

Ethnobotany of Mountain Regions

*Series Editors:*

R. W. Bussmann · N. Y. Paniagua-Zambrana

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F. Merlin Franco *Editor*

# Ethnobotany of the Mountain Regions of Southeast Asia

 Springer

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## Series Editors

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Ethnobotanical research in recent years has increasingly shifted into applied aspects of the discipline, including climate change research, conservation, and sustainable development. It has by now widely been recognized that “traditional” knowledge is always in flux and adapting to a quickly changing environment. Trends of globalization, especially the globalization of plant markets, have greatly influenced how plant resources are managed nowadays. While ethnobotanical studies are now available from many regions of the world, no comprehensive encyclopedic series focusing on the worlds mountain regions is available in the market. Scholars in plant sciences worldwide will be interested in this website and its dynamic content.

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F. Merlin Franco  
Editor

# Ethnobotany of the Mountain Regions of Southeast Asia

With 418 Figures and 1 Table

 Springer

*Editor*

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*Dedicated to the folk healers of Southeast Asia*

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## Preface

Plants assume ethnobotanical importance only when they are associated with human societies. Use of plants as medicine, food, fodder, and cultural purposes all happen in specific cultural and landscape contexts. This is a major factor often ignored by biologists studying human-plant relationship. Touting a plant as an ethnobotanically important one without providing adequate information on the societies that use them, or the context of use, distorts the picture. Chapters included in this volume provide comprehensive information on the medicinal, food, cultural, and phytochemical values of selected plant species, along with the cultural context. Gleaning out these information from published literature was not an easy task as a good percentage of published articles merely mention the plant use without specifying the community and context of its use. Also, most literature do not provide an understanding on how plant use has changed over times. Our authors have taken extra care to ensure that these information are presented, wherever possible. Another highlight of this volume is that majority of our contributing authors are budding ethnobiologists. These youngsters are poised to emerge as torch bearers of ethnobiology in Southeast Asia, and the larger Asian continent. We hope that this volume would serve as an important reference material for academics, plant lovers, and members of local communities of Southeast Asia.

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## Acknowledgments

This volume took birth with an invitation from Rainer W. Bussmann and Narel Y. Paniagua-Zambrana, series editors of *Ethnobotany of Mountain Regions*. I thank both of them for providing me the opportunity to edit the volume and also the freedom to include sections on biocultural importance of the selected species.

I express my sincere gratitude to all individual authors who have contributed to this volume. However, I should specifically place on record the important role played by Anisatu Z. Wakhidah, a young ethnobiologist from Indonesia. Her entry into the project came at a time when we had suffered a major setback with a few authors dropping out. She had helped me network with other ethnobiologists from Indonesia. Without her, this project would have taken longer to complete.

For this volume, I had the privilege to work with an extremely efficient team at Springer Nature including Eric Stannard, Johanna Klute, and Sylvia Blago. The experience and patience of Johanna and Sylvia helped a lot in troubleshooting various unforeseen glitches that arose especially during the initial stages of the project.

Special thanks to D. Narasimhan, former professor of botany at Madras Christian College, Chennai, and Santhana Ganesan of Singapore Botanical Gardens for their moral support and encouragement.

I thank the Institute of Asian Studies at Universiti Brunei Darussalam for supporting me throughout this project. Though ethnobiology is an interdisciplinary subject, in Asia it is often considered as a part of the natural sciences due to the domination of a bioprospecting narrative. I am indebted to my home institute for appreciating the interdisciplinary value of this project and permitting me to work on this.

F. Merlin Franco



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# Contents

## Volume 1

<b>Part I Country Profiles</b> .....	<b>1</b>
<b>Introduction to Ethnobotany of the Mountain Regions of Southeast Asia</b> .....	<b>3</b>
F. Merlin Franco and Wendy A. Mustaqim	
<b>Part II Plant Profiles</b> .....	<b>29</b>
<i>Abrus precatorius</i> L. FABACEAE .....	31
Krishnamoorthy Devanathan	
<i>Acer laurinum</i> Hassk. SAPINDACEAE .....	43
Rina Ratnasih Irwanto and Arifin Surya Dwipa Irsyam	
<i>Acorus calamus</i> L. ACORACEAE .....	49
Kreni Lokho and F. Merlin Franco	
<i>Acrothamnus suaveolens</i> (Hook.f.) C.J.Quinn ERICACEAE .....	55
Wendy A. Mustaqim	
<i>Aeschynanthus radicans</i> Jack GESNERIACEAE .....	59
Rina Ratnasih Irwanto and Arifin Surya Dwipa Irsyam	
<i>Agathis borneensis</i> Warb. ARAUCARIACEAE .....	65
A. Nithaniyal Stalin and F. Merlin Franco	
<i>Agathis dammara</i> (Lamb.) Poir. ARAUCARIACEAE .....	73
Richard Francisco Clemente	
<i>Aleurites moluccana</i> (L.) Willd. EUPHORBIACEAE .....	79
Wendy A. Mustaqim and Reza Raihandhany Yus	
<i>Alpinia vanoverberghii</i> Merr. ZINGIBERACEAE .....	89
Racquel C. Barcelo and Jonathan M. Barcelo	

