MORPHOLOGY AND MICROANATOMY DESCRIPTION OF BỒNG NGA TRUẬT, OR FINGERROOT, (*Boesenbergia rotunda* (L.) Mansf) COLLECTED IN KIEN GIANG PROVINCE

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ABSTRACT

Background: *Bồng Nga truật, or Fingerroot, (Boesenbergia rotunda (L.) Mansf syn. Boesenbergia pandurata (Roxb.) Schltr.), also known as Ngải bún, is a common ginger species in Mekong Delta. Its tuber roots and rhizomes are often used to cook rice noodles as an alternative to Tumeric (Curcuma longa L.). Despite being used commonly in Indonesia and Thailand, the plant has not been used and researched as a herb in Vietnam. This research was for starting projects to increase the value of this species.* ***Objectives:*** *This study was to primarily describe morphological and microanatomical figures of Bồng Nga truật, together with characteristic figures in rhizome and tuber root powder.* ***Materials and methods:*** *The whole plant of Fingerroot, including rhizomes and tuber roots, was collected in Giong Rieng, Kien Giang. A portion of rhizomes and tuber roots was then cleansed and basked to dry in December 2019. Fresh samples were used for the microanatomy study, dried sample was pulverized for the powder study. All of the observations were done following general instructions in Vietnam Pharmacopoeia V.* ***Results:*** *The study described botanical figures of Bồng Nga truật sample in Giong Rieng, Kien Giang, including morphology, microanatomy of whole plant and characteristic particles in Bồng Nga truật rhizome and tuber root powders. The plant had common figures of Zingiberaceae and looked similar to Tumeric except for leaf sheath bases, flowers, and particular palmated tuber shapes. Microanatomy of leaf veins and leaf blades was characterized by large sub-rectangle secretory vesicles, V-shaped vascular bundles reinforced by hardened tissues on both sides. Rhizome and tuber root microanatomy were not specific. However, tubers of Fingerroot were more likely tuber root than colonial rhizome as referred. Similarly, particles found in powder samples were common among Zingiberaceae species.* ***Conclusions:*** *The sample has common morphological figures compared with one in Malaysia, and common figures of Zingiberaceae.*

Keywords: *Ngải bún, Bồng Nga truật, Boesenbergia, figures, powder.*

I. INTRODUCTION

Bồng Nga truật, whose English name is Fingerroot, (*Boesenbergia rotunda* (L.) Mansf *syn. Boesenbergia pandurata* (Roxb.) Schltr.) is a common ginger species in the Mekong Delta. It is also called "Ngải bún" because it is commonly used to cook rice noodles as an alternative to Tumeric (*Curcuma longa* L.). It was used in Indonesia and Thailand as remedies to treat inflammatory diseases such as rheumatism, muscle pain, febrifuge, gout, dental caries, dermatitis, dry cough, cold, swelling, wounds…; gastrointestinal disorders such as flatulence, stomach ache, dyspepsia, and peptic ulcer, diarrhea, and dysentery. It can also be used as a diuretic, a tonic for women after childbirth, a beauty aid for teenage girls, an aphrodisiac and to prevent leukorrhea [1], [2], [3]. Within modern methodologies, many substances were isolated from Fingerroot, mostly flavonoids and essential oil [3]; and several activities of Fingerroot were confirmed, including anti-inflammation, antiparasitic, antifungal, antiviral, inhibition of intestinal biofilm formation, antioxidant, anti-glycation, anti-hyperlipidemic, antiulcer, antitumor, wound healing, aphrodisiac, and reproduction enhancement [3], [4], [5], [6], [7]. However, it was not mentioned as a medicinal herb in Vietnamese books on medicinal materials, and a limited number of research was done on it in Vietnam. Trung Nhan Nguyen et al. (2020) established pinostrobin as a reference standard for quantitative analysis [8]. This study described the morphology and micro-anatomy of this species as an initiation for prolonged projects.

II. MATERIALS AND METHOD

2.1. Materials

Rhizomes and tuber roots of Fingerroot were collected in Giong Rieng, Kien Giang, then cleaned and basked to dry in December 2019. Samples were identified by comparing morphological features with the descriptions in the referred article.

