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A new subspecies of *Tesia olivea* (Sylviidae) from Chiang Mai province, northern Thailand

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Abstract We collected several individuals of the Slaty-bellied Tesia *Tesia olivea* in the temperate rain forest of the sub-Himalayan region of northeastern Burma/Myanmar in February/March 2004 and March 2006. Subsequent comparison of these with *T. olivea* from northeastern India and northern Thailand revealed that while our northeastern Burma/Myanmar birds were similar to those from northwestern India, specimens of both populations were distinctly different from *T. olivea* from Chiang Mai Province of northern Thailand and northern Vietnam. Herein, we designate the latter populations as members of a new subspecies of *T. olivea* based on analyses of variations in morphometric characters, plumage, song, and mitochondrial (mt)DNA sequence.

Keywords Burma/Myanmar · New description · Speciation · Subspecies · Taxonomy · *Tesia olivea* · Thailand

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Introduction

The genus *Tesia* currently includes five recognized species, three of which (*castaneocoronata*, *cyaniventer*, and *olivea*) occur in the sub-Himalayan region along the southern slopes of the Himalayas and the southeast Asian mountains in northern Thailand, Laos and Burma/Myanmar, and southwestern China east to Vietnam. Two species are endemic to Indonesia (Java: *T. superciliaris*; Flores and Sumbawa: *T. everetti*) and are of minor relevance here.

The genus *Tesia* was first described by Hodgson (1837, compare discussion on dates of first descriptions in Dickinson and Pittie 2006). The nominate taxon, *T. cyaniventer* (Gray-bellied or Yellow-browed Tesia), occurs in northern India, Nepal, southeast Bangladesh, south China (Yunnan), Burma/Myanmar, northwest Thailand, and northern Vietnam, in dense humid forest understory and bamboo forests (500–2550 m a.s.l.) (Penhallurick 2005; Rasmussen and Anderton 2005). *Tesia castaneocoronata* (Burton 1836), the Chestnut-headed Tesia, is found in northeast India, Nepal, Bhutan, Bangladesh, central-south China (Sichuan, Yunnan), southeast Tibet, Burma/Myanmar, northwest Thailand, and northern Vietnam (Smythies 1953;

King et al. 1995; Robson 2000). The habitat is typically undergrowth of oak and rhododendron forests, from lowlands up to elevations of 3660 m a.s.l. (Robson 2000). *Tesia olivea* (McClelland 1840; in Horsfield 1840; compare Dickinson 2003 and Walters 2003 for discussion on the first description of *Tesia*), the Slaty-bellied Tesia, lives in dense humid forest undergrowth in lowlands up to 2000 m a.s.l. in northern India, Nepal, Bhutan, central and southwest China (southeast Sichuan and Yunnan), Burma/Myanmar, northwest and southwest Thailand, northern Laos, and northern Vietnam (Robson 2000; Rasmussen and Anderton 2005).

Tesia olivea and *T. cyaniventer* were long (since at least 1854; Walters 2003) considered to be conspecific and to simply represent variation within a single species. This state persisted until Ludlow (1937) showed that they occupied different elevational zones and that the variation could not be sexual, age, or seasonal. Information regarding the distribution and natural history of both species is still somewhat confounded in the literature and collections. No type specimen of *olivea* is known to exist, and the drawing upon which that name is based has equivocal value in terms of identification. Walters (2003) recently designated a neotype for *T. olivea* (Walters 2003), which is an adult male collected by H. Stevens at Margherita (Assam, India) and stored in the bird collection of the Natural History Museum at Tring, UK (BMNH #1942.Whi.1.5372). *Tesia olivea* and *T. cyaniventer* are both considered monotypic, and subspecies have not been described or mentioned before (Martens and Eck 1995; Robson 2000; Dickinson 2003; Rasmussen and Anderton 2005; Baierlein 2006).

We collected specimens that appeared to be different from other specimens of *T. olivea* and *T. cyaniventer* in collections. We systematically evaluated the identification and placement of the new specimens using morphological and genetic characters. Based upon these studies, we propose a new subspecies.

Methods

We conducted avifaunal surveys during expeditions in the Hkakabo Razi National Park and the Northern Forest Complex during February/March 2001, February 2004, September 2005, March 2006, and July 2006 (Renner et al. 2007); the participants included representatives from the Myanmar Nature and Wildlife Conservation Division and the Smithsonian National Zoological Park's Conservation and Research Center. These areas are in the extreme northern portion of Kachin State, Burma/Myanmar (Fig. 3), and our purpose was to inventory the poorly known avifauna of the pre-montane temperate rain forest habitat of this region (Renner et al. 2007). During 2004, we mist-netted four *T. olivea* in the vicinity of Naung Mung (sometimes known as Naun Mong or combination of the two names). We were allowed to export two of the specimens (Table 2) for identification to the United States, while leaving two skins (04–070 and 04–079) in the Myanmar National Museum Collection, now located in Hlawga Park (17°01′N, 96°05′E, Taukkyan Ward, Mingaladon Township, Yangon Division; Table 2). All *Tesia* individuals were captured at Naung Mung in February 2004 (two at capture site NM/04–2 at 27°30.00′N, 97°47.00′E, 550 m, and two at NM/04–3, 27°29.30′N, 97°49.21′E, 600 m; Table 2). An additional specimen was obtained at the location NM/04-2 during our March 2006 trip (2006–3281; Table 2). No *T. olivea* were encountered at Naung Mung during February 2001 or July 2006, when they presumably are at somewhat higher elevations.

