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PHYLOGENETIC RELATIONSHIPS OF LOCALLY CULTIVATED *Garcinia* SPECIES WITH SOME WILD RELATIVES

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ABSTRACT

Garcinia is known for their edible fruit and a number of species from the wild have been selected and cultivated not just for their fruits but also for other uses such as vegetables and traditional medicine. Phylogenetic relationships of five locally cultivated and 12 wild species of *Garcinia* were determined using the sequence of the internal transcribed spacer region (ITS). Sequence analysis generated by both Parsimony and Bayesian inference resulted in almost identical tree topology containing five main monophyletic clades. The monophyly of these clades are congruent with previous taxonomic classification although a few clades require more representative samples to give clearer picture.

Garcinia cowa

(kandis) and

G. atroviridis

(asam gelugor) clustered within sect. Brindonia,

G. hombroniana

(beruas) and

G. mangostana

(mangosteen) fall within clade of sect.

Garcinia

and

G. prainiana

(kecupu) exhibit as basal clade of sect. Xanthochymus.

ABSTRAK

Garcinia telah dikenali kerana buahnya yang boleh dimakan dan terdapat beberapa spesies liar yang telah dipilih dan dijadikan tanaman bukan sahaja kerana buahnya bahkan juga kerana kegunaannya sebagai sayuran dan ubatan tradisi. Pertalian filogenetik sebanyak lima spesies yang ditanam dan 12 spesies liar telah ditentukan dengan menggunakan jujukan kawasan yang ditranskripsi dalaman (ITS). Analisis jujukan yang dijana daripada kaedah Parsimoni dan inferens Bayes menghasilkan pohon filogeni yang agak serupa topologinya dengan lima klad utama. Monofili klad ini adalah sejajar dengan pengelasan taksonomi yang telah dilakukan walaupun terdapat sebilangan kecil klad yang memerlukan lebih banyak wakil spesies bagi memperjelaskan keadaan. *G. cowa* (kandis) dan *G. atroviridis* (asam gelugor)

terkumpul di dalam seksyen Brindonia,

G. hombroniana

(beruas) dan

G. mangostana

(manggis) tergolong dalam klad seksyen

Garcinia

dan

G. prainiana

(kecupu) menunjukkan sebagai klad dasar iaitu di dalam seksyen Xanthochymus.

Key words: Phylogenetic relationships, *Garcinia* species, ITS

REFERENCES

- Altschul, S.F., Thomas, L.M., Alejandro, A.S., Jinghui, Z., Zheng, Z., Webb, M. and David, J.L. 1997. Gapped BLAST and PST-BLAST: A new generation of protein database search programs. *Nucleic Acid Research* 25: 3389- 3402.
- Burkill, I.H. 1935. *A Dictionary of the Economic Product of the Malay Peninsula* 1. Reprint Edition (1966). Kuala Lumpur, Ministry of Agriculture and Co-Operatives.
- Baldwin, B.G. 1992. Phylogenetic utility of the internal transcribed spacers of nuclear ribosomal DNA in plants: an example from Compositae. *Molecular Phylogenetic & Evolution* 1(1): 3-16.
- Baldwin, B.G., Sanderson, M.J., Porter, J.M., Wojceichowski, M.F., Campbell, C.S. and Donoghue, M.J. 1995. The ITS region of nuclear ribosomal DNA: A valuable source of evidence on angiosperm phylogeny. *Annals Missouri Botanical Garden* 82: 247-277.
- Corner, E.J.H. 1940. *Wayside Trees of Malaya* 1, 3rd Edition (1988). Kuala Lumpur, Malaysia Nature Society.
- Crespo, M.B, Lledo, M.D., Fay, M.F. and Chase, M.W. 2000. Subtribe Vellinae (Brassicaceae, Brassicaceae): a combined analysis of ITS nrDNA sequences and morphological data. *Annals of Botany* 86: 53-62.
- Doyle, J.J. and Doyle, J.L. 1990. Isolation of plants DNA from fresh tissues. *Focus* 12: 13- 15.
- Felsenstein, J. 1985. Confidence limit on phylogenies; an approach using bootstrap. *Evolution* 39: 783-791.
- Fitch, W.M. 1970. Towards defining the course of evolution: minimum of change for specific tree topology. *Systematic Zoology* 20: 406-416.
- Gustafsson, M.H.G., V. Bittrich & P.F. Stevens. 2002. Phylogeny of Clusiaceae based on rbcL sequences. *International Journal of Plant Sciences* 163(3): 1045-1054.
- Hooker, J.D. 1875. *Garcinia*. In: J.D. Hooker (ed.), *Flora of British India* 1: 259. L. Reeve & Co., London.
- Jones, S.W. 1980. *Morphology and Major Taxonomy of Garcinia (Guttiferae)*. Unpublished Ph D. thesis University of Leicester UK.
- Kamiya, K., Harada, K., Ogino, K., Kajita, T., Yamazaki, T., Lee, H.S. and Ashton, P.S. 1998. Molecular phylogeny of Dipterocarp species using nucleotide of two non-coding regions in chloroplast DNA. *Tropics*, 7(3/4): 195-207.
- King, G. 1890. *Materials for a flora of the Malayan Peninsula*. *J. As. Soc. Beng.* 59: 156.
- Kollipara, K.P., Singh, R.J. and Hymowitz, T. 1997. Phylogenetic and genomic relationship in the genus *Glycine* Willd. based on sequences of ITS region of nuclear rDNA. *Genome* 40: 57-68.
- Liston, A., Robinson, W.A., Pinero, D., and Alvarez-Buyyla, E.R. 1999. Phylogenetics of *Pinus* (Pinaceae) based on nuclear ribosomal DNA internal transcribed spacer region sequences.

