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The Status of Dipterocarpaceae Plants in Taiwan

Sheng-Zehn Yang[1*], Po Hao Chen[2]

[1]Department of Forestry, National Pingtung University of Science and Technology, Pingtung
[2]Liouguei Research Center, Taiwan Forest Research Institute, Liouguei District, Kaohsiung, Graduate Institute of Bioresources, National Pingtung University of Science and Technology, Pingtung
Email: *yangsz@mail.npust.edu.tw

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Abstract

The Dipterocarpaceae family is famous for timber productions in Southeast Asia. The Shuangxi tropical arboretum in Taiwan introduced some dipterocarp species in 1935. However, the changes in abundance and regeneration of each dipterocarp species are unknown. This study aimed to investigate their diameters patterns and regeneration ability over a long period. The results showed that only four dipterocarp species were survived in this arboretum. An individual plant of *Dipterocarpus gracilis* Blume had a diameter of 5.7 cm. A young seedling was 90 cm in height, and some fruits germinated directly on the ground. A few fruits of *Dipterocarpus grandiflorus* (Blanco) Blanco were collected; however, and no seedlings have been found thus far, and its annual growth rate was 2.82% as the fastest growth speed. The annual growth rate of *Rubroshorea polysperma* (Blanco) P. S. Ashton & J. Heck was 2.32%, which is the second growth speed among the different species. Moreover, the abundance of *R. polysperma* increased as the fruits germinated. In particular, an uneven-aged forest of *R. polysperma* was established near the southwest area of the No. 2225 nature conservation protection forest, and an individual with a 100 cm DBH was also found. The fruits of *Rubroshorea palosapis* (Blanco) P. S. Ashton & J. Heck. could not be collected, but a young seedling appeared, with a height of approximately 150 cm. Therefore, Taiwan should be considered as the new distribution site for the Dipterocarpaceae family, all four dipterocarp species can grow in this area and need to be protected carefully.

Keywords

Dipterocarpaceae, *Dipterocarpus*, *Rubroshorea*, Shuangxi Tropical Arboretum, Protection Forest

1. Introduction

The Dipterocarpaceae family comprises approximately 550 species in 17 genera distributed worldwide [1]. They are mainly evergreen trees that grow in tropical rainforests, generally grow between 40 and 70 m in height and are an important timber resource in Southeast Asia. *Dipterocarpus* and *Shorea* are two important genera of this family, and are mainly distributed in Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam, India, NE India, western Indonesia, and Nepal [1]. Because they produce large volume of wood, different regions of the world are always intent on planting these species. There are approximately 70 species of *Dipterocarpus* and 200 species of *Shorea*. These two genera differ in the characteristics of their fruits; *Dipterocarpus*: calyx in fruit with a distinct tube, free, fruit sepals 2, enlarged; *Shorea*: no obvious calyx tube in fruit, fruit sepals 5, 3 large and 2 small. Owing to the wing-like characteristics of the Dipterocarpaceae fruit, it spreads like a parachute, with the help of the wind. The fruit has two persistent wing-shaped calyxes. The seeds do not need to be dormant, and can germinate directly, as long as the temperature and humidity are suitable.

Romadini *et al*. [2] indicated that the mean observed heterozygosity was lower than expected heterozygosity in seedling populations of *Dipterocarpus gracilis* Blume, suggesting that the genetic structure of seedlings was similar to the consequence of inbreeding, and the genetic diversity decreased when mature trees were reduced. The seeds viability of *Dipterocarpus grandiflorus* (Blanco) Blanco was short (3 - 5 days), and must be sown immediately [3]. The species *Rubroshorea palosapis* (Blanco) P. S. Ashton & J. Heck exhibited poor growth and survival under wide spacing, waterlogged and in exposed bare soil, and early growth could be hampered by high soil temperatures [4].

