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Analysis on Characteristics of *Lysidice rhodostegia* and Its Planting and Cultivation Optimization

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Abstract *Lysidice rhodostegia* is a kind of evergreen tall arbor, belonging to *Lysidice*, Caesalpiniaceae. Because of luxuriant branches and leaves, beautiful flowers and bright colors, it has a certain greening effect and ornamental value. Moreover, the researchers also find that *L. rhodostegia* has rich medicinal effects that have not been developed yet. In this paper, the morphological characteristics, ecological habits, geographical distribution and main functions of *L. rhodostegia* are briefly described. Then, conventional planting technology of *L. rhodostegia* is analyzed, and the optimization strategy of planting and cultivation technology of *L. rhodostegia* is put forward. Finally, some prospects for the future development of *L. rhodostegia* industry is proposed. The research could lay a solid foundation for cultivating varieties of *L. rhodostegia* with excellent characters.

Key words *Lysidice rhodostegia*, Characteristics, Sowing cultivation, Optimization analysis

1 Introduction

Lysidice rhodostegia is a kind of evergreen tall arbor, belonging to *Lysidice*, Caesalpiniaceae. It mainly grows in valleys and hills in Hainan, Yunnan, Guangxi and Guizhou, and is important rare medicinal flower species.

2 Characteristics of *L. rhodostegia*

2.1 Morphological characteristics of *L. rhodostegia* *L. rhodostegia* is a woody plant, and its tree species can be as high as 30 m. The crown is round or nearly round, with thick white or dark gray bark. The leaves are oval and hairless, and it is pinnate compound leaf. The flowers have a faint fragrance, and the inflorescence is conical. The color of the flowers is mainly white or light yellow, and a few are purple or purple yellow. Summer is the main flowering season of *L. rhodostegia* every year. The fruit is flat and is a pod. When the color of the fruit gradually changes from cyan to gray, the fruit is ripe. The seed is oval, and its surface is shiny and translucent, and its color is mainly yellowish brown.

Besides *L. rhodostegia*, there is another plant in *Lysidice*—*Lysidice brevicalyx*. They are very similar in morphology and characteristics. So in the application of landscaping, staff and even researchers unfamiliar with *L. rhodostegia* are easy to confuse the two plants. To distinguish the two, it can first observe the characteristics. *L. brevicalyx* is a tall tree, and its petals are white in appearance. The seeds of *L. brevicalyx* have a thick cortical layer, which contains a layer of sticky gum. *L. rhodostegia* is a small arbor with pink petals. The seed coat of *L. rhodostegia* is thin and crisp, and there is no sticky gum inside. Additionally, they also have obvious differences in microstructure. There is no obvious

cortex at the root of *L. brevicalyx*, but there is a prominent and obvious forehead in the middle, and the stem wood layer is relatively thick. There is a thick cortex at the root of *L. rhodostegia*, and obvious and orderly arranged crystals are outside the cortex.

2.2 Ecological habits of *L. rhodostegia* *L. rhodostegia* likes light and humid environment, and is suitable for warm and humid climate. It mainly grows in high mountains and hills, but it can also survive in barren, dry and hot places. In growth process, *L. rhodostegia* has distinct difference. *L. rhodostegia* in juvenile stage needs a shady and cool growing environment. For adult *L. rhodostegia*, sufficient light is more beneficial to its flourishing. *L. rhodostegia* has good adaptability to soil, and can grow in acidic and alkaline soil conditions. The fertile and well drained soil is most suitable for the growth of *L. rhodostegia*. *L. rhodostegia* has strong cold and frost resistance, and could survive for several days above 0 °C. The most suitable growth temperature of *L. rhodostegia* is 18–25 °C. *L. rhodostegia* has strict requirements on the precipitation of the growing place, and it requires that the annual precipitation of the growing place is at least above 1 000 mm.

2.3 Distribution range of *L. rhodostegia* *L. rhodostegia* is mainly distributed in five cities of Guangdong Province, such as Dongguan and Meizhou, and a small amount is distributed in Yunnan and Guangxi. With the continuous expansion of the urbanization process and the government departments vigorously promoting the ecological development of the city in recent years, the distribution of *L. rhodostegia* begins to be extensive.