2.2. Research method

Morphology figures were described before collection. Microanatomy samples were prepared from fresh plant samples, according to the method described in Vietnam Pharmacopeia, 2018 edition, Appendix 12.18. The dried rhizome and tuber samples were ground into fine powders. Microanatomy samples and powders were observed via Olympus CX21FS1 (Japan). All were done at the Pharmacognosy laboratory in Tay Do University.

III. RESULTS

3.1. Morphology characteristics

The plant was herbaceous, about 30 – 50 cm high. Fake stems were made of leaf sheaths, 15 – 25 cm long, and colors changed gradient from light green on top to orange and to red at the bottom, each shoot carried 3-5 single leaves.

Figure 1. Whole plant Fingerroot (*Boesenbergia rotunda* (L.) Mansf)

Figure 2. Leaves of Fingerroot

1 – 2 flowers were hidden at the base of foliage. Calyx formed a light pink tube, where petals were attached. Petals were violet pink, one made up a small lip and the others made a large lip.

Figure 3. Flowers of Fingerroot

Rhizomes are sub-globular or cone-shaped, from which tubers grow downward like fingers. References indicated tubers are also rhizomes, but they are more likely tuber roots.

Figure 4. Rhizomes and tuber roots of Figerroot

3.2. Microanatomy

3.2.1. Leaves

The leaf vein cross-section was arc-shaped, with the downside convex, and upside concave; both side epidermis consisted of 1 layer of sub-rounded cells, scattered with small non-glandular and glandular hairs. Parenchyma consisted of sub-rounded cells, larger in the center; scattered with V-shaped vascular bundles, phloem upside, and xylem downside. The most downside bundles were reinforced with lignified hardened tissues. Large cell division-induced secretory vesicles were formed downside, covered by compressed cells, containing starch granules.

The leaf blade had the same structure as the leaf vein and did not contain palisade tissue. Most of the important tissues gathered in the middle, including a thin band made of

a few layers of small cells containing chloroplasts, V-shaped vascular bundles reinforced by hardened tissues, downside in young veins, and both sides in elder veins, secretory vesicles were smaller to disappeared outward.