We compared the plumage and morphometric characteristics of our Burma/Myanmar specimens with *T. olivea* from other regions, using specimens from the Smithsonian's National Museum of Natural History, Washington D.C. (NMNH: 13), American Museum of Natural History, New York (AMNH: 17), Academy of Natural Sciences, Philadelphia (ANSP: 3), Museum of Zoology at the University of Michigan, Ann Arbor (UMMZ: 9), Peabody Museum of Natural History, Yale University, New Haven, (YPM: 8), Kunming Institute of Zoology, Yunnan, China (KIZ: 3), the Field Museum of Natural History, Chicago (FMNH: 4), Museé National d'Histoire Naturelle, Paris (MNHN: 2), and the Museum of Comparative Zoology, Harvard University, Cambridge (MCZ: 4). We determined age in both taxa by label indication (ossification if stated).

We compared tape recordings and sonagrams as follows: for the nominate from Bhutan, one recording sequence of three songs presumably given by the same individual (Connop 1993), and another recording sequence of three songs presumably given by the other individual, recorded by D. Farrow; for Chiang Mai, Thailand, one recording of six songs presumably given by the same individual (Scharringa 2005).

In addition, we analyzed DNA from five individuals: three from India and two from Southeast Asia (Table 1). DNA was extracted from toe pad samples of four museum specimens ($n_{\text{India}} = 3$, $n_{\text{Thailand}} = 1$), and from one tissue sample from Vietnam (Table 1). The tissue samples were extracted using a Qiagen DNeasy Extraction kit (Qiagen, Valencia, CA) by one of the authors (SCR) in the main Genetics Laboratory at the Smithsonian National Zoological Park. The toe pad samples were extracted by another author (RCF) using a standard phenol-chloroform/centrifugal dialysis method (Fleischer et al. 2001) in a dedicated "ancient DNA" laboratory located in a separate building to reduce chances of contamination with modern DNA or PCR products. We amplified portions of two mtDNA genes from

Table 1 Localities and measurements of *Tesia olivea olivea* and *T. o. chiangmaiensis* skin specimens

Collection no.[a]	Field no.	Location, Province	County	Collector	Date	Elevation (m a.s.l.)	Sex[b]	Body mass (g)	BL (mm)	BW (mm)	BH (mm)	Wing (mm)	Tarsus (mm)	Cytb[c] (bp)	ND2[c] (bp)
AMNH 409.650	311	Dalu, Chindwin	Burma/ Myanmar	Vernay-Hopwood	8 February 1935	–	–	–	9.1	3.6	2.6	43.5	22.8	–	–
AMNH 409.649	377	Dalu, Chindwin	Burma/ Myanmar	Vernay-Hopwood	13 February 1935	–	♂	–	8.7	3.4	2.6	44.6	22.4	–	–
ANSP 052.152	–	Darjeeling	India	–	–	–	–	–	D	3.9	2.7	41.2	22.4	–	–
ANSP 052.153	1,788	Darjeeling	India	–	1856	–	–	–	10.2	4.5	2.5	44.8	24.7	EU431988 (81)	0
USNM 106.523	–	Darjeeling	India	WE Brooks	–	–	♀	–	8.4	4.5	2.5	44.1	20.8	–	–
USNM 390.497	183	Fort Denning, northeast Assam	India	SD Ripley	–	790	♂	–	8.9	4.2	2.7	45.4	D	EU431986 (714)	EU431993 (517)
UMMZ 185.819	–	Kohima, Naga Hills, Assam	India	WN Koelz	18 January 1951	–	–	–	9.8	3.1	2.5	–	24.0	–	–
UMMZ 185.815	–	Kohima, Naga Hills, Assam	India	WN Koelz	2 June 1950	–	♂	–	8.4	2.9	2.9	–	23.7	–	–
UMMZ 185.817	–	Kohima, Naga Hills, Assam	India	WN Koelz	18 January 1951	–	♂	–	10.7	3.1	2.7	–	24.1	–	–
UMMZ 185.820	–	Kohima, Naga Hills, Assam	India	WN Koelz	27 June 1950	–	♂	–	10.7	2.9	2.8	–	23.2	–	–
AMNH 199.971	–	Margherita, Assam	India	HN Coltart	16 December 1901	–	♀	–	9.4	3.7	2.6	41.7	D	–	–
AMNH 590.776	–	Margherita, Assam	India	HN Coltart	9 December 1901	–	♀	–	9.9	3.5	2.8	45.6	20.7	–	–
AMNH 590.777	–	Margherita, Assam	India	HN Coltart	16 December 1901	–	♀	–	9.4	4.2	2.6	46.5	23.3	–	–
AMNH 590.775	–	Margherita, Assam	India	HN Coltart	8 December 1901	–	♀	–	9.1	3.4	3.1	39.1	21.9	–	–
AMNH 590.774	–	Margherita, Assam	India	HN Coltart	7 December 1901	–	♂	–	9.3	4.1	3.2	50.1	23.0	–	–
AMNH 590.773	–	Margherita, Assam	India	HN Coltart	25 November 1903	–	♂	–	D	D	D	46.5	23.3	EU431989 (301)	EU431991 (158)
ANSP 174.357	–	Menoka, Assam	India	WN Koelz	18 February 1952		♀	–	7.9	3.6	2.5	42.9	22.4	–	–
UMMZ 185.836	–	Menoka, Kawrup District, Assam	India	T Rup Chand	12 December 1953	–	–	–	10.7	3.1	D	–	24.2	–	–
UMMZ 185.827	–	Menoka, Kawrup District, Assam	India	WN Koelz	10 February 1952	–	♀	–	10.2	3.0	2.7	–	22.3	–	–
UMMZ 185.828	–	Menoka, Kawrup District, Assam	India	WN Koelz	10 February 1952	–	♂	–	8.7	3.0	2.7	–	23.3	–	–
UMMZ 185.831	–	Menoka, Kawrup District, Assam	India	WN Koelz	11 February 1952	–	♂	–	10.0	3.3	2.6	–	24.2	–	–
UMMZ 185.832	–	Menoka, Kawrup District, Assam	India	WN Koelz	11 February 1952	–	♂	–	8.7	3.0	2.6	–	23.3	–	–