Approximately 270 tropical special trees introduced from Southern Asia in 1935 and planted in the Shuangxi tropical arboretum, southern Taiwan. The Shuangxi tropical arboretum is located in Guangxingli, Meinong District, Kaohsiung County and was established in 1935. This arboretum belongs to the No. 2225 Nature Conservation Protection Forest, 52 Compartments (454 ha), the Qishan Workstation, Pingtung Branch, Forestry and Nature Conservation Agency, Ministry of Agriculture (**Figure 1**). The protected forest (24.7 ha) has a designated area of approximately 7.56 ha for planting introduced species and hiking trails. This arboretum is made up of hilly terrain with altitudes approximately 90 - 100 m, aspects mainly west and northwest, slopes of approximately 5˚ - 30˚. The annual precipitation of approximately 3000 mm, and most of the rainfall is concentrated in summer. Approximately ten dipterocarp species were cultivated in this arboretum. According to the data recorded in [5], between 1950 to 1978, *Dipterocarpus tuberculatus* Roxb., *Hopea pierrei* Hance, *Hopea plagata* (Blanco) S. Vidal, and *Shorea guiso* (Blanco) Blume and *Shorea teysmanniana* Dyer ex Brandis disappeared.

From 1957 to 2010, the arboretum plant illustrations, phenology investigations, and dynamics in abundance and regeneration of dipterocarp plants were

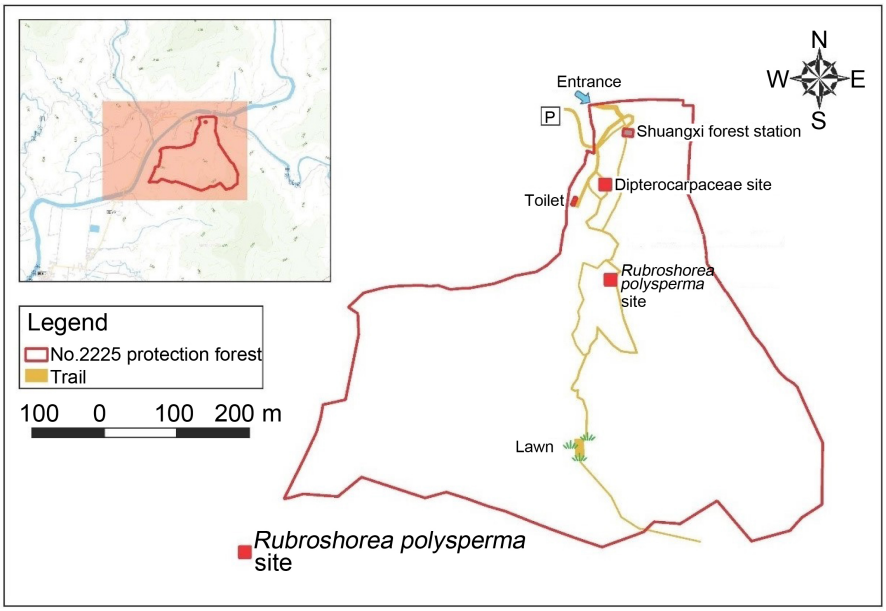

Figure 1. Shuangxi tropical arboretum is located in Meinong district, Kaohsiung County, southern Taiwan and was established in 1935. This arboretum belongs to the No. 2225 Nature Conservation Protection Forest (25.7 ha), 52 Compartments (454 ha), the Qishan Workstation, Pingtung Branch, Forestry and Nature Conservation Agency, Ministry of Agriculture. Approximately 7.56 ha has been designated for planting introduced species and hiking trails; four Dipterocarpaceae species were cultivated in this area. Three red square are the dipterocarp species planted site.

conducted and discussed [5]-[13]. Therefore, it is necessary to determine whether the status of the dipterocarp plants had changed from 2010 to 2021, especially the diameter at breast height (DBH), survival, and seedling regeneration of each dipterocarp species in this arboretum. The dipterocarp plants had grown approximate 90 years here, in which the habitats are different from the equatorial and windless zone. So investigating their adaption and regeneration are needed over a long period. The information on the development and regeneration of Dipterocarpaceae planted in southern Taiwan can be used to compare the adaptability of Dipterocarpaceae plants in different areas.

2. Materials and Methods

We surveyed the three sites where dipterocarp plants were planted. The first site planted four dipterocarp plants with an area of approximately 0.08 hectares. The second site was located on both sides of the trail and planted one dipterocarp species with an area of approximately 0.12 hectares. The third site was located in the southwest corner of this arboretum and planted one dipterocarp species with an area of approximately 0.33 hectares. At each site, we investigated the DBH of each mature dipterocarp plants and observed the number of seedlings or fruits in the field.