<i>Angiopteris evecta</i> (G.Forst.) Hoffm. MARATTIACEAE .....	93
Muhamad Muhaimin and Wendy A. Mustaqim	
<i>Anodendron borneense</i> (King & Gamble) D.J.Middleton APOCYNACEAE .....	103
Mark Lloyd Granaderos Dapar	
<i>Aquilaria malaccensis</i> Lam. THYMELAEACEAE .....	109
Wendy A. Mustaqim	
<i>Araucaria cunninghamii</i> var. <i>papuana</i> Lauterb. ARAUCARIACEAE .....	127
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Areca catechu</i> L. ARECACEAE .....	135
Rina Ratnasih Irwanto and Arifin Surya Dwipa Irsyam	
<i>Arenga pinnata</i> (Wurmb) Merr. ARECACEAE .....	143
Wawan Sujarwo and Ary Prihardhyanto Keim	
<i>Argemone mexicana</i> L. PAPAVERACEAE .....	155
Krishnamoorthy Devanathan	
<i>Artocarpus heterophyllus</i> Lam MORACEAE .....	169
Krishnamoorthy Devanathan and A. Nithaniyal Stalin	
<i>Asplenium nidus</i> L. ASPLENIACEAE .....	181
Muhamad Muhaimin	
<i>Bauhinia monandra</i> Kurz FABACEAE .....	189
Mark Lloyd Granaderos Dapar	
<i>Biancaea sappan</i> (L.) Tod. FABACEAE .....	195
Krishnamoorthy Devanathan	
<i>Biophytum umbraculum</i> Welw. OXALIDACEAE .....	213
Anisatu Z. Wakhidah and Wendy A. Mustaqim	
<i>Calamus manillensis</i> (Mart.) H. Wendl. ARECACEAE .....	219
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson ANNONACEAE .....	225
Wendy A. Mustaqim and Diny Hartiningtias	
<i>Canarium ovatum</i> Engl. BURSERACEAE .....	239
Marina Silalahi and Anisatu Z. Wakhidah	
<i>Cardiospermum halicacabum</i> L. SAPINDACEAE .....	245
Krishnamoorthy Devanathan	
<i>Castanopsis argentea</i> (Blume) A. DC. FAGACEAE .....	255
Aisyah Handayani and Syafitri Hidayati	

<i>Centella asiatica</i> (L.) Urb. <b>APIACEAE</b> .....	261
Anisatu Z. Wakhidah and Wendy A. Mustaqim	
<i>Chloranthus elatior</i> Link <b>CHLORANTHACEAE</b> .....	269
Heri Santoso	
<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob <b>ASTERACEAE</b> .....	275
Kryssa D. Balangcod and Ashlyn Kim D. Balangcod	
<i>Cibotium barometz</i> (L.) J.Sm. <b>CYATHEACEAE</b> .....	283
Daniele Cicuzza	
<i>Cinnamomum burmanni</i> (Nees & T.Nees) Blume <b>LAURACEAE</b> .....	289
Wawan Sujarwo and Ary Prihardhyanto Keim	
<i>Cinnamomum cebuense</i> Kosterm <b>LAURACEAE</b> .....	297
Mark Lloyd Granaderos Dapar	
<i>Cinnamomum mercadoi</i> S.Vidal <b>LAURACEAE</b> .....	305
Mark Lloyd Granaderos Dapar	
<i>Cinnamomum sintoc</i> Blume <b>LAURACEAE</b> .....	311
Aisyah Handayani and Syafitri Hidayati	
<i>Clitoria ternatea</i> L. <b>FABACEAE</b> .....	317
Marina Silalahi	
<i>Cordia dichotoma</i> G.Forst. <b>BORAGINACEAE</b> .....	323
A. Nithaniyal Stalin	
<i>Cratoxylum sumatranum</i> (Jack) Blume <b>HYPERICACEAE</b> .....	333
Mark Lloyd Granaderos Dapar	
<i>Curcuma longa</i> L. <b>ZINGIBERACEAE</b> .....	339
Marina Silalahi	
<i>Dianella ensifolia</i> (L.) Redouté <b>ASPHODELACEAE</b> .....	347
Kreni Lokho and Wendy A. Mustaqim	
<i>Dillenia philippinensis</i> Rolfe <b>DILLENIACEAE</b> .....	353
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Diplazium esculentum</i> (Retz.) Sw. <b>ATHYRIACEAE</b> .....	359
Daniele Cicuzza	
<i>Donax canniformis</i> (G.Forst.) K.Schum. <b>MARANTACEAE</b> .....	365
Marina Silalahi and Anisatu Z. Wakhidah	
<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe <b>ANACARDIACEAE</b> .....	373
Mark Lloyd Granaderos Dapar	
<i>Durio zibethinus</i> L. <b>MALVACEAE</b> .....	379
Wendy A. Mustaqim	