Table 1 continued

Collection no.[a]	Field no.	Location, Province	County	Collector	Date	Elevation (m a.s.l.)	Sex[b]	Body mass (g)	BL (mm)	BW (mm)	BH (mm)	Wing (mm)	Tarsus (mm)	Cytb[c] (bp)	ND2[c] (bp)
USNM 585.144	302	Namdapha Sanctuary, Tirap, Miao, Arunachal Pradesh	India	SD Ripley	08 Dec ember 1981	610	♂	6.0	10.1	4.4	2.8	46.6	23.1	–	–
YPM 019.925	683	54 miles [~79 km] east of Phek, Kohima, Naga Hills, Assam	India	SD Ripley	7 December 1950	1400	♂	8.5	8.7	4.1	2.8	45.8	D	–	–
AMNH 409.651	23	Nanya Seik, Chindwin	Burma/ Myanmar	Vernay–Hopwood	12 January 1935	–	–	–	9.9	3.7	2.6	45.1	D	–	–
USNM 633.684[d]	2004–069	Naung Mung, Kachin State	Burma/ Myanmar	–	–	600	♀	–	10.1	4.0	2.5	46.9	22.3	–	–
AMNH 590.791	1373	Salween Valley, northwest Yunnan	China	G Forrest	21 April 1921	1800	♀?	–	8.5	2.6	4.3	47.0	23.4	–	–
MNHN 4208		Sikkim	India	A Boucard	27 June 1874	–	♀	–	8.6	4.1	2.5	47.8	21.9	–	–
MNHN (no number)	Sikkim	India	A Boucard	–	–	–	–	7.7	3.8	2.4	42.9	23.4	–	–	
AMNH 590.785	–	Sikkim	India	–	–	–	–	–	D	D	D	D	D	–	–
USNM 148.804	–	Sikkim	India	A Boucard	–	–	–	–	8.7	4.1	2.7	47.8	24.0	–	–
USNM 584.500	191	Tirap, Miao, Arunachal Pradesh	India	SD Ripley	8 March 1979	290	♂	8.0	9.2	4.3	2.5	47.8	24.0	–	–
Tesia olivea olivea								Mean (all)	9.30	3.64	2.72	45.17	23.37		
								± SD (all)	0.84	0.55	0.35	2.55	2.06		
								♀ mean	9.15	3.66	2.81	44.62	22.11		
								♂ mean	9.34	3.56	2.74	46.69	23.42		
KIZ 001.654	011981	"Yunnan"	China	–	9 March 1965	1900	♀	–	–	–	–	–	–	–	–
KIZ 072.025	010391	"Yunnan"	China	–	7 April 1972	–	♂	–	–	–	–	–	–	–	–
AMNH 291.923	691	Chapa (sometimes 'Sapa'), Tonkin	Vietnam	J Delacour & P Jabouille	1 November 1929	–	–	–	8.5	3.8	2.9	43.7	D	–	–
AMNH 291.920	1869	Chapa (sometimes 'Sapa'), Tonkin	Vietnam	J Delacour & P Jabouille	30 November 1929	–	♀	–	10.0	3.9	3.1	41.0	22.7	–	–
AMNH 291.921	2270	Chapa (sometimes 'Sapa'), Tonkin	Vietnam	J Delacour & P Jabouille	6 December 1929	–	♀	–	10.0	4.1	2.9	43.5	22.9	–	–
FMNH 076.152	–	Chapa (sometimes 'Sapa'), Tonkin	Vietnam	J Delacour	4 November 1929	–	♂	–	D	3.8	2.5	42.4	22.0	–	–
MCZ 267.879	–	Chapa (sometimes 'Sapa'), Tonkin	Vietnam	B Bjorkergen	16 January 1939		♂	–	8.7	4.5	2.5	43.6	23	–	–
FMNH 305.986	268	Doi Angka	Thailand	HG Deignan	22 April 1931		–	–	8.6	4.0	2.6	46.6	23.2	–	–
USNM 335.800	403	Doi Angka	Thailand	HG Deignan	5 September 1935	–	♀	–	8.5	2.7	2.8	39.4	20.8	–	–
FMNH 305.989	269	Doi Angka	Thailand	HG Deignan	22 April 1931	1660	♀	–	9.0	3.8	2.54	39.2	22.1	–	–

