# ヤマモモ科 Myrica esculenta Buch.-Ham. Ex D. Don の樹皮の内部形態およびアーユルヴェーダ生薬"KAPHAL BOKRA" および"KATPALA POTHU"の基原



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# Anatomical Study of the Bark of *Myrica esculenta* Buch.-Ham. ex D. Don (Myricaceae) and the Botanical Origin of Ayurvedic Crude Drug "KAPHAL BOKRA" and "KATPALA POTHU"

御影雅幸*・近藤直子*・鈴木三男**：ヤマモモ科 *Myrica esculenta* Buch.-Ham. ex D. Don の樹皮の内部形態およびアーユルヴェーダ生薬 "KAPHAL BOKRA" および "KATPALA POTHU" の基源

**Abstract**

In the course of the anatomical studies of the bark of woody plants in Nepal, the bark of *Myrica esculenta* Buch.-Ham. ex D. Don, the only wild species in the country of the Family Myricaceae, was studied.

The bark of *M. esculenta* is said to be used as an Ayurvedic crude drug, and together with *M. rubra* Sieb. et Zucc., the bark is also utilized in Chinese medicine. Therefore, the study for confirming the botanical origin of two Ayurvedic crude drugs and one Chinese drug assumed to be the bark of *Myrica* species was also carried out.

As a result, the bark of *M. esculenta* and *M. rubra* was clearly distinguished by the differences of figures of sclerenchyma cells or idioblasts, shape of ray tissue, and diameters of fibers. An additional study of the correlation between the thickness of the bark and the diameter of the trunk showed that the bark of *M. esculenta* was 2 to 4 times thicker than that of *M. rubra* of same trunk size. Besides, it was proven that both KAPHAL BOKRA, an Ayurvedic crude drug circulating in Nepalese markets, and KATPALA POTHU in Sri Lankan markets are the bark of *M. esculenta*, peeled off from the trunk of 5 to 20 cm in diameter, additionally the YANG MEI PI produced in China as the bark peeled off from the trunk of *M. rubra* with the diameter of 10 to 25 cm.

**Key words**: *Myrica esculenta*, *Myrica rubra*, bark anatomy, KAPHAL BOKRA, KATPALA POTHU.

As to anatomical studies of woody plants, the woody part has been observed rather than bark, though it is considered that the bark also has a lot of taxonomical and ecological informations. This tendency is assumed to be originated in the differences of value in use, namely, the wood is more worthy as building materials, wood pulp, etc., than bark. On the other hand, as the herbal medicines, the bark is more important than woody part. It may be apparent from the fact that the bark contains more chemical constituents than wood or mechanical tissue. This may be the reason why the bark anatomy has been studied mainly in the pharmacognostical field up to now.

In the present paper, the bark of *Myrica esculenta* Buch.-Ham. ex D. Don of the family Myricaceae was studied in the course of the anatomical studies of the bark of woody plants in Nepal. On the other hand, the bark of this genus has been utilized as the remedies for diarrhea, asthma, bleeding and so on all over the world. Therefore, intending to make interdiscriplinary research, pharmacognostical studies for confirming the botanical origin of the crude drug derived from the bark of *Myrica* species are also

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done.

The genus *Myrica* consists of about 30 species (Ohwi 1965), and the only species listed above is growing wild in Nepal (Hara *et al.* 1982).

The bark of this species is well known as a remedy in Ayurveda, the Indian traditional medical system, and also in Yunani, the Arabic medicine (Kirtikar *et al.* 1935). The crude drugs both KAPHAL BOKRA purchased in Nepal and KATPALA POTHU in Sri Lanka were assumed to be the bark of this species (Banerji 1955; Manandhar 1980; Dept.of Medicinal Plants 1970; Attygalle 1917). Besides, in Chinese traditional medicine, the bark of *M. rubra* Sieb. et Zucc. has been said to be used under the name of YANG MEI PI 〔楊梅皮〕 or YOH BAI HI in Japanese, and also the bark of *M. esculenta* locally in Yunnan Prov. (Jiang-su-xin-yi-yuan 1977). Of the four *Myrica* species growing wild in China, the two listed above have big trunk and thick bark as like as crude drug YANG MEI PI, while others are shrubs and have thinner bark (Kuang *et al.* 1979). Therefore, the latter two species are not likely to be the botanical origin of the crude drug in China. The botanical origins of these drugs; KAPHAL BOKRA, KATPALA POTHU, YANG MEI PI, have not clarified yet except the drug produced in Japan, which was confirmed anatomically as the bark of *M. rubra* (Munesada 1932). However, since no measured value was presented in the report by Munesada, it is difficult to make sure of the diagnostics among *M. esculenta* and *M. rubra*. Therefore, the supplementary data on *M. rubra* will be also given in the present paper. Additionally, the correlation between bark thickness and trunk diameter is studied to estimate the diameter of trunk from which the bark, or the crude drugs, peeled off.