<i>Elaeagnus triflora</i> Roxb. ELAEAGNACEAE .....	387
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Equisetum ramosissimum</i> Desf. EQUISETACEAE .....	391
Muhamad Muhaimin and Wendy A. Mustaqim	
<i>Erechtites valerianifolius</i> (Link ex Spreng.) DC. ASTERACEAE .....	401
Mark Lloyd Granaderos Dapar	
<i>Erythrina subumbrans</i> (Hassk.) Merr. FABACEAE .....	407
Rina Ratnasih Irwanto, Arifin Surya Dwipa Irsyam, and Reza Raihandhany Yus	
<i>Etlingera alba</i> (Blume) A.D. Poulsen ZINGIBERACEAE .....	413
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Etlingera coccinea</i> (Blume) S. Sakai & Nagam. ZINGIBERACEAE .....	417
Krishnamoorthy Devanathan and Wendy A. Mustaqim	
<i>Eurycoma longifolia</i> Jack SIMAROUBACEAE .....	425
Wendy A. Mustaqim, Reza Raihandhany Yus, and Muhammad Badrut Tamam	
<i>Ficus benamina</i> (L.) MORACEAE .....	439
Anisatu Z. Wakhidah, Dafi Al Anshory, and Wendy A. Mustaqim	
<i>Ficus minahassae</i> (Teijsm. & de Vriese) Miq. MORACEAE .....	447
Wendy A. Mustaqim and Wisnu H. Ardi	
<i>Ficus montana</i> Burm.f. MORACEAE .....	453
Wendy A. Mustaqim	
<i>Ficus padana</i> Burm.f. MORACEAE .....	459
Arifin Surya Dwipa Irsyam, Wendy A. Mustaqim, and Rina Ratnasih Irwanto	
<i>Ficus racemosa</i> L. MORACEAE .....	465
Dewi S. Amboupe and Wendy A. Mustaqim	
<i>Ficus septica</i> Burm.f. MORACEAE .....	471
Wendy A. Mustaqim	
<i>Flacourtia inermis</i> Roxb. SALICACEAE .....	479
Wendy A. Mustaqim and Reza Raihandhany Yus	
<i>Flemingia strobilifera</i> (L.) W.T.Aiton FABACEAE .....	485
Wendy A. Mustaqim	
<i>Flueggea virosa</i> (Roxb. ex Willd.) Royle PHYLLANTHACEAE .....	493
Wendy A. Mustaqim	
<i>Garcinia binucao</i> (Blanco) Choisy CLUSIACEAE .....	499
Racquel C. Barcelo and Jonathan M. Barcelo	

