SOME BIOLOGICAL AND ECOLOGICAL CHARACTERISTICS OF *Callerya speciosa* (Champ.) Schot AS THE SCIENTIFIC BASIS FOR RARE AND VALUABLE MEDICINAL PLANT PRESERVATION

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SUMMARY

Callerya speciosa (Champ.) Schot is a valuable medicinal plant, used mainly in traditional medicine as a tonic, and for cough, fever, urinary retention treatment... In recent years, *Callerya speciosa* are being exploited massively resulting in decreasing gene sources. The study was carried out to study some morphological and ecological characteristics of *Callerya speciosa* in Hoanh Bo, Quang Ninh province and Son Dong, Bac Giang province. The research showed that *Callerya speciosa* was a species of erect shrub or climber - leaves irriparipinnate. Leaflets 3 - 11, irregularly ovoid, glabrous on both surfaces, margin entire, secondary nerves pinnate, apice acutes, base obtuses. The species is distributed mainly in rehabilitated forests, with an average elevation of 110 - 160 alt., tree component in forest conditions is reletively diverse; Shrubs and herbaceous carpet grow at average rate. At present, it is mainly exploited from nature and sold to collectors. In order to preserve and develop *Callerya speciosa*, apart from measures to prevent illegal devastative exploitation of natural resources, there should be measures to propagandize, raise awareness for officials, local people and visitors. In addition, it is necessary to study the creation of plant varieties, to promote the planting and promotion of natural regeneration in places where natural conditions are appropriate.

Keywords: *Callerya speciosa*, ecology, medicinal plant, morphology, preservation.

1. INTRODUCTION

Callerya speciosa (Champ.) Schot is a valuable medicinal plant, used mainly in traditional medicine as tonic, and for cough, fever, urinary retention treatment... (Vo Van Chi, 1997), so it is often exploited. For several years, it has been exploited in Bac Giang, Bac Kan, Cao Bang, Quang Ninh provinces for export across borders (Pham Thi Viet Hong, 2015). Due to the massive exploitation, the species resource in the provinces adjacent to the northern border fell sharply. Measures should be taken to control and restrict the exploitation of this medicinal plant species. At the same time, research for further planting on a large scale should be carried out.

At present, in the area of Hoanh Bo (Quang Ninh) and Son Dong (Bac Giang), *Callerya speciosa* is mainly exploited from nature and there is no study to raise and plant them. Therefore, we propose to implement the project "Some biological and ecological characteristics of *Callerya speciosa* as the scientific basis for rare and valuable medicinal plant preservation".

2. RESEARCH METHODOLOGY

The method mainly used was field interviews and surveys on transect lines and sample plots. The topic used traditional survey instruments used in forest inventory based on The Forestry Handbook (MARD, 2006).

Throughout the study period, two sites were surveyed on 8 routes and 5 sample plots were established in places where there were *Callerya speciosa*. To survey the species' market, the subject interviewed 100 households and some staffs at both research sites.

3. RESULT AND DISCUSSION

3.1. Morphological characteristics of *Callerya speciosa*

3.1.1. Morphological characteristics in the wild

From the survey results of the species's distribution network, in both study sites, we investigated that there were a total of 13 individuals distributed on 5 plots. After selecting the standard plants and described 6 of them, the morphological characteristics of the species were shown in table 1.

Table 1. Morphological characteristics of *Callerya speciosa*

CTC	Parasitic body		Root body (tuber)		Root		Leave				Leaflet	
	D_0 (cm)	Length (cm)	Length (cm)	Width (cm)	No of roo	Length (cm)	No of leave	Petiole (cm)	Length (cm)	Width (cm)	Length (cm)	Width (cm)
1	0.3	16	4	3	1	15	4	5.5	15	8.5	8.5	3.5
2	0.5	12	10	2.5	2	15	0	0	0	0	0	0
3	3	1500			>10		>20	10	37.5	18	13.5	3.5
4	1	>5m		3.5	>10		>20	6	33	17.5	14.3	4.4
5	1	22	30	1.7	2	160	4	7.5	23	13.5	12.5	5.2
6	1	220	35	1.5	1	180	>20	6.5	21.5	13.5	10.5	4

Callerya speciosa is a long climber, the stem near the root is grayish brown and smooth without hairs, the young stem is green and has a lot of soft hairs.

It has bulged roots turning to tubers; the size varies a lot, ranging from 3.5 x 1.5 - 35 x 1.5 cm; lean tubers with sweet taste, yellowish brown.