## Experiments

**1. Materials** (all the materials are stored in the Faculty of Pharmaceutical Sciences, Kanazawa University 〔KANP〕)

1) *Myrica esculenta*—(Nepal) Dailekh Distr., Bheri Zone, M. Suzuki *et al.* 9194042; Godawari Bot. garden, Kathmandu, M. Suzuki *et al.* 9263261, S. Noshiro 9263262; Kaski Distr., Gandaki Zone, M. Mikage *et al.* 932008; Myagdi Distr., Dhaulagiri Zone, M. Mikage *et al.* 932049; Nawakot Distr., Bagmati Zone, M. Suzuki *et al.* 9460010 and 9460021. Lamjung Distr., Gandaki Zone, H. Ohba *et al.* 8340387, for wood anatomy.

2) *Myrica rubra* (Jap. Name: Yamamomo) —(Japan) Shingu-shi, Wakayama Pref., M. Mikage *et al.* 1, 3, 6, 8~11, 13, 17, 18; Akatsukayama, Toyokawa-shi, Aichi Pref. M. Mikage *et al.* 61, 63, 66, 70~72; Yawatano, Ito-shi, Shizuoka Pref., M. Mikage *et al.* 76, 78~82; Is. Iriomote, Yaeyama-gun, Okinawa Pref., M. Suzuki 604.

3) KAPHAL BOKRA circulated in Kathmandu, Nepal— 〔KANP—1602〕,a purchase from Gyan Man Jagat Hitman Singha, Aug. 1991; 〔KANP-1280〕(KAFAL BOKRA), id., Sept. 1991; 〔KANP-N 61〕(KAFAL BOKARA), from A. K. Shakya & N. K. Shakya, 1986.

4) KATPALA POTHU circulated in Colombo, Sri Lanka— 〔KANP-2210〕, a purchase from W. Wilbert Co., May 1993.

5) YANG MEI PI produced in China—〔KANP-2004〕, a gift from Tochimoto-tenkaido, Osaka, May 1992.

**2. Inner structures**

1) *Myrica esculenta* (Figs. 1, 3—A)

(*in transverse section and macerated material*)

The bark is 2 to 27 mm thick. The cork layer, the outermost layer, 200 to 3500 μm thick, consists of alternate layers of thin walled cells and U-shaped thickened cells measuring 35 to 60 μm wide. The phelloderm is unclear. Many sclerenchyma cells and idioblasts of 60 to 400 μm long appear mainly in outer part of the cortex arranging tangentially and sometimes radially (Fig. 1-$B_2$). The secondary phloem rays consisting of 2 to 4 parenchyma cell layers narrowly run up to 1/3 to 2/3 in the bark, that is undilated rays (Fig. 1-A). The ray parenchyma cell measures 40 to 75 μm long. The fiber bundles consisting of several fibers with diam. of 23 to 54 μm and length of 360 to 1030 μm appear in the phloem. In the thick bark, parenchymatous layers invade tangentially in the phloem, and sclerenchyma cells gradually appear in this tissue (Figs. 1-$A_2$, $B_3$).

