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New records and geographic distribution of *Microhyla gadjahmadai* Atmaja et al., 2018 (Amphibia, Microhylidae) from West Sumatra, Indonesia

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Abstract. The last report of *Microhyla gadjahmadai* was recorded from Vila Hijau on Curup, Bengkulu Province, Indonesia. Here, we report this species from the conservation area and palm-oil plantation of PT. Tidar Kerinci Agung, Solok Selatan and Dharmasraya Regency, West Sumatra Province. These new records extend the known distribution by 213 km to the north-northwest from the nearest previously known occurrence. These finds add to the information known about this species and as an indicator to support management for further conservation strategy of the forest.

Keywords. Amphibians, palm-oil plantation, range extension

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Introduction

The frog family Microhylidae is among the most speciose groups of Anura, comprising 690 species and 12 subfamilies (Frost 2020; Streicher et al. 2020). Much of this diversity is from tropical habitats (Savage, 1973; Van Bocxlaer et al. 2006; Van der Meijden et al. 2007; Kurabayashi et al. 2011). Among the 12 currently recognized subfamilies of microhylids, the subfamily Microhylinae, with 100 species, is widely distributed in South, Southeast, and East Asia (Garg and Biju, 2019; Frost, 2020). Of these Asian lineages, it is the narrow-mouthed frogs of the genus *Microhyla* Tschudi, 1838 that have the widest distribution and highest diversity, ranging from the Ryukyu Islands (Japan), India, Indochina, the Sunda Shelf, and the Philippines (Matsui et al. 2005; Atmatja et al. 2018). *Microhyla* currently contains 41 species, seven of them known to occur in Sumatra: *M. achatina* Tschudi, 1838; *M. berdmorei* Blyth, 1856; *M. fissipes* Boulenger, 1884; *M. heymonsi* Vogt, 1911, *M. palmipes* Boulenger, 1897; and *M. superciliaris* Parker, 1928, and the recently described *M. gadjahmadai* Atmatja et al. 2018. Matsui et al. (2011) examined specimens from Sumatra that are morphologically similar to specimens of *M. achatina* from Java and discovered that these specimens form a monophyletic group that is genetically distinct from other described *Microhyla*. Atmatja et al. (2018) recognized the diversity within the *Microhyla achatina* complex and described the Sumatran population that Matsui et al. (2011) referred to as "*Microhyla* sp. 3" as *M. gadjahmadai*.

Until now, *M. gadjahmadai* was only known from the areas in Bengkulu Province (Rejang Lebong, Bengkulu Utara, and Kepahiang Regency), Lampung Province (Tanggamus and Lampung Tengah Regency), and South Sumatra Province (Muara Enim Regency and Pagar Alam City), Indonesia, at elevations of 700–1647 m. *Microhyla gadjahmadai* occurs in a variety of habitats ranging from primary and secondary forests to open areas such as farmlands (Atmatja et al. 2018). In

this study, we found new populations of *M. gadjahmadai* in palm-oil plantations, and we believe that the controlling companies should protect watershed forests and secondary forests in plantations to help maintain populations of this endemic Sumatran species.

Methods

We conducted field surveys in the Prof. Sumitro Djojohadikusumo Conservation Area and palm-oil plantation of PT. Tidar Kerinci Agung, South Solok Regency and Dharmasraya Regency, in West Sumatra. Fieldwork was done in October 2022. The survey was conducted in three locations during the first three days: on the banks of the Mangun River for a distance of 1 km; in oil-palm plantations by following plantation roads for distance of 1 km; and in a secondary forest between palm-oil plantations and a conservation area in a transect for a distance of 1 km. Individuals caught were photographed and released. Identification of specimens as *Microhyla gadjahmadai* used the original description of this species by Atmaja et al. (2018).

Results

***Microhyla gadjahmadai* (Atmaja et al., 2018)**
Figures 1, 2; Table 1

New records. INDONESIA – **West Sumatra Province** • Dharmasraya Regency, Asam Jujuhan District, palm-oil plantation; 01°35′28.5″S, 100°30′19.3″E; 450 m alt.; 24.III.2021; Sepriyoga Virdana obs. • same locality but 01°36′31.1″S, 100°29′58.3″E; 585 m alt.; 13.VIII.2022; Sepriyoga Virdana obs. • Solok Selatan Regency, Sangir Balai Janggo District, conservation area; 01°34′33.4″S, 100°29′34.1″E; 493 m alt.; Sepriyoga Virdana et al. obs.