The scientific names of some dipterocarp plants were treated according to [14]. In this study, five species of the Dipterocarpaceae family were included,

viz., *Anisoptera thurifera* (Blanco) Bl., *Dipterocarpus gracilis* Blume, *Dipterocarpus grandiflorus* (Blanco) Blanco, *Shorea squamata* (Blanco) Dyer ex Vidal, and *Shorea polysperma* (Blanco) Merr. [9]. They were dominated species in the Nanyang Islands, Indochina Peninsula. According to [14], *Dipterocarpus grandiflorus* (Blanco) Blanco is the accepted name, *Mocanera grandiflora* Blanco in Fl. Filip.: 451 (1837) is the homotypic synonym; *Rubroshorea palosapis* (Blanco) P. S. Ashton & J. Heck. is the accepted name, *Shorea squamata* (Blanco) Dyer ex Vidal is the synonym; *Rubroshorea polysperma* (Blanco) P. S. Ashton & J. Heck. is the accepted name, *Shorea polysperma* (Blanco) Merr. is the synonym.

To understand the growth patterns of the five Dipterocarpaceae species, 1) we collected the data about the original numbers and DBH of seedlings of each species from 1935 to 1949, data provided from the Kaohsiung Forestry Management office; 2) we referred to the results reported in [5] [7]-[12] to collect the data from 1949 to 2008; 3) in 2019 and 2021, we measured each dipterocarp species DBH. Using the collected data, we drew the changes of DBH curves for 1949, 1978, 1997, 2008, 2019, and 2021.

The DBH values of each dipterocarp species were used to calculate their compound annual growth rate according to the formula on [15]. Compound annual growth rate (%) of each species were calculated: firstly, divide the present by the past value, then multiply that number by 1/N (where N is the number of years pasted); secondly, subtract the result by 1. The collected specimens are preserved in the Provincial Pingtung Institute (PPI) of the Department of Forestry, National Pingtung University of Science and Technology.

3. Results

In this arboretum, the abundance and the DBH value of each dipterocarp species were recorded for the first time in 1949, the results were presented in **Table 1**. According to the formula [15], the species *Dipterocarpus gracilis* of annual growth rate from 1949-2023 = 1.39% (**Table 2**), that the results of each plants were presented in **Table 2**. The species *Anisoptera thurifera* (Blanco) Bl. is native to the Philippines and Malaysia, and its DBH value was 16 cm in 1949, and increased to 34 cm in 2019. There is no record of flowering or fruiting, this plant fell down by strong wind in 2019 (**Table 1**). As a result, we listed the differences between these dipterocarp plants, and drew a diagram of the changes in their diameters at breast height (**Figure 7**) as well as the annual growth rate of each species (**Figure 8**). As a result, only four Dipterocarpaceae species survived in the arboretum. Below is a brief introduction to the analysis of the morphologies and status of the four Dipterocarpaceae species in Shuangxi tropical arboretum.

1) *Dipterocarpus gracilis* (**Figure 2(B)**, **Figure 3**): branchlet surfaces are covered with long hairs and then glabrous, stipules scars are obvious. The leaves are elliptic or oblong in shape, 9 - 15 cm long, 4 - 8 cm wide, sharp or blunt at the apex with short hairs on both sides, and 15 pairs of lateral veins; petiole is 2 - 3 cm long, densely covered with long hairs. Five petals, connate and curled at the

Table 1. Diameter at breast height of the Dipterocarpaceae species from 1935 to 2021 in the Shuangxi arboretum, Meinong Dist., Kaohsiung City.

Species	Dip grac		Dip gran		Rub pol		Rub pal		Ani thu	
	Id	Max-dbh (cm)	Id	Max-dbh (cm)	Id	Max-dbh (cm)	Id	Max-dbh (cm)	Id	Max-dbh (cm)
1935	3	-	1	-	9	-	2	-	2	-
1949	3	13	1	5	9	16	1	17	2	16
1978	1	24	1	18	4	34	1	28	1	24
1997	1	26	1	27	11	61	1	39	1	30
2008	1	30	1	34	21	71	1	48	1	33
2019	2	34.5	1	36.8	200	82.8	2	54.7	0	34
2021	2	35	1	37	>500	83.5	2	55	0	-

Note: Dip grac: *Dipterocarpus gracilis*, Dip gran: *Dipterocarpus grandiflorus*, Rub pol: *Rubroshorea polysperma*, Rub pal: *Rubroshorea palosapis*, Ani thu: *Anisoptera thurifera*, Id: individual numbers of plants. *Anisoptera thurifera* fell down by strong wind in 2019.