Leaves irriparipinnate, alternate; petiole is from 5.5 - 10 cm, with hairs; leave size is from 15 x 8.5 cm to 37.5 x 18 cm; leaftets 3 - 11, alternate, size from 8.5 x 3.5 to 14.3 x 4.4 cm, irregularly ovoid, glabrous on both surfaces, margin entire, secondary nerves pinnate, apice acutes, base obtuses (Figure 1).

Compared with the species description in the previous documents such as Vietnam Red Book (2007), leaves of *Callerya speciosa* are irriparipinnate with 7 - 17 leaflets, as can be seen in nature in the study area, the number of leaflets of the *Callerya speciosa* may be less, leaf size is also shorter and smaller than this in the previous publication (Vietnam Red Book 2007). This may be due to the fact that during the study, *Callerya speciosa* found are regenerated or young trees, morphology is much fluctuate.

Callerya spesiosa has simple raceme inflorescence, axillary or terminal, 10 - 20 cm long. Individual flowers are big size and located in inflorescence, rachis and sepals covered with yellowish brown hairs. Flower bisexual, sepals 5 and petals 5, unequal. Petal white with the big petal, glabrous and has scars in its both two sides. Ovary ovoid, one ovule (Figure 2). Fruit as a pod, flat, brown pupescent.

Figure 1. Leaves and tubers of *Callerya speciosa*

Figure 2. Flower of *Callerya speciosa*

3.1.2. Phenological characteristic of Callerya speciosa

Table 2. Phenological characteristic of *Callerya speciosa*

Month		1	2	3	4	5	6	7	8	9	10	11	12
Leaf bud appear		x	x										
Leave	Young leaves		x	x									
	Fallen leaves										x	x	x
Flower	Flower bud appear			x	x								
	Flowering					x							
	Start blooming					x	x						
	Blooming						x	x					
	Flowering ending							x	x				
Fruit	Young fruit								x				
	Mature fruit									x	x		
Seed	Young seed								x				
	Old seed										x	x	
	Seed falling											x	x

Based on the table above,we could know the growth and development characteristics of *Callerya speciosa*. From here it is possible to understand the variations such as the time of budding, leaf, flower, fruit... of the species annually to study the characteristics of the species in appropriate times and archieve the highest result.

3.2. Ecological characteristics of *Callerya speciosa*

3.2.1. Distribution

During the survey, individuals encountered were mainly regenerated individuals and those that had lost their tubers, leaving only the vines. The reserves of *Callerya speciosa* in the area were depleted, as a result of local people's

overexploitation and narrowing habitat. Regenerated individuals were often unevenly distributed on the ground, creating gaps, which were reflected in the implementation of the survey and the results of the study on the distribution of regenerated trees.

Table 3. *Callerya speciosa* density according to forest status

Plot	Status	Individual/Plot	Species density/ha	Growth rate
01	Rehabilitation forest IIa	3	60	Medium
02	Acacia plantation	4	80	Medium
03	Rehabilitation forest IIa	3	60	Medium
04	Rehabilitation forest IIa	1	40	Medium
05	Wood and bamboo mixed forest	2	40	Medium

Based on the table 3, it could be seen that the regeneration density of the species was very low, unevenly distributed. Individuals were found mainly in the location of the foothills and slopes of the study area with an average elevation of 110 - 135 m alt. and some have the cluster distribution therefore the bare forest ground has no regenerated trees, regeneration is mainly at the roots of the large trees.

3.2.2. Timber trees composition in distribution areas of Callerya speciosa

Based on the results of the study in two areas, we have synthesized the data of the tree species layer formation where there are *Callerya speciosa* in table 4.

Table 4. Timber trees composition in distribution areas of *Callerya speciosa*

Plot	Forest status	Location	Forest cover	Timber tree composition
01	Rehabilitation forest IIa	Slope	0.84	7.22Li + 0.56 VT + 0.56 Dg + 0.56 DB + 0.56 Mi + 0.56 Qu
02	Acacia plantation	Slope	0	0
03	Rehabilitation forest IIa	Foot	0.4	3.5TN + 1.7 De + 1.3TT + 1.3 KN + 0.9 ST + 1.3 LK
04	Rehabilitation forest IIa	Slope	0.2	1.82Dg + 1.82Tr + 1.82KX + 1.82Li + 0.91CM + 0.91TN + 0.9De
05	Wood and bamboo mixed forest	Slope	0.85	5.3Sp + 3.5TT + 0.4Li + 0.4Dg + 0.4Bu

In which:

Bu: *Garcinia oblongifolia*
CM: *Antidesma ghasembilla*
DB: *Prunus zippeliana*
De: *Xylopia vielana*
Dg: *Castanopsis indica*
Ke: *Acacia mangium*
KN: *Machilus sp*
KX: *Cinnadenia paniculata*
Li: *Erythrophleum fordii*
LK: Other species
Mi: *Artocarpus heterophillus*
Qu: *Cinnamomum cassia*
VT: *Endospermum chinense*
Sp: Unidentified species
ST: *Toxicodendron succedanea*
TN: *Cratoxylum polyanthum*
Tr: *Canarium album*
TT: *Aporosa microcalyx*

From the results in the table above, it could be seen that the species was distributed in the rehabilitation forest with simple tree composition.

One notable point is that three quarters of plotss had *Erythrophleum fordii*. *Callerya speciosa* was also often distributed near well-growing *Erythrophleum fordii* or climb on the broken tree. More research is needed on the relationship between these two species. In addition, the species often accompanied with *Callerya speciosa* including Litchee, Cinamon, Acacia...

3.2.3. Regenerated plants composition

Table 5. Regenerated plants composition in distribution areas of *Callerya speciosa*

Plot	Forest status	Location	Forest cover	Regenerated plants composition
01	Rehabilitation forest IIa	Slope	0.84	2.14Li + 2.14Qu + 2.14Dg + 1.43VT + 1.43Ng + 0.72Ga
02	Acacia plantation	Slope	0	10Ke
03	Rehabilitation forest IIa	Foot	0.4	3.7Tđg + 1.2Mgt + 1ST + 0.7Li + 0.6De + 0.5KN + 0.5TN + 1.8LK
04	Rehabilitation forest IIa	Slope	0.2	2.9Dg + 1MCK + 0.9Tđt + 0.6Tr + 0.6MĐ + 0.6XĐ + 3.4LK
05	Wood and bamboo mixed forest	Slope	0.85	2.8Tđt + 1.4Tđg + 1De + 1ThT + 0.9SM + 2.9LK

In which:

De: *Xylopia vielana*
Dg: *Castanopsis indica*
Ga: *Anthocephalus indicus*
Ke: *Acacia mangium*
KN: *Machilus sp*
Li: *Erythrophleum fordii*
LK: Other species
MCK: *Microcos paniculata*
MĐ: *Archidendron clypearia*
Mgt: *Cryptocarya sp*
Ng: *Gironniera subaequalis*
Qu: *Cinnamomum cassia*
SM: *Madhuca pasquieri*
ST: *Toxicodendron succedanea*
Tđg: *Ardicia sp1*
Tđt: *Ardicia sp2*
TN; *Cratoxylum polyanthum*
ThT: *Ailanthus triphysa*
Tr: *Canarium album*
VT: *Endospermum chinense*
XĐ: *Prunus arborea*

It is possible to see the composition of regenerated species in plots were quite diverse, the average height was 1.5 - 2 m. The composition of regenerated trees in the study sites are quite abundant, the number of species is small but the species density is quite large (Table 5). The dominant species were *Erythrophleum fordii*, *Cinnamomum cassia*, *Castanopsis indica*, *Ardicia sp*….

3.2.4. Shrubs and herbaceous plants composition

Table 6. Shrubs and herbaceous plants composition in distribution areas of *Callerya speciosa*

Plot	Forest status	Location	Forest cover	Shrubs and herbaceous plants composition	Average height	Growth
01	Rehabilitation forest IIa	Slope	35%	Fern, *Callerya speciosa*, *Psychotria reevesii*… other grass	1 - 1.5 m	Medium
02	Acacia plantation	Slope	0	No		
03	Rehabilitation forest IIa	Foot	70%	Fern, *Psychotria reevesii,* other grass	0.5 - 1 m	Medium
04	Rehabilitation forest IIa	Slope	75%	Fern, *Psychotria reevesii, Calamus sp*, other grass	0.3 - 1 m	Medium
05	Wood and bamboo mixed forest	Slope	27.5%	Fern, *Psychotria reevesii, Calamus sp*, *Indosasa sinica,* other grass	0.5 - 1 m	Medium

Based on the table 6, it can be seen that the composition of the shrubs and herbaceous plants is quite diversified, with average height of less than 1m and medium growth.

3.2.5. Soil condition

We have conducted ground excavation in the distribution plots of *Callerya speciosa*, the results showed that the mechanical components mainly sandy loam, weak and heavy soils… the proportion of stone is quite low only from 10 - 20%.

