

**MYRICA RUBRA (LOUR.) SIEBOLD & ZUCC. (MYRICACEAE): A USEFUL PLANT RESOURCE IN VIETNAM**

Nguyen Sinh Khang<sup>1</sup>, Bui Hong Quang<sup>1</sup>, Vu Tien Chinh<sup>2</sup>  
 Nguyen Tien Hiep<sup>3</sup>, Nguyen Quang Hieu<sup>3</sup>  
 Nguyen Thanh Son<sup>4</sup>, Xia Nian-He<sup>4</sup>, Davidson Christopher<sup>5</sup>

<sup>1</sup>*Institute of Ecology and Biological Resources,*

*Vietnam Academy of Science and Technology, Vietnam*

<sup>2</sup>*Vietnam National Museum of Nature,*

*Vietnam Academy of Science and Technology, Vietnam*

<sup>3</sup>*Center for Plant Conservation, Vietnam*

<sup>4</sup>*South China Botanical Garden, Chinese Academy of Science, China*

<sup>5</sup>*Idaho Botanical Research Foundation, U.S.A*

Myricaceae, a small family of shrubs and trees, comprises four genera mostly distributed in Africa and the Americas (Herbert, 2004). Linnaeus (1753) established the genus *Myrica* and recorded five species. According to Lu and Bornstein (1999), *Myrica* L. has approximately 50 species occurring nearly worldwide, except for some warm temperate parts of Old World and Australia. *Myrica rubra* (Lour.) Siebold & Zucc., an evergreen tree of subtropical region of China, Korea, Japan and Philippines (Lu & Bornstein, 1999), is popular for its fruits of delicious taste, pleasant fragrance, and traditional medicine (Chen et al., 2004).

In Vietnam, several authors (Pham Hoang Ho, 1999; Nguyen Tien Ban, 2003) have taxonomically studied Myricaceae, and recorded one *Myrica esculenta* Buch.-Ham. ex. D. Don with three varieties; *M. esculenta* var. *balansae* Dode; *M. esculenta* var. *chevalieri* (Dode) Phamh; *M. esculenta* var. *tonkinesis* (A. Chev.) Dode. However, Chan and Huyen (2000) recognized one to two species of *Myrica* for Vietnam. They recognized *Myrica rubra* from Vietnam but did not provide any information about distribution, examined specimen, as well as morphological characteristics. While compiling the Flora of Hong Kong, Xia (2007) recorded distribution of *Myrica rubra* in Vietnam but he did not provide any information about localities as well as studied specimens from Vietnam. Forth the present paper, the authors after examining all the specimens of *Myrica* from Vietnam kept at (HN, IBSC, MO), and doing field observations in northern Vietnam, confirmed that *Myrica rubra* (Lour.) Siebold & Zucc. occurs in Lao Cai and Ha Giang provinces of Vietnam. In this short communication, data on morphology, ecology, phenology and distribution are provided along with line drawing and color photos.

**I. MATERIAL AND METHODS**

Specimens kept in herbaria of HN (Institute of Ecology and Biological Resource, Hanoi, Vietnam), IBSC (South China Botanical Garden, Guangzhou, China), and MO (Missouri Botanical Garden, St. Louis, U.S.A) were examined and field observations were made during 2012–2017 in Hoang Lien National Park, and Ha Giang Province. Fresh flowers and inflorescences from living plants were stored in 70% ethanol. For identification, measurements of the floral parts for descriptions were taken from both herbarium and liquid-fixed materials. In describing quantitative characters, infrequent extreme values (i.e. rarely occurring minimal and maximal values) of a variation range are parenthesized before and after the normal variation range.

## II. RESULT AND DISCUSSION

*Myrica rubra* (Lour.) Siebold & Zucc., Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4: 230. 1846; Lu & Bornstein in Fl. China 4: 276. 1999; Xia in Fl. Hongkong 1: 126, fig. 92. 2007. TYPE: Japan, Burgen, H, sn (Holotype: M). - *Morella rubra* Lour. Fl. Cochinch. 2: 548. 1790. TYPE: Habitat culta in China, agrestis, fruticosa et multo minor in China, 1790. Lourei J. de 5481 (Holotype: P).

