



SYSTEMATIC STUDY OF STREAM FROG *Hylarana signata* (Günther, 1872) COMPLEX (ANURA, RANIDAE) FROM SUMATRA

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ANIMAL BIOSCIENCE STUDY PROGRAM
FACULTY OF MATHEMATIC AND NATURAL SCIENCES
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SUMMARY

AMAT RIBUT. Systematic Study of Stream Frog *Hylarana signata* (Günther, 1872) Complex (Anura, Ranidae) from Sumatra. Supervised by ACHMAD FARAJALLAH, and AMIR HAMIDY.

The *Hylarana signata* complex comprises many species in Indonesia, yet its taxonomy remains unresolved, particularly in Sumatra. This is largely due to morphological conservatism, which makes the boundaries among lineages difficult to discern. Given the external similarity among Sumatran frogs, the presence of cryptic species currently identified as *H. signata*, *H. picturata*, or other related species is highly likely. The nominal concepts of *H. signata* and *H. picturata* are rooted in Borneo, and thus the “signata/picturata-like” populations from Sumatra require careful evaluation based on type diagnoses and modern genetic data. This study aims to clarify the taxonomic status of Sumatran populations within the *H. signata* complex and to update the distribution of *H. sundabarat*.

Molecular and morphological analyses were conducted on samples of the *H. signata* complex from Sumatra and Kalimantan housed in the Museum Zoologicum Bogoriense. Specifically, we examined specimens labeled as *H. picturata*, *H. signata*, *H. siberu*, *H. centropeninsularis*, *H. fantastica*, and *H. sundabarat*. Molecular analyses were based on 18 newly generated sequences combined with 30 reference sequences from NCBI, including outgroups. Phylogenetic trees were reconstructed from 444 bp of the 16S rRNA gene using Bayesian Inference, Maximum Likelihood, and Neighbor-Joining methods, and genetic distances were calculated using p-distance. Morphological analyses involved measurements of 32 morphometric characters from adult male specimens. Principal Component Analysis (PCA), Kruskal–Wallis tests, and Dunn’s post hoc tests were used to assess morphological differentiation within the *H. signata* complex.

The phylogenetic analyses revealed two distinct lineages, which are described in this study as new species, *H. anantambanii* and *H. hellenae*. The genetic distance between these two species is 4.81%, and exceeds 8% relative to other species within the *H. signata* complex. PCA results showed that the two new species do not overlap with each other, although each partially overlaps morphometrically with closely related species. Both new species can be distinguished by a combination of external characters, including the size and position of the humeral glands, dorsolateral stripe patterns, and webbing formulas. The phylogenetic results also confirm the presence of *H. sundabarat* in several provinces of Sumatra where specimens had previously been identified as *H. signata* and *H. picturata*, thereby clarifying its distribution across the Sunda Shelf.

These findings make an important contribution by clarifying the composition of the *H. signata* complex in Sumatra and highlighting patterns of endemism and the importance of montane protected areas for biodiversity conservation. Further studies are needed, particularly on tadpole morphology and bioacoustic characterization of each species within the *H. signata* complex.

Keywords: Integrative taxonomy, Mitochondrial 16S rRNA, Phylogenetics, *Pulchrana*, Sumatra.



RINGKASAN

AMAT RIBUT. Studi Sistematika Katak Sungai *Hylarana signata* (Günther, 1872) Kompleks (Anura, Ranidae) dari Sumatra. Dibimbing oleh ACHMAD FARAJALLAH dan AMIR HAMIDY.

Katak *Hylarana signata* kompleks memiliki banyak spesies di Indonesia, namun taksonominya masih belum terselesaikan, khususnya di Sumatra. Hal ini disebabkan oleh konservatisme morfologi membuat yang batas antar garis keturunan sulit dipahami. Mengingat kemiripan eksternal antara katak Sumatera memungkinkan adanya spesies tersembunyi yang diidentifikasi sebagai *H. signata* atau *H. picturata* atau spesies lainnya. Konsep nominal *H. signata* dan *H. picturata* berakar di Borneo, populasi "*signata/picturatalike*" Sumatera memerlukan evaluasi yang cermat terhadap diagnosis berbasis tipe dan data genetik modern. Studi ini bertujuan untuk mengklarifikasi status taksonomi populasi Sumatera dalam kompleks *H. signata* dan untuk memperbarui distribusi *H. sundabarat*.

Analisis molekuler dan morfologi dilakukan pada sampel kompleks *H. signata* populasi Sumatra dan Kalimantan dari *Museum Zoologicum Bogoriense*. Khususnya, memeriksa sampel dengan label *H. picturata*, *H. signata*, *H. siberu*, *H. centropeninsularis*, *H. fantastica*, dan *H. sundabarat*. Analisis molekuler dilakukan dengan menggunakan 18 sekuens ditambah dengan 30 dari referensi NCBI termasuk outgroup. Pembuatan pohon filogenetik dari 444 bp 16S rRNA menggunakan *Bayesian Inference*, *Maximum Likelihood* dan *Neighbour-joining* serta menghitung jarak genetic menggunakan *p-distance*. Analisis morfologi dilakukan dengan mengukur 32 karakter morfometrik dari sampel Jantan dewasa. Analisis *Principal Component Analysis* (PCA), Kruskal-Wallis, dan Dunn test digunakan untuk membedakan morfologi dalam kompleks *H. signata*.

Hasil pohon filogenetik mengungkap dua garis keturunan yang berbeda, yang dalam studi ini dideskripsikan sebagai spesies baru yang kami berinama *H. anantambanii* dan *H. hellenae* Jarak genetik antara keduanya (4,81%) dan lebih dari 8% dengan spesies lainnya dalam kompleks *H. signata*. Analisis PCA menunjukkan dua spesies baru tidak saling tumpang tindih, namun masing-masingnya tumpang tindih morfometrik parsial dengan spesies kerabat. Kedua spesies baru dapat dibedakan berdasarkan kombinasi karakter eksternal seperti ukuran dan posisi kelenjar humeral, pola garis dorsolateral, serta formula selaput renang. Hasil pohon filogenetik juga mengonfirmasi keberadaan *H. sundabarat* di beberapa provinsi di Sumatra yang sebelumnya tercatat sebagai *H. signata* dan *H. picturata*, sehingga memperjelas sebarannya di Paparan Sunda.

Temuan ini memberikan kontribusi penting karena memperjelas komposisi kompleks *H. signata* di Sumatra serta menyoroti endemisme dan pentingnya kawasan lindung pegunungan untuk konservasi biodiversitas. Studi lebih lanjut diperlukan khususnya pada karakterisasi kecebong dan bioakustik masing-masing spesies dalam kompleks *H. signata*.

Kata kunci: Filogenetik, *Pulchrana*, Sumatra, Taksonomi integratif, 16S rRNA Mitokondria.



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SYSTEMATIC STUDY OF STREAM FROG *Hylarana signata* (Günther, 1872) COMPLEX (ANURA, RANIDAE) FROM SUMATRA

AMAT RIBUT

Thesis
as one prerequisite to obtaining a
Magister of Science degree on
Animal Biosciences Study Program

**ANIMAL BIOSCIENCE STUDY PROGRAM
FACULTY OF MATHEMATIC AND NATURAL SCIENCES
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FOREWORD

All praise and gratitude are due to Allah SWT for His mercy and blessings, which made it possible for this research entitled *Systematic Study of the Stream Frog Hylarana signata* (Günther, 1872) Complex (Anura, Ranidae) from Sumatra to be completed.

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May this scientific work be useful and contribute to the advancement of science.

Bogor, Januari 2026

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