine. Qin Zhendong from Northwestern University (1979), and Li Jiashi from Beijing University of Chinese Medicine (1986) hold that the medical function of bark and leave of Eucommia is almost the same. Members from Shaanxi Province Eucommia Clinical Cooperation Group also think that Eucommia has a moderating effect of endocrine<sup>[4]</sup>. The traditional way uses the Eucommia by putting the bark into medicine, which is a huge waste of resources. The Qingdao Garden Office in the Department of Biology, Peking University used stumpage peeling method to replace the traditional peeling method.

In recent years, Du Hongyan's group has made new progress in Eucommia purification separation technology, and now they are able to get high purity of chlorogenic acid, Aucubin, offering necessary theoretical basis for medicine for the development of Eucommia green products.

### **Development of Eucommia health care product**

In recent years, more attention has been given to the development of our Eucommia natural health products. China first develop the Duzhong Jing- a health drink that uses Eucommia leaf as the main raw material, Eucommia tea, Eucommia wine in Henan and Hunan and many other products. Among them, Eucommia has the largest production scale, accounting for more than 90 percent of the whole Eucommia production<sup>[8]</sup>.

In the 1990s, Northwest A&F University made the research achievement that “Eucommia medicinal ingredients extraction and natural health products development”. And the Northwest A&F University has proved that Eucommia has a great function for increase immune functions<sup>[7]</sup>.

In 1992, Du Hongyan's group initiated the Eucommia male flower tea processing, preservation methods and Eucommia antioxidant preservation methods, making storage process of male flower tea processing technology better. In addition, the group used Eucommia leaves, wood branches, Eucommia seed Hectometre, etc., to develop Eucommia function feed and mushrooms, among which the mushroom and Eucommia tree mushroom has gained National Invention Patent<sup>[1]</sup>.

Currently, although Eucommia tea is being sold in Japan, Hongkong and other places, on the whole, Eucommia has a low sales in domestic market, and the international market development range is narrow, most companies only have domestic market and only a few companies have oversea market. The Eucommia products in foreign countries are sold in the form of raw materials at a low price. In the foreign shops, the products' packaging and labels will be changed, which is very unfavorable for China to open up the international Eucommia market. Similarly, the domestic market does not have enough propaganda for health care products, and people still lack knowledge and understanding of Eucommia. Most of the production status is slump, and the Eucommia product are relatively low-grade products, which has some negative impact on the Eucommia product development process.

### **Eucommia feed development**

Add Eucommia into the feed can make meat fresh and prevent disease, which has a significant meaning for improving our food quality and safety. The feed developed by Du Hongyan team owns a national patent<sup>[1]</sup>.

Eucommia leaf feed features simple processing technology, broad market, so it is another important way of Eucommia leaf resource development. However, the Eucommia leaf feed is still in the small area pilot phase, a scale production has yet to be formed. Vigorously develop low cost, quick Eucommia leaf fodder, can greatly increase the income of farmers in the producing areas.

### **Eucommia rubber development**

Eucommia rubber was hard rubber. In 1982, Yan Ruifang, the researcher of the Chinese Academy of Sciences invented Eucommia rubber elastomer. Eucommia rubber development has own high attention from the State Council and relevant ministries<sup>[1]</sup>.

Due to the high cost and low rubber extracted from *Eucommia* leave, the above research has a low application in production. If we take a two-stage development of *Eucommia* leaf, first extract medicinal ingredients and health components from *Eucommia* leaf, and then extract rubber from the leaf residue, it will greatly reduce the cost of *Eucommia* rubber extraction.

At present, China has an annual *Eucommia* rubber production of 30 to 50 tons. And there are problems such as high cost, low speed, and low scale and so on. In the meantime, although *Eucommia* rubber market has huge potential, *Eucommia* rubber product market has yet to be formed.

### **Eucommia industrial economy**

Since the 1950s, *Eucommia* base building has been going on in the *Eucommia* production zones in China. After several year's effort, the cultivation area and yield of *Eucommia* in China have experienced huge increase, and *Eucommia* production has experienced rapid development. However, in recent years, development of *Eucommia* industry has been seriously lagging behind. Currently, there are about 20 *Eucommia* production and processing enterprises, including Henan Hengrui Industrial Co., Ltd., Shaanxi Lueyang Huarui *Eucommia* Co. Ltd. These companies are just starting to take shape and produce a wide range of products, and most of them mainly produce *Eucommia* tea and *Eucommia* medicine.

In recent years, *Eucommia* industry has made big progress, especially in terms of fine seed breeding and orchard cultivation mode have gain initial results, which indicates that China will gradually change from the traditional bark-based pharmaceutical production *Eucommia* cultivation pattern to the new cultivation mode of *Eucommia*-based, full utilization of fruit, leaves, bark, and male flower. But at present, there are still problems hampering sustainable development of *Eucommia* industry.