Plot 02 has been burned in recent years to plant acacia, so there is no humus on the griund surface, mostly weak and medium soils, and quite a lot of nutrients so *Callerya speciose* individuals in Plot 02 were very well

developed and larger than any other plots.

The remaining plots were *Erythrophleum fordii* forest plantation, rehabilitation forests, almost reaching natural forests, so the mechanical components had humus, the soil is quite porous

3.3. *Callerya speciosa* market

Households interviewed were mainly forest owners who were contracted by the State and people working in the forest. For many generations, the main job of the local people was resource exploitation from the forest, some households contracted to forests could excersise forest planting and exploitation of Non Timber Forest Products (NTFPs). In both areas, the medicinal plants are heavily exploited, the values that the forest exploitation brings were quite high. Along with other forest products, the exploitation of *Callerya speciosa* for sale also gives people a considerable income.

According to people, depending on the quality and size of the bulb, traders can buy fresh *Callerya speciosa*'s root at prices from 30,000 - 100,000 VND/kg.

On some forums about medicinal plants, it is being offered for about 200,000 - 400,000 VND/kg fresh.

This species is mainly freshly saled. In recent years, the demand for it increased rapidly and the rate of exploitation increased, resulting in the consequence of the medicinal plant resources decline sharply. Natural *Callerya speciosa* has become very rare, so the finding this species has become very difficult.

In the area of Hoanh Bo, Quang Ninh province, the forest is mainly contracted to households, so when people go to exploit the species, or other non-timber forest products, almost no penalty was made. Therefore, the exploitation of *Callerya speciosa* in the recent years has been almost open.

For the area of Khe Ro in Tay Yen Tu Natural Reserves (NR), although the area is under the control of the NR, the local people's exploitation of NTFPs is relatively difficult to control and with low efficiency. In addition, local people still have a tradition of exploiting NTFPs, especially medicinal plants in the forest, including *Callerya speciosa*.

Survey data show that up to 90% of households are involved in collecting *Callerya speciosa* in the forest. The parts collected mainly were tubers, stems, possibly whole plants.

After harvesting, *Callerya speciosa* is sold to traders who also buy many other medicinal plants. Some local people say that local medicinal plants are sold to China where there is a high demand for rare and valuable natural medicines plants of Vietnam.

3.4. Some solutions to preserve *Callerya speciosa*

3.4.1. Assessment of species preservation

- 65% of households interviewed said that the reserves of *Callerya speciosa* in the wild is only about 5 - 20% compared with the reserve 10 years ago.
- 65% of households think that in the next 10 years, *Callerya speciosa* will be very rare, and 35% of those do not think so.
- Solution: 80% of households think that it had to be re-planted, 10% of those think it should be harvested in the right way and 10% think that it is strictly forbidden to exploit to conserve the species.
- Assessment of management status for the species: the people think that the management is still loose, not highly effective.

3.4.2. Planting and preservation situation of Callerya speciosa

- Almost all households interviewed did not plant *Callerya speciosa*.
- Place for seed collection: The seed is collected in natural forests. People dig their roots and plant them under a tree in the garden.
- Breeding needs: According to the survey data, only some households have planted *Callerya speciosa* in the garden, while the remaining ones considered it unnecessary and can be exploited if necessary. In addition, some households said that *Callerya speciosa*

is not commonly used so it is not known how to grow.

3.4.3. Some preservation solutions

The results of this research have shown that *Callerya speciosa* is in danger of extinction in the study area. The main reason is that the species had been heavily exploited but its regeneration is very difficult due to lack of seed source. Consequently, conservation measures in these areas on the one hand must include measures to limit or prevent illegal exploitation, on the one hand, to strengthen or promote the regeneration of the species under the forest canopy. In addition, it is necessary to apply the cloning method to develop better. Based on the analysis of research results obtained and consultation with management staff, technical staff and local people, the following solutions have been developed:

- Strengthen the management and protection of forests and to identify all ecological distribution areas of Callerya species to be used for local species conservation planning.

- Further raise awareness on biodiversity conservation and conservation of *Callerya speciosa* for cadres and civil servants in the area.

- Strengthen the propaganda and education to raise awareness of conservation in general and conservation of *Callerya speciosa* in particular for people in the buffer zone and tourists.

- Develop *Callerya speciosa* plantation forest in the buffer zone or areas with similar site conditions. At the same time promote natural regeneration where it is present.

- Further research is needed to propagate cloning of the species for conservation and provide good quality seedlings for local people to develop valuable medicinal plant sources.