**Description (Fig. 1 & 2):** Small trees evergreen, dioecious, from 3 to 8 m tall; trunk up to 45 cm; bark gray. Branchlets and buds usually glabrous, rarely puberulent; twigs lenticellate, and having prominent scars of fallen leaf. Petiole (3)5-10(15) mm, glabrous to puberulent adaxially; leaves simple, alternate, often aggregated at short apex, cuneate-obovate or ovate-oblong to oblanceolate, (3)7-12(17) x (0.8)1.5-2.5(3.5) cm, leathery, glabrous on both surface, abaxially pale green, sparsely to moderately golden glandular, adaxially dark green, rarely pale green, base cuneate, margin entire or serrate in apical 1/2 of leaf (especially in young leaf), apex obtuse to acute; midrib and secondary veins somewhat flat to sunken adaxially, slightly prominent abaxially, (6)7-10(12) pair of secondary veins. Male spikes simple or inconspicuously branched, solitary in leaf axils, (1.5)1.7-2.2(2.8) cm; peduncle glabrous (rarely puberulent); bracts imbricate, suborbicular, ca. 1-1.5 mm, glabrous at both side, but abaxially golden glands and puberulent at margin. Male flowers with 2-4 ovate to suborbicular-deltoid bracteoles, sparsely ciliate; bracteoles glabrous at dorsal and ventral side but puberulent at margins and golden glands abaxially. Stamens (4)6-8(12), filaments free or united at base; anthers ellipsoid, ca. 1 x 1.5 mm, red at apical and yellow at base, longitudinal dehiscence. Female spikes solitary in leaf axils, (0.6)1.0-1.4(1.6) cm long, glabrous, many flowered; bracts imbricate, glabrous, golden glands at abaxial. Female flowers with 4 bracteoles. Ovary ovoid, velutinous; stigmas 2. Drupe dark red or purple-red at maturity, subglobose to globose, (1.3)1.5-1.8(2.0) x (1.0)1.3-1.5(1.8) cm; exocarp papilliferous, mesocarp fleshy and juicy, endocarp hard, seed erect.

**Notes:** *Myrica rubra* can be differentiated from *Myrica esculenta* by having male spikes simple or inconspicuously branched, less than 3 long (vs. male inflorescence branched, 4-9 cm long), male flower with 2-4 bracteoles (vs. without bracteole), female flower with 4 bracteoles (vs. 2 bracteoles), usually single fruit per a female spike (vs. many fruits per an infructescence).

**Ecology and phenology:** In Vietnam, *Myrica rubra* grows in secondary evergreen broad-leaved forests on silicate mountains of Hoang Lien National Park, and Cao Ma Po Commune, at an elevation around 1500-1900 m. Mountains of Hoang Lien N. P. are characterized by the tropical climate monsoon associated with mountains, and an annual average temperature of 12.8-15.2°C (the lowest temperature in January and the highest in July), the annual average rainfall of 2833-3552.4 mm, and the annual average relative humidity of 87- 90% (Nguyen Khanh Van et al., 2000). *M. rubra* usually occurs in open areas, and can grow up when their trunks have been cut down for firewood by local people (Fig. 2 G & H). They also can survive after forest fires as reported by local people from Cao Ma Po Commune, Vang Cha Phin Village (Fig. 2 I & J). Population of *M. rubra* in Cao Ma Po Commune is usually associated with *Alnus nepalensis* D. Don, *Schima* sp, *Magnolia* spp, *Lithocarpus* sp., *Sycopsis* sp., *Cinnamomum* sp., *Lyonia* sp., *Mahonia* sp., *Berberis* sp., *Viburnum* sp., *Ligustrum sinense* L., *Hypericum* sp., *Polygala* sp., *Eribotrya* sp., *Liparis* sp., *Impatiens* sp., *Anemone* sp., *Gentiana* sp., etc. and some species of ferns to form a forest structured by three main stratum (trees, shrubs, and herbs). *M. rubra* flowers in March-April, and fruiting can be seen in May-June.

