PROC. ENTOMOL. SOC. WASH.
112(2), 2010, pp. 214–228

NOTES AND NEW RECORDS OF FLEAS (INSECTA: SIPHONAPTERA) FROM BIRDS AND MAMMALS COLLECTED IN SOUTHERN CHINA

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Abstract.—During 2004–2007, 1,222 birds comprising 184 species and 540 small mammals comprising 61 species were examined for ectoparasites as part of a broader biodiversity survey and inventory program conducted in Guangxi and Guizhou Provinces in southern China. A collection of 87 fleas was obtained. They included eight species representing seven genera and four families: *Dasypsyllus gallinulae gallinulae* (Dale), *Macrostylophora jiangkouensis* Li and Huang (Ceratophyllidae); *Palaeopsylla incurva* Jordan, *Palaeopsylla remota* Jordan (Ctenophthalmidae); *Nycteridopsylla iae* Beaucournu and Kock, *Thaumapsylla breviceps* Rothschld (Ischnopsyllidae); and *Aviostivalius klossi* Jordan and Rothschild, and *Lentistivalius insolli* Traub (Pygiopsyllidae). Illustrations are provided to supplement those in the original description of *M. jiangkouensis*. The host preference for *L. insolli* for passerine birds is established with certainty and its derivation and distribution are discussed. The potential impact of predatory ants on flea populations at low elevations in tropical latitudes is considered.

Key Words: Ceratophyllidae, Ctenophthalmidae, ectoparasites, Ischnopsyllidae, Pygiopsyllidae, *Aviostivalius*, *Macrostylophora*, *Lentistivalius*, *Nycteridopsylla*, *Palaeopsylla*, *Thaumopsylla*

DOI: 10.4289/0013-8797-112.2.214

The tropical region of southern China is part of the Indo-Burma biodiversity hotspot, one of the richest and most threatened centers of biodiversity on earth (Myers et al. 2000). In the past, the political landscape of China made the description and documentation of biodiversity in this region difficult; however, in 2004–2007 we conducted biotic surveys of terrestrial vertebrates in five nature reserves in Guangxi and Guizhou Provinces. Ectoparasites were sampled from terrestrial vertebrates as part of the survey. Here we report on the fleas (Siphonaptera) that were collected from small mammals and birds.

* Edited by Jerry Cook; accepted by Michael W. Gates

MATERIALS AND METHODS

Fleas were collected from the following sites (Fig. 1).

Site 1. Jing Xi County Nature Preserve, located in Guangxi Province,

Fig. 1. Map illustrating biodiversity study areas: Jing Xi County Nature Preserve, Shiwandashan National Nature Preserve, Kuan Kuoshui Nature Preserve, Dashahe Nature Preserve, and Shuipu (Maolan National Nature Preserve).

elevation 900–1400 m, 23°07′12″N, 105°57′36″E, September–October 2004. The fieldwork was based along a rapid stream in secondary forest at 950 m. Old banana cultivation was evident with less disturbed ridge top forests of many large trees 20–30 m in height with some reaching ~50 m.

Site 2. Shiwandashan National Nature Preserve, located in Guangxi Province, elevation 300–900 m, 21°13′48″N, 107°52′48″E, March–May 2005. Field-

work was based along a winding paved road, through steep mountains of the preserve at 500 m. Secondary forests had maximum tree heights of ~25 m.

Site 3. Kuan Kuoshui Nature Preserve, located in Guizhou Province, elevation 1450–1750 m, 28°13′48″N, 107°09′36″E, March–May 2006. Fieldwork was based in deciduous and evergreen forests with some trees achieving ~25 m. Valley floor and surrounding hills were cultivated. Streams drained into a small lake on the valley floor.

Site 4. Dashahe Nature Preserve, located in Guizhou Province, elevation 1350–1650 m, 29°10′12″N, 107°34′12″E, March–May 2006. Fieldwork was based in heavily disturbed natural vegetation at 1350 m. Maximum height of trees was ~15 m, secondary growth surrounded the valley, much of which was agricultural plots of tobacco, etc. Secondary vegetation surrounded the valley and some native vegetation lined a small river running through the steep karst landscape.