Molecular Phylogenetic Evolution 11(1): 95-109.

Nabandith, V., M. Suzui, T. Morioka, T. Kaneshiro, T. Kinjo, K. Matsumoto, Y. Akao, M. Iinuma & N. Yoshimi. 2004. Inhibitory effects of crude alpha-mangostin, a xanthone derivative, on two different categories of colon preneoplastic lesions induced by 1, 2-dimethylhydrazine in the rat. *Asian Pacific Journal of Cancer Prevention* 5(4): 433-438.

Richards, A.J. 1990. Studies in *Garcinia* dioecious tropical forest trees: The origin of the mangosteen *Garcinia mangostana* L. *Botanical Journal of Linnaean Society* 103(4): 301-308.

Ridley, H.N. 1922. *Flora of Malay Peninsula* 1. London, Lovell Reeve.

Rismita, Sari. 2000. Review of *Garcinia* (Clusiaceae) Based on Molecular Systematics. A Phylogenetic study of molecular data of *Garcinia* spp. Unpublished M. Sc. Thesis. Department of Tropical Plant Science, School of Tropical Biology., James Cook University.

Ronquist, F. & J.P. Huelsenbeck, 2003. MRBAYES 3: Bayesian phylogenetic inference under mixed models. *Bioinformatics* 19: 1572-1574.

Rukachaisirikul, V., P. Pailee, A. Hiranrat, P. Tuchinda, C. Yoosook, J. Kasisit, W.C. Taylor & V. Reutrakul. 2003. Anti-HIV-1 protostane triterpenes and digeranylbenzo- phenone from trunk, bark and stems of *Garcinia speciosa*. *Planta Medica* 69(12): 1141- 1146.

Schulthies, L.M. and Baldwin, B.G. 1999. Molecular phylogenetic of Fouquieriaceae: evidence from nuclear rDNA ITS studies. *American Journal of Botany* 86(4): 578-589.

Stevens, P.F. 2001 onwards. Angiosperm Phylogeny Website. Version 6. <http://www.mobot.org/MOBOT/research/APweb/>. May 2006.

Swofford, D.L. 1999. PAUP*: Phylogenetic Analysis Using Parsimony Ver. 4.0. Sineur, Sunderland, Massachusetts.

Thompson, J.D., Gibson, T.J., Plewniak, F., Jeanmougin, F. and Higgins, D.G. 1997. The CLUSTAL X Windows, flexible strategies for multiple sequencing alignment aided by quality analysis tools. *Nucleic Acid Research* 25(4): 4876-4882.

Vesque, J. 1893. Guttiferae. In: A. deCandolle and C. deCandolle (eds.), *Monographiae Phanerogamarum Prodrromi Nunc Continuato, Nunc Revisio* vol. VIII. Sumptibus G. Masson, Paris.

Wallich, N. 1832. *Plantae Asiatica Rariores*. Vol. 3. Richard Taylor for Treuttel & Würtz, Treuttel jun. & Richter, London, Paris & Strassburg.

White, T.J, Bruns, T., Lee, S., and Taylor, J. 1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetic. In Innis M, Gelfland D, Snisky J, White T. (eds.), *PCR Protocols: A Guide to Methods and Amplification*. Academic Press, San Diego.

Whitmore, T.C. 1973. Guttiferae. In T.C. Whitmore (ed.) *Tree Flora of Malaya* 2: 162- 236. Kuala Lumpur, Longman Malaysia.

Yapwattanaphun, C., S. Subhadrabandhu, C. Honsho & K. Yonemori. 2004. Phylogenetic Relationship of Mangosteen (*Garcinia mangostana*) and several wild relatives (*Garcinia* spp.) revealed by ITS sequence data. *Journal of the American Society for Horticultural Science* 129(3): 368-373.

