

## Geographic Extension of *Odorrana aureola* Stuart, Chuaynkern, Chan-ard and Inger, 2006 in Thailand (Amphibia: Anura: Ranidae)

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Stuart *et al.* (2006b) described thirteen specimens from Phu Luang Wildlife Sanctuary (Loei Province, Thailand) accompanied with three specimens from Phu Kra-dueng National Park (Loei Province, Thailand) which were originally reported as *Rana livida* (Blyth, 1856) by Taylor (1962) as a new species named *Odorrana aureola*. Molecular information supported the view that this new species was different from the related species *Rana livida* (from syntypes and specimens from Kaeng Krachan National Park, Phetchaburi Province, Thailand) and its sympatric species *Rana cf. chloronota* (previously reported as *Rana livida*) (Stuart *et al.*, 2006a). Until now, the distribution of *Odorrana aureola* was known only from Phu Luang Wildlife Sanctuary and Phu Kra-dueng National Park (Figure 2).

During a herpetological survey in 2006, we conducted a field survey in the area of Phetchabun and Uttaradit Provinces. From these areas, we obtained seven specimens

which were assigned to *Odorrana aureola* by using morphological characters compared to type specimens (see Stuart *et al.*, 2006b) and original description. The specimens were catalogued and kept at the collection of the Thailand Natural History Museum (THNHM), Pathum Thani, Thailand. Information of these voucher specimens are as follows: THNHM 13101-13102 (field tags Y 0017-18, two adult females), collected by Y. Chuaynkern, C. Inthara and R. Songchan in 18 July 2006 from Phu Soi Dao Waterfall, Phu Soi Dao National Park, Nam Paad District, Uttaradit Province; THNHM 13103-13104 (field tags Y 0076-77, two adult females), THNHM 13105-13106 (field tags Y 0078-79, two adult males), collected by Y. Chuaynkern, C. Inthara, R. Songchan and Chamlong Insorn in 21 July 2006 from Sai Thip Waterfall, Phu Soi Dao National Park, Nam Paad District, Uttaradit Province; THNHM 13107 (field tag Y 0269, an adult male), collected by Y. Chuaynkern in 17 July 2006 from Phu Hin Rong Kla National Park, Nakhon Thai District, Phetchabun Province (Figure 1).

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**Figure 1.** Live photo of *Odorrana aureola* from Phu Hin Rong Kla National Park, Nakhon Thai District, Phetchabun Province. THNHM 13107 (field tag Y 0269), an adult male with SVL 56.7 mm. Photography by Y. Chuaynkern (18 July 2006).

Additional old specimen deposited at the collection of the THNHM which were original designated as *Rana livida*, was also included to this study and was re-assigned to *Odorrana aureola* based on morphological characters as similar as those specimens from Phetchabun and Uttaradit Provinces. An information of this specimen was confirmed by Sunchai Makchai of the THNHM (per.com.: 18 April 2008) as follows: THNHM 07766 (field tag DLD 740-3, an adult male), collected by Doyle L. Damman in 25 July 1979 from Chom Thong District, Chiang Mai Province.

The specimens have morphological characters that agree with Stuart *et al.* (2006b) in having posterior surface of forearm, ventral half of flank, anterior surface of thigh, posterior surface of thigh, posterior surface of shank, and dorsal surface of foot black with distinct, vermiform, bright yellow (creamy-

white in preservative) markings, upper lip stripe yellow (creamy-white in preservative), males with gular pouches, and females with unpigmented eggs. Some morphological measurements are shown in Table 1. Compared to the measurements provided by Stuart *et al.* (2006b), the male and female specimens from the provinces of Uttaradit and Phetchabun were slightly larger than the type specimens from Loei Province and Chiang Mai Province. Summarized new data with Stuart *et al.* (2006b), the female of *Odorrana aureola* is bigger than male. Body size of adult males ranged from 62.5 mm to 70.5 mm whereas adult females ranged from 81.1 mm to 109.1 mm.

Stuart *et al.* (2006b) provided information that *Odorrana aureola* was collected at an elevation above 1,000 m asl. The specimens from the provinces of Uttaradit and Phetchabun were collected between 1,000-1,600 m



**Table 1.** Selective measurements (in mm) of *Odorrana aureola* from Chom Thong District (Chiang Mai Province), Phu Soi Dao National Park (Uttaradit Province) and Phu Hin Rong Kla National Park (Phetchabun Province).

