

The Biosystematic Study of *Endiandra* R.Br. (Lauraceae) in New Guinea

Deby Arifiani, author

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Abstrak

ABSTRACT

Endiandra R.Br. is a genus consisted of more than 100 tree and shrub species that are distributed in Asia and Australia with several species found in Pacific Islands (Rohwer 1993). New Guinea and Australia are the most-rich areas of *Endiandra* with approximately 50 species and 38 species respectively. Unlike Australian *Endiandra* which have been treated thoroughly, the New Guinean species are less known and difficult to recognize. No recent research was done for *Endiandra* from New Guinea since over four decades ago where materials for a revision of Lauraceae was prepared by Kostermans in 1969. Moreover, based on observation on the specimens, New Guinea is thought to be the main distribution area of *Endiandra*, therefore it is important to undertake a taxonomic treatment of New Guinean *Endiandra*. During observation of herbarium specimens of *Endiandra*, it is noted that the flowers of *Endiandra* are composed by different floral parts. Staminal glands located nearby the stamens can be present or absent in different species. It is noted that all species of *Endiandra* from Borneo bear no staminal glands at the base of the stamens, however 31 out of 38 species of Australian *Endiandra* do bear glands. It is important to know the variation of New Guinean species in terms of the presence of glands because the character might be useful for further categorization within *Endiandra*. Based on the facts above, the study of the genus *Endiandra* was carried in three related topics. The first topic entitled Species enumeration of *Endiandra* R.Br. (Lauraceae) in New Guinea. This study was carried out at the Herbarium Bogoriense (BO) using *Endiandra* specimens available at BO and recently collected specimens from Waigeo Island. Loan specimens from Singapore Botanic Gardens (SING) were also studied, including images of type specimens from The Natural History Museum, London (BM); National Botanic Garden of Belgium (BR); Harvard University Herbaria, Massachusetts (HUH); Royal Botanic Gardens, Kew (K); Nationaal Herbarium Nederland, Leiden (L); Muséum National d'Histoire Naturelle, Paris (P); and Smithsonian Institution, Washington, D.C. (US). Forty six species of *Endiandra* are recognized from New Guinea, with discovery of six new species, i.e., *Endiandra areolata*, *E. crassitepala*, *E. cupulata*, *E. kassamensis*, *E. lanata* and *E. rifaiana*. It is noted that 36 species are endemic to New Guinea, distributed in both West Papua and Papua New Guinea. Ten species are distributed further to the West up to Celebes, Moluccas and to the Southeast in Australia. Most New Guinean species of *Endiandra* bear staminal glands in their flowers, only eight species lack of glands. To understand the importance of staminal glands for creating grouping within *Endiandra*, the second and third topics were carried out in this study. The second topic entitled The phylogenetic relationships of New Guinean species of *Endiandra* and *Beilschmiedia* (Lauraceae) based on morphological characters. The study was aimed to understand the relationships among *Endiandra* species in New Guinea, the distribution of species with and without staminal glands in the cladogram and to understand the relationships of *Endiandra* and *Beilschmiedia*. Selected morphological characters from the study of Topic 1 were analyzed to understand the relationships of *Endiandra* species. Fifty taxa, consisted of 41 species of *Endiandra*, 6 species of *Beilschmiedia* (as in-

groups) and 3 species of *Cryptocarya* (as outgroups) with 47 characters were analyzed using Maximum Parsimony method and resulted in 86 most parsimonious trees. Even though the species with staminal glands are grouped together in clades I, II, III, IV and VI, the species with and without staminal glands are grouped together in clade V. Therefore, in this study, the grouping within *Endiandra* based on the presence and absence of staminal glands was not well supported. Moreover, *Endiandra* and *Beilschmiedia* are forming their own clades, suggesting the two genera are monophyletic based on morphological characters. Stamen number and position in the floral whorls determined the generic delimitation between the two genera. *Endiandra* has 3 or 6 stamens in the 3rd whorl or 2nd and 3rd whorls (respectively), whereas *Beilschmiedia* has 9 or 6 stamens in the 1st, 2nd and 3rd whorls or 1st and 2nd whorls (respectively). However, characters selection is subjective, which different characters used for the phylogenetic analysis will result in different grouping. Therefore, finding new characters that are reliable for grouping is needed, and phylogenetic analysis using those characters are suggested to be carried out to improve the knowledge on the species relationships of *Endiandra*. The third topic entitled Phylogenetic relationships of *Endiandra* R.Br. (Lauraceae) inferred from ITS regions of nrDNA sequences was aimed to understand the relationships among *Endiandra* species and between *Endiandra* and *Beilschmiedia*. Molecular data of ITS region of nrDNA sequences was explored for the first time to understand the phylogenetic relationships of *Endiandra*. Thirty one species of *Endiandra* and *Beilschmiedia* were analysed, including 7 species of *Cryptocarya* used as outgroups. The parsimony analysis of the ITS sequences of nrDNA has resulted in 108 equally parsimonious trees. One of most parsimonious trees suggested that *Beilschmiedia* cannot be separated from *Endiandra* which explained the difficulty of distinguishing the two based on morphology. The staminal glands distributed in the lower clades of the tree, left the terminal clade with a group of glandless species with an exception of *E. monothyra* B. Hyland. Staminal gland is a good character for practical purpose but the grouping based on the present and absence of staminal gland is not well supported by the ITS sequences of nrDNA. Improving the resolutions of the cladogram for more reliable interpretations of the species relationships within *Endiandra* is suggested by adding more samples and introducing more suitable markers.