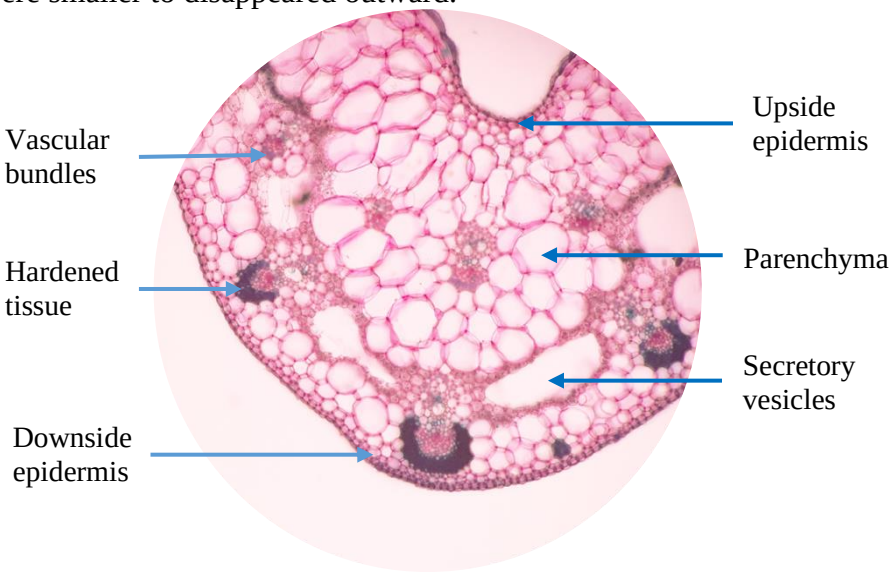

Figure 5. Microanatomy of main leaf vein of Fingerroot

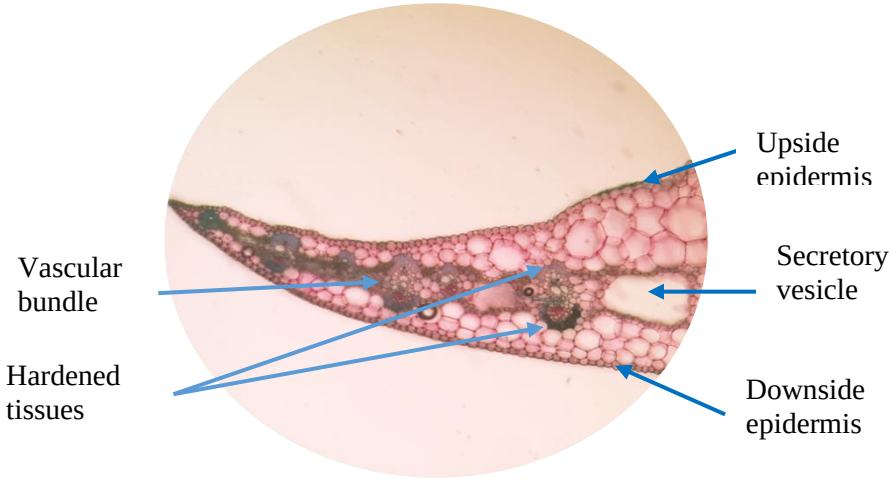

Figure 6. Microanatomy of leaf blade of Fingerroot

3.2.2. Tuber roots

Microanatomy pictures of Fingerroot tubers indicated the structure of a Liliopsida plant root rather than a rhizome. The epidermis consisted of a 5-layer suberoid, scattered with plenty of glandular and non-glandular hairs. Then, thick cortical parenchyma was made of large sub-rounded cells, scattered with glandular cells containing essential oil and lignified cells, which were more common toward the inside than outside. The core was separated by an endoderm. Centripetal xylem vessels and sieve tubes were interspersed along the endoderm. The main difference between microanatomy of young and elder tuber roots was that there were more lignified cells and they were distributed more broadly to the cork and the core.