Table 1 continued

Collection no.[a]	Field no.	Location, Province	County	Collector	Date	Elevation (m a.s.l.)	Sex[b]	Body mass (g)	BL (mm)	BW (mm)	BH (mm)	Wing (mm)	Tarsus (mm)	Cytb[c] (bp)	ND2[c] (bp)
USNM 336.597	2019	Doi Chingdao	Thailand	HG Deignan	9 December 1936	–	♀	–	8.2	4.1	2.5	41.0	22.6	–	–
USNM 535.403	410	Doi Inthanon, Chiang Mai	Thailand	B King	9 December 1964	1494	–	–	9.6	4.7	2.8	44.6	22.6	EU431987 (601)	EU431992 (739)
USNM 535.401 Paratype	*314*	*Doi Inthanon, Chiang Mai*	*Thailand*	*B King*	*26 November 1964*	*2560*	♀	–	*8.6*	*3.3*	*2.5*	*42.0*	*21.8*	–	–
USNM 535.400 Holotype	*253*	*Doi Inthanon, Chiang Mai*	*Thailand*	*B King*	*13 November 1964*	*1700*	♂	–	*8.9*	*3.9*	*2.8*	*43.1*	*22.1*	–	–
USNM 535.402	315	Doi Inthanon, Chiang Mai	Thailand	B King	26 November 1964	2560	♂	–	10.1	4.3	2.7	41.8	23.0	–	–
USNM 535.405	1650	Doi Pha Pok, Chiang Mai	Thailand	B King	2 November 1965	2134	♂	–	9.5	3.7	2.4	43.4	22.3	–	–
KIZ 960.218	019757	Gongshan, along the Nujiang (Salween) River, northwest Yunnan (=Gaoligongshan)	China	–	26 April 1996	1750	♂	–	–	–	–	–	–	–	–
AMNH 291.926	2116	Lang Tu Va, Tonkin	Vietnam	J Delacour & P Jabouille	4 December 1929	–	–	–	9.7	4.1	2.7	43.8	21.5	–	–
YPM 018.269	9278	Lhou Soung (=Lang Son)	Laos	D Beaulieu	17 January 1940	–	♀	–	7.7	D	D	45.1	22.0	–	–
MCZ 196.628	389	Mt. Angka	Thailand	JA Griswold Jr	18 March 1937		♀	–	8.5	3.6	2.6	44.25	20.6	–	–
AMNH 833.702	cjv36	Mt. Tay Con Linh, Vi Xuyen District, Ha Giang Province	Vietnam	CJ Vogel	8 May 2000	–	♂	8.5	8.2	4.3	2.7	45.5	22.3	EU431990 (756)	0
FMNH 076.155	3430	Nam Da, Tonkin	Vietnam	J Delacour	30 December 1929	–	♀	–	9.3	3.7	D	41.5	21.5	–	–
YPM 018.262	9442	Phukobo (Phu Kobo)	Laos	D Beaulieu	11 February 1940	–	♂	–	D	D	D	45.4	22.1	–	–
YPM 018.263	7362	Phukobo (Phu Kobo)	Laos	D Beaulieu	7 May 1939	–	♂	–	8.1	3.8	2.8	43.6	22.3	–	–
YPM 018.264	9364	Phukobo (Phu Kobo)	Laos	D Beaulieu	20 January 1940	–	♂	–	8.3	3.7	2.6	45.5	21.9	–	–
MCZ 267.881	448	Phukobo (Phu Kobo)	Laos	J Delacour	15 December 1938		♂	–	8.1	4.1	2.8	44.7	23.1	–	–
MCZ 267.880	298	Phukobo (Phu Kobo)	Laos	J Delacour	11 December 1938		♂	–	8.9	D	D	42.8	22.8	–	–
YPM 018.267	7,444	Phukobo (Phu Kobo)	Laos	D Beaulieu	21 May 1939	–	♂	–	8.9	4.1	2.6	44.1	22.3	–	–
YPM 018.265	7,568	Phukobo (Phu Kobo)	Laos	D Beaulieu	11 June 1939	–	♀	–	8.2	4.2	2.7	42.9	21.0	–	–
YPM 018.266	6,671	Phukobo (Phu Kobo)	Laos	D Beaulieu	62 January 1939	–	–	–	2.1	3.5	2.7	45.3	22.0	–	–
AMNH 203.499	–	Um Rang (75 km northwest)	Thailand	AS Vernay	5 February 1924	1030	–	–	8.7	4.0	2.6	43.6	D	–	–

Table 1 continued

Collection no.[a]	Field no.	Location, Province	County	Collector	Date	Elevation (m a.s.l.)	Sex[b]	Body mass (g)	BL (mm)	BW (mm)	BH (mm)	Wing (mm)	Tarsus (mm)	Cytb[c] (bp)	ND2[c] (bp)
Tesia olivea chiangmaiensis								Mean (all)	8.6	3.9	2.7	43.3	22.2		
								± SD (all)	1.4	0.4	0.2	1.8	0.7		
								♀ mean	8.8	3.7	2.7	41.8	22.0		
								♂ mean	8.7	4.0	2.6	43.9	22.3		
Student's *t* test[e]							All	*P*	0.03*	0.05*	0.56	0.01*	0.01*		
							♀	*P*	0.27	0.86	0.59	0.04*	0.49		
							♂	*P*	0.06	0.05*	0.13	0.00*	0.00*		

Holo- and paratype values are shown in italics

BL Bill length; *BW* bill width at operculum (nares); *BH* bill height at operculum (nares); *Wing* unflattened wing length from bow to tip; *D* defective feature, not measured or analyzed

[a] For abbreviations, see "Methods" section

[b] As indicated on label

[c] GenBank Access Codes of DNA samples analyzed and base pairs successfully extracted