2.4 Main functions of *L. rhodostegia* The first main function of *L. rhodostegia* is landscaping. *L. rhodostegia* is woody plant. Its trunk is tall and straight, and its tree shape is tall, and its leaves are evergreen. Moreover, the flowers are bright in color, beautiful in appearance, long in flowering period, and highly ornamental. Additionally, *L. rhodostegia* has strong germination ability, grows fast after transplantation, and has a high survival

rate. Therefore, *L. rhodostegia* can be planted alone as the main ornamental tree species, or clustered as a matching scene for garden greening.

Another main function of *L. rhodostegia* is its medicinal function. Phenols, terpenoids and ketones are the main components in the roots, leaves and stems of *L. rhodostegia*, and it contains a small amount of alcohols and organic acids. These active ingredients can be applied to the preparation of Chinese herbal medicine, and can be used for hemostasis, stasis, heat clearing and detoxification, treatment of traumatic injuries and arthritis.

L. rhodostegia also has antioxidant and anti arrhythmia function. The staff can separate compounds such as anthocyanin and gallate from the flowers and leaves of *L. rhodostegia*, which have high antioxidant capacity. The researchers also found that the ethyl acetate extracted from *L. rhodostegia* could dilate the isolated arteries of animals. The aqueous solution extracted from the root can also reduce the time of cardiac arrhythmia in animals, but this series of studies need to be further explored and excavated.

Additionally, *L. rhodostegia* also has the function of detecting air quality, which can serve ecological benefits. When $PM_{2.5}$ concentration in the air is higher, the leaf color of *L. rhodostegia* changes significantly, from green to withered and yellow, and finally death occurs. Therefore, *L. rhodostegia* is an indicator plant to measure whether the air pollution is serious.

Finally, *L. rhodostegia* can be widely used in the construction industry. The trunk of *L. rhodostegia* is hard and straight enough, not easy to deform, and has strong bearing capacity, so it can be used as an excellent building material.

3 Planting of *L. rhodostegia*

Because of various functions and wide applications, it is an important research topic to vigorously promote the application of *L. rhodostegia*, among which the planting research of *L. rhodostegia* is the most basic. At present, the main propagation mode of *L. rhodostegia* is sowing cultivation.

3.1 Seed collection of *L. rhodostegia* When selecting the tree species of *L. rhodostegia* for collecting seeds, the tree species with long growth time and without obvious diseases and pests should be selected first. Ten years is a growth period, and the tree species growing for more than ten years is the best for seed collection. The time of seed collection is from the early September to the late October, during which there is a large number of mature seeds. As the fruit of *L. rhodostegia* is a pod, when the fruit of *L. rhodostegia* matures, the pod will crack. Therefore, it needs to collect the mature fruit of *L. rhodostegia* in time to prevent the fruit from scattering. After the mature seeds are collected in cloth bags or paper bags, the outside pod wall is gently poked with fingers or tweezers. After taking out the seeds, they are placed in a cool and dry place without direct sunlight. After 2 to 3 d, all the seeds will be dried.

The seeds of *L. rhodostegia* prefer cool and shady environment. Under normal storage conditions, the seeds of *L. rhodostegia* can be stored for 1–2 years. The researchers found that the

germination ability of *L. rhodostegia* seeds is related to the content of water in the seeds. That is, when the content of water in the seeds is high, the seeds have strong germination ability and rapid germination. Therefore, the seeds of *L. rhodostegia* should be stored in a cool and dry place, and should not be exposed to the sun, otherwise the activity of the seeds will be greatly reduced.