**Distribution:** Vietnam (Lao Cai Province, Sa Pa District, Hoang Lien N. P., San Sa Ho Commune; Ha Giang Province, Quan Ba District, Cao Ma Po Commune), China, Japan, Korea and Philippines.

**Examined specimens:** Lao Cai province, Sa Pa district, Hoang Lien N. P., San Sa Ho commune, trail to Sin Chai village, secondary evergreen broad-leaved forests on slopes of silicate mountains, around point N 22°21'15.8", E 103°46'44.5", elevation 1815 m a.s.l., 5 May 2012, *Jacinto C. Regalado et al., Jr 1806* (HN, MO); Near Ton station at N 22°20'36.0", E 103°49'09.1", elevation 1850 m a.s.l., 11 April 2017, *Bui Hong Quang et al., QK 03* (HN); Ha Giang province, Quan Ba district, Cao Ma Po commune, Vang Cha Phin village, secondary evergreen broad-leaved forests on slopes of silicate mountains, at N 23°05'50.3", E 104°48'15.0", elevation 1870 m a.s.l., 16 March 2017, *Nguyen Sinh Khang et al., NSK 847 & NSK 848* (HN); at N 23°05'27.8", E 104°48'28.1", elev. 1850 m a.s.l., 12 May 2017, *Nguyen Sinh Khang et al., NSK 880 & NSK 881* (HN); Ha Giang prov., Quan Ba distr., Cao Ma Po com., Vang Cha Phin vill., secondary evergreen broad-leaved forests on slopes of silicate mountains at N 23°05'19.2" E 104°48' 37.4", elev. 1800 m a.s.l., 13 May 2017, *Nguyen Sinh Khang et al., NSK 907* (HN); Ha Giang prov., Quan Ba distr., Cao Ma Po com., Vang Cha Phin vill., secondary evergreen broad-leaved forests on slopes of silicate mountains at N 23°05'06.7", E 104°48'40.8", elev. 1730 m a.s.l., 13 March 2017, *Nguyen Sinh Khang et al., NSK 908 & NSK 909* (HN); around point N 23°05'22.6", E 104°49'12.3", elev. 1680 m a.s.l., 13 March 2017, *Nguyen Sinh Khang et al., NSK 917 & NSK 918* (HN); at N 23°05'30.2", E 104°49'00.2", elev. 1580 m a.s.l., 13 March 2017, *Nguyen Sinh Khang et al., NSK 920* (HN); Ha Giang prov., Quan Ba distr., Cao Ma Po com., Chin Chu Lin vill., secondary evergreen broad-leaved forests on slopes of silicate mountains, around point N 23°06'09.4", E 104°48'24.9", elev. 1876 m a.s.l., 14 March 2017, *Nguyen Sinh Khang et al., NSK 934 & NSK 938* (HN).

**Uses:** In Vietnam, *Myrica rubra* fruits are used to prepare an alcoholic beverage. It is a very popular tree for other benefits; ripened fruit possess richness of vitamin content and has delicious taste, pleasant fragrance, and used as traditional medicine in China (Chen et al., 2004). It can also be processed into sweets, jam, juice and wine, or canned in syrup (Li et al., 1992). Fruits of Red bayberry (*Myrica rubra*) is reputed to have health benefits (ethno-botanical) effects, including anti-diarrhoea, anti-vomit, settling the upset stomach (Joice et al., 2005). Moreover, several compounds extracted from leaves and bark of Red bayberry have shown promising activity of anti-inflammatory (Kim et al, 2013), anti-oxidant (Zhang et al., 2016), anti-microbial (Su et al, 2014), and anti-cancer (Kou et al., 2004) properties. *M. rubra* can be used for the recovery of vegetation in wastelands because it can grow well on sterile soils due to the nitrogen-fixing bacteria in its root system (Sasakawa, 1995), and it is also a fire-resistant species (Deng et al., 2012). It has been given high priority in horticulture and forest planting in several countries for economic development such as China (He et al., 2004), Australia (Joyce et al., 2005; Joyce & Sanewski, 2010), and United States of America (Sharpe & Knapp, 1972; Chai & Chen, 2016).