(*in tangential section near cambium*) Some rays appear in fusiform with 2 to 6 cells wide, and some in linear with single cell line. Procum-

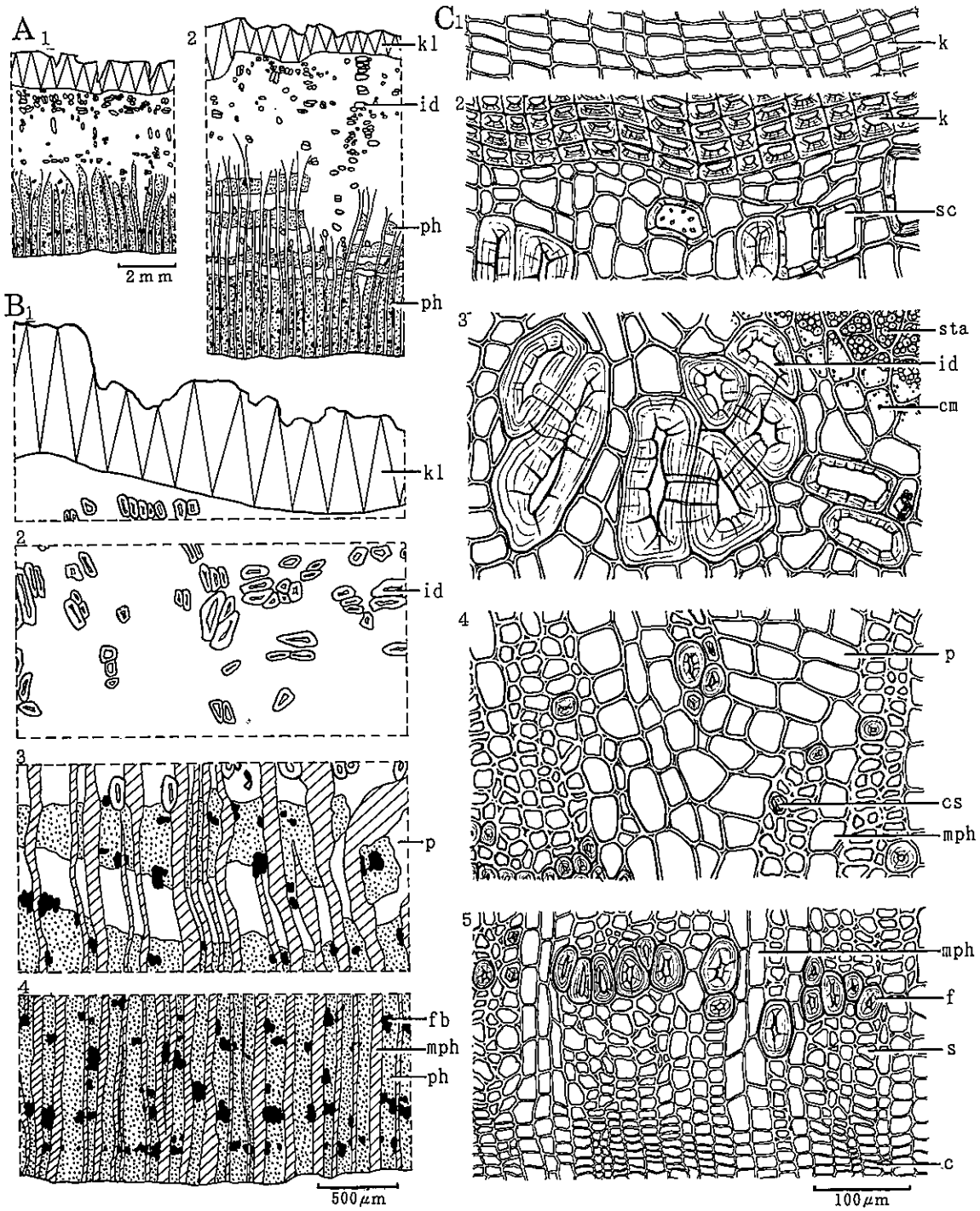


Fig. 1. The bark of *Myrica esculenta*.

A, B : Illustrating transverse sections. C : Detailed drawing of the transverse section : 1, cork layer consist of thin walled cell ; 2, U-shaped thicken cork cell and upper part of cortex ; 3, sclerenchyma and idioblast ; 4, a part of phloem ; 5, near cambium.