Table 2. Annual growth rate of the four dipterocarp species from 1949 to 2021 in the Shuangxiarboretum, Meinong Dist., Kaohsiung City.

Species	Dip grac		Dip gran		Rub pol		Rub pal	
	Max-dbh (cm)	Agr (%)	Max-dbh (cm)	Agr (%)	Max-dbh (cm)	Agr (%)	Max-dbh (cm)	Agr (%)
1949	13	-	5	-	16	-	17	-
1978	24	2.14	18	0.42	34	2.63	28	1.74
1997	26	3.72	27	1.31	61	3.12	39	1.76
2008	30	3.64	34	1.28	71	1.39	48	1.91
2019	34.5	1.60	36.8	0.72	82.8	1.41	54.7	1.20
2021	35	0.72	37	0.27	83.5	0.42	55	0.27
Agr (%)	-	1.39	-	2.82	-	2.32	-	1.64

Note: Dip grac: *Dipterocarpus gracilis*, Dip gran: *Dipterocarpus grandiflorus*, Rub pol: *Rubroshorea polysperma,* Rub pal: *Rubroshorea palosapis,* Agr (%): annual growth rate. For example: *Dipterocarpus gracilis* of annual growth rate from 1949-1978 = (24/13) ^(1/29)-1 = 0.0214, annual growth rate from 1978-1997 = (26/24) ^(1/19)-1 = 0.0372, annual growth rate from 1997-2008 = (30/26) ^(1/11)-1 = 0.0364, annual growth rate from 2008-2019 = (34.5/30) ^(1/11)-1 = 0.01565, annual growth rate from 2019-2021 = (35/34.5) ^(1/2)-1 = 0.0072, annual growth rate from 1949-2021 = (35/13) ^(1/72)-1 = 0.013851.

base, white or pink-white in color (**Figure 3(G)**). Nut-like fruits, growing in an enlarged calyx tube with two erect wings (**Figure 3(D)**). Its diameter at breast height was 13 cm in 1949, and grew to 35 cm by 2021 (**Figure 3(A)**). Compared to the other three dipterocarp plants, its annual growth rate was the slowest, at approximately 1.39%. In 2008, an individual was found to have a diameter of approximately 5.7 cm and grew very well. In 2019, a young seedling with a

Figure 2. The four dipterocarp plants growing in the first cultivated site with an area of 0.08 hectares. (A): *Dipterocarpus grandiflorus*, (B): *Dipterocarpus gracilis*, (C): *Rubroshorea polysperma*, (D): *Rubroshorea palosapis.*

Figure 3. *Dipterocarpus gracilis.* (A). A diameter at breast height of approximately 35 cm in 2021; only one individual of this species growing in this arboretum. (B). A naturally regenerated seedling, from 30 cm in height on September 10, 2019, to 90 cm on October 30, 2022. (C). One fruit germinated a short bud from the fruit top on September 5, 2022. (D). Fruit with two enlarged wings modified from the sepals. Photographed on October 18, 2022. (E). Another fruit germinated 2 cotyledons and a leaf bud from the fruit top. (F). The mature fruits period from September to November, photographed on July 10, 2008. (G). petals 5, adnate at the base, pink-white. Photographed on July 29, 2008. (C) and (E) Were photographed on October 05, 2022.

height of approximately 40 cm was found, and a protective net was set up to take care of the young seedling. In 2022, the plant height reached 90 cm (Figure 3(B)), indicating that *D. gracilis* can adapt to natural regeneration. Mature fruits fell onto the ground, around the tree; they had germinated buds, two cotyledons, and new leaves (Figures 3(C)-(E)).

2) *Dipterocarpus grandiflorus* (Figure 2(A), Figure 4): the stem cross section of branchlets are cylindrical, and red stipules (Figure 4(D)) surround the terminal buds, which fall early and leave ring-shaped stipulated scars. Leaves are ovate or broad-ovate, 12 - 15 cm long, 7 - 12 cm wide, sharp at the apex, round or blunt at the base, with 10 pairs of lateral veins, and abaxial surface convex (Figure 4(B)); petioles 3 - 5 cm long (Figure 4(C)), glabrous, and swollen at the apex. Five petals, connate and curled at the base, and white with a red band in the middle (Figure 4(E)). Nut-like fruits, with an enlarged calyx tube and two erect wings (Figure 4(F)). Only one individual survived in the arboretum. Its