### III. CONCLUSION

*Myrica rubra*, a fire – resistant tree with valuable benefits, is documented in detail for its Vietnamese occurrence along with data on morphology, ecology and distribution. The data will hopefully be useful for formulating a conservation strategy of this species in Vietnam.

**Acknowledgment:** We cordially thank authorities of Lao Cai and Ha Giang provinces for providing facilities to our field surveys which were financially supported by research program (IEBR.DT.03/17-18) of Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology. The authors are indebted to Ms. Le Kim Chi for her nice drawing, and curators of Herbaria (HN, IBSC, MO) for their kind help.

## REFERENCES

1. **Chai C. Y. & Chen Y. F.**, 2016. Introduction of Yangmei Elite Varieties in California, *World Journal of Forestry* 5(1): 1–6.
2. **Chen K., Xu C., Zhang B. & Ferguson I. B.**, 2004. Red bayberry: Botany and horticulture, *Horticultural Reviews* 30: 83–114.
3. **Deng C. N., Pan X. M., Zhang H. Y. & Pan X. L.**, 2012. Fire-resistance of six tree species to fire probed by chlorophyll fluorescence, *Journal of Food, Agriculture & Environment* 10(2): 1329–1333.
4. **He X. H., Chen L. G., Asghar S. & Chen Y.**, 2004. Red Bayberry (*Myrica rubra*), a Promising Fruit and Forest Tree in China, *Journal of the American Pomological Society* 58(3): 163–168.
5. **Herbert J.**, 2004. *Systematics and biogeography of Myricaceae*. PhD dissertation, University of St Andrews, St Andrews, Scotland, UK, 266 pp.
6. **Joyce D. & Sanewski G.**, 2010. The Commercial Potential of Red Bayberry in Australia, *RIRDC Publication* No. 10/200, 36 pp.
7. **Joyce D., Khurshid T., Liu S., McGregor G., Li J. & Jiang Y.**, 2005. Red Bayberry—A New and Exciting Crop for Australia?, *RIRDC Publication* No. 05/081, 26 pp.
8. **Kim H. H., Kim D. H., Kim M. H., Oh M. H., Kim S. R., et al.**, 2013. Flavonoid constituents in the leaves of *Myrica rubra* Sieb. et Zucc. with anti-inflammatory activity, *Archives of Pharmacal Research* 36(12): 1533–1540.
9. **Kuo P. L., Hsu Y. L., Lin T. C., Lin L. T. & Lin C. C.**, 2004. Induction of apoptosis in human breast adenocarcinoma MCF-7 cells by prodelphinidin B-2 3,3'-di-O-gallate from *Myrica rubra* via Fas-mediated pathway, *Journal of Pharmacy and Pharmacology* 56(11): 1399–1406.
10. **Le Mong Chan & Le Thi Huyen**, 2000. *Forest Plants “Thực Vật Rừng”*, Agricultural Publishing House, Hanoi, pp: 149–150.
11. **Li Z. L., Zhang S. L. & Chen D. M.**, 1992: Red bayberry (*Myrica rubra* Sieb. & Zucc.): A valuable evergreen tree fruit for tropical and subtropical areas, *Acta Horticulture* 321:112–121.
12. **Linnaeus**, 1753. *Species Plantarum* 2: 1024.
13. **Loureiro J. M. de**, 1790. *Flora conchinchinensis* 2: 584.
14. **Lu A. & Bornstein A. J.**, 1999. *Myricaceae* in Wu Z. Y. & Raven P. H. (eds.). *Flora of China* Vol. 4, Science Press & Missouri Botanical Garden Press, Beijing & St. Louis, pp: 275–276.
15. **Nguyen Khanh Van, Nguyen Thi Hien, Phan Ke Loc & Nguyen Tien Hiep**, 2000. *Bioclimatic diagrams of Vietnam*, Vietnam National University Publishing House, Hanoi, pp: 120–121.
16. **Nguyen Tien Ban (eds.) et al.**, 2003. *Checklist of Plant Species of Vietnam* Vol. 2. Angiosperm, Agricultural Publishing House, Hanoi, pp: 274–275.