<b><i>Garcinia mangostana</i> L. CLUSIACEAE</b> .....	505
Mark Lloyd Granaderos Dapar	
<b><i>Gaultheria leucocarpa</i> Blume ERICACEAE</b> .....	517
Wendy A. Mustaqim and Eka Setiawan	
<b><i>Geodorum densiflorum</i> (Lam.) Schltr. ORCHIDACEAE</b> .....	525
Wendy A. Mustaqim	
<b><i>Gnetum gnemon</i> L. GNETACEAE</b> .....	531
Marina Silalahi	
<b><i>Gunnera macrophylla</i> Blume GUNNERACEAE</b> .....	539
Kryssa D. Balangcod and Ashlyn Kim D. Balangcod	
<b><i>Helminthostachys zeylanica</i> (L.) Hook. OPHIOGLOSSACEAE</b> .....	545
Daniele Cicuzza	
<b><i>Hippobroma longiflora</i> (L.) G. Don CAMPANULACEAE</b> .....	551
Anisatu Z. Wakhidah, Syafroni Pranata, and Wendy A. Mustaqim	
<b><i>Homalanthus macradenius</i> Pax &amp; K.Hoffm. EUPHORBIACEAE</b> .....	557
Mark Lloyd Granaderos Dapar	
<b><i>Hoya lacunosa</i> Blume APOCYNACEAE</b> .....	563
Wendy A. Mustaqim and Wisnu H. Ardi	
<b><i>Hyptis capitata</i> Jacq. LAMIACEAE</b> .....	567
Mark Lloyd Granaderos Dapar	
<b><i>Ixora philippinensis</i> Merr. RUBIACEAE</b> .....	573
Mark Lloyd Granaderos Dapar	
<b>Volume 2</b>	
<b><i>Kaempferia galanga</i> L. ZINGIBERACEAE</b> .....	579
Marina Silalahi	
<b><i>Leea manillensis</i> Walp. VITACEAE</b> .....	587
Mark Lloyd Granaderos Dapar	
<b><i>Leptosolen haenkei</i> C. Presl ZINGIBERACEAE</b> .....	593
Racquel C. Barcelo and Jonathan M. Barcelo	
<b><i>Leucosyke capitellata</i> (Poir.) Wedd. URTICACEAE</b> .....	599
Mark Lloyd Granaderos Dapar	
<b><i>Lilium philippinense</i> Baker LILIACEAE</b> .....	605
Teodora D. Balangcod and Ashlyn Kim D. Balangcod	
<b><i>Liquidambar excelsa</i> (Noronha) Oken ALTINGIACEA</b> .....	613
Aisyah Handayani and Syafitri Hidayati	

<i>Lithocarpus jordanae</i> (Laguna) Rehder FAGACEAE .....	619
Melanie S. Subilla and Zenaida G. Baoanan	
<i>Litsea cubeba</i> (Lour.) Pers. LAURACEAE .....	625
Rina Ratnasih Irwanto, Arifin Surya Dwipa Irsyam, and Reza Raihandhany Yus	
<i>Lygodium circinnatum</i> (Burm.f.) Sw. LYGODIACEAE .....	633
Daniele Cicuzza	
<i>Lygodium microphyllum</i> (Cav.) R. Br. LYGODIACEAE .....	639
Muhamad Muhaimin	
<i>Macaranga magna</i> Turrill EUPHORBIACEAE .....	645
Teodora D. Balangcod and Kryssa D. Balangcod	
<i>Macaranga tanarius</i> (L.) Müll.Arg. EUPHORBIACEAE .....	651
Wendy A. Mustaqim	
<i>Maclura cochinchinensis</i> (Lour.) Corner MORACEAE .....	663
Arifin Surya Dwipa Irsyam, Wendy A. Mustaqim, and Rina Ratnasih Irwanto	
<i>Medinilla pendula</i> Merr. MELASTOMATACEAE .....	669
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Melanolepis multiglandulosa</i> (Reinw. ex Blume) Rchb. & Zoll. EUPHORBIACEAE .....	675
Mark Lloyd Granaderos Dapar	
<i>Melastoma malabathricum</i> L. MELASTOMATACEAE .....	681
Wendy A. Mustaqim	
<i>Melia dubia</i> Cav. MELIACEAE .....	707
A. Nithaniyal Stalin	
<i>Murraya paniculata</i> (L.) Jack RUTACEAE .....	715
Wendy A. Mustaqim and Reza Raihandhany Yus	
<i>Musa balbisiana</i> Colla MUSACEAE .....	727
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Mussaenda philippica</i> A.Rich. RUBIACEAE .....	733
Mark Lloyd Granaderos Dapar	
<i>Myrmecodia brassii</i> Merr. & L.M.Perry RUBIACEAE .....	739
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Myrmecodia lamii</i> Merr. and L.M. Perry RUBIACEAE .....	745
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Nepenthes maxima</i> Reinw. ex Nees NEPENTHACEAE .....	751
Wendy A. Mustaqim	

