

# Molecular phylogeny of *Nycticebus* inferred from mitochondrial genes

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**Abstract:** Researchers are still discussing the classification of *Nycticebus*. We established a molecular phylogeny covering all recognized taxa in *Nycticebus* to provide information for further evaluation. We sequenced partial D-loop (ca. 390 bp) and cytochrome b genes (425 bp) from 22 specimens. We separated most of the major groups except for some mixing of *Nycticebus. coucang* *cucang* and *N. bengalensis*. *Nycticebus pygmaeus* diverged earlier from the ancestral stock than the other taxa. *Nycticebus coucang menagensis* was well discriminated from *N. c. coucang*. It may be possible to explain the mixing of *Nycticebus coucang coucang* and *N. bengalensis* by the hybridization between the 2 groups in the field. Although our data did not provide direct evidence for or against the new proposal that *Nycticebus coucang javanicus* be raised to the rank of a distinct species (*N. javanicus*), we have good evidence for regarding *N. c. menagensis* as a species. ?? 2006 Springer Science+Business Media, Inc.

**Author Keywords:** Classification; Mitochondrial gene; Molecular phylogeny; Slow loris

**Index Keywords:** cytochrome; hybridization; mitochondrial DNA; phylogeny; primate; *Nycticebus*; *Nycticebus bengalensis*; *Nycticebus coucang*; *Nycticebus coucang coucang*; *Nycticebus coucang javanicus*; *Nycticebus coucang menagensis*; *Nycticebus pygmaeus*

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References:

1. Cheng, Z.P., Zhang, Y.P., Shi, L.M., Liu, R.Q., Wang, Y.X., Studies on the chromosomes of genus *Nycticebus* (1993) *Primates*, 34, pp. 47-53
2. Corbet, G.B., Hill, J.E., (1980) A World List of Mammalian Speices, , British Museum (Natural History), London
3. Dao, V.T., Sur une nouvelle espece de *Nycticebus* au Vuetnam (1960) *Zool. Anz.*, 164, pp. 240-243
4. Ellerman, J.R., Morrison-Scott, T.C.S., (1951) Checklist of Palaearctic and Indian Mammals 1758-1945, , British Museum (Natural History), London
5. Groves, C.P., Systematics of the genus *Nycticebus* (1971) Proceeding of the Third International Congress of Primatology, Zurich 1970, Vol. 1: Taxonomy, Anatomy, Reproduction, pp. 44-53. , Biegert, J., and Leutenegger, W. (eds.), Karger, Basel
6. Groves, C.P., Systematics of tarsiers and lorises (1998) *Primates*, 39, pp. 13-27
7. Groves, C.P., (2001) Primate Taxonomy, , Smithsonian Institution Press, Washington, DC
8. Hasegawa, M., Kishino, H., Yano, T., Dating of the human-ape splitting by a molecular clock of mitochondrial DNA (1985)

J. Mol. Evol., 22, pp. 160-174

9. Hill, W.C., (1953) Primates: Comparative Anatomy and Taxonomy, I: Strepsirrhini, , The Edinburgh University Press, Edinburgh
10. Irwin, D.M., Kocher, T.D., Wilson, A.C., Evolution of the cytochrome b gene of mammals (1991) J. Mol. Evol., 32, pp. 128-144
11. Kimura, M., A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences (1980) J. Mol. Evol., 16, pp. 111-120
12. Kumar, S., Tamura, K., Jakobsen, I.B., Nei, M., MEGA2: Molecular evolutionary genetics analysis software (2001) Bioinformatics, 17, pp. 1244-1245
13. Lu, X.M., Fu, Y.X., Zhang, Y.P., Evolution of mitochondrial cytochrome b pseudogene in genus Nycticebus (2002) Mol. Biol. Evol., 19, pp. 2337-2341
14. Lu, X.M., Wang, Y.X., Zhang, Y.P., Divergence and phylogeny of mitochondrial cytochrome b gene from species in genus Nycticebus (2001) Zool. Res., 22, pp. 93-98
15. Ma, S., Wang, Y., The recent distribution, status and conservation of primates in China (1988) Acta Theriol. Sinica, 8, pp. 250-260
16. Petter, J.J., Petter-Rousseaux, A., Classification of the prosimians (1979) The Study of Prosimian Behavior, pp. 281-286. , Doyle, G. A., and Martin, R. D. (eds.), Academic Press, New York
17. Posada, D., Crandall, K.A., Modeltest: Testing the model of DNA substitution (1998) Bioinformatics, 14, pp. 817-818
18. Sambrook, J., Russell, D., (2001) Molecular Cloning, , Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York
19. Swofford, D.L., (1998) Paup \*, Phylogenetic Analysis Using Parsimony (\* and Other Methods). Version 4, , Sinauer Associates, Sunderland, MA
20. Tajima, F., Simple methods for testing the molecular evolutionary clock hypothesis (1993) Genetics, 135, pp. 599-607
21. Wang, W., Su, B., Lan, H., Interspecific differentiation of the slow lorises (genus Nycticebus) inferred from ribosomal DNA restriction maps (1996) Zool. Res., 17, pp. 89-93
22. Xia, X., Xie, Z., Data analysis in molecular biology and evolution (2001) J. Hered., 92, pp. 371-373
23. Zhang, Y.P., Cheng, Z.P., Shi, L.M., Phylogeny of the slow lorises (genus Nycticebus): An approach using mitochondrial DNA restriction enzyme analysis (1993) Int. J. Primatol., 14, pp. 167-175

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