Abbreviations. c, cambium ; cm, crystal of myricitrin ; cs, single crystal ; f, fiber ; fb, fiber bundle ; id, idioblast ; k, cork cell ; kl, cork layer ; mph, phloem ray ; p, parenchyma cell, parenchyma tissue ; ph, phloem ; s, sieve tube ; sc, sclerenchyma cell ; sta, starch grain

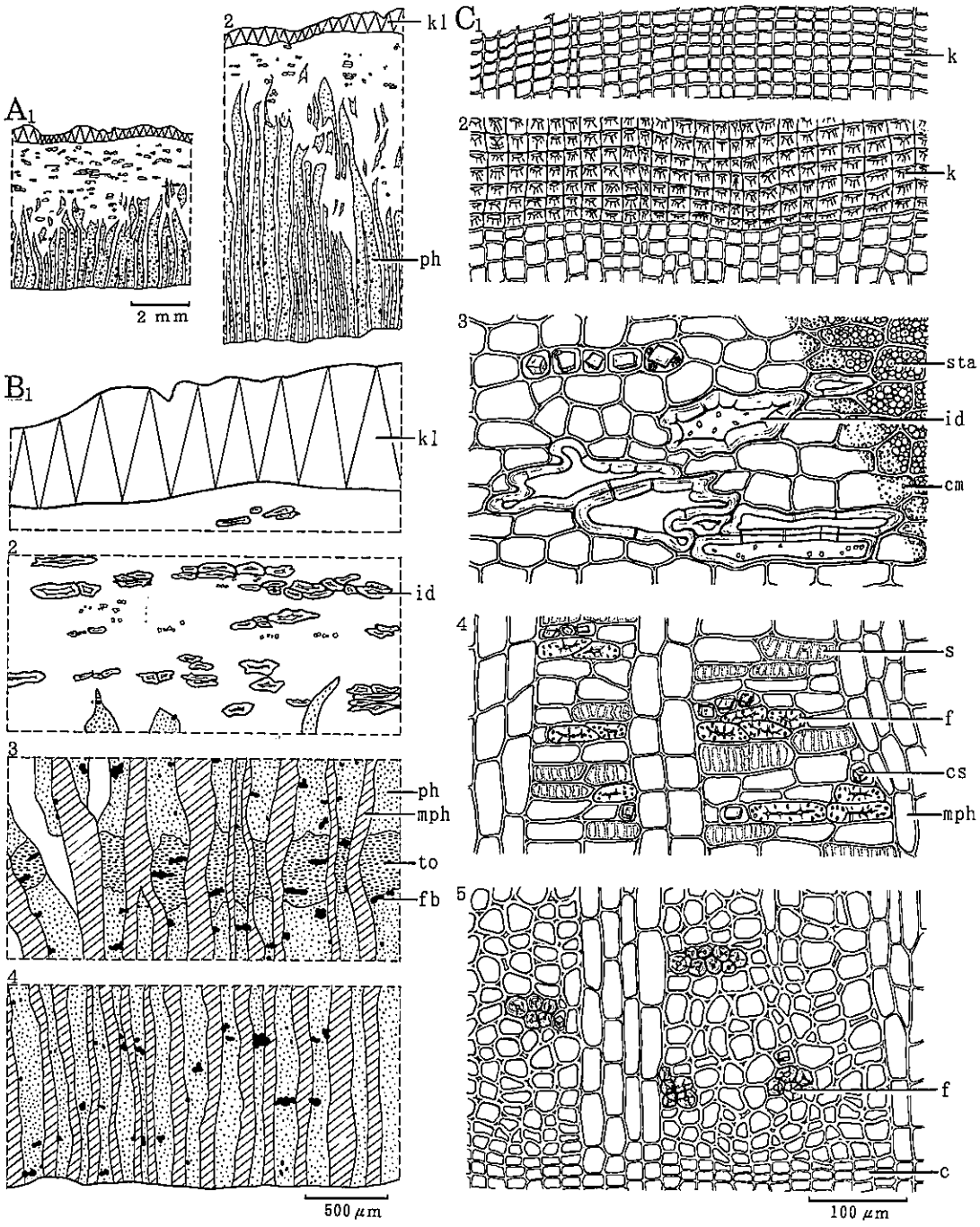


Fig. 2. The bark of *Myrica rubra*.
A, B : Illustrating transverse section. C : Detailed drawing of the transverse section. 1, cork layer consist of thin walled cell ; 2, U-shaped thicken cork cell and cork cortex ; 3, sclerenchyma and idioblast ; 4, a part of phloem where the tissue obliquely arranged ; 5, near cambium.
Abbreviations same as Fig. 1, and to, obliquely arranged tissue.