Figure 4. *Dipterocarpus grandiflorus*. (A). A diameter at breast height of approximately 37 cm in 2021; only one individual of this species growing in this arboretum. (B). Abaxial surface leaf with obvious stipules scars, and approximately 10 pairs of lateral veins, prominently raised on the back. (C). Adaxial surface leaf, with a petiole 3 - 5 cm long. (D). Large red stipules, enclosing terminal bud, caducous and leaving a stipules scar. (E). Petals 5, adnate at the base, white with a reddish median stripe. (F). Nut-like fruit, enclosed in an accrescent calyx tube, with two erect wing-like calyx lobes. (D) was photographed on September 26, 2008, and (A)-(C), (E)-(F) on July 4, 2008.

diameter at breast height was 5 cm in 1949 (Table 1), and it was the smallest of the studied species (Figure 7). However, the diameter reached 37 cm in 2021 (Figure 4(A)), and the annual growth rate was 2.82%, surpassing that of *D. gracilis* and ranking the first. To date, no seedlings had been found.

3) *Rubroshorea palosapis* (Figure 2(D), Figure 5): branchlets are covered with stellate hairs, stipules are long-ovate, persistent (Figure 5(C) and Figure 5(D)) with stellate hairs. Leaves are ovate-elliptic, 18 - 25 cm long, 6 - 10 cm wide (Figure 5(B)), acuminate at the apex, round or slightly cordate at the base, with long hairs on the adaxial surface and stellate hairs on the abaxial surface, with

Figure 5. *Rubroshorea palosapis.* (A). A diameter at breast height of approximately 55 cm in 2021; only one individual of this species growing in this arboretum. (B). Bright leaves growing at the top of the plant. (C). Adaxial surface leaf, petiole 1.2 cm long, stipules long ovate, 18 mm long, 8 - 9 mm wide, persistent, and covered with stellate hairs. (D). Abaxial surface leaf, with approximately 18 pairs of lateral veins, raised prominently. (E). A naturally regenerated seedling approximately 40 cm in height on September 10, 2019, which grew to 150 cm by October 30, 2022.

18 pairs of lateral veins; petioles are 1.2 cm long, stout, and covered with stellate hairs. Only one individual survived the arboretum. In 1949, its diameter was 17 cm (Table 1), ranking first; however, in 2021 it reached a diameter of 55 cm (Figure 5(A)), lagging behind the second growing species *R. polysperma* (83.5 cm) (Figure 7), the annual growth rate was 1.64%. In 2019, a young seedling, with a height of approximately 40 cm, was found; in 2022, the plant height reached to 150 cm (Figure 5(E)).

4) *Rubroshorea polysperma* (Figure 2(C), Figure 6): branchlets are slender

Figure 6. *Rubroshorea polysperma.* (A), growing in 52 protective forests, with a diameter at breast height of approximately 100 cm in 2021. (B). *R. polysperma* regenerated an uneven-aged forest naturally in the 52 protective forest. (C). A plant with a diameter at breast height of approximately 83.5 cm was growing in this arboretum in 2021. (D). Inflorescence axillary or terminal on the branchlets, flowers lax cymose panicles, sepals 5, unequal, outer 3 larger and inner 2 smaller. (E). Fruits germinated and the root length about 4 - 5 cm found in the 52 protective forest. (F). Mature fruits. (G). Sprouting fruits with different root lengths. (A)-(C) was photographed on November 18, 2021. D was photographed on August 6, 2008. (E)-(G) was photographed on August 15, 2023.

and covered with short hairs. Leaves are oblong, 8 - 10 cm long, 3 - 4 cm wide, acute at the apex, rounded at the base, short-haired on the abaxial surface, 10 - 15 pairs of lateral veins, and abaxial surface convex; petioles are 0.8 - 1.2 cm long, and hairy. The inflorescence is axillary or terminal, in lax cymose panicles (**Figure 6(E)**), sepals are 5, unequal, outer 3 larger, and inner 2 smaller. Its diameter was 16 cm in 1949; 71 cm in 2008 (**Table 1**), and up to 83.5 cm in 2023 measured (**Figure 6(D)**), with an annual growth rate 2.32%. The number of seedlings reached approximately 180, around the arboretum trail, indicating that *R. polysperma* can regenerate. In 2022, the southwest area of the No. 2225 nature conservation protection forest, which occupies an area of approximately 0.33 ha, had an individual of approximately 100 cm in diameter (**Figure 6(A)**, **Figure 6(C)**) growing and establishing an uneven-aged forest (**Figure 6(B)**). This species can naturally regenerate in this habitat.