<i>Nothofagus brassii</i> Steenis NOTHOFAGACEAE .....	757
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Nothofagus starckenborghiorum</i> Steenis NOTHOFAGACEAE .....	763
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Oroxylum indicum</i> (L.) Kurz BIGNONIACEAE .....	769
Krishnamoorthy Devanathan	
<i>Pandanus amaryllifolius</i> Roxb. ex Lindl. PANDANACEAE .....	783
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Pandanus antaresensis</i> H.St.John PANDANACEAE .....	791
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Pandanus conoideus</i> Lam. PANDANACEAE .....	799
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Pandanus julianettii</i> Martelli PANDANACEAE .....	807
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Papuacedrus papuana</i> (F.J. Mueller) H.L.Li CUPRESSACEAE .....	817
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Passiflora foetida</i> L. PASSIFLORACEAE .....	825
Dewi S. Amboupe and Wendy A. Mustaqim	
<i>Peperomia pellucida</i> (L.) Kunth PIPERACEAE .....	835
Anisatu Z. Wakhidah, Cindy Novianti, and Wendy A. Mustaqim	
<i>Phaleria macrocarpa</i> (Scheff.) Boerl. THYMELAEACEAE .....	843
Wendy A. Mustaqim, Reza Raihandhany Yus, and Muhammad Badrut Tamam	
<i>Phanera semibifida</i> (Roxb.) Benth. FABACEAE .....	857
Mark Lloyd Granaderos Dapar	
<i>Phyllanthus emblica</i> L. PHYLLANTHACEAE .....	863
Arifin Surya Dwipa Irsyam, Wendy A. Mustaqim, and Rina Ratnasih Irwanto	
<i>Phyllocladus hypophyllus</i> Hook.f. PODOCARPACEAE .....	873
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Pinus merkusii</i> Jungh. & de Vriese PINACEAE .....	881
Wendy A. Mustaqim	
<i>Piper betle</i> L. PIPERACEAE .....	889
Marina Silalahi	
<i>Piper decumanum</i> L. PIPERACEAE .....	901
Mark Lloyd Granaderos Dapar	

<i>Piper sarmentosum</i> Roxb. <b>PIPERACEAE</b> .....	907
Kreni Lokho and F. Merlin Franco	
<i>Pittosporum resiniferum</i> Hemsl. <b>PITTOSPORACEAE</b> .....	913
Melanie S. Subilla and Zenaida G. Baoanan	
<i>Platostoma palustre</i> (Blume) A.J.Paton <b>LAMIACEAE</b> .....	921
Heri Santoso	
<i>Plectocomia elongata</i> Mart. ex Blume <b>ARECACEAE</b> .....	927
Arifin Surya Dwipa Irsyam, Wendy A. Mustaqim, and Rina Ratnasih Irwanto	
<i>Polygala paniculata</i> L. <b>POLYGALACEAE</b> .....	933
Kreni Lokho and Wendy A. Mustaqim	
<i>Proiphys amboinensis</i> (L.) Herb. <b>AMARYLLIDACEAE</b> .....	941
Anisatu Z. Wakhidah and Wendy A. Mustaqim	
<i>Rubus fraxinifolius</i> Poir. <b>ROSACEAE</b> .....	947
Maverick N. Tamayo and Zenaida G. Baoanan	
<i>Sambucus javanica</i> Reinw. ex Blume <b>VIBURNACEAE</b> .....	955
Marina Silalahi and Anisatu Z. Wakhidah	
<i>Saurauia bontocensis</i> Merr. <b>ACTINIDIACEAE</b> .....	963
Melanie S. Subilla and Zenaida G. Baoanan	
<i>Saurauia elegans</i> (Choisy) Fern.-Vill. <b>ACTINIDIACEAE</b> .....	969
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Saurauia sparsiflora</i> Elmer <b>ACTINIDIACEAE</b> .....	973
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Schefflera elliptica</i> (Blume) Harms <b>ARALIACEAE</b> .....	977
Kreni Lokho and Krishnamoorthy Devanathan	
<i>Schima wallichii</i> (DC.) Korth. <b>THEACEAE</b> .....	983
Aisyah Handayani and Syafitri Hidayati	
<i>Shorea javanica</i> Koord. & Valeton <b>DIPTEROCARPACEAE</b> .....	991
Anisatu Z. Wakhidah, I. Gusti Ayu Rai Sawitri, and Wendy A. Mustaqim	
<i>Smilax bracteata</i> C. Presl. <b>SMILACACEAE</b> .....	999
Krishnamoorthy Devanathan	
<i>Sphaeropteris tomentosissima</i> (Copel.) R. M. Tryon <b>CYATHEACEAE</b> .....	1003
Ary Prihardhyanto Keim and Wawan Sujarwo	
<i>Spondias pinnata</i> (L.f.) Kurz. <b>ANACARDIACEAE</b> .....	1009
Wawan Sujarwo and Ary Prihardhyanto Keim	