[d] See also Table 2

[e] Between the two geographic ranges only for specimens with clearly labeled sexes; asterisk (*) indicates significance at $P \leq 0.05$ according to the two-tailed *t* test, two-sample unequal variance

the tissue sample, using primers CytbCor3 (5′-GACTCCTC CTAGTTTATTTGGG-3′) and Cytb1 (Kocher et al. 1989) for cytochrome b (752 bp used for analysis) and primers H6313 to L5419 for ND2 (930 bp) and L5419 to H6113 (692 bp). Portions of these same gene regions were amplified from museum specimen DNA in smaller segments. For cytochrome b, we used primer combinations Cytb1/Cytb2, Cytb2/CytbS2H, Cytb1/CytbX, Cytb-wow/Cytb2rc (all provided in Fleischer et al. 2006), and Cytb-CorL (5′-ACTGCGACAAAATCCCATTC-3′)/CytbCor3. For ND2, we used primer combinations L5419/H5578 (Fleischer et al. 2006), L5580 (5′-AAACTAGGCCTAGTT CCATTCC-3′)/H5766 (5′-GGATGAGAAGGCTAGGAT TTTKCG-3′), L5969 (5′-AACTATCAACAYTAATAACC TCRTG-3′)/H6113 (Shapiro et al. 2004), and L5969/H6313 (Sefc et al. 2003). The products were sequenced using ABI sequencing protocols (see Fleischer et al. 2006) on an ABI3100 DNA analyzer (ABI, Foster City, CA). We aligned and edited sequences with the program Sequencher ver. 4.12 (Gene Codes Corp, Ann Arbor, MI). We were able to align Cytb sequences to an existing *T. olivea* Cytb sequence from GenBank (DQ008512), and ND2 sequences to a *C. cetti* ND2 sequence (AY382354). Sequences were compared and uncorrected pair-wise divergence levels calculated using PAUP* (Phylogenetic Analysis Using Parsimony; Swofford 2002). Finding similar divergence patterns or levels in two or more independently amplified gene regions supports the notion that the gene sequences are derived from mtDNA and are not nuclear pseudo-genes (Sorenson and Fleischer 1996).

Results

The comparisons of morphometrics showed that *T. olivea* in Burma/Myanmar is similar to those from northwestern India and Nepal, while those from the Chiang Mai region in northern Thailand differed significantly in both plumage characteristics and morphometrics. We then borrowed further specimens for study, including some from Vietnam and Laos (Table 1). All specimens with labeled locations and sex were grouped into two pools: one group consisting of specimens from the southern slopes of the Himalayas in northern India and northern Burma/Myanmar ($n_{total} = 32$) and the other pool consisting of specimens from northern Thailand, Laos and Vietnam ($n_{total} = 31$). A Student's *t* test for the variables bill length, bill width, wing length and tarsus (bill width, wing length and tarsus for males only) revealed that the groups are significantly different ($P \leq 0.05$; Table 1).

The results of the analyses indicate the Thailand, Laos, and Vietnam specimens represent a new taxon. We propose to name the taxon *Tesia olivea chiangmaiensis* ssp. nov.

Holotype

National Museum of Natural History, Smithsonian Institution, Washington D.C., USNM #535.400, ♂, Doi Inthanon, Chiang Mai, Chiang Mai Province, Thailand; collected and prepared by B King 13 November 1964 (field #253). Further data cited from original label: "irides dk brown; max. black; tipped horn; rictus, mand. + mouth orange; feet & claws yellowish brown length 91 mm testes 1 mm."

Diagnosis

A sylviid warbler assignable to the genus *Tesia*, which is very similar to *T. o. olivea* in general appearance and color pattern. Separable from *T. o. olivea* by its shorter wings and tarsi (comparative measurements for *T. o. olivea* and *T. o. chiangmaiensis* in Table 1); crown lacks the iridescent yellow to orange, upperparts are slightly grayer and less olive green. Two specimens from Indian localities from the entire *T. olivea* series differed in lacking the iridescent crown, but we consider these to be immature specimens of *olivea*. The two other species of the genus occurring in the region (*castaneocoronata* and *cyaniventer*) clearly differ from *olivea* in song, morphometrics, and plumage appearance.

Description and measurements of holotype

The colors follow Smithe (1975) and refer to the museum specimen of the holotype, unless otherwise stated. The mandible is Sepia (119) and maxilla Pale Horn (92) in museum specimens (live birds and new museum specimen have an orange bill, but bill-colors fade within a short time). Ventral parts are uniformly dark gray, and the crown and dorsal parts are dark green (260), slightly shining but not iridescent. The unflattened wing is 43.1 mm, the bill (base of skull to tip), 8.9 mm, the bill depth at nares, 3.9 mm, and the tarsus, 22.1 mm (Table 1).

Paratype

♀ USNM #535.401 collected 26 November 1964 at Doi Inthanon, Chiang Mai, Chiang Mai Province, Thailand. Collected and prepared by B King (field #314). Further data cited from original label are: "♀ B King 314 iris dk brown; mx. black, mand., rictus and mouth orange; feet and claws yellowish brown, length 85 mm; ovary inactive."

Description and measurements of paratype

The paratype is indistinguishable from our holotype in terms of plumage characteristics. The unflattened wing is 42.0 mm, the bill (base of skull to tip), 8.6 mm, the bill depth at nares, 3.3 mm, and the tarsus, 21.8 mm (Table 1). There is no apparent sexual dimorphism among the two type specimens (Fig. 1) in terms of either plumage or morphometric characteristics.

Etymology

We name this taxon for the province of Chiang Mai in northern Thailand, which is the provenance of the type specimens and the locality of the specimens in which we first noted the differences.