17. **Pham Hoang Ho**, 1999. *An Illustrated Flora of Vietnam* Vol. 1, Youth Publishing House, Hochiminh City, pp: 611–612.
18. **Sasakawa H.**, 1995. Effect of *Frankia* Inoculation on Growth and Nitrogen-Fixing Activity of *Myrica rubra* Seedlings Prepared Aseptically, *Soil Science and Plant Nutrition* 41(4): 691–698.
19. **Sharpe R. H. & Knapp F. W.**, 1972. The Strawberry tree, *Myrica rubra* Sieb. and Zucc., *Florida State Horticultural Society*: 326–328.
20. **Siebold P. F. (B.) V. & Zuccarini J. G.**, 1846. *Abhandlungen der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften* 4, Munich, pp: 230.
21. **Su H. M., Chen W., Fu S. L., Wu C., Li K., et al.**, 2014. Antimicrobial effect of bayberry leaf extract for the preservation of large yellow croaker (*Pseudosciaena crocea*), *Journal of the Science of Food and Agriculture* 94(5): 935–942.
22. **Xia N. H.**, 2007. *Myricaceae* in Hu Q. M. & Wu D. L. (eds.). *Flora of Hong Kong* Vol. 1, Agriculture, Fisheries and Conservation Department, Hong Kong, pp: 125–126.
23. **Zhang Y., Zhou X. Z., Tao W. Y., Li L. Q., Wei C. Y., et al.**, 2016. Antioxidant and antiproliferative activities of proanthocyanidins from Chinese bayberry (*Myrica rubra* Sieb. et Zucc.) leaves, *Journal of Functional Foods* 27: 645–654.

**MYRICA RUBRA (LOUR.) SIEBOLD & ZUCC. (MYRICACEAE): NGUỒN TÀI  
NGUYÊN THỰC VẬT CÓ GIÁ TRỊ Ở VIỆT NAM**

**Nguyễn Sinh Khang, Bùi Hồng Quang,  
Vũ Tiến Chính, Nguyễn Tiến Hiệp, Nguyễn Quang Hiếu,  
Nguyễn Thành Sơn, Xia Nian-He & Davidson Christopher**

**TÓM TẮT**

Dâu rượu (*Myrica rubra* (Lour.) Siebold & Zucc.), một trong những cây tài nguyên có giá trị nhất trong chi Thanh mai (*Myrica* L.), cho quả ăn ngon và giàu chất dinh dưỡng, có giá trị lớn đối với y dược và cải tạo môi trường đất, được xác định là cây ưu tiên trồng rừng nhằm phát triển kinh tế ở một số nước phát triển như Trung Quốc, Úc và Hoa Kỳ. *Myrica rubra* chính thức được xác nhận có ở Việt Nam dựa vào những tiêu bản thực vật và các dữ liệu về hình thái, sinh học, sinh thái, phân bố của chúng tại vùng núi cao tỉnh Lào Cai và Hà Giang. Dâu rượu thường mọc trong rừng thứ sinh cây lá rộng thường xanh trên núi đá silicate ở VQG Hoàng Liên (huyện Sa Pa) và xã Cao Mã Pờ (huyện Quản Bạ), nơi có độ cao trên 1500 đến khoảng 1900 m so với mặt nước biển.