<i>Staurogyne elongata</i> (Nees) Kuntze ACANTHACEAE .....	1015
Aisyah Handayani and Syafitri Hidayati	
<i>Stenochlaena palustris</i> (Burm. f.) Bedd. BLECHNACEAE .....	1021
Daniele Cicuzza	
<i>Syzygium cumini</i> (L.) Skeels MYRTACEAE .....	1027
Anisatu Z. Wakhidah and Wendy A. Mustaqim	
<i>Syzygium leucoxylon</i> Korth. MYRTACEAE .....	1035
Krishnamoorthy Devanathan and Jurgenne H. Primavera	
<i>Syzygium malaccense</i> (L.) Merr. & L.M.Perry MYRTACEAE .....	1041
Wendy A. Mustaqim	
<i>Tasmannia piperita</i> (Hook.f.) Miers WINTERACEAE .....	1051
Melanie S. Subilla and Zenaida G. Baoanan	
<i>Taxus wallichiana</i> Zucc. TAXACEAE .....	1059
Muhamad Muhaimin, Arifin Surya Dwipa Irsyam, and Wendy A. Mustaqim	
<i>Tetrastigma loheri</i> Gagnep. VITACEAE .....	1067
Marina Silalahi and Anisatu Z. Wakhidah	
<i>Tinospora crispa</i> (L.) Hook.f. & Thomson MENISPERMACEAE .....	1071
Mark Lloyd Granaderos Dapar	
<i>Tithonia diversifolia</i> (Hemsl.) A.Gray ASTERACEAE .....	1079
Teodora D. Balangcod and Ashlyn Kim D. Balangcod	
<i>Uncaria gambir</i> (W.Hunter) Roxb. RUBIACEAE .....	1085
Rina Ratnasih Irwanto, Arifin Surya Dwipa Irsyam, and Reza Raihandhany Yus	
<i>Uncaria lanosa</i> Wall. RUBIACEAE .....	1091
Mark Lloyd Granaderos Dapar	
<i>Vaccinium barandanum</i> S. Vidal ERICACEAE .....	1097
Racquel C. Barcelo and Jonathan M. Barcelo	
<i>Vaccinium myrtoides</i> (Blume) Miq. ERICACEAE .....	1101
Melanie S. Subilla and Zenaida G. Baoanan	
<i>Viburnum luzonicum</i> Rolfe VIBURNACEAE Raf. ....	1107
Melanie S. Subilla and Zenaida G. Baoanan	
<i>Vitex negundo</i> L. LAMIACEAE .....	1115
A. Nithaniyal Stalin	
<i>Vitex parviflora</i> A.Juss. LAMIACEAE .....	1125
Mark Lloyd Granaderos Dapar	

*Xanthosoma sagittifolium* (L.) Schott ARACEAE ..... 1131  
Arifin Surya Dwipa Irsyam, Wendy A. Mustaqim, and  
Rina Ratnasih Irwanto

**Photographs and Findings** ..... 1137



# *Papuacedrus papuana* (F.J. Mueller) H.L.Li

## CUPRESSACEAE

Ary Prihardhyanto Keim and Wawan Sujarwo

### Synonyms

*Libocedrus arfakensis* L. Gibbs; *L. papuana* F.Muell.; *L. torricellensis* Lauterbach; *Papuacedrus arfakensis* (L. Gibbs) H.L.Li; *P. papuana* var. *arfakensis* (L. Gibbs) R. J.Johns; *P. torricellensis* (Lauterbach) H.L.Li.; *Thuja papuana* (F.Muell.) Voss. (Eckenwalder 2009; POWO 2020).

### Local Names

**English:** Papuan incense cedar; **Indonesia:** *sedar papua* (Standard Indonesian), *araum* (Karooon, Papua), *butaga* (Manikiong), *butayeka* (Manikiong), *duwak* (Keban), *yuta* (Nairi, Watabung), *matu* (Kepauko), *nipau* (Keban), *pomoan* (Manikiong), *sowa* (Keban, Anjai), *sukou* (Wapi, Migote), *swa* (Anjai), *tera* (Garaina), *tuwa* (Keban), *wonga* (arfak); **Papua New Guinea:** *ab* (Nega, Kepilam), *aiap* (Enga), *aip* (Enga), *autibo* (Kepauko), *bit* (Yogom), *dautie* (Kepauko), *dzagosa* (Asaro, Kefamo), *dzasihanini* (Asaro, Kefamo), *eis* (Karooon), *gagman* (Hagen, Togoba), *gamuga* (Hagen, Togoba), *hohoba* (Lei), *hap* (Enga, Kepilam), *iwunturra* (Manki), *kaibelkombam* (Wahgi, Minj), *kaipil* (Wahgi, Minj), *kamgenkuna* (Hagen, Togoba), *kap* (Enga, Kepilam), *mondalasap* (Mendi), *mondilasop* (Mendi), *ogeleh* (Chimbu, Masul), *oleh* (Chimbu, Masul), *ongol* (Wahgi. Minj), *urenak* (Mendi), *ye-enka* (Nauti).