	Chiang Mai		Uttaradit		Phetchabun			Chiang Mai		Uttaradit		Phetchabun	
	n=1 adult male	n=2 adult males	n=4 adult females	n=1 adult male	n=1 adult male	n=2 adult males		n=4 adult females	n=1 adult male	n=2 adult males	n=4 adult females	n=1 adult male	
SVL	62.5	70.2±0.4 (69.9-70.5)	102.6±5.7 (96.3-109.1)	68.3	IN	7.2	7.5±0.6 (7.1-7.9)	10.3±0.3 (10-10.7)	7				
HW	21.5	23.7±0.1 (23.6-23.7)	34±1.3 (33.1-36)	23.4	EN	6.4	7±0.1 (6.9-7)	9.8±0.9 (9.2-11.1)	6.2				
HL	25.6	28.3±0.8 (27.7-28.8)	39.5±1.6 (38-41.6)	27.4	EL	9.2	8.8±0 (8.7-8.8)	12.1±0.4 (11.6-12.6)	10.4				
IFE	11.8	12.6±1.5 (11.5-13.7)	17.9±1.6 (16.2-19.6)	11.7	TYD	4.6	5.4±0.2 (5.3-5.6)	6.3±0.6 (5.5-6.9)	5.5				
IBE	17.4	18.1±0.1 (18.1-18.2)	24.6±1.1 (23.7-26.2)	18	TYE	2.1	2.3±0.2 (2.2-2.4)	3.9±0.4 (3.5-4.4)	2.1				
FLL	15.3	17.3±0.4 (17-17.6)	24.3±1.4 (22.9-26.1)	16	IUE	4.4	5.6±0.5 (5.2-5.9)	8.2±0.7 (7.7-9.2)	6.5				
HAL	17.9	20.1±0.3 (19.9-20.3)	28.5±2 (27.3-31.5)	19.3	UEW	6.1	6.8±0 (6.7-6.8)	9.5±0.6 (8.7-10.1)	7.3				
TFL	11.5	11.9±0.5 (11.5-12.3)	17.7±1.6 (16.2-20)	11.9	IMT	3.4	4±0.4 (3.8-4.3)	6.5±0.4 (6.1-7)	4.3				
TL	40.4	44±0.9 (43.4-44.6)	65.4±5.1 (61.2-72.6)	42.3	ITL	9.5	10.5±0 (10.4-10.5)	15.5±1.3 (13.8-16.8)	9.5				
FOL	36.5	40±0.5 (39.6-40.4)	57.9±4 (55.5-63.9)	37.7	FL	35.4	42.1±2.2 (40.6-43.7)	58±5.2 (53.6-64.4)	37.1				
FTL	21.5	22.6±0.1 (22.5-22.7)	33.9±2.2 (32-37.1)	21.8	TFOL	52.7	57.4±0.4 (57.1-57.7)	83.1±5.3 (79.2-90.9)	55.4				

**Note:** SVL=snout vent length, HW=head width, HL=head length (from the back of the mandible to the tip of snout), IFE=distance between the front of the eyes, IBE=distance between the back of the eyes, FLL=forelimb length (from the elbow to the base of the outer tubercle), HAL=hand length (from the base of the outer palmar tubercle to the tip of the toe), TFL=third finger length (from the base of the first subarticular tubercle), TL=tibia length, FOL=foot length (from the base of the inner metatarsal tubercle to the tip of the toe), FTL=fourth toe length (from the base of the first subarticular tubercle to the tip of the toe), IN=internarial space, EN=distance from the front of the eye to the nostril, EL=eye length, TYD=greatest tympanum diameter, TYE=distance from tympanum to the back of the eye, IUE=minimum distance between upper eyelids, UEW=maximum width of inter upper eyelid, IMT=length of inner metatarsal tubercle, ITL=inner toe length, FL=femur length (from vent to knee), TFOL=from heel to tip of toe fourth toe. Those selective measurements are followed the several works of Ohler (i.e. Ohler, 1996; Ohler and Dubois, 1999; Ohler *et al.*, 2000 and 2002).



**Figure 2.** Map showing localities of recent distribution of *Odorrana aureola* (solid circles). 1= Type locality: Phu Luang Wildlife Sanctuary, Phu Rue District, Loei Province (Thailand); 2=Phu Kradueng National Park, Phu Kradueng District, Loei Province; 3=Phu Hin Rong Kla National Park, Nakhon Thai District, Phetchabun Province (Thailand); 4=Phu Soi Dao National Park, Nam Paad District, Uttaradit Province; and 5=Chom Thong District, Chiang Mai Province.

asl, which concur with Stuart *et al.* (2006b). However, one specimen from Uttaradit Province was collected at 620 m asl near of Soi Dao Waterfall. This information indicates that the frog can occur below 1,000 m asl but it seems to have habitat preferences at more than 1,000 m asl. At its type locality, Phu Luang Wildlife Sanctuary, this species is found above 1,000 m asl where, as with the sympatric species *Rana cf. chloronota*, it is found below 1,000 m asl. In Phu Soi Dao National Park, Uttaradit Province, we found that only *Odorrana aureola* occupied stream from 600 to 1,400 m asl.

**Recent distribution.—THAILAND:**  
**CHIANG MAI PROVINCE,** Chom Thong

District, “no specific locality” (this study). **LOEI PROVINCE,** Phu Kradueng District, Phu Kradueng National Park (Taylor, 1962; Stuart *et al.*, 2006b); Phu Rue District, Phu Luang Wildlife Sanctuary (Chan-ard, 2003; Stuart *et al.*, 2006a, b). **PHETCHABUN PROVINCE,** Nakhon Thai District, Phu Hin Rong Kla National Park (this study). **UTTARADIT PROVINCE,** Nam Paad District, Phu Soi Dao National Park (this study).

Prior to this study, *Odorrana aureola* was only known from the type locality. Our specimens represented the first provincial records in the provinces of Chiang Mai, Phetchabun and Uttaradit. The recent distribution map of this species is shown in Figure 2. Based on the current scientific literature, *Odorrana aureola* is tentatively endemic to Thailand, but might be expected in Laos. The specimens from Uttaradit were primarily collected in small streams from the mountain tops and lower elevations in Thailand. The mountain tops bordered between Thailand and Laos. Further research is needed to determine if this species occurs in mountains in Laos adjacent to our survey sites in Thailand.

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