Site 5. Shuipu village, Libo County, near Maolan National Nature Preserve, located in Guizhou Province, elevation 635–850 m, 25°29′05″N, 107°52′54″E, March–May 2007. Fieldwork was based in and around Shuipu village in gently sloping cultivated valley approximately 500 m wide and several kilometers long. The valley was surrounded by steep, rugged, karst formations. Perennial streams flowing into valley were diverted to agricultural fields.

Methods for the collection and preservation of ectoparasites were detailed in Hastriter and Bush (2006) and Hastriter and Whiting (2003). Procedures for preparing illustrations are outlined in Hastriter and Bush (2006). DNA voucher specimens are deposited in the Brigham Young University flea collection and the remaining specimens are divided among the collections of both authors. Nomenclature for birds and mammals follow those of Inskipp et al. (2001) and Wilson and Reeder (2005), respectively. All associated hosts were collected and prepared as museum specimens. Mammal specimens are deposited at the Royal Ontario Museum, Toronto, Canada, except for a subsample of specimens that remained with local authorities in China. The bird specimens are deposited at the Kansas Museum of Natural History, Lawrence, KS (identified herein by KU#), except for a subsample of specimens that remained with local authorities in China (identified herein by BWB#, RLB#, or SEB#).

Results and Discussion

A total of 540 mammals representing 61 species (Table 1) and 1,222 birds representing 174 species were examined (Table 2). Eight species of fleas were recovered: two from bats, four from ground dwelling mammals, and two from birds. Only three of the 17 bat genera represented in our study harbored fleas. With the exception of *Myotis* Kaup and *Pipistrellus* Kaup, other genera examined are not known to harbor fleas in China, nor have any of the *Myotis* and *Pipistrellus* species in our study been documented previously as hosts of fleas.

Fleas were recovered from only five of 16 ground dwelling mammal species. Of those five infested species, only 8 of 85 specimens harbored fleas, and then only in low numbers. These low numbers were especially true at the three lowest elevation sites (Jing Xi, Shiwandashan and Shuipu), where fleas were only recovered from three (4.5%) of 45 positive host species (6.7%). Fleas were more common on ground-dwelling mammals at the two highest elevation sites (Kuan Kuoshui and Dashahe), where fleas were collected from 5 of 40

Table 1. Mammals examined for fleas from five field sites in southern China: Jing Xi (J.X.), Shiwandashan (Shiw.), Kuan Kuoshui (K.K.), Dashahe (Dash.), and Shuipu (Shui.). Numbers in parentheses indicate individual hosts that harbored fleas.

Order/Family	Scientific Name	J.X.	Shiw.	K.K.	Dash.	Shui.	Total	Fleas
Chiroptera								
Hipposideridae	*Aselliscus stoliczkanus*	0	0	0	0	3	3	
	Hipposideros armiger	2	0	4	0	3	9	
	H. larvatus	0	1	0	0	29	30	
	H. pomona	3	0	0	0	2	5	
Megadermatidae	*Megaderma lyra*	0	0	2	0	4	6	
Pteropodidae	*Cynopterus sphinx*	20	7	0	0	0	27	
	Rousettus leschenaulti	16 (4)	0	0	0	0	16	*[1]
	Sphaerias blanfordi	19	0	0	0	0	19	
Rhinolophidae	*Rhinolophus affinis*	26	19	0	0	0	45	
	R. lepidus	0	0	0	0	2	2	
	R. luctus	0	1	0	0	1	2	
	R. macrotis	1	0	0	0	6	7	
	R. paradoxalophus	1	0	1	0	10	12	
	R. pearsonii	4	4	9	11	7	35	
	R. pusillus	1	4	0	1	8	14	
	R. rouxii	3	11	9	2	16	41	
	R. yunnanensis	5	0	0	0	6	11	
	Rhinolophus n. sp.	0	0	1	0	0	1	
Vespertilionidae	*Eptesicus serotinus*	0	0	0	1	0	1	
	Harpiocephalus harpia	1	3	0	0	2 (1)	6	*[2]
	Ia io	0	0	2	0	1 (1)	3	*[2]
	Kerivoula hardwickii	1	0	3	0	0	4	
	Miniopterus magnater	1	1	1	0	0	3	
	Murina aenea	1	0	0	0	0	1	
	M.aurata	6	1	0	0	2	9	
	M. cyclotis	41	7	0	0	0	48	
	M. leucogaster	11	2	0	0	0	13	
	M. tubinaris	9	0	0	0	0	9	
	Murina sp.	0	0	0	0	1	1	
	Myotis altarium	0	0	0	0	1	1	
	M. daubentonii	0	0	0	0	3	3	
	M. montivagus	0	6	0	0	0	6	
	M. muricola	3	2	0	2	0	7	
	M. mystacinus	0	0	0	0	8	8	
	M. ricketti	0	0	3	0	0	3	
	M. siligorensis	1	0	2	1	0	4	
	Pipistrellus cadornae	1	0	0	0	0	1	
	P. ceylonicus	0	0	0	1	0	1	
	P. coromandra	0	1	0	0	0	1	
	P. paterculus	1	2	0	0	0	3	
	P. pulveratus	0	1	0	0	0	1	
	Pipistrellus sp.	1	0	0	0	0	1	
	Scotomanes ornatus	0	4	0	0	0	4	
	Vespertilio sinensis	0	0	0	3	0	3	
Erinaceomorpha								
Erinaceidae	*Neotetracus sinensis*	0	0	0	0	1	1	
Rodentia								
Cricetidae	*Eothenomys melanogaster*	0	0	2	0	0	2	

