

SCIENTIFIC NOTE

FIRST RECORD OF *ANOPHELES BALABACENSIS* FROM WESTERN SUMBAWA ISLAND, INDONESIA

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ABSTRACT. An anopheline mosquito surveillance was conducted in the malaria endemic areas of Utan Rhee and Lunyuk counties, eastern Sumbawa Island, in 2004 and 2005. Eight species of *Anopheles* were collected, including a new record of *An. balabacensis* on the island.

KEY WORDS *Anopheles balabacensis*, new record, Sumbawa Island, Indonesia

The Leucosphyrus group of *Anopheles* mosquitoes consists of 3 subgroups and at least 20 species (Sallum et al. 2005). This group has attracted special attention because of its medical importance, because some of its members, such as *An. balabacensis* Baisas, *An. dirus* complex, and *An. leucosphyrus* Doenitz, often play important roles in malaria transmission in the forest areas of southeastern Asia (Baimai 1988). The members of this group are widely distributed in southeastern Asia—from southern India and Sri Lanka to the Philippines and Sulawesi, Indonesia. Until recently, all reports on the distribution of the members of this group had been limited to the northwestern side of the Wallace Line, except Sulawesi Island, which is now considered to consist of different parts of the Oriental and Australasian regions. However, recent articles contain records of *An. balabacensis*—a member of the Leucosphyrus subgroup—from Lombok Island, 38 km east of Bali Island across the Wallace Line (Kawada et al. 2004, Sallum et al. 2005). Here we report a record of *An. balabacensis* from Sumbawa Island, 20 km east of Lombok Island (Fig. 1).

We conducted an anopheline mosquito surveillance in the malaria endemic areas of Utan Rhee and Lunyuk counties, located in the eastern part of Sumbawa Island, in 2004 and 2005. Utan Rhee County is located in the northwestern part and northern coastal region of Sumbawa Island, and Lunyuk County is located in the southwestern part and southern coastal region facing the Indian Ocean.

Larvae were sampled from potential breeding sites such as stream banks, rock pools,

springs, and fish ponds, with the use of a dipper (13 cm in diameter and 6 cm in depth). The collected larvae were preserved in 70% alcohol solution or reared to the adult stage for identification.

Outdoor human-baited collection and Centers for Disease Control and Prevention (CDC) light-trap collection were conducted at 2 village settlements in Lunyuk County in 2005. In the outdoor human-baited collection, mosquitoes were collected on an hourly basis from 1800 to 2300 h. Two villagers stayed inside a double-net trap that was comprised of a small net (1.2 × 1.2 × 2 m) placed inside a large net (3.2 × 3.2 × 2 m), with the lower edge of the latter pulled up and fixed at 30 cm above the ground. A light trap was placed outside and inside the house for the all-night operations (1800 to 0700 h the next morning). The collected mosquitoes were kept in plastic cups and later carried to the field station for identification.

The mosquitoes were identified on the basis of the morphological keys, descriptions, and illustrations of Reid (1968) and Sallum et al. (2005). The species of larvae were identified by the morphology of the 4th instars according to the keys of Reid (1968).

During the study period, a total of 8 species of *Anopheles* were collected by larval sampling (Table 1): *An. balabacensis*, *An. sundaicus* Rodenwaldt, *An. subpictus* Grassi, *An. indefinitus* Ludlow, *An. barbirostris* Van der Wulp, *An. vagus* Doenitz, *An. maculatus* Theobald s.l., and *An. flavirostris* Ludlow. *Anopheles balabacensis* larvae were collected in a rock pool in Luk A (08°29'20"S, 117°17'17"E), Utan Rhee County. The pool was located in a small rock hole (25 × 12 × 5 cm) in a big stone (1.5 × 1.2 × 1 m) in a dried-up river under heavy shade. The water was clean, with some leaves and other organic debris.

Adults of 2 *Anopheles* species were caught by outdoor human-baited collection and indoor

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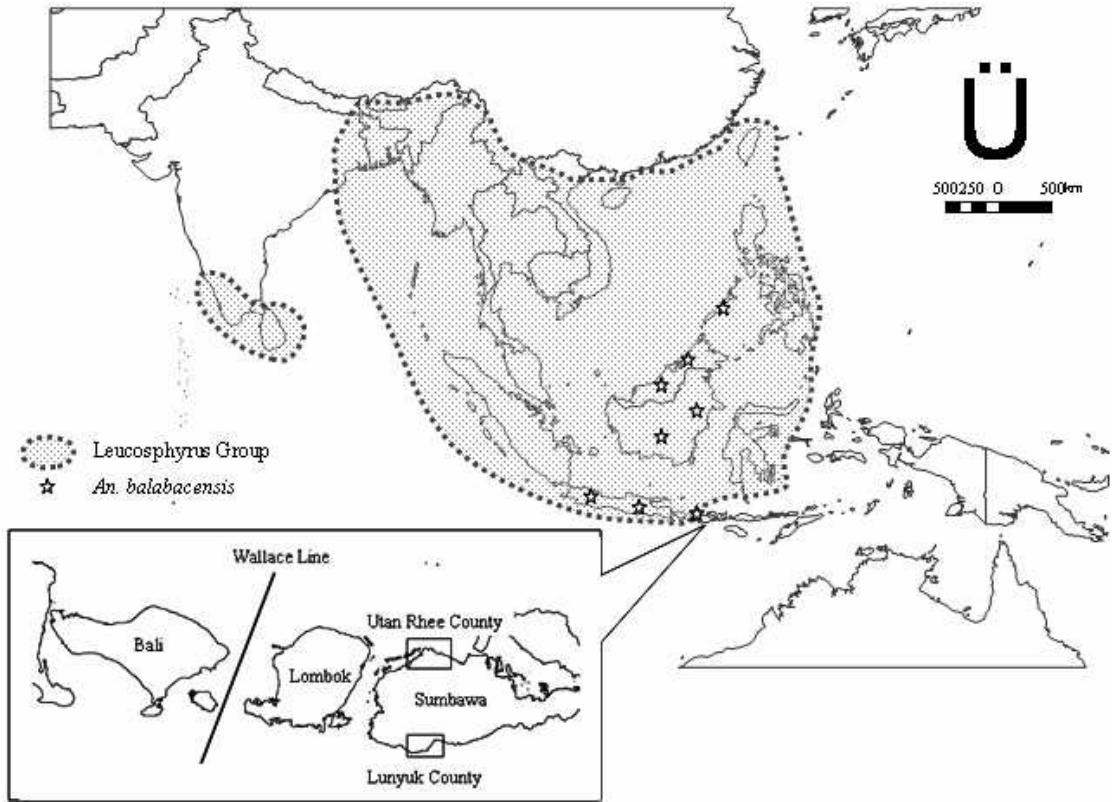


