



A revision of genus *Vatica* L. (Dipterocarpaceae) in borneo, III: Stigma variant of some selected *Vatica* species from Sabah and Sarawak

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Abstract

The family Dipterocarpaceae is an important tropical forest tree with 15 genera and over 600 species worldwide. The genus *Vatica* was first described by Linnaeus in 1773 and was the third-largest genus in the family with approximately 80 species in the world. About 71 species are distributed in Malesia and 44 of them are recorded in Borneo. Those make Borneo island the best representative and considered an epicentre of the species. *Vatica* is the most difficult genus in Dipterocarpaceae to study as it has excessive variation in-term of habit, habitat, morphological and anatomical features. Informally the genus has been divided into three sections; *Sunaptea*, *Vatica* and *Pachynocarpus* based on the calyx morphology. An inclusive study on the stigma was piloted on 13 selected *Vatica* taxa to examine disparities in shapes that may be useful in the classification and identification of species. Eight types of stigma shapes were observed on the 13 selected *Vatica* species, *viz.* cordate, hexagonal, ovoid, perigonal, semispherical, stars, quadrogonal and ovolanceolate. The tremendous stigma variants of the *Vatica* flowers resulted that the stigma types could be a good supportive characteristic for species identification.

Keywords: *Vatica*, stigma type, dipterocarpaceae, dipterocarps

Introduction

Marco Polo was perhaps the first who mentioned a dipterocarp species when visiting Fansur in North Sumatra. This famous tree, yielded so-called champor (*Kapur barus*), a product worth its weight in gold at that time [1]. However, the first overview of the family Dipterocarpaceae was presented by A. de Candolle in 1858 in the *Prodromus*, after more than a century after Linnaeus. The genus *Vatica* was first described by Carl Linnaeus in 1771 (published in 1773) based on the type specimen, *Vatica chinensis*, which is still a puzzle, and might or might not be from China. With approximately 80 species worldwide, the genus *Vatica* was the third largest in the family Dipterocarpaceae and 71 species (88%) were found in Malesia. Borneo with 44 species is considered a centre of diversity [2].

The genus *Vatica* L. or locally known as *resak* or *rasak*, is a small to medium-sized tree and among important hard and semi-hard woods for timber and construction materials. There are about 70–75 species of *Vatica* in the world that are distributed from Sri Lanka, Southern and Eastern India, Myanmar, Thailand, Indochina, Southern China, throughout Malesia and Papua New Guinea and considered the third largest genus of the family Dipterocarpaceae. Of the total number, 46 species are found in Borneo [including *V. adenanii* Meekiong *et al.* [3] and *V. abang-zoharii* Meekiong, Yahud & Latiff [4] and therefore the island is considered the centre of species distribution.

The genus *Vatica* is distinguishable from other genera in the Dipterocarpaceae by the absence of looped intra-marginal nerves on the leaves, the winged fruits enclose less than half of the nut, anther is glabrous and style is stout [5, 6, 7]. Systematic studies of the genus have been carried out by many researchers such as Ashton [5, 8], Maury-Lechon and

Curtet [9], Meekiong *et al.* [2, 3, 4, 10] Metcalfe and Chalk [11], Solereder [12], Symington [13] and many others. Detailed studies on the flowers of *Vatica* species however not yet been intensively conducted due to difficulties to gather fresh flower samples. Thus, we recognized species in Dipterocarpaceae were flowering between two to seven years [14]. Besides, Ashton [5], Symington [13], Woon and Keng [15] who addressed the importance of the stamens in the dipterocarps flowers as additional characteristics for identification, no other researchers have studied the flowers. In the course of our studies of the genus in Sarawak, specimens of thirteen species were observed. Hence, a study was conducted to determine the significance of the *Vatica* stigma for species identification in Sabah and Sarawak, whereby the study focused on differences in stigma morphologies between species in the genus.

Materials and Methods

The flowers of thirteen selected *Vatica* species from Sabah and Sarawak were examined. Fresh flowers samples used in this study were collected from various localities in Sabah and Sarawak while the dried flowers samples were obtained from the Herbarium of Sarawak Forestry Department (SAR) and the Herbarium of Universiti Malaysia Sarawak [with permission] and verification of specimens also conducted at Herbarium of Sabah Forestry Department (SAN). Dried samples were used for those species that were not flowering during the study period. The flower samples were dissected (Figure 1) to remove the sepals and expose the reproductive parts, stamens, ovary, style and stigma. The stigmas were observed and examined, and subsequently, illustrations were made via stereo microscopes.