Table 1. Continued.

Order/Family	Scientific Name	J.X.	Shiw.	K.K.	Dash.	Shui.	Total	Fleas
Muridiae	*Chiropodomys gliroides*	1	0	0	0	0	1	
	Leopoldamys edwardsi	0	0	0	0	1	1	
	Niviventer confucianus	2	12 (2)>	17	8	4	43	*[3]
	N. fulvescens	9	11	3	0	4 (1)>	27	*[3]
	N. montivagus	0	1	0	0	0	1	
	Rattus nitidus	0	1	0	0	1	2	
	R. tanezumi	0	0	0	0	1	1	
Platacanthomyidae	*Typhlomys cinereus*	0	0	0	0	1	1	
Sciuridae	*Callosciurus swinhoei*	1	0	0	0	0	1	
	Tamiops swinhoei	0	2	1 (1)	0	0	3	*[4]
Soricomorpha								
Soricidiae	*Anourosorex squamiceps*	0	0	4 (2)	0	0	4	*[5]
	Crocidura attenuata	1	3	0	0	3	7	
	C. fuliginosa	0	0	7 (2)	0	1	8	*[6]
	C. horsfieldi	3	2	0	0	0	5	
	Crocidura sp.	1	1	0	0	0	2	
	Total species	32	26	17	9	29	61	
	Total individuals	197	110	71	30	132	540	

[1] *Thaumapsylla breviceps.*
[2] *Nycteridopsylla iae.*
[3] *Aviostivalius klossi.*
[4] *Macrostylophora jiangkouensis.*
[5] *Palaeopsylla remota.*
[6] *Palaeopsylla incurva.*

positive host species (12.5%). Similar effects of elevation were also documented in a survey of the Hengduan Mountains in southwestern China. Gong et al. (2005) found that flea diversity was low at 1000 m, but both species richness and abundance increased with elevation up to 3800 m, where flea diversity peaked. Minimal numbers of fleas at low elevations may be explained by the presence of predatory ants. In areas where fleas and predatory ants coexist, ants may reduce flea populations by feeding on their susceptible immature stages. Several facts support this hypothesis. First, tropical ant species diversity and abundance is known to decrease with increased elevation in tropical areas, as has been shown in Costa Rica (Janzen 1973), India (Sabu et al. 2008), Malaysia (Brühl et al. 1998), Panama (Olson 1994), and Venezuela (Janzen et al. 1976). Second, during field-work in Papua New Guinea, the senior author noted that ants were commonly collected from traps and nests of ground dwelling mammals below 1,000 m elevation, where fleas were virtually absent. Third, in Bexar County, Texas, nests of Cotton Rats (*Sigmodon hispidus* Say and Ord) are typically infested by mites and fleas; however, if fire ants (*Solenopsis* sp.) are present, the nests are devoid of mites and all stages of fleas (pers. obs. senior author, 1998). Although other factors may contribute to a dearth of fleas at lower elevations, the potential impact of predatory ants on flea populations should be more thoroughly investigated.