Table 2 Collected specimens of *T. olivea olivea* from Naung Mung, northern Kachin State, Burma/Myanmar

Collection no.	Field no.	Netline NM-	Date	Elevation (m a.s.l.)	Sex	Body mass (g)	BL (mm)	BW (mm)	BH (mm)	Wing (mm)	Tarsus (mm)	Specimen type
USNM 633.684[a]	2004-069	04-2	8 February 2004	600	♀	–	10.1	4.0	2.5	46.9	22.3	Skin and partial alcohol
USNM 633.685[b]	2004-070	04-2	8 February 2004	600	♂	–	–	–	–	–	–	Skin and partial alcohol
USNM 633.689[b]	2004-079	04-3	8 February 2004	600	♂	–	–	–	–	–	–	Skin and partial alcohol
USNM 633.716	2004-109	04-3	10 February 2004	600	–	–	–	–	–	–	–	Skeleton
Uncatalogued[b]	2006-3281	06-2[c]	9 March 2006	600	♂	8.4	–	–	–	–	–	Skin and partial skeleton

BL Bill length; *BW* bill width at operculum (nares); *BH* bill height at operculum (nares); *Wing* unflattened wing length from bow to tip

[a] See also Table 1

[b] Not exported from Burma/Myanmar or to be returned to the National collection

[c] Resembles location NM-04-2 in Naung Mung

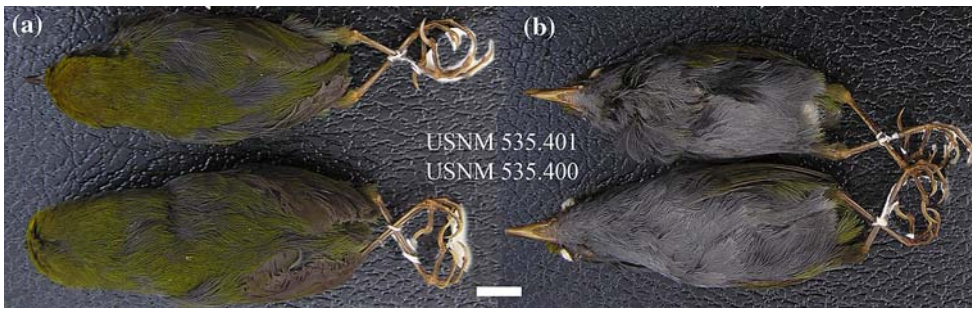

Fig. 1 **a** Dorsal view of ♂ holotype *Tesia olivea chiangmaiensis* ssp. nov. USNM (National Museum of Natural History) #535.400 collected by B. King 13 November 1964 in Doi Inthanon, Chiang Mai, Thailand and ♀ paratype USNM #535.401 collected 26 November 1964 at the same location. **b** Ventral view of the same specimens. Scale: (*white bar*): 10.0 mm. Photos: Swen C. Renner

Vocalizations

Our samples of vocalizations show that the songs of *T. o. olivea* and *T. o. chiangmaiensis* are very similar (Fig. 4). However, there are a few minor differences between the samples. The introductory strophe, which comprises soft unmodulated whistles on different pitches, consists of zero to six notes in *T. o. olivea*, most of which are fairly sustained (up to 0.2 s), while *T. o. chiangmaiensis* has six to seven notes, most of which are very short. The frequency range for *T. o. olivea* is 1.3–6.1 kHz, while that of *T. o. chiangmaiensis* is 3.0–6.5 kHz. The main song strophe (the loud part following the introductory whistles) of *T. o. olivea* has a distinctly descending pattern, which that of *T. o. chiangmaiensis* lacks. The main strophe length of *T. o. olivea* varies from 1.0–1.2 s, while that of *T. o. chiangmaiensis* varies from 0.8–1.3 s.

Mitochondrial DNA (mtDNA) analysis

We obtained the Cytb sequence for five individuals and a sixth from GenBank (three of each subspecies), but we obtained the ND2 sequence from only three individuals (two *T. o. olivea* and one *T. o. chiangmaiensis*). The mtDNA sequence analysis revealed only minor genetic differences among individuals and between the taxa. There was no evidence of reciprocal monophyly in trees constructed from the sequence nor of any fixed nucleotide differences between the two taxa for either Cytb or ND2. The average uncorrected pairwise sequence divergence between groups for Cytb was 0.53%, while variation was 0.37% for within *T. o. chiangmaiensis* and 0.86% for within *T. o. olivea*. The mean uncorrected divergence between the two taxa for ND2 was 0.40%, while divergence within *T. o. olivea* was 0.60%. Thus, there is no support from our mtDNA data for the designation of the two morphologically based taxa as subspecies. However, as we discuss below, since the two groups can be differentiated accurately by morphometric characteristics, we are convinced that the subspecies level designation is justified.

Discussion and remarks

Variation within the type series

The birds in our two samples are very similar in terms of both morphology (Table 1) and appearance, and differences are not discernible either within *T. o. olivea* (32) or *T. o. chiangmaiensis* (31). The measurements within each of the two samples do not differ from a normal bell-shaped distribution ($P > 0.05$, χ^2). The specimens examined show no sexual dimorphism in plumage, and morphometrics are not significantly different between sexes (*t* test). Immature *T. o. olivea* lack the shining crown found in the adults, however, both immature and adult *T. o. chiangmaiensis* are similar and lack the shining crown.

Sixty-three specimens of *T. olivea* have been examined from 22 localities (18 of which are distinguishable in Fig. 3) for morphometric and plumage characteristics (Tables 1, 2; Figs. 1, 2): the ♂ holotype and ♀ paratype and 30 additional specimens for *T. o. chiangmaiensis*, and 31 specimens of *T. o. olivea*. While differences between the two taxa are apparent (see above), differences within each taxon are not discernable based on plumage or morphometric characteristics. The specimens found in Arunachal Pradesh and northeast Burma/Myanmar are significantly different in some morphometric characteristics (Table 1) and exhibit a brighter iridescent crown and head feathers than those from Thailand, Laos, and Vietnam.