3.2 Seed treatment of *L. rhodostegia* As the fruit of *L. rhodostegia* is a pod, the seed coat needs to be damaged before soak. For *L. rhodostegia*, the best damage method is mechanical damage. After the damage work is completed, *L. rhodostegia* needs to be soaked. Because the surface of *L. rhodostegia* seeds is extremely dry and the internal water content is low, if the seed interior of *L. rhodostegia* cannot get enough water before sowing, it is difficult for the seeds to reach the germination state. Therefore, the seeds of *L. rhodostegia* need to be fully soaked before sowing. First, the seeds are soaked in boiling water (100 °C) for several minutes to make the outer layer of the seed coat soft. After the seeds are naturally cooled, it starts timing, and the seeds should be soaked for at least one day and one night (24 h). After soaking, the swollen seeds are removed. After natural drying, they could be sown. The unexpanded seeds need to be soaked again with slightly boiling hot water, that is, they can be soaked again for one day and one night with 75 °C hot water, which can be repeated for three times. After soaking, the germination rate of the seeds can reach more than 90%.

3.3 Sowing land treatment According to the ecological habits of *L. rhodostegia*, the planting land should be preferably selected where there is sufficient light and water. For the selection of planting plots, the flat plots with no obvious slope shall be preferred. The requirements of the sowing land to soil are also consistent with the conventional requirements of most sowing, that is, the sowing land requires fertile soil and good drainage.

Before sowing, land preparation, fertilization and border treatment shall be carried out for the plot. The sown land shall be turned over for 50 cm first, and basic fertilizer treatment shall be given priority, mainly organic fertilizer. After land preparation, a rectangular border land with a height of 30 cm and a width of 130 cm shall be set up. After the border land surface is scraped, an appropriate amount of herbicide shall be applied to spray the seedbed.

3.4 Seeding treatment The soaked seeds are placed in the nutrient bed prepared in advance for germination. When the seeds sprout and grow for about one month, about 2–3 true leaves, the seedlings can be transferred to the pre treated culture soil containing garden soil for further cultivation. At this time, attention should be paid to strengthening water and fertilizer treatment. When the seedlings gradually grow to about 30 cm high, they can be planted.

The seeds of *L. rhodostegia* can also be sown directly in the nursery in spring and autumn. After the preliminary treatment of the sowing land is completed, the seeds shall be sown in the border land, and a little thin soil shall be spread on the surface to cover the seeds. After sowing, the border surface needs to be

slightly leveled and watered, and then covered with thin plastic layers. After sowing, watering shall be carried out every day in the early morning and evening to ensure soil wetness. In addition, it should be noted that there should be no ponding in the furrows after watering, and watering should be appropriate. In addition, timely weeding should be carried out.

After about 6 months of growth, the seedlings of the sown seeds will show two kinds of height stratification. The height of the seedlings reaches 50 cm, and the width of the ground stem is greater than 0.5 cm, and there are five obvious branches on the trunk. This kind of *L. rhodostegia* seedlings are first-class high-quality seedlings. The height of the seedlings is 30–40 cm, and the width of the ground stem is 0.3–0.5 cm, and there are three to five obvious branches on the trunk. This kind of *L. rhodostegia* seedlings are second-class high-quality seedlings. The second-class seedlings can be further cultivated. About one month, the second-class seedlings can reach the quality level of the first-class seedlings, that is, there are five to eight obvious branches on the trunk.

If the seedlings reach the first-class level, they can be cultivated out of the nursery. There are not too many professional requirements when young seedlings are moved out of the nursery. It should pay attention to that the soil layer of the cultivated soil is compact and complete, and growth status of young seedlings is good, without pest erosion. When seedlings are removed, they need to be packed in boxes. For seedlings with small growth and few branch points, more can be packed in boxes. Seedlings with stronger growth and more branching points can be packed less in the box. The transplanted seedlings need cool and ventilated treatment; the seedlings that have not been transplanted out of the nursery shall be refined to prepare for the next transplantation.

3.5 Planting treatment First of all, the planting land should be preferably located in a place with good drainage and fertile soil. Second, the soil layer should be fertilized before planting.

When transplanting first-class high-quality seedlings of *L. rhodostegia*, it must be ensured that the root of high-quality seedlings carries large soil mass. The best time for high-quality seedlings to be transplanted is in the afternoon just after the rain, because the soil moisture is sufficient at this time, which is easy for young seedlings to survive after transplanting. If high-quality seedlings are transplanted at other times, water and fertilizer management should be strengthened for the transplanted seedlings to ensure sufficient soil moisture in the transplant site, and moisture and heat preservation treatment should be done regularly. In addition, it should be noted that the transplanted seedlings should be pruned before planting. After all the dead branches and rotten leaves are pruned, a large amount of water evaporation can be reduced, which can also ensure the survival rate of the seedlings.