Two flea species from birds were found among 19 bird species that were

Table 2. Birds examined for fleas from five field sites in southern China: Jing Xi (J.X.), Shiwandashan (Shiw.), Kuan Kuoshui (K.K.), Dashahe (Dash.), and Shuipu (Shui.). Numbers in parentheses indicate individual hosts that harbored fleas.

Order/Family	Avian Species	J.X.	Shiw.	K.K.	Dash.	Shui.	Total	Fleas
Apodiformes								
Apodidae	*Apus pacificus*	0	0	0	4	0	4	
Caprimulgiformes								
Caprimulgidae	*Caprimulgus indicus*	1	2	0	0	1	4	
Charadriiformes								
Scolopacidae	*Scolopax rusticola*	1	0	0	0	0	1	
Ciconiiformes								
Ardeidae	*Butorides striatus*	1	0	0	0	0	1	
	Egretta garzetta	0	0	1	0	0	1	
	Gorsachius melanolophus	0	1	0	0	0	1	
Columbiformes								
Columbidae	*Chalcophaps indica*	3	2	0	0	0	5	
	Streptopelia chinensis	0	0	0	2	0	2	
	S. orientalis	0	0	1	0	0	1	
	Treron sieboldii	1	0	0	0	0	1	
Coraciiformes								
Alcedinidae	*Alcedo hercules*	1	0	0	0	0	1	
	A. atthis	0	0	0	0	4	4	
	Ceyx erithacus	0	1	0	0	0	1	
Cuculiformes								
Cuculidae	*Clamator coromandus*	0	1	0	0	0	1	
	Cuculus micropterus	0	0	1	0	0	1	
	Hierococcyx fugax	0	1	0	0	0	1	
	Phaenicophaeus tristis	0	1	0	0	0	1	
Falconiformes								
Accipitridae	*Accipiter virgatus*	1	0	0	0	0	1	
Gruiformes								
Rallidae	*Amaurornis phoenicurus*	0	0	0	0	1	1	
Passeriformes								
Aegithalidae	*Aegithalos concinnus*	0	0	0	3	12	15	
Aegithinidae	*Chloropsis hardwickii*	1	0	0	0	2	3	
Campephagidae	*Coracina macei*	2	0	0	0	0	2	
	C. melaschistos	3	0	1	0	0	4	
	Hemipus picatus	1	1	0	0	0	2	
	Pericrocotus divaricatus	0	2	0	0	0	2	
	P. ethologous	0	0	0	2	0	2	
	P. flammeus	1	4	0	0	2	7	
	P. solaris	0	0	0	0	2	2	
Cinclidae	*Cinclus pallasii*	0	0	0	5	0	5	
Corvidae	*Dendrocitta formosae*	1	0	0	0	0	1	
	Garrulus glandarius	0	0	1	0	0	1	
	Urocissa erythrorhyncha	0	0	2	2	0	4	
Dicaeidae	*Dicaeum concolor*	0	5	0	0	0	5	
Dicruridae	*Dicrurus hottentottus*	8	1	0	0	0	9	
	D. leucophaeus	5	1	0	0	0	6	
Emberizidae	*Emberiza elegans*	0	0	11	5	0	16	
	E. godlewskii	0	0	0	1	0	1	
	E. pusilla	0	0	7	1	7	15	
	E. spodocephala	0	0	4	2 (1)	7	13	*[1]

Table 2. Continued.