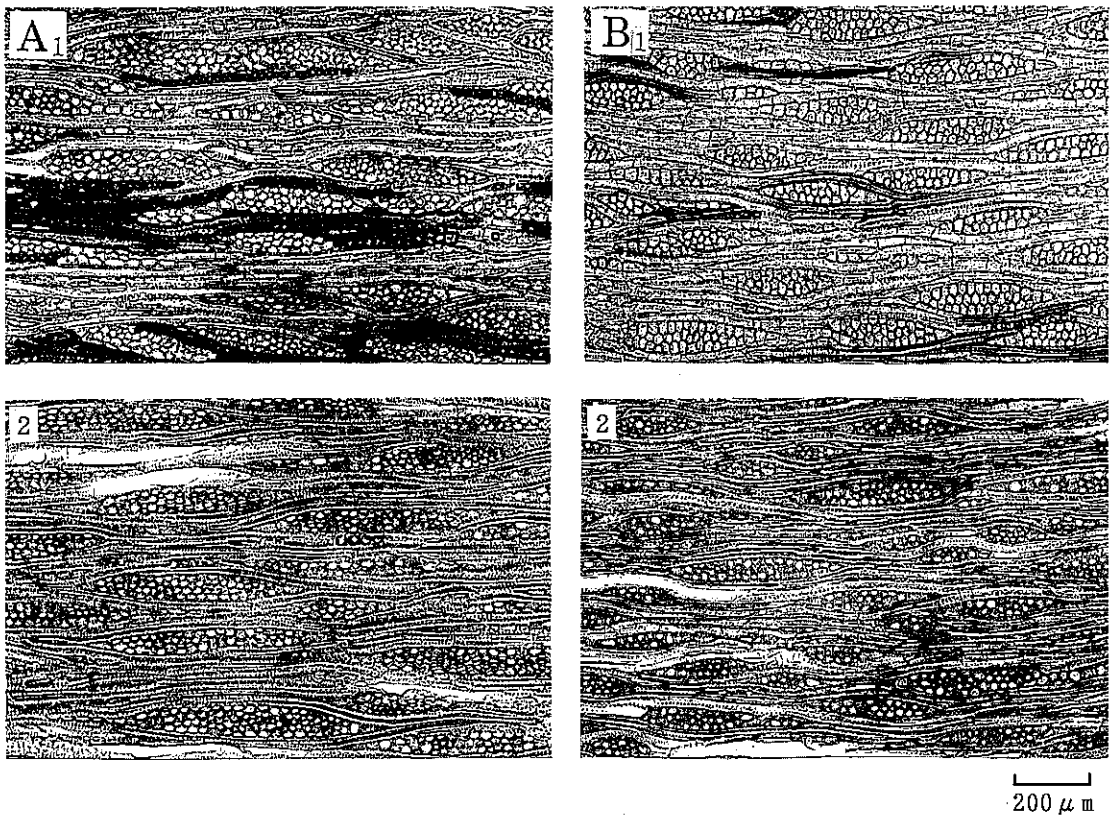


Fig. 3. Tangential sections of the bark and wood at the portions of about 1 to 3 mm inner from cambium (1, bark; 2, wood). A, *Myrica esculenta*; B, *M. rubra*.
The figure shows that the structure of the phloem rays in tangential section is similar to that of xylem ray to some extent, even at fairly inner part from cambium, in the case of the bark having undilated rays.

bent ray cell measures 20 to 40 μm in diam., and upright one 40 to 90, normally 50 to 60 μm long. The ray measures 40 to 110 μm wide and 250 to 1200 μm long.

Comparing with the tangential sections of the bark and wood at 1 to 3 mm apart form the cambium, the anatomical characters, such as length and cell layers of ray, were quite similar to each other (Fig. 3-A), and also coincide well with the result of Suzuki's report (1991) on the wood structures of this species from Nepal.