Although *Eucommia* industry has entered the stage of making full use of the fruit, leaf, male flower, bark, and wood, and has formed the situation of comprehensive development of pharmaceuticals, functional food, functional feed, functional edible fungus, it still not able to produce the engineering technology products, nor has it formed well-known *Eucommia* brands. In the future, the *Eucommia* industry should build a modern Industrial technology system of taking *Eucommia* rubber industry as the leader, comprehensively developing *Eucommia* Chinese medicine and functional products, and making comprehensive use of *Eucommia* fruit, leaves, male flower, bark, wood. In terms of the *Eucommia* production and processing mode, we should take the method of deep processing and recycling. For example, the use of *Eucommia* leaf can take the two-stage development mode of Shaanxi Changlin *Eucommia* Company as a model to first extract the medicinal ingredients and health components in *Eucommia* leaf, and then extract *Eucommia* rubber and functional feed from leaf residue. This can reduce *Eucommia* rubber extraction costs as well as increase farmers' net income.

So far, there is only a few research on the economic aspect of *Eucommia* in China, and the researches are mainly focused on probing the economic benefits of *Eucommia*. Zhang Zhentian from Yishui County Forestry Bureau in Shandong Province, starting from the ecological and economic point of view, talked about the feasibility of developing *Eucommia* in Shandong Province, put forward the way and the main mode of developing *Eucommia* in Shandong, and got the conclusion that *Eucommia* is an ideal spices for Shandong to build ecological economic forestry. Feng Zhong from Linyi Forestry Bureau analyzed the economic benefits for Shandong to develop *Eucommia*, and pointed out that *Eucommia* development in the region has a large market potential. Pei Hongbin from Life Science School, Shanxi Normal University made research and analysis on the community structure and productivity of the *Eucommia* forest and ecological forest introduced by Anzhe County in Shanxi Province, and concluded that *Eucommia* is an ideal species for building ecological economic forestry in this place. Wang Zhutong, garden field of Baoyinhu Farm in Jinhu County made a preliminary analysis of the economic benefits, and concluded that planning *Eucommia* has good economic benefit. And if we further improve the production process of recycled bark, the economic benefit will also increase.

## **PROBLEMS AND COUNTERMEASURES IN EUCOMMIA INDUSTRY DEVELOPMENT**

### **Improve the legal and policy system, strengthen policy support**

Facing the status quo that *Eucommia* are suffering predatoryhacking and mess stripping and is being endangered, the government should formulate relevant laws and regulations, increase inspection and supervision, standardize gutta cultivation, harvesting, processing and marketing techniques. The government should also improve policy system, including forestry policy, forest policy, science and technology promotion policy and other policies. In addition, it should also promote afforestation technology, construct *Eucommia* rubber industrial material forests, offer government subsidies in artificial *Eucommia* breeding, offer tax incentives or cuts, so as to fully mobilize the enthusiasm of farmers to be involved in *Eucommia* cultivation and standardize the management and protection of farmers and harvest behavior, achieve "who invests, who benefit", and encourage the whole social subjects to participate in various social activities of *Eucommia* industry<sup>[6]</sup>.

### **Make greater efforts to promote scientific research and transformation**

When dealing with the low fine seeds proportion and low utilization of the orchard cultivation mode, it is urgent that we improve the added value and commercial value of *Eucommia* products by the strong support and promote of research

and transformation platform. At present, based on the Forest Research Center in China Academy of Forestry, the State Forestry Administration set up a " National Engineering Research Center for Eucommia Forestry" to develop fine new breeds, new planting models and technologies, train research personnel, increase the conversion rate of scientific research, and conduct training of the related knowledge among Eucommia producers to standardize the technology and behavior, improve Eucommia product market analysis and response capacity, reduce business risk and improve the comprehensive utilization and economic value of Eucommia.

#### **Establish new Eucommia industries demonstration zone, cultivate leading enterprises**

As for the status quo that the current business model is still Eucommia workshop based, and scale economies have yet to be formed, and the utilization value, economic value, social value of Eucommia products are relatively low, the government should, based on Eucommia Engineering Center at all levels, establish national and regional Industries Demonstration Zone or demonstration garden, and focus on supporting the production, supply and integration of large enterprises, form the industrialization of business model of "enterprise plus base plus farmers", improve enterprise capability of independent innovation, thus boosting the healthy development of the whole industry.

#### **Establish product marketing system**

In view of the relatively backward Eucommia product marketing system, enterprises should gradually adopt some modern marketing tools inmarketing, such as network marketing, website promotion, etc. In addition, enterprises should vigorously promote the brand management strategy to further consolidate the Japanese market, open up European and domestic markets, and actively support the regional industry associations to improve the farmers' organization, strengthen Eucommia social service system, and strive to form a three marketing system, namely, a market transaction domained marketing system, a domestic cities domained distribution network system and a foreign trade domained export system, to achieve higher product brand value and higher economic interest of the industry.

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