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## Botany and Ecology

**Description:** *Papuacedrus papuana* is an evergreen monoecious tree growing up to 35 to 50 m, trunk up to 1 m in diameter, tree height less than 10 m tall in subalpine scrub. Bark reddish brown and scaly at first, darkening with age. Crown pyramidal in youth but spreading, dome shaped, and with drooping branches in age. Shoots arranged in flattened, fern-like sprays with branchlets arising alternately or in opposite pairs more or less evenly on the front and rear of the parent side twigs. Lateral scale leaves up to 10–16 mm long in juveniles with the tip spreading to 3–6 mm, progressively smaller and tighter to the branchlet in more mature trees, down to 1 mm long in the most exposed adult foliage. Facial leaves much smaller and not changing as much in size with maturity, 1–3.5 mm long. Pollen cones 4–25 mm long, with 4–10 pairs or quartets of pollen scales. Seed cones 8–15 mm long, the seed scales often with fine radiating ridges extending from the bract tip. Triangular free tip of bract 1–2 mm long. Seeds 2–3 mm long, the larger wing extending straight out from the egg-shaped body by more than twice its width (Van Royen 1980; Farjon 1998, 2000, 2008; Eckenwalder 2009).

**Phenology:** *Papuacedrus papuana* flowers and fruits the whole year around. Keim et al. (2018) collected *P. papuana* with good seed cones and seed scales in the subalpine scrub around the vicinity of Lake Habbema at 3200 m altitude (Fig. 1).

**Distribution and Habitat:** *Papuacedrus papuana* is the sole extant member of the genus *Papuacedrus*. The other known species, such as *P. australis* (Tasmania; Hill and Carpenter 1991), *P. prechilensis* (Chilean Patagonia; Wilf et al. 2009), and *P. shenii* (Fossil Hill, King George Island, Antarctica; Zhou and Li 1994) are extinct. The distribution areas of *P. papuana* include New Guinea and the Moluccas, particularly Halmahera Island (Van Balgooy 1976; Van Steenis 1979; Van Royen 1980; Farjon 1998, 2000, 2008; Eckenwalder 2009). *Papuacedrus papuana* is found in the montane rainforests up to subalpine scrub mostly in highland New Guinea,

**Fig. 1** Mature seed cone showing the seed scales open wide. (© Ary P. Keim)



**Fig. 2** Habit of *Papuacedrus papuana* found in the vicinity of Habbema Lake, Jayawijaya at 3200 m altitude. (© Ary P. Keim)



where the species forms pure strands or mixed with other conifers and hardwoods mostly from 1500 to 3900 m altitudes (Van Royen 1980; Eckenwalder 2009). In highland New Guinea, the species is regarded as the marker of the subalpine vegetation (Van Royen 1980). In the vicinity of Habbema Lake in the Jayawijaya Range, *Papuacedrus papuana* is abundantly found in Subalpine Forest, especially in the Lower Subalpine Forest at 3200–3500 m altitudes, where the species forms widespread pure strands (Fig. 2) (Keim et al. 2018). In this vegetation type, *P. papuana* is also found cohabitant with other conifers such as *Phyllocladus hypophyllus* (Podocarpaceae), *Podocarpus brassii* (Podocarpaceae), and hardwood dicots such as *Nothofagus brassii* and *N. starkenborghiorum* (Keim et al. 2018); thus, in accordance with Van Royen (1980). The presence of the pure strand formation of *P. papuana* has also been noticed by Brass (1941a, b; see also Brass 2012) and Archbold et al. (1942). The scenery was photographed by Brass in 1938 (see De Laubenfels 1988) and is not significantly different with the situation observed by us during our visit to Lake Habbema in 2011 and 2014 (see Keim et al. 2018). Thus, at least in 2014, the pure strand formation of *P. papuana* was still generally well preserved. Keim et al. (2018) also observed the presence of *P. papuana* in the Subalpine Scrub (2400–3650 m altitudes). However, the population is mostly composed by individuals with height 3 m or lower, lower than the

population found in the Subalpine Forest, located side by side. *Papuacedrus papuana* can be found up to Subalpine Grassland at around 3200–4000 m altitudes with fairly tall individuals up to 5 m (Keim et al. 2018). The obvious presence of *P. papuana* in the Subalpine Forest of the Lake Habbema marks the species as the species marker of the subalpine vegetation in the vicinity. As the same phenomenon is also observed in many Lower Subalpine Forests in highlands New Guinea, *P. papuana* has been widely accepted as the marker species of subalpine vegetation zone throughout highland New Guinea (Hope 1976; Mangen 1993; Johns et al. 2007; Eckenwalder 2009; Kartawinata 2013; Keim et al. 2018).