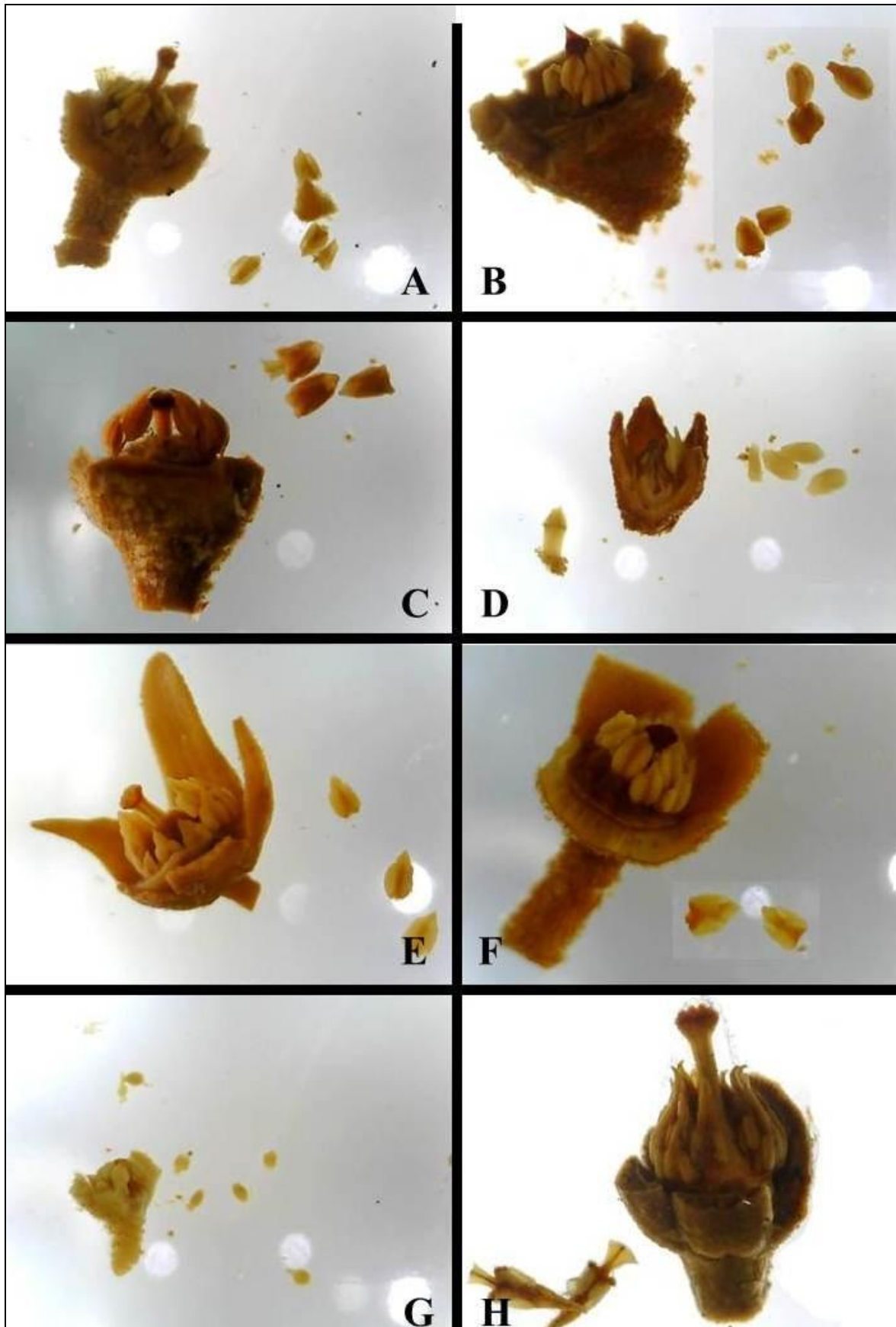


Fig 1: Flowers samples dissected to observe the stigma of *Vatica* species in Sarawak dan Sabah. A: *V. brunigii*; B: *V. congesta*; C: *V. coriacea*; D: *V. globosa*; E: *V. micrantha*; F: *V. nitens*; G: *V. odorata*; H: *V. Rynchocarpa*

Specimens examined

Vatica adenanii Meekiong, M.S. Nizam, A. Latiff & Yahud [S.66788, S.66790 (SAR)]; *Vatica brunigii* P.S. Ashton [S.17300, S.68170 (SAR)]; *Vatica compressa* P.S.

[S.49944, S.69658 (SAR)]; *Vatica congesta* P.S. Ashton [Sinclair 10219, S.15606, S.29476 (SAR)]; *Vatica coriacea* P.S. Ashton [Meekiong s.n. 2016 (Herbarium of Universiti Malaysia Sarawak), S.10296 (SAR)]; *Vatica globosa* P.S.