Three specimens in the bird collection of the Kunming Institute for Zoology (KIZ) were also examined (these three specimens are not located and not illustrated in Fig. 3). The three specimens are from "Yunnan", southwest China, with one coming from Gongshan, which is close to the Burma/

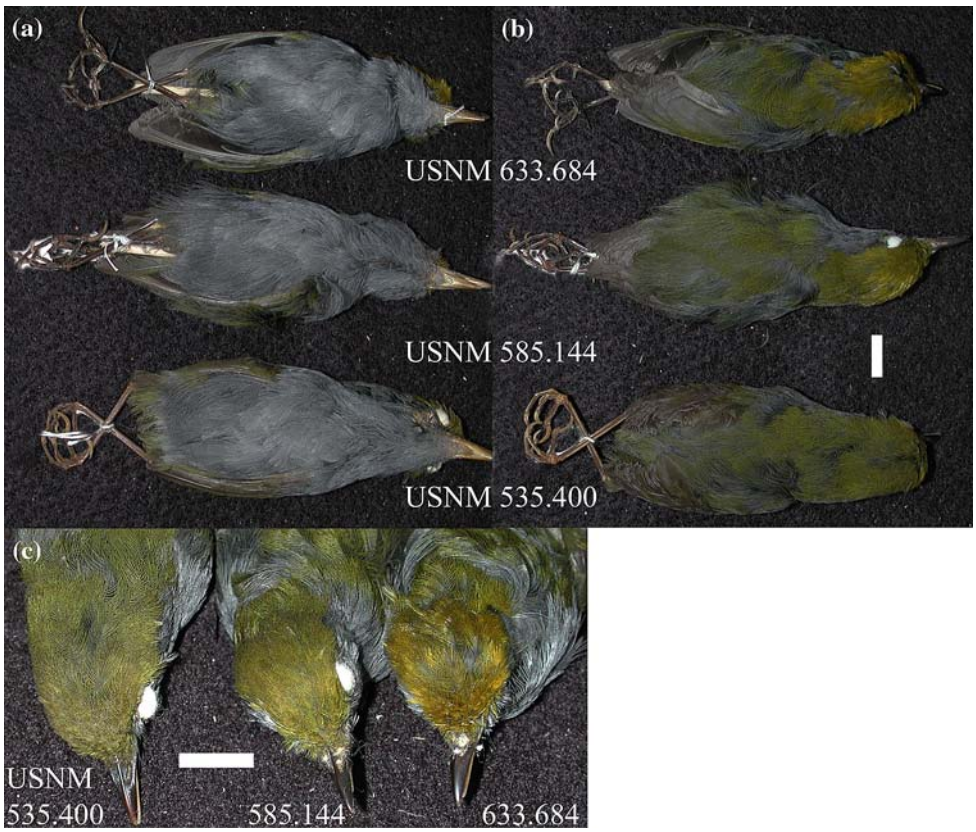

Fig. 2 **a** Ventral view of *T. o. olivea* from the Hkakabo Razi region (USNM #633.684, field #2004–069), *T. o. olivea* from Arunachal Pradesh (northeast India; USNM #585.144), and holotype *T. o. chiangmaiensis* ssp. nov. (USNM #535.400). **b** Dorsal view. **c** Crown pattern. Scale (*white bars*): 10.0 mm. Photos: Swen C. Renner

Myanmar (Table 1). We could not compare them directly with other specimens from both groups because the specimens were not exported to one of our reference collections. However, two of the authors (JPD and SCR) examined the three specimens in January 2007 and assigned them with high probability to the Thailand form because the crown appears to be less shining and less iridescent than that in the nominate. This result would indicate the border between both forms may lie along the Gaoligongshan Mountains or one of the larger rivers to the east (Nujiang or sometimes Salween) or west (Mali Hka/Malehka/Male Hka, a tributary of the Irrawaddy/Ayeyerwady, sometimes "eastern branch of the Irrawaddy") of the mountain range. Since we could not compare these specimens directly with any others specimens, doubt about the final assignment of the three specimens to one of the two regions remains, and clear geographic delineation between the two subspecies has not been resolved. We suggest additional collecting along the Gaoligongshan to elucidate the biogeography of this group.

Variation between *Tesia* species and subspecies

The general appearance implies a close relationship between *T. o. olivea* and *T. o. chiangmaiensis*, while the other four species of the genus (*castaneocoronata*, *cyaniventer*, *everetti*, and *superciliaris*) are clearly distinctive. *Tesia olivea* and *T. cyaniventer* are somewhat similar in appearance, but they differ in crown color (brighter in *olivea*), eye-stripe (darker in *cyaniventer*), ventral parts (paler in *cyaniventer*), and mandible (orange in a live *olivea*, pale in *cyaniventer*) (Fig. 2).

No subspecies have previously been described for *T. olivea*. The differences between the nominate and *T. o. chiangmaiensis* are significant and justify treatment of the new taxon as a subspecies. Songs from specimens from both localities indicate only minor differences between the populations (Fig. 4); hence, subspecies (rather than species) status seems most warranted. Although minor differences are apparent between the nominate and *chiangmaiensis* in the small sample of vocalizations, it remains to be demonstrated that these are consistent differences, whether this species has dialects, or whether they truly diagnose the subspecies. Further sampling and study of numerous individuals from multiple localities will be required to establish the significance of these differences. The songs of the nominate and *chiangmaiensis* are clearly much more similar to each other than either is to those of *T. cyaniventer* or especially *T. castaneocoronata* (detailed descriptions and sonagrams of the latter two species can be found in Martens and Eck 1995 and Rasmussen and Anderton 2005).