Many starch grains of 5 to 10 μm diam. are recognized in parenchyma cells. Some parenchyma cells in the phloem contain a single crystal of calcium-oxalate of 10 to 30 μm diam. as a member of crystal cell lines, and some in the cortex contain several single crystals. The crystal of myricitrin is not so typical in shape such as observed in *M. rubra* (Munesada 1932).

2) *Myrica rubra* (Figs. 2, 3-B)

(*in transverse section and macerated material*) The bark is 2 to 14 mm thick. The cork layer measures 150 to 1900 μm thick, and the phelloderm of 50 to 350 μm thick is characteristic of the species. The cork cell measures 20 to 40 μm in tangential diam. All sclerenchyma cells measuring 60 to 370 μm long arrange tangentially in the cortex. Idioblasts are more variable in figure than those of *M. esculenta*. The ray is similar to the former species. In the phloem, the cells of some zonal part are arranged obliquely (Figs. 2-$B_3$, $C_4$). Phloem fibers measure 16 to 33 μm diam. and 330 to 1030 μm long. Starch grains of 5 to 8 μm diam., simple crystals of calcium-oxalate of 10 to 25 μm, and a lot of small crystals of myricitrin are observed.

(*in tangential section*) The ray measures normaly 170 to 600 μm long, sometimes up to 1000

μm or more. Procumbent ray cell measures 20 to 40 μm in diam., and upright one 30 to 70 μm long.

### 3. Correlation between thickness of bark and diameter of trunk (Fig. 4)

Studying the ratio of the thickness of the bark to the diameter of the trunk, it was made clear that the ratio in *M. esculenta* was 2 to 4 times higher than that in *M. rubra*, on the trunk of the same size.

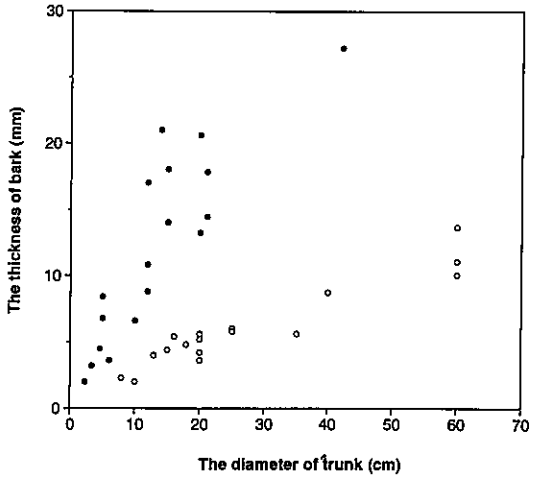


Fig. 4. Correlation between the diameter of the trunk and the thickness of the bark of *Myrica esculenta* and *M. rubra*. The ordinate shows the thickness of bark and the abscissa the diameter of trunk. ○ : *M. rubra*, ● : *M. esculenta*.
Referring to this figure, the diameter of the trunk from which the commercial Myrica bark produced can be estimated.

### 4. Crude drug and its botanical origin

1) **KAPHAL BOKRA and KATPALA POTHU** (Figs. 5-A, B) : The samples consist of the bark curling inside or the broken pieces with thick and tight cork, measure 5 to 15 mm thick, 2 to 5 cm wide, up to 15 cm long. The surface of the cork is rough, and light-gray to light-brown in color, sometimes moss-grown. The inner surface is flat, and purplish black to dark brown in color. The cortex is reddish brown, dark brown or purplish brown in color. Yellowish wood sometimes remains attaching to the bark. The bark has incense-like odour and astringent somewhat acrid taste.

The two crude drugs agree well to the bark of *M. esculenta* anatomically. It is also estimated from the result showing in Fig.4 that the bark was peeled off from the trunk having diameter of 5 to 20 cm.

2) **YANG MEI PI** produced in China (Fig. 5-C) : The drug is cut in pieces into 5 to 15 mm in diam. The bark with tight cork layers is peeled off along cambium, 2 to 4 mm thick. The drug has more light taste than that of KAPHAL BOKRA.

This sample agrees well to the bark of *M. rubra* anatomically. The diameter of original trunk is estimated as 10 to 25 cm.

## Results and discussion

1. Referring to the result of anatomical observation of the bark of *Myrica esculenta* and that of *M. rubra*, it was made clear that the former was distinguished from the latter by the presence of larger phloem fibers in diameter, more variable sclerenchyma cells in figure, and radially elongated sclerenchyma cells, in the cross sections.