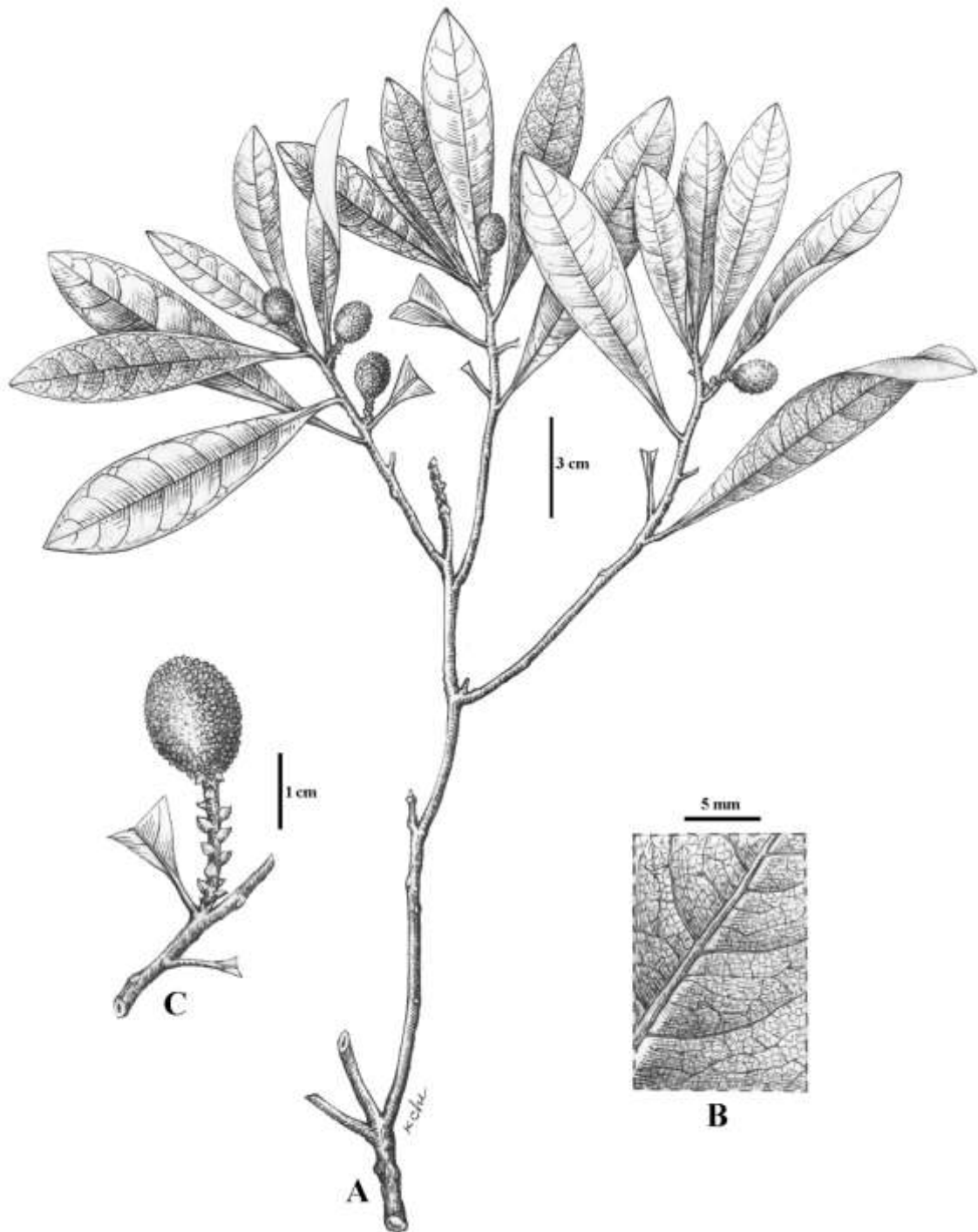


Figure 1: *Myrica rubra* (Lour.) Siebold & Zucc.,  
A - A fruiting branchlet, B - Abaxial surface of leaf blade, C - Fruiting twig  
(Drawn from Jr. 1806 (HN) by Kim Chi)