Fig. 1. Map showing the distribution ranges of the Leucosphyrus group and *Anopheles balabacensis* within the study area of the present article.

CDC light-trap collection in Sampa Goal (09°04'22"S, 117°06'57"E), Lunnyuk County. *Anopheles balabacensis* and *An. sundaicus* were caught by outdoor human-baited collection, and *An. sundaicus* was caught by indoor CDC light-trap collection. A female *An. balabacensis* was collected during the period from 2200 to 2250 h near the forest margin, which is 150 m away from the border of the village.

The most recent intensive study on Sumbawa Island (Soekirno et al. 2006) recorded 9 *Anopheles* species. The present study confirmed 5 of the 9 species reported by Soekirno et al. (2006). In addition, we are the 1st to report the occurrence of *An. balabacensis* on Sumbawa Island. This is the 2nd case of distribution of the Leucosphyrus group on Nusa Tenggara Islands east of the Wallace Line. This region has a mixture of fauna of Oriental and Australasian origins. Further investigation is necessary to confirm the distribution of this group in the eastern regions.

The genetic difference between the population of *An. balabacensis* in Sumbawa and Lombok and other populations is of interest. The values of the ratio of the proboscis to the

length of the forefemur (range: 1.02–1.09, mean: 1.06) of the specimens from Sumbawa (6 females) are similar to those reported by Sallum et al. (2005; range: 1.01–1.11, mean: 1.06). However, the ratio of the palpus to the proboscis of the Sumbawa specimens (range: 0.86–0.91, mean: 0.89) was a little less than that reported by Sallum et al. (2005; range: 0.86–0.95, mean: 0.92). Molecular genetic analysis may clarify when and how the populations of *An. balabacensis* were established in the islands east of the Wallace Line.

Anopheles balabacensis is one of the important malaria vectors on Lombok Island (Maekawa J.T., unpublished data), as observed in other places in its distribution range. It is possible that this species plays an important role in malaria transmission in the forest areas of Sumbawa Island. However, further investigation is required to confirm this.

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Table 1. A list of study area, location of the collection site, method, site, date of collection, and collected species.¹

Study area	Location	Collection			Collected species
		Methods	Site or habitat	Date ²	
Uthan Rhee county					
BMG	cp	Larval collection	Fish pond	March 9, 2004	<i>Anopheles sundaicus</i> , <i>An. subpictus</i> , <i>An. indefinitus</i>
STB	cp		Fish pond	March 9, 2004	No identification (8 L1, 2 larva)
LKA	m		Spring	March 9, 2004	No identification (2 L1, 2 larva)
	m		River	June 8, 2004	<i>Anopheles barbirostris</i> , <i>An. maculatus</i> s.l.
			Rock pool		<i>Anopheles balabacensis</i>
SMG	h		River	March 10, 2004	<i>Anopheles maculatus</i> s.l., <i>An. flavirostris</i>
BDL	h		River	March 10, 2004	Not collected
SBD	h		Pool	March 10, 2004	No identification (8 L1, 2 larva)
WNG	h		River	March 10, 2004	<i>Anopheles maculatus</i> s.l., <i>An. flavirostris</i>
				June 8, 2004	<i>Anopheles maculatus</i> s.l., <i>An. flavirostris</i>
Lunyuk county					
LGB	cp	Larval collection	Lagoon	July 19, 2005	<i>Anopheles sundaicus</i>
SPG	m	Larval collection	River	July 19, 2005	<i>Anopheles vagus</i> , <i>An. barbirostris</i>
		Human baited Light trap (4 traps)	Outdoor Two houses (indoor/outdoor)		<i>Anopheles balabacensis</i> , <i>An. sundaicus</i> <i>Anopheles sundaicus</i> (only indoor collection)
SPBA	m	Larval collection	River	July 20, 2005	<i>Anopheles maculatus</i> s.l., <i>An. flavirostris</i>
		Human baited Light trap (8 traps)	Outdoor Four houses (indoor/outdoor)	July 21, 2005	Not collected Not collected
SPBB	m	Larval collection	River	July 21, 2005	<i>Anopheles maculatus</i> s.l., <i>An. favirostris</i> , <i>An. barbirostris</i>

¹ cp, coastal plain area; m, mountainous area; h: hilly area; BMG: Bina Marga; STB, Setowe Brang; LKA, Luk A; SMG, Simongkah; BDL, Batu Dulang; SBD, Sebodo; WNG, Wono Gili; LGB, Liang Bagik; SPG, Sampa Goal; SPBA, Sampa Bontong Atas; SPBB, Sampa Bontong Bawah.

² Collection time; human-baited collection 1800–2300 h, Centers for Disease Control light trap 1800–0700 h.

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