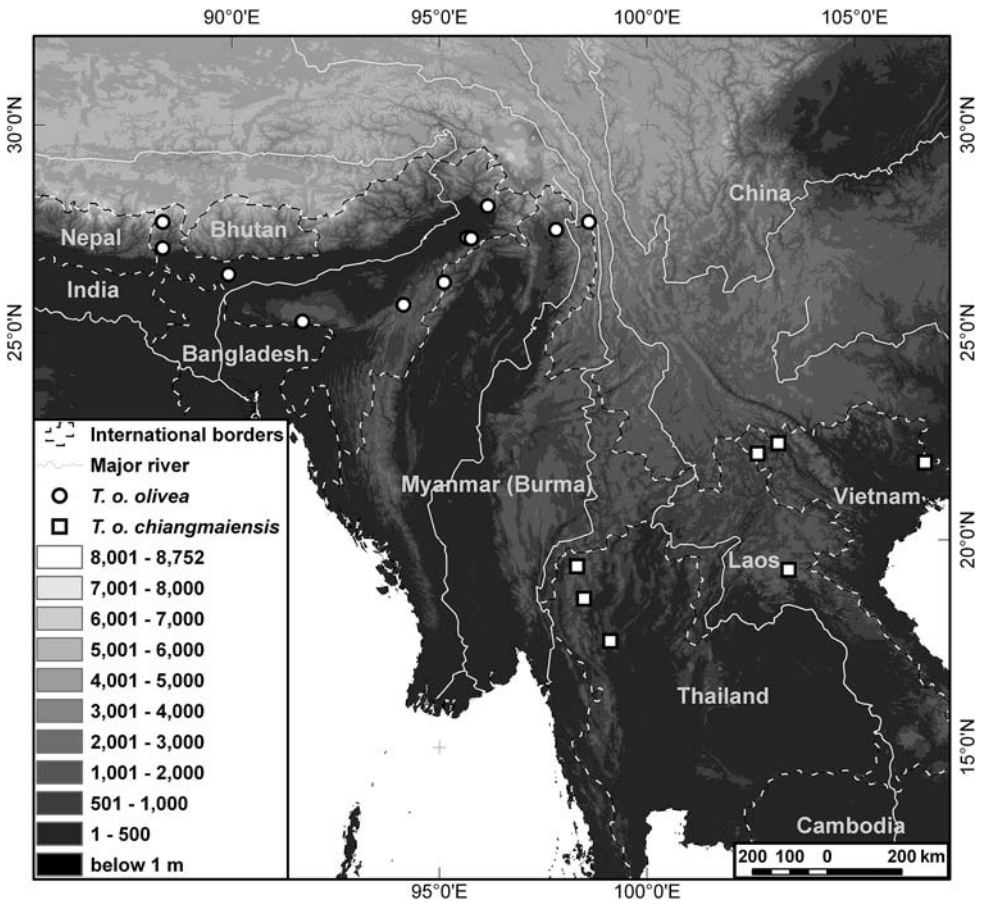

Fig. 3 Collecting localities of *T. olivea* specimens. Map: Swen C. Renner

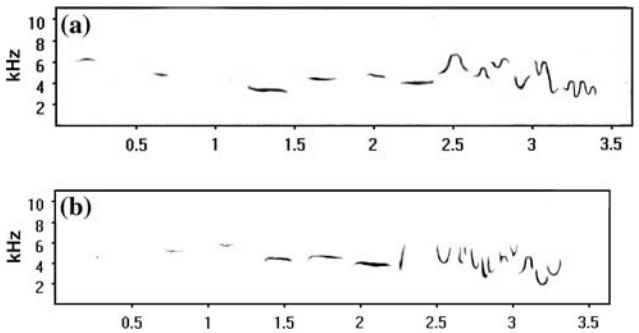

Fig. 4 Sonagrams of *T. olivea chiangmaiensis* from Thailand (**a**) (Scharringa 2005) and *T. o. olivea* from Bhutan (**b**) (Connop 1993)

Alternatively, mtDNA analysis does not support subspecies status because there is no evidence of reciprocal monophyly among the taxa, no fixed nucleotide differences, and very low average sequence divergence for two different genes. This is not entirely unexpected for taxa that are considered to be valid subspecies on the basis of morphological or ecological differences. A number of cases have been reported in which well-differentiated subspecies of birds have not shown differences in mtDNA or other sequences (e.g., Greenberg et al. 1998; Bulgin et al. 2003; Mila et al. 2007).

Notes

Tesia olivea is relatively scarce in collections in comparison to the other more frequently collected *Tesia* species. The abundance of *T. olivea* in collections from northeast Burma/Myanmar may be unusually high due to higher collection efforts (Renner et al. 2007).

We observed differences in the two taxa by chance while working on the bird collection of the NMNH in Washington D.C. We would not have detected the differences without the new reference material from our recent surveys in northern Burma/Myanmar. Our study clearly highlights how vital ongoing surveys are to increase our knowledge as well as how important it is to maintain extensive reference collections from many localities.

Zusammenfassung

Beschreibung einer neuen Unterart von *Tesia olivea* (Sylviidae), Chiang Mai Provinz, Nordthailand

In der südlichen Himalajaabdachung im Norden Birmas/Myanmars wurden während ornithologischer Sammlungsaktivitäten im Februar/März 2004 und März 2006

mehrere *Tesia olivea* Individuen im Regenwald der gemäßigten Breiten gefangen. Ein anschließender Vergleich dieser mit Museumsbälgen aus Nordostindien und Nordthailand ergab, dass, während die Vögel aus Nordbirma denen aus Nordwestindien glichen, die Bälge aus beiden Regionen deutliche Unterschiede zu *T. olivea* aus der Chiang Mai-Provinz (Nordthailand) und aus dem nördlichen Vietnam aufwiesen. Hier ordnen wir die letztere Population basierend auf Varianzen in Morphometrie, Gefieder, Gesang und mtDNA Sequenzen einer neuen Unterart von *T. olivea* zu.

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