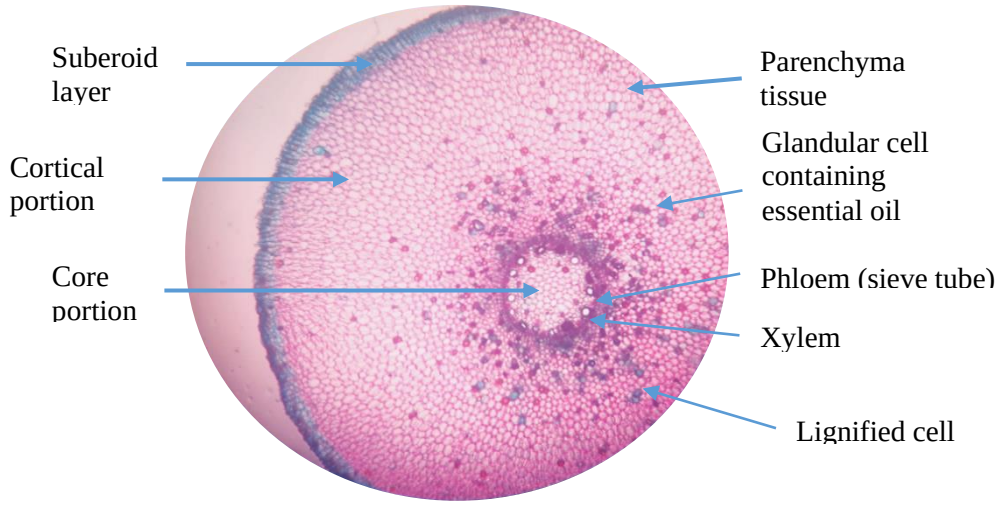

Figure 7. Microanatomy of young Fingerroot tuber roots

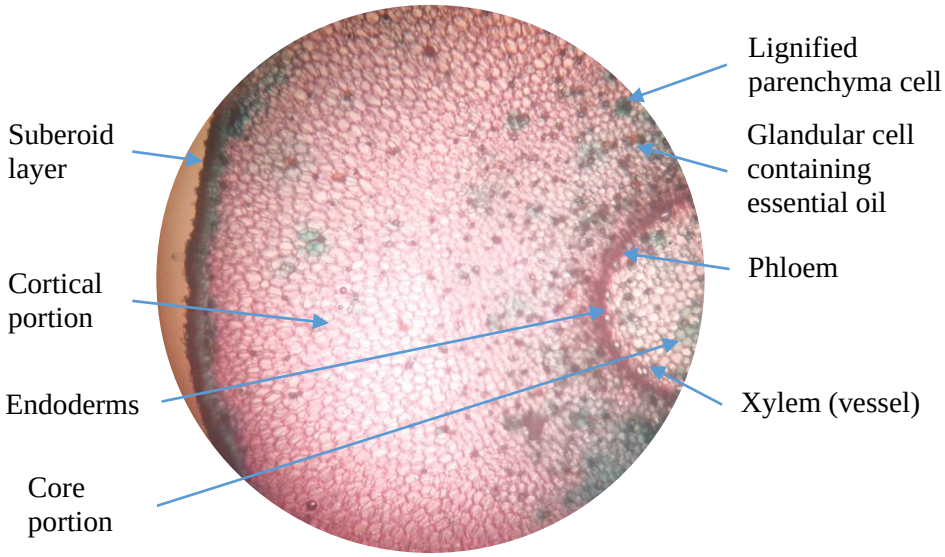

Figure 8. Microanatomy of elder Fingerroot tuber roots

3.3.3. Rhizome

Fingerroot rhizome microanatomy structure was typical of Liliopsida plants. Two main differences from the tuber root microanatomy were that: firstly, the cork portion was thin, and the core portion was thick; then, vascular bundles were not interspersed but scattered. The most out was suberoid epidermis. Cortical parenchyma cells were mostly lignified, sub-rounded, larger outside and smaller toward endoderms, scattered with glandular cells containing essential oil. Endoderm consisted of lignified cells and seemed thicker. The thick core portion was scattered with vascular bundles, the outer portion was full of glandular cells containing essential oil, and the inner portion was crowded with lignified cells.

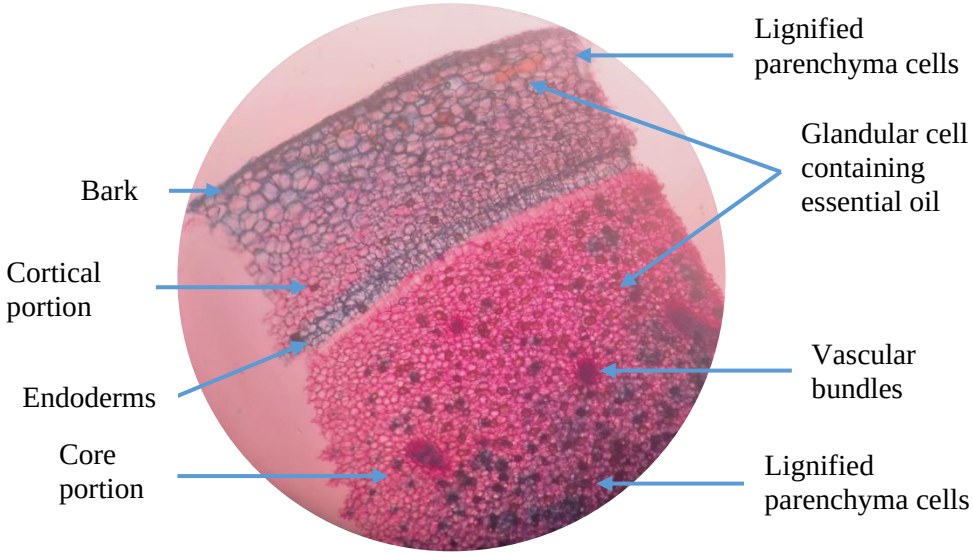

Figure 9. Microanatomy of Fingerroot rhizome

3.3. Powder analysis

In corresponding to microanalysis, dried rhizome, and tuber root powders provided the same set of typical particles, shown in Figures 10, 11, and 12 below:

Figure 10. Cork fragment, Parenchyma fragment, and Endoderm fragment

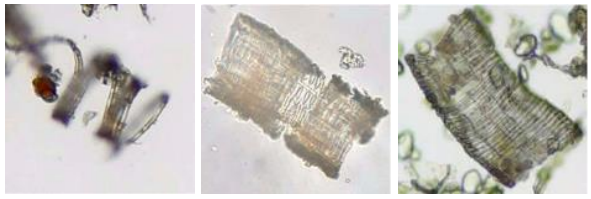

Figure 11. Helix xylem fragment, Matrix xylem fragment, Unclear xylem fragment

Figure 12. Bell-shaped starch granules, Fiber tissue, Coloured resin particle

IV. DISCUSSION

Fingerroot samples from Giong Rieng, Kien Giang had the same morphology characteristics as the ones described in references [3]. However, while the reference called fingerroot tubers as colonial rhizomes, the microanatomy results indicated that they were tuber roots rather than rhizomes. Besides, microanatomy and powder analysis results

showed common characteristics of Zingiberaceae plants. Leaves had separated downside vascular bundles reinforced by hardened tissues, tuber roots had interspersed xylem and phloem bundles, and rhizomes had scattered vascular bundles. There were scattered essential oil-containing cells and an accumulation of lignified cells around the endoderm in tuber roots and rhizomes.

V. CONCLUSION

The study described morphology and microanatomy characteristics of Fingerroot samples collected in Giong Rieng, Kien Giang, Viet Nam. Microanatomy results suggested that colonial tubers of Fingerroots were tuber roots, rather than rhizome. Although people usually use entire rhizomes and tuber roots of Fingerroot, microanatomy suggested that rhizomes had more essential oil and potential pungent flavor. Moreover, while young tuber roots seemed to have more essential oil-containing cells than elder tuber roots, it is necessary to study further for usage potency because Fingerroot's bioactivities come from both essential oil and flavonoid contents.

REFERENCES

1. Organization, W. H., Traditional medicine in Asia. WHO Regional Office for SEA. 2002.
2. Chuakul, W. and Boonpleng, A. Ethnomedical uses of Thai Zingiberaceous plant (1). 2003.
3. Eng-Chong, T., Yean-Kee, L., Chin-Fei, C., Choon-Han, H., Sher-Ming, W., et al. *Boesenbergia rotunda*: from ethnomedicine to drug discovery. *Evidence-Based Complementary and Alternative Medicine*. 2012. 201. https://doi.org/10.1155/2012/473637.
4. Ongwisespaiboon, O. and Jiraungkoorskul, W. Fingerroot, *Boesenbergia rotunda* and its aphrodisiac activity. *Pharmacognosy Reviews*. 2017. 11(21), 27. https://doi.org/10.4103%2Fphrev.phrev_50_16.
5. Rosdianto, A. M., Puspitasari, I. M., Lesmana, R. and Levita, J. Bioactive compounds of *Boesenbergia sp*. and their anti-inflammatory mechanism: A review. *Journal of Applied Pharmaceutical Science*. 2020. 10(7), 116-126. http://dx.doi.org/10.7324/JAPS.2020.10715.
6. Wang, T., Liu, C., Shu, S., Zhang, Q. and Olatunji, O. J. Therapeutic efficacy of polyphenol-rich fraction of *Boesenbergia rotunda* in diabetic rats: a focus on hypoglycemic, antihyperlipidemic, carbohydrate metabolism, antioxidant, anti-inflammatory and pancreato-protective activities. *Frontiers in Bioscience-Landmark*. 2022. 27(7), 206. https://doi.org/10.31083/j.fbl2707206.
7. Yotarlai, S., Chaisuksunt, V., Saenphet, K. and Sudwan, P. Effects of *Boesenbergia rotunda* juice on sperm qualities in male rats. *Journal of medicinal plants research*. 2011. 5(16), 3861-3867.
8. Nguyen, T. N., Do Van, N. T., Do, T. P. A. and Nguyen, T. T. M. Establishing pinostrobin reference standard for quantitative analysis of the rhizomes of *Boesenbergia pandurata*. *VNUHCM Journal of Natural Sciences*. 2020. 4(4), 901-909. https://doi.org/10.32508/stdjns.v4i4.948.