Based on the morphological characteristics of the four plants, we created a bracketed key for identification.

1) Stipules persistent, long ovate in shape……*Rubroshorea palosapis*
a) Stipules caducous, or without stipule……2
2) Branchlets without stipular scars……*Rubroshorea polysperma*
b) Branchlets with stipular scars……3
3) Leaf abaxial surface hairs……*Dipterocarpus gracilis*
c) Leaf abaxial surface glabrous……*Dipterocarpus grandiflorus*

4. Discussion

According to the IUCN Red List of Threatened Species [16], *D. gracilis* is native to Assam to W. & Central Malesia, Java Island, Indonesia, and listed as "Vulnerable"; *D. grandiflorus* is native to Bangladesh to Indo-China, W. Malesia to Philippines (NW. Luzon), and listed as "Critically Endangered"; *R. palosapis* is native to Philippines, and listed as "Least Concern"; and *R. polysperma* is native to Philippines and Caroline Islands, and listed as "Least Concern".

The DBH of the genus *Rubroshorea* (**Figure 7**) was approximately 50 cm or more, which was larger than that of the genus *Dipterocarpus* with a DBH of 30 cm over these growth period. The annual growth rates of these four dipterocarp species were different from 1949 to 1997, in which *D. gracilis and R. polysperma* were faster than others. From 1997 to 2021, the growth rates of each species gradually decreased (**Figure 8**), especially *D. gracilis* and *R. polysperma* declined significantly, but still faster than *D. grandiflorus*, and *R. palosapis*.

The Shuangxi tropical arboretum had existed for 88 years. Small seedlings have appeared under the *R. polysperma* forest, along the hiking trail, and natural seedlings of different ages were found near the southwest area of the No. 2225 protection forest, showing that *R. polysperma* (**Figure 6(B)** and **Figure 6(C)**) had a strong natural regeneration ability to establish its population abundance as well as to promote afforestation.

Only one individual of *D. gracilis*, *D. grandiflorus*, and *R. palosapis* survived,

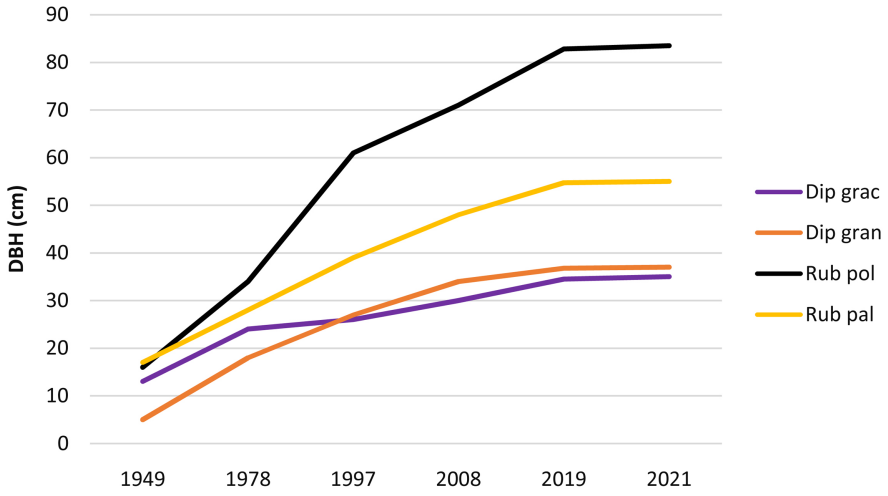

Figure 7. Changes in the diameters at breast height, of the four Dipterocarpaceae species in the Shuangxi arboretum, Meinong District, Kaohsiung City. Note: Dip grac: *Dipterocarpus gracilis*, Dip gran: *Dipterocarpus grandiflorus*, Rub pol: *Rubroshorea polysperma*, Rub pal: *Rubroshorea palosapis.*