Ashton [MK3100 (Herbarium of Universiti Malaysia Sarawak), S.14485 (SAR)]; *Vatica havilandii* Brandis [S.23224, S.23227 (SAR), SAN39280 (SAN)]; *Vatica mangachapoi* Blanco [Haviland 2826 (SAR), SAN29380 (SAN)]; *Vatica micrantha* Slooten [MK2310 (Herbarium of Universiti Malaysia Sarawak, S.25016 (SAR)]; *Vatica nitens* King [S.10032, S.20281 (SAR)]; *Vatica odorata* (Griff.) Sym. [S.10061, S.24704, S.36676 (SAR)]; *Vatica parvifolia* P.S. Ashton [S.7537, S.12508 (SAR), SAN16370 (SAN)]; *Vatica rynchocarpa* P.S. Ashton [Meekiong s.n. 2012 (Herbarium of Universiti Malaysia Sarawak), S.12107, S.22572 (SAR)]

Results and Discussion

The stigma of the thirteen selected *Vatica* species showed tremendous variants among the species. Eight types of stigma (Figure 2) of the thirteen *Vatica* species were observed as listed in Table 1. Since this was the first attempt at the stigma study on the dipterocarps flower, the terminology used in this report was based on basic shapes and new terminology was introduced. The eight shape types were cordate, hexagonal, ovoidal, perigonal, star-shaped, semispherical and include two new terminologies were

introduced quadrogonal and ovolanceolate. The description of each terminology is listed in Appendix 1.

The stigma shape of the *Vatica* species showed a constant pattern among individual flowers that were examined. The hexagonal, ovolanceolate, perigonal, semispherical and quadrogonal of stigma types were unique and represented by one species for each type. While the cordate and star-shaped were represented by three species each and *V. dulitensis* and *V. mangachapoi* were the two species that had ovoid stigma shapes.

Table 1: Type of Stigma shapes of the thirteen *Vatica* species of Sabah and Sarawak

Stigma shape	species
Cordate	<i>V. congesta</i> , <i>V. coriacea</i> , <i>V. odorata</i>
Hexagonal	<i>V. compressa</i>
Ovoid	<i>V. adenanii</i> , <i>V. mangachapoi</i>
Perigonal	<i>V. havilandii</i>
Semispherical	<i>V. parvifolia</i>
Star	<i>V. micrantha</i> , <i>V. nitens</i> , <i>V. rynchocarpa</i>
Quadrogonal	<i>V. brunigii</i>
Ovolanceolate	<i>V. globosa</i>

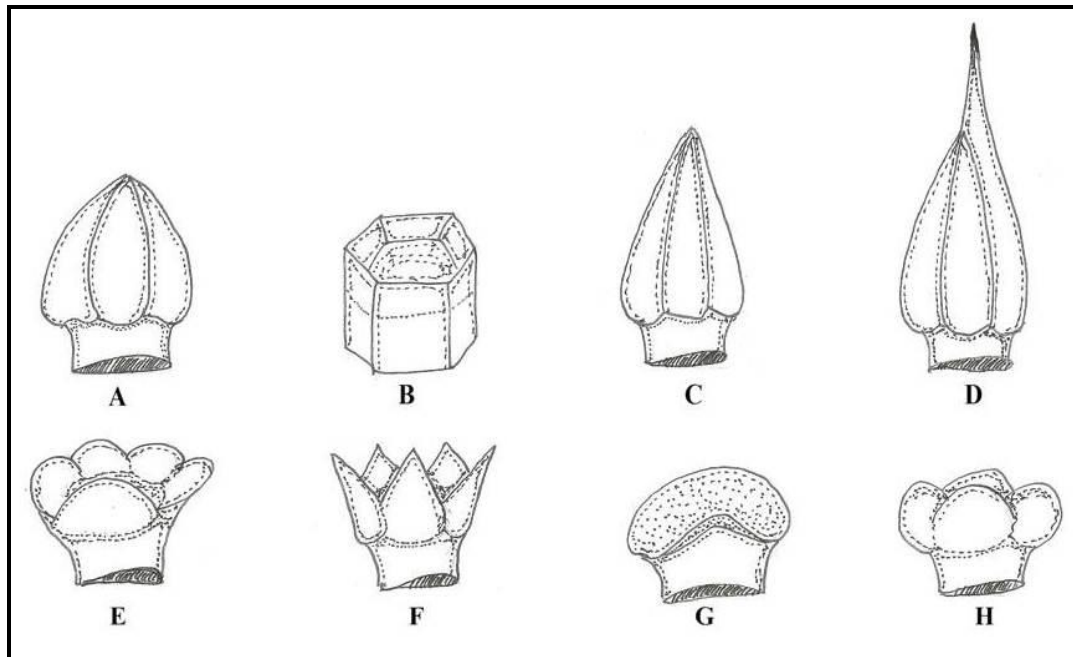


Fig 2: Stigma types of the *Vatica* species in Sabah and Sarawak. A: Cordate, B: hexagonal, C: ovoid, D: ovolanceolate, E: perigonal, F: star-shaped, G: semispherical, H: quadrogonal

Conclusion

This preliminary study showed that the stigma types of the *Vatica* flower have tremendous variants among the species and each type tends to be constant for every individual species. The initial conclusion suggests that the stigma type could be used as a strong supportive characteristic for species identification. However, a better supposition on the use of stigma type for a supportive identification could be more useable with full information on all available species.

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