2. Through the comparative anatomical study, it was confirmed that Ayurvedic crude drugs either KAPHAL BOKRA circulating in Nepal or KATPALA POTHU circulating in Sri Lanka were the bark of *M. esculenta*, and Chinese crude drug YANG MEI PI produced in China was the bark of *M. rubra*. Moreover, it is estimated that both KAPHAL BOKRA and KATPALA POTHU have been peeled off from the trunk of 5~20 cm in diameter, and YANG MEI PI from the trunk of 10~25 cm. It is important to estimate the size of original trunk from which the crude drug of bark origin is peeled off, because the quantity and quality of chemical constituents included in the bark may depend on the size of trunk (Namba *et al.* 1987).

3. *M. esculenta* does not grow wild in Sri Lanka. So the KATPALA POTHU has been imported properly from abroad, possibly from India, since early times. This fact may be a reason why the botanical origin of KATPALA POTHU is rather complicated (Attygalle 1917).

4. In the case of *Myrica* species examined in this study, the structure of ray tissue of the bark in tangential section, even at the inner portion of 1 to 3 mm apart from the cambium, was

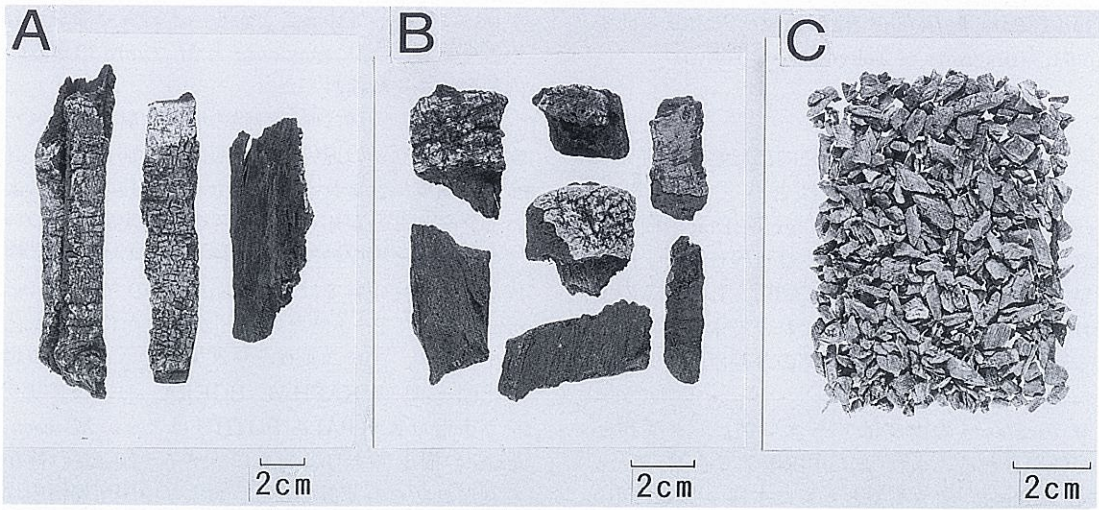


Fig. 5. Crude drugs derived from the bark of *Myrica* spp.
A, KAPHAL BOKRA in Nepalese market. B, KATPALA POTHU in Sri Lankan market. C, YANG MEI PI (Japanese name, YOH BAI HI) produced in China in Japanese market.
The botanical origins of A and B are *M. esculenta*, and C is *M. rubra*.

considerably similar to those of wood, because of their undilated long phloem rays. Though this phenomenon may be natural consequence (Esau 1953), it is very important to realize that many descriptions ever reported on the wood ray tissue may be very useful to study bark rays of the same species.