Three individuals were collected at site 1 (near the river), one individual was collected at site 2 (within the palm oil plantation), and one individual was collected at site 3 (at the buffer zone). Of the three locations, *Microhyla gadjahmadai* are most commonly found on the riverbanks.

Identification. All observed specimens match the original description of *M. gadjahmadai*. Snout–nose length 18.2–21.3 mm in adult males and 20.4–25.5 mm adult females. Body stout. Nostril–eyelid length ½ length of snout. Outer palmar tubercle single. Tibiotarsal articulation reaching center of eye. Finger and toe tips dilated. Median longitudinal grooves on dorsum. Toe webbing relatively reduced (free of webbing: 1¾ phalanges on outer surface of second toe, three phalanges on inner and outer surface of third toe, four phalanges on inner and outer surfaces of fourth toe, and 2¾ phalanges on inner surface of fifth toe). Thin, short, dark temporal stripe present over a wider cream stripe, extending from postorbital area to insertion of forelimb (Atmaja et al. 2018) (Fig. 2).

Figure 1. *Microhyla gadjahmadai* photographed in West Sumatra, Indonesia. **A, B.** In an open area along a palm-oil plantation road. **C.** In secondary forest between the conservation area and the palm-oil plantation.

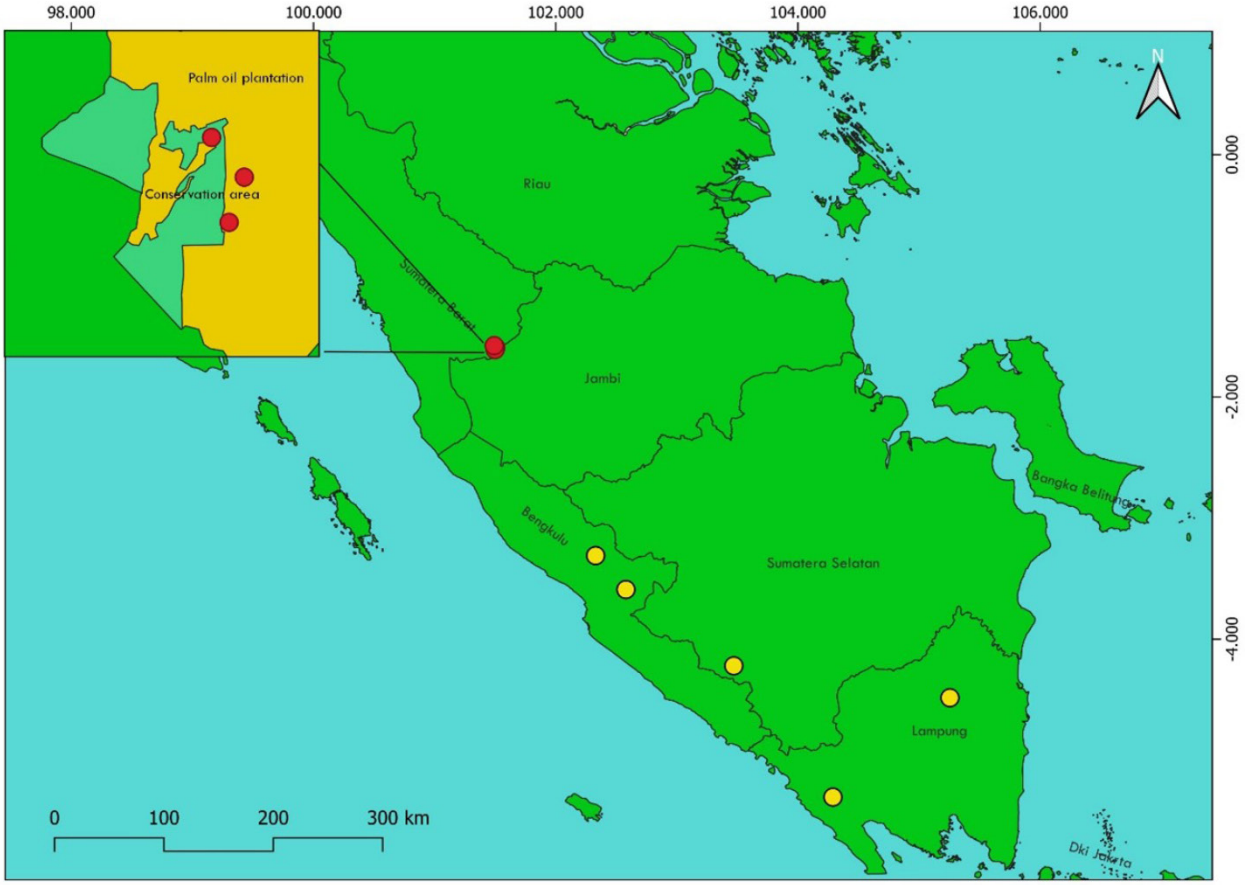

Figure 2. Distribution of *Microhyla gadjahmadai* in West Sumatra (conservation area and palm oil plantation). Yellow circles indicate the previously known locations (Atmaja et al. 2018). Red circles indicate the new records (this study).

Discussion

Previously, *Microhyla gadjahmadai* was found in Bengkulu Province, South Sumatra Province, and Lampung Province at elevations of 700–1647 m. Our new records of this species from West Sumatra are similar to the findings of Atmaja et al. (2018) and confirm that this species may have a much wider distribution in Sumatra than previous realized. We found *M. gadjahmadai* adjacent to the Barisan Hills in Dharmasraya and South Solok districts, and it was found not far from rivers and often in open areas to secondary forests, matching previous ecological observations (Atmaja et al. 2018). We found that *M. gadjahmadai* is often found in open areas such as along roads, and individuals were even collected during the day. Based on these