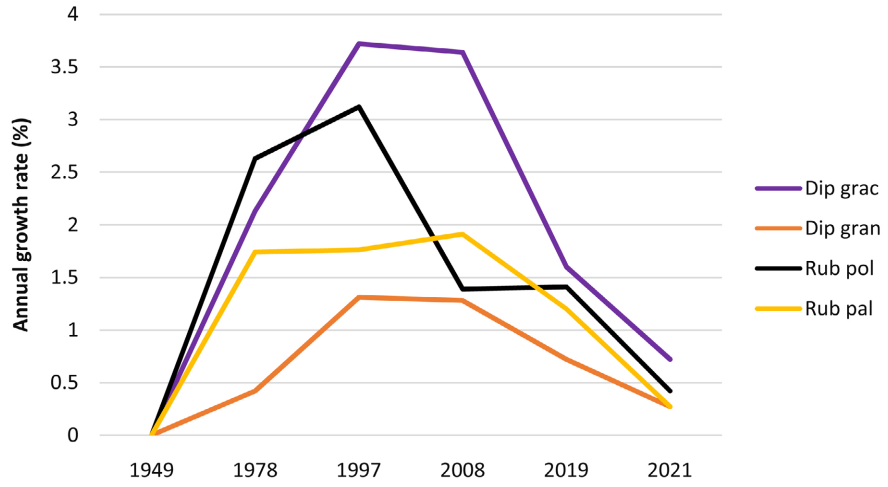

Figure 8. Annual growth rate of the four Dipterocarpaceae species in the Shuangxi arboretum, Meinong District, Kaohsiung City. Note: Dip grac: *Dipterocarpus gracilis*, Dip gran: *Dipterocarpus grandiflorus*, Rub pal: *Rubroshorea palosapis*, Rub pol: *Rubroshorea polysperma*.

with diameters of approximately 30 - 50 cm, under different growth condition. In 2022, mature fruits of *D. gracilis* germinated buds on the ground directly (**Figure 3(C)** and **Figure 3(E)**). [2] indicated the mature trees of *D. gracilis* were reduced as well as the genetic diversity decreased, and should be a priority evaluation in the in-situ and ex-situ conservation of genetic resources. So protecting the mature individual of this population in this arboretum are more valuable.

No seedlings were found for *D. grandiflorus* but few fruits were collected on the ground (**Figure 4(F)**). The viability of its seeds was short (3 - 5 days), and must be sown immediately [3]. So we guessed that why this species was still no seedlings developed on the ground. Currently, *D. grandiflorus* is listed as criti-

cally endangered due to massive deforestation and habitat loss. In addition, this species only blooms once every few years, and its reproduction speed is much slower than that of the deforestation rate. The natural regeneration seedlings were found for *R. palosapis*, but no fruits were collected. Wide spacing, waterlogged site and exposed bare soil generally influenced poor growth and survival of *R. palosapis* and its early growth could be hampered by high soil temperatures [4]. However, this species habitat in this arboretum differed from the above-mentioned growth condition, and regenerated seedlings well.

In summary, only four species survived in the Shuangxi tropical arboretum. The growth potential of these dipterocarp species had gradually declined, and the microhabitat of these four dipterocarp species appeared *Parkia roxburghii* G. Don., which grew faster and occupied the growth space of each other. This species was one of introduced plants and had regenerated naturally. Transplanting all the *P. roxburghii* seedlings to appropriate locations was essential to avoid competing for growth space and affecting the growth of the dipterocarp species, to prolong their life and let the new seedlings grow vigorously.

5. Conclusion

Dipterocarpaceae species were cultivated in the Taiwan Shuangxi tropical arboretum in 1935. This study aimed to assess their status and adaptability. The results showed that the diameter of *R. polysperma* reached approximately 100 cm, and its abundance increased significantly, showing that the growth speed of this species was faster; moreover, this species established an uneven-aged forest. A young seedling of *D. gracilis* developed, and some fruits germinated on the ground. No seedlings were found for *D. grandiflorus* and few mature fruits were collected, but young seedlings were observed for *R. palosapis*. Unlike in Southeast Asia, the Dipterocarpaceae species grew and regenerated naturally at these latitudes, especially *R. polysperma* for timber productions. Therefore, Taiwan should be considered as one distribution site for Dipterocarpaceae. Among these *D. gracilis* and *D. grandiflorus* have been listed as vulnerable and critically endangered species, respectively. Thus, the *Dipterocarpus* genus may be more deserving of protection. Therefore, planning to use the *Rubroshorea* genus for silviculture and promoting the sustainable timber usages of *R. polysperma* is very important. In the future, different species of Dipterocarpaceae can be introduced into the arboretum for experimentation, thus facilitating the timber production in Taiwan to gradually increase.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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