3.6 Post planting management After planting *L. rhodostegia*, water and fertilizer management shall be carried out, and attention shall be paid to observing whether there are pests and diseases, dead branches and leaves, and post planting management and pruning shall be done well. There is no significant difference

in the post planting management between *L. rhodostegia* and other woody plants, that is, conventional pruning and shaping treatment can be used. Although there are few pests and diseases in *L. rhodostegia*, they should be checked in a timely manner. Once they are found, they should be promptly controlled by using insecticide lamps or spraying pesticides or other chemical or biological means.

4 Optimization analysis of *L. rhodostegia* cultivation

Sowing cultivation is main breeding method of *L. rhodostegia*. In order to obtain more excellent varieties of *L. rhodostegia*, in addition to local protection and introduction, it can also start from the cultivation of *L. rhodostegia*, optimize and analyze the cultivation techniques and management methods of *L. rhodostegia*, so as to cultivate more high-quality varieties of *L. rhodostegia*.

4.1 Optimization of cultivation site In the cultivation of *L. rhodostegia*, in addition to meeting the most basic requirements of flat terrain and fertile soil, another key element is the requirements of the staff for land preparation. It requires the staff to fully prepare the land for border treatment in advance for the cultivation land where we want to cultivate *L. rhodostegia*. Among them, after the cultivation land is prepared, thin plank shall be used to scrape the land after the preparation as the border, and then the diluted acetochlor emulsifiable concentrates shall be sprayed evenly to prevent weeds from appearing in the border.

4.2 Optimization of seed picking for *L. rhodostegia* The optimization of seed picking in *L. rhodostegia* can start with the selection of tree species. The best *L. rhodostegia* tree species are those with good growth, no pests and diseases, and flourishing growth. When the pods of *L. rhodostegia* are picked, they need to be gently removed by hand, and the picked fruits should be placed in a cool and ventilated place for drying, and then the seeds should be stored. When storing seeds, attention should be paid to the fact that the germination capacity of stored seeds will decrease significantly after stored more than one year. Therefore, when optimizing the cultivation of *L. rhodostegia*, high-quality seeds collected in the same year should be selected as sowing objects.

4.3 Optimization of seed treatment of *L. rhodostegia* Before sowing, it is necessary to soak the seeds of *L. rhodostegia*. The optimization for the treatment of *L. rhodostegia* seeds is that *L. rhodostegia* seeds need to be gently washed five to six times with running water before pretreatment. First, the seeds should be soaked in 100 °C boiling water, and then soaked in daily water after 10 min. When the obvious swelling phenomenon on the surface of the seeds can be observed with the naked eye, seeding can be carried out.

4.4 Optimization of seeding time of *L. rhodostegia* First, the sowing season of *L. rhodostegia* seeds is selected. For *L. rhodostegia*, although the sowing season is spring and autumn, relevant research shows that sowing in early spring is more conducive to plant growth and reproduction, so spring is the best sowing season for *L. rhodostegia*. The second is the adoption of sowing method. For *L. rhodostegia*, the most suitable sowing method is tradi-

tional sowing, and the most suitable sowing quantity is 1 kg/m². It should keep in mind that the sown seeds cannot be overlapped. After seeding, the seeding field needs to be covered. The optimization for seeding field coverage is that the covering is mainly thin soil. After covering, it needs to be compacted with wood plates, but not too solid, just to ensure that the compacted soil is not loose. After covering, it needs to be watered and irrigated. It should be noted that the sowing land needs to be watered in the morning and evening every day to ensure that the soil is moist enough and *L. rhodostegia* grow well, but the sowing land can not be waterlogged. Therefore, the sowing land can not be watered or even less in cloudy days.