observations, we hypothesize this species likely also occurs in the Bukit Barisan area in West Sumatra. The presence of *M. gadjahmadai* has increased the number of endemic amphibian species in Sumatra to 42, and we hypothesize that the unique geological formation of the Bukit Barisan Mountains may have a relationship with speciation and endemism across this region (Hamidy and Kurniati 2015; Atmaja et al. 2018). Lastly, *M. gadjahmadai* was found in the palm-oil plantations of PT. Tidar Kerinci Agung, and implore companies to protect habitat, such as watershed forests and secondary forests around palm-oil plantations to help maintain

Table 1. Occurrence data of *Microhyla gadjahmadai*.

Province	Regency	Latitude	Longitude	Altitude (m)	Reference
Lampung	Tanggamus	05°18′14.4″S	104°17′23.6″E	700–1647	Atmaja et al. 2018
Lampung	Lampung Tengah	04°28′59.1″S	105°15′21.6″E	700–1647	Atmaja et al. 2018
Bengkulu	Kepahiang	03°18′36″S	102°19′48″E	700–1647	Hamidy and Nurrohim 2010
Bengkulu	Kepahiang	03°35′24″S	102°34′48″E	750	Hamidy and Nurrohim 2010
South Selatan	Maura Enim	04°13′11.6″S	103°28′16.5″E	1624	Atmaja et al. 2018
West Sumatra	Dharmasraya	01°35′28.5″S	100°30′19.3″E	450	This report
West Sumatra	Dharmasraya	01°36′31.1″S	100°29′58.3″E	585	This report
West Sumatra	Solok Selatan	01°34′33.4″S	100°29′34.1″E	493	This report

populations of this endemic Sumatran species.

Our new records of *M. gadjahmadai* extend the known geographic range of this species by 213 km to the north-northwest from the nearest previously known locality (Fig. 2). These new records contribute occurrence data useful for conservation of this species and may possibly provide insight into the historical biogeography of *Microhyla*. As this is a Sumatran endemic species, further research should be done to add more data on its biology and ecology, and to help gain insights into other endemic amphibian species in Sumatra.

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Author Contributions

Conceptualization: ES, SV. Data curation: MA. Investigation: NE, GW. Methodology: SV, MA. Project administration: GW, SV, ES, NE, CPK. Resources: CPK, NE, GW. Supervision: CPK. Validation: MA. Visualization: ES. Writing – original draft: SV. Writing – review and editing: MA, CPK.

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