4. CONCLUSION

The study has been carried out to study some morphological and ecological characteristics of *Callerya speciosa* in Hoanh Bo, Quang Ninh province and Son Dong, Bac Giang province. The study showed that the morphology of the young and regenerated trees is different from that described in the previous documents. The species is distributed in the forest where the restoration is quite diverse, regenerated layer and fresh carpet is quite rich. The soil has the mechanical components from weak to heavy soil. Today, this species is mainly exploited for sale to traders in China.

In order to preserve and develop Catba, besides measures to prevent illegal exploitation natural resources, there should be measures to propagandize and raise awareness for conservation staff, residents and visitors. In addition, it is necessary to study the creation of plant varieties, to promote the planting and promotion of natural regeneration in places where natural conditions are appropriate.

REFERRENCES

1. Ministry of Science and Technology, Vietnam Academy of Science and Technology (2007). *Vietnam Red Book, Part II - Plants.* Natural Science and Technology Publishing House, Hanoi.

2. Ministry of Agriculture and Rural Development (2000). *Name of Vietnam forest trees*. Agricultural Publishing House, Hanoi.

3. Vo Van Chi (1997). *Dictionary of medicinal plants in Vietnam.* Medical Publishing House.

4. Vo Van Chi (2003). *Dictionary of Popular Plants, Volume 1.* Science and Technology Publishing House.

5. Pham Hoang Ho (1993). *An Illustrated Flora of Vietnam, Volume I.* Youth Publishing House.

6. Pham Thi Viet Hong (2015). *Study on botanical characteristics and chemical composition of Callerya genus collected in Bac Giang.* PhD thesis, Hanoi University of Pharmacy.

7. Le Thi Thanh Huong, Tran Thi Ngoc Anh, Nguyen Thi Ngoc Yen, Nguyen Trung Thanh, Nguyen Nghia Thin (2012). Study on the status of rare medicinal plants in Thai Nguyen province. Vietnam National University *Journal of Science, Natural Science and Technology* 28 (2012), pp. 173-194.

8. Tran Dinh Ly (1993). *1900 useful species in Vietnam.* Statistical Publishing House.

NGHIÊN CỨU MỘT SỐ ĐẶC ĐIỂM SINH VẬT HỌC, SINH THÁI HỌC LOÀI CÁT SÂM (*Callerya speciosa* (Champ.) Schot) LÀM CƠ SỞ KHOA HỌC CHO BẢO TỒN LOÀI CÂY THUỐC QUÝ HIẾM

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TÓM TẮT

Cát sâm (*Callerya speciosa* (Cham.) Schot) là cây thuốc quý, được sử dụng chủ yếu trong y học cổ truyền làm thuốc bổ, chữa ho, sốt, bí tiểu tiện… Trong những năm gần đây, Cát sâm đang bị khai thác ồ ạt dẫn đến nguồn gen bị suy giảm mạnh. Bài viết là tóm tắt kết quả nghiên cứu về một số đặc điểm sinh học và sinh thái học loài Cát sâm tại khu vực Hoành Bồ, tỉnh Quảng Ninh và Sơn Động, tỉnh Bắc Giang. Qua nghiên cứu cho thấy Cát sâm là loài dây leo thân gỗ, có rễ củ phình to; lá kép lông chim một lần lẻ, có từ 3 - 11 lá chét, lá chét hình trứng hoặc hình trái xoan thuôn dài, 2 mặt đều phủ lông mềm màu trắng, mép lá nguyên, hệ gân lông chim nổi rõ mặt sau, đầu lá nhọn, đuôi tròn hơi lệch. Cát sâm phân bố chủ yếu ở các trạng thái rừng phục hồi, có độ cao trung bình từ 110 - 160 m, tổ thành loài cây gỗ ở các trạng thái rừng tương đối đa dạng; Cây bụi thảm tươi sinh trưởng ở mức trung bình. Hiện nay cây Cát sâm chủ yếu được khai thác từ tự nhiên và bán tươi cho các người thu mua. Để bảo tồn và phát triển loài Cát sâm, bên cạnh những biện pháp ngăn chặn tình trạng khai thác trái phép, khai thác cạn kiệt nguồn tài nguyên, cần có những biện pháp tuyên truyền, nâng cao nhận thức cho cán bộ, người dân và du khách. Ngoài ra, cần nghiên cứu tạo giống cây, khuyến khích gây trồng, xúc tiến tái sinh tự nhiên ở những nơi có điều kiện tự nhiên thích hợp.

Từ khóa: Bảo quản, *Callerya speciosa*, cây thuốc, hình thái học, sinh thái học.

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