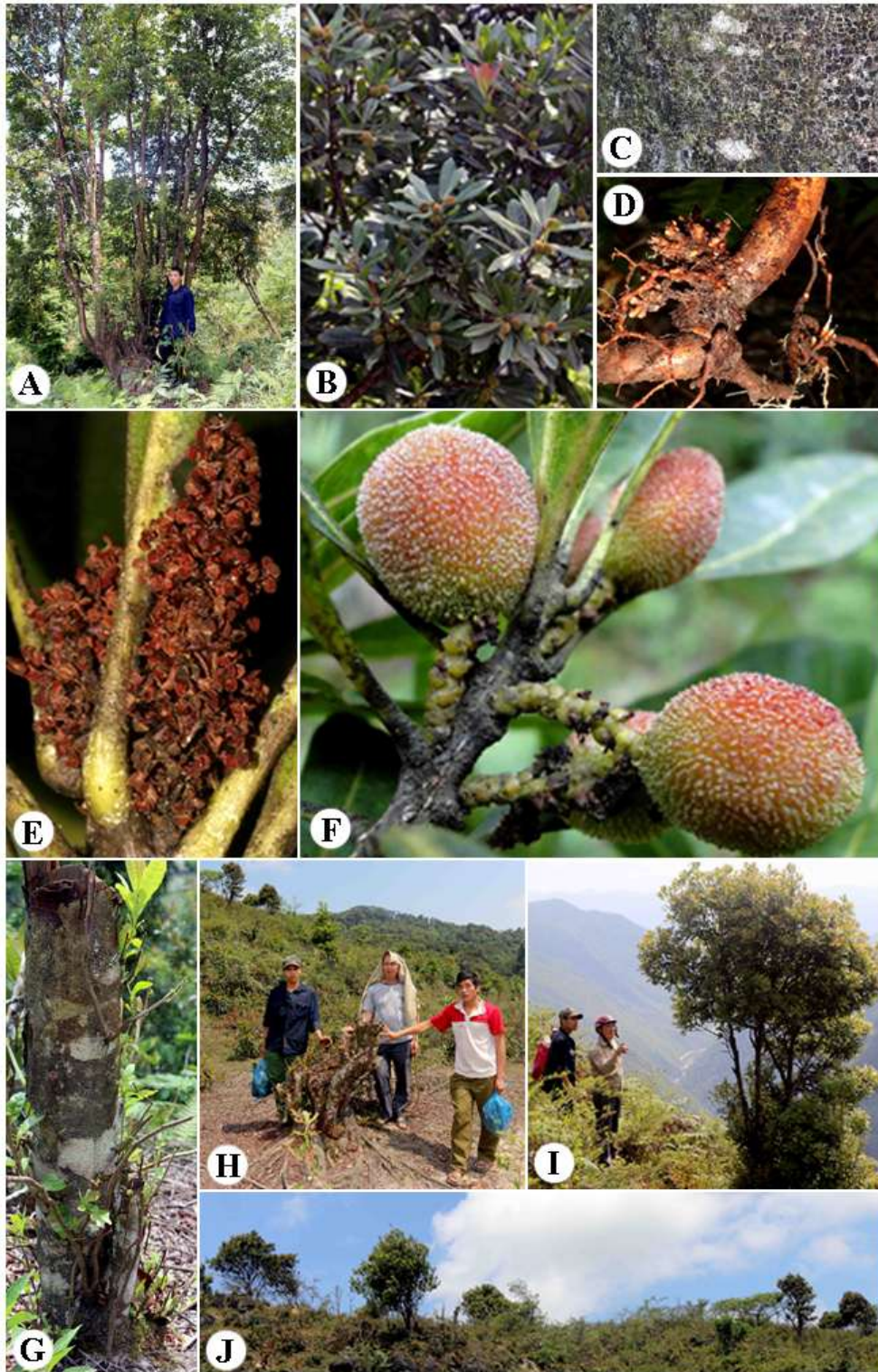


Figure 2: *Myrica rubra* (Lour.) Siebold & Zucc.,

A - Habit, B - Fruiting branchlets, C - Bark, D - Roots, E - Male spikes, F - Fruits,  
G-J - Trunk giving sprouts and survival of trees after fire burns in the wild.