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**摘　要**

ネパール産木本植物の樹皮の内部形態解析研究の一環として，ヤマモモ科ではネパール唯一種の *Myrica esculenta* Buch.-Ham. ex D. Don の樹皮を検討した．また本属植物の樹皮は世界各地で下痢，喘息，出血などの治療薬として利用されているので，より学際的な研究を指向し，これまで未発表であった本属植物樹皮由来の各種生薬の基源確証研究をも行った．

*M. esculenta* の樹皮はアーユルヴェーダ薬物として使用されるとされ，また中国医学でも *M. rubra* Sieb. et Zucc. ヤマモモとともに本種の樹皮が用いられるとされるが，すべてこれまで確証がなかった．一方，日本産の漢薬「楊梅皮」については *M. rubra* の樹皮であることがすでに宗定により組織学的に確証されている．両種の樹皮は大きさや色などの外見が互いに類似していることから，本研究では宗定の報告を参考に，*M. esculenta* と *M. rubra* の樹皮の内部形態を比較検討した．

その結果，両種は厚膜細胞の形，放射組織の形状，繊維の太さなどの違いにより明確に区別された．さらに，樹皮に含まれる化学成分が幹や枝の太さによって異なることが知られているので，実験種について木の太さと樹皮の厚さの関係を調査した結果，樹皮は同じ太さの幹では *M. esculenta* の方が *M. rubra* に比して2～4倍厚いことが明らかになった．以上の結果，アーユルヴェーダ生薬でネパール市場に出回っている KAPHAL BOKRA，およびスリランカ市場の KATPALA POTHU はともに *M. esculenta* の樹皮であり，ともに太さ5～20 cm の幹から剥がれたものであること，および中国産楊梅皮は *M. rubra* の太さ10～25 cm の幹から剥がれた樹皮であることを確証した．

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○ R.I. Miller (ed.) **Mapping the Diversity of Nature** (ISBN 0-412-45510-2) B5判変型，XVII + 218頁．1994年，Chapman & Hall. DM 125。

英国，米国，カナダ，オーストラリア，ベルギー，ケニア，コスタリカ，香港など8か国・地域，22人の著者による論文集で，動植物を通じた生物分布図の作成をめぐる最近の諸問題を取り扱ったものである。生物分布図はわが国でもしばしば作成されるが主に技術上の制約と経験に依存して作成されており，方法論についてはもとより，手法についても理論的な検討を踏まえたものはほとんど見あたらない。この論文集の特徴はこの点がしっかりしていることで，第1部の序論と第8部の未来に向けての可能性の部分を読むだけでも得られるところが多いと思われる。また，多くの事例が掲載されており，参考になるところが少なくない。

ごく近い将来の方向としては，Global Positioning Systems (GPS) ならびに Geographical Information Systems (GIS) の広範な利用が大きな可能性を持つことを強調している。わが国でも GPS はいまや容易に使用できる手段となってきたし，国土地理院の数値地図や国土地理情報の整備とあいまつて，コンピュータ上での生物分布図の作成や環境要因分布図の重ね合わせが，十分可能な段階を迎えている。そのような時期であるだけに分布図をめぐる諸問題の理論的研究が急がれるのであるが，この論文集はそのために大いに貢献するものと思われる。

気象学や狭義の地球科学では以前から，観測の精度や数値計算の必要から観測の密度と現象のスケールなどをめぐる具体的問題についての数理的な研究がおこなわれてきた。この点，生物分布図では従来からかなり無反省であった。たとえば，メツシュの大きさによって捉えられる現象のスケールが規定されるのであるが，特にわが国ではその吟味がどれほど行われているか疑問である。この論文集ではこの点での問題意識は十分にうかがえるが数理的に掘り下げた検討は見あたらず，今後の課題としてのこされている感がある。あるいは，適当な執筆者がいなかったからかもしれない。　(古池　博)

○ 萩原博光・山本幸憲・伊沢正名　**日本変形菌類図鑑 Myxomycetes of Japan**　A5判，168頁．1995年7月19日，平凡社．3,800円．

「あるときはアメーバ，あるときはキノコ　奇妙な生活と華麗な色彩をもつ変形菌」とは本書の帯の言葉である。菌類は今ではもちろん植物界とは別の界として分類されているが，植物をじっくりと見ながら徘徊している我々植物屋にとって，目にとまりにくい動き回る生物とは異なり，よく目にするものであることは確かである。一方で，普通のキノコやカビですらよくわからないのに，ましてや変形菌類はしばしば目にする割には，未知の生物群ではなかろうか。本書は普通種は網羅しているとのこと，とりあえずは絵合わせは出来るという