4.5 Optimization of seedbed management About 20 d after the sowing, about one fifth of the *L. rhodostegia* seeds show signs of germination. At this time, the plastic film covered in the sowing field should be removed in time. The optimization of seedbed management is to use wettable powder to spray evenly inside the shed through the staff, so as to avoid excessive humidity and heat inside. After about 10 d, the seeds of *L. rhodostegia* will germinate and cotyledons will grow. Optimization of seedbed at this time; the seedling thinning can optimize the survival rate of the plant in the seedbed. The seedling thinning of *L. rhodostegia* can be handled in batches; first of all, young seedlings with strong growth and two real leaves can be preferentially transplanted into the nutrition bag prepared in advance. After about a week, the remaining seedlings can be transplanted for thinning. After thinning, the seedlings in the nutrition bag also need to be watered with enough water. In sunny days, they need to be watered once in the morning, noon and evening respectively. When the weather is too hot, it can also be watered in the morning and evening. In cloudy days, it depends on the situation, and a small amount of water should be applied. In case of rainy days and waterlogging seasons, the accumulated water in the seedbed shall be timely removed and cleaned.

To optimize the late stage management of *L. rhodostegia*, chemical fertilizer or organic fertilizer should be applied to the growing area. When the seedlings grow for two months, they can be topdressed. In the process of pest control of *L. rhodostegia*, it is necessary to focus on the root control, and eliminate the spread of pests and diseases.

4.6 Optimization of transplant management of *L. rhodostegia* *L. rhodostegia* has broad requirements for soil, but in order to obtain more and better *L. rhodostegia*, it needs to optimize the preparation of nutrient soil. The nutrient soil shall be more than 70% paddy soil, and the remaining soil type shall be uniformly mixed with a large proportion of river sand and a small amount of burnt soil. The bags containing nutrient soil shall preferably be 10 or 15 cm sterilized bags. After the sterilized bags are filled with nutrient soil, they shall be placed neatly on the soil surface of the finished border. When the seedlings are transplanted to the nutrition bag, it is necessary to build a shade shed to shade the transplanted seedlings. When the seedlings in the shed grow for more than one month, the growth of the seedlings in the shed is ob-

served. When the seedlings in the shed grow uniformly and well, it is necessary to dismantle the shade shed in the sowing field in time. Weeds in the shade shed shall be cleaned regularly to prevent overgrowth of weeds in the shed and competition with *L. rhodostegia*. When weeding, it should focus on manual weeding, and reduce the use of chemical and biological weeding.

4.7 Optimization of the conditions for *L. rhodostegia* to come out of the garden After the sowing of *L. rhodostegia* is completed, they can leave the nursery after at least half a year of propagation and culture. Optimization of *L. rhodostegia* when they come out of the garden; before leaving the nursery, the height of *L. rhodostegia* seedlings shall be at least 30 cm. Therefore, if you want to obtain high-quality *L. rhodostegia* resources, at least the height of *L. rhodostegia* seedlings shall meet 50 cm. When the height of *L. rhodostegia* seedling is 80 cm, the watering can be appropriately reduced, as long as the watering condition meets the requirement that the soil at the root of *L. rhodostegia* is wet. The transplanted nursery shall pay attention to the shade and ventilation during transportation, and *L. rhodostegia* shall be packaged in time.

5 Prospects

L. rhodostegia is a kind of woody plant with good ecological value and high-quality ornamental value. At the same time, *L. rhodostegia* is an excellent evergreen native tree species, and its development in the garden landscape has extremely important value. Therefore, *L. rhodostegia* plays an extremely important role in the development of nursery resources, garden ecological greening and public welfare afforestation in China. Additionally, *L. rhodostegia* is also of vital importance to the development of China's pharmaceutical industry. At present, many compounds beneficial to human beings can be extracted and separated from *L. rhodostegia*, which have many beneficial functions for human beings, such as antioxidant function, anti vasodilator function and anti cardiac arrest function. In order to further expand the application and use value of *L. rhodostegia*, it needs to carry out the breeding of fine varieties and further optimize the cultivation technology of *L. rhodostegia*, hoping to make an important support for improving the economic value of *L. rhodostegia* and lay a solid foundation for cultivating varieties with excellent properties.

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