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## Local Medicinal Uses

**Indonesia:** The Dani people of the Baliem Valley, Jayawijaya Range use the leaves and bark of *Papuacedrus papuana* for curing high fever, possibly caused by infection; the plant could be a potential source of antibiotic. Leaf or bark decoction is drunk, and fever is noticeably reduced by the following morning (personal observation). Although the leaves of *P. papuana* are also eaten by people in Watut and other places in the Eastern Highlands of Papua New Guinea (Powell 1976), there is no published information regarding the medicinal uses of the leaves.

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## Phytochemistry

*Papuacedrus*, together with other members of subfamily Callitroidea (genera *Libocedrus*, *Austrocedrus*, and *Pilgerodendron*), is characterized chemically by major amounts of amentoflavone and its 4''-monomethyl ether, as well as trace amounts of hinokiflavone or its derivatives detectable by permethylation of the extract (Gadek and Quinn 1983). Being the sole member of the genus, *Papuacedrus* here refers to *P. papuana*. Markham et al. (1990) reported that *P. papuana* contains flavonoid 3-diglycosides in the form of quercetin and myricetin. *Papuacedrus papuana* is also observed to contain other forms of flavonoids and bioflavonoids 3 and 4. The plant is also known to produce resin (Langenheim 2003). However, compared to other genera of Cupressaceae, the composition of resin from *Papuacedrus* is still largely unknown. It is suggested here that the resin of this species is likely in the form of oleoresin containing monoterpenes, the chemical substance found in majority of conifers (Springbob and Kutchan 2009). The species is also believed to contain the active compounds podophyllotoxin and deoxypodophyllotoxin, which are proven to be tumor inhibitors (Fitzgerald et al. 1957; see also Pan et al. 2009).

**Fig. 3** The leaves of *Papuacedrus papuana*.  
(© Ary P. Keim)



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### Local Food Uses

**Indonesia:** The leaves of *P. papuana* (Fig. 3) are eaten as vegetables by the people of Watut and other places in Eastern Highlands of Papua New Guinea (Powell 1976). However, there is no such report from Baliem Valley, Jayawijaya Range. The Dani people of the valley do eat the leaves of *P. papuana*, but for medicinal and supernatural-related purposes only.

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### Biocultural Importance

**Indonesia:** *Papuacedrus papuana* is considered sacred by the Dani throughout the Baliem Valley and adjacent areas. They even consider *Papuacedrus papuana* as more sacred than *Phyllocladus hypophyllus* (the *sina* wood). This is apparently due to the conspicuous strong cypress-like aroma of the wood, rarity of the species, and sacred habitat where it is found (Lake Habbema). The timber is used for building



purposes and the bark is used for roofing (Van Royen 1980; Milliken 2006). Despite being a good source of building materials, the woods of *P. papuana* are very rarely used for building fences by the Dani people and have never been used for pigs' fences. According to the Dani, the wood of *P. papuana* is too sacred for building something that is not for humans (personal observation). The Dani also use the green wood for fuel and the smokes produced gives off little heat (Archbold et al. 1942). The smoke gives a good aroma that triggers a pleasant feeling that helps them to better sleep; thus, the smoke could act as sedatives (personal observation). The resin (see Langenheim 2003; Boer et al. 2005) is also harvested by the Dani and traditionally used as incense. It is also used in healing rituals as well as other magic. The resin is burnt and the smoke is blown over patients, accompanied with specific chants. We observed that even the Javanese who live in Wamena (the capital of Jayawijaya Regency) also use the resin in their traditional rituals (including healing rituals), possibly as a substitute for the traditional Javanese incense.

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## Economic Importance

**Indonesia:** The wood of *P. papuana* is highly prized by the Dani and mainly used for constructing houses (Purwanto and Walujo 1992; Arobaya and Pattiselanno 2007). Despite being a fairly light wood (with density of 0.37 g/cm<sup>3</sup>; see Soewarsono 1965; Reyes 1992; Lemmens 1995), the wood of *P. papuana* is regarded as one of the highly demanded building materials in highlands New Guinea and has been massively harvested (Van Royen 1980). Fortunately, the population in the subalpine forest near Habbema Lake is still preserved well according to last exploration made in 2014 (Keim et al. 2018). Keim et al. (2018) recorded the evidence of massive illegal logging of *Papuacedrus papuana* that has followed the development of the Trans Papua highway through the vicinity of Lake Habbema. The 2013 IUCN status of Near Threatened accorded to *Papuacedrus papuana* (Thomas 2013) might have to be revised. As with many other tropical montane conifer genera, *Papuacedrus papuana* is not found in cultivation, except in some botanical collections, and no cultivar selection has taken place (Eckenwalder 2009).

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