Order/Family	Avian Species	J.X.	Shiw.	K.K.	Dash.	Shui.	Total	Fleas
	E. tristrami	0	0	0	0	1	1	
	Latoucheornis siemsseni	0	0	0	0	2	2	
	Melophus lathami	0	0	0	0	4	4	
Estrilididae	*Lonchura striata*	0	0	0	0	14	14	
Fringillidae	*Carduelis sinica*	0	0	1	0	0	1	
	Carpodacus erythrinus	0	0	0	0	6	6	
Hirundinidae	*Hirundo daurica*	0	0	0	0	5	5	
	Hirundo rustica	0	0	0	0	1	1	
Laniidae	*Lanius schach*	0	0	0	0	1	1	
Monarchidae	*Hypothymis azurea*	0	1	0	0	0	1	
	Rhipidura albicollis	6	0	0	0	0	6	
	Terpsiphone paradisi	1	10	0	0	0	11	
Motacillidae	*Anthus hodgsoni*	1	0	0	2	10	13	
	Motacilla alba	2	0	0	0	2	4	
	M. cinerea	1	0	0	4	0	5	
Muscicapidae	*Copsychus saularis*	0	0	1	0	0	1	
	Culicicapa ceylonensis	9	1	4	0	16	30	
	Cyanoptila cyanomelana	4	1	0	0	0	5	
	Cyornis banyumas	12	7	0	0	4	23	
	C. hainanus	2	5	3 (1)	0	1	11	*[1]
	C. rubeculoides	1	0	0	0	0	1	
	Enicurus leschenaulti	1	0	3 (1)	0	2	6	*[1]
	E. schistaceus	4	5	0	0	4	13	
	Eumyias thalassina	3	0	1	1	0	5	
	Ficedula hyperythra	1	1	0	0	0	2	
	F. mugimaki	0	0	0	0	1	1	
	F. parva	1	1	0	0	2	4	
	F. tricolor	0	0	0	0	2	2	
	F. zanthopygia	0	2	0	0	0	2	
	Luscinia cyane	3	0	0	0	0	3	
	L. sibilans	0	0	0	0	1	1	
	Muscicapa ferruginea	3	0	0	0	0	3	
	M. muttui	4	3	0	4	1	12	
	M. sibirica	1	0	0	0	0	1	
	Myiomela leucura	2	2	3 (2)	0	0	7	*[1]
	Myophonus caeruleus	1	0	1 (1)	0	4	6	*[1]
	Niltava davidi	0	0	7 (1)	1	10	18	*[1]
	N. grandis	7	0	0	0	0	7	
	N. macgrigoriae	18	2	0	0	0	20	
	Phoenicurus auroreus	0	0	2	1	0	3	
	Rhinomyias brunneatus	2	1	0	0	0	3	
	Rhyacornis fuliginosus	0	2	0	11 (1)	0	13	*[1]
	Saxicola ferrea	1	0	0	1	1	3	
	S. torquata	0	0	0	0	1	1	
	Zoothera citrina	4	7	0	0	5	16	
	Z. dauma	0	0	0	0	3	3	
	Z. sibirica	2	0	0	0	0	2	
	Zoothera sp.	1	0	0	0	0	1	
Nectariniidae	*Aethopyga christinae*	0	7	0	0	4	11	
	A. gouldiae	0	0	1	1	0	2	
	Arachnothera magna	1	1	0	0	0	2	

Table 2. Continued.

Order/Family	Avian Species	J.X.	Shiw.	K.K.	Dash.	Shui.	Total	Fleas
Oriolidae	*Oriolus chinensis*	0	1	0	0	0	1	
Panuridae	*Paradoxornis alphonsianus*	0	0	4	0	1	5	
	P. gularis	1	3	1	0	0	5	
	P. verreauxi	0	0	7	0	0	7	
	P. webbianus	0	0	0	2 (2)	5	7	*[1]
Paridae	*Melanochlora sultanea*	1	0	0	0	0	1	
	Parus major	0	0	2	0	4	6	
	P. monticolus	0	0	16 (1)	2	0	18	*[1]
	P. spilonotus	0	0	0	0	1	1	
	P. venustulus	0	0	0	0	7	7	
	Parus sp.	1	0	0	0	0	1	
	Sylviparus modestus	0	0	2	0	0	2	
Passeridae	*Passer rutilans*	0	0	1	1	12	14	
Pycnonotidae	*Alophoixus flaveolus*	6	0	0	0	0	6	
	Alophoixus pallidus	3	8	0	0	0	11	
	Hemixos castanonotus	2	9	0	0	11	22	
	Hypsipetes leucocephalus	0	2	0	0	1	3	
	H. mcclellandii	10	4	3	2	4	23	
	Pycnonotus jocosus	1	5	0	0	0	6	
	P. sinensis	0	2	0	0	3	5	
	P. xanthorrhous	0	0	1	2	12	15	
	Spizixos semitorques	0	0	0	6	16	22	
Sittidae	*Sitta frontalis*	1	0	0	0	0	1	
Sturnidae	*Acridotheres cristatellus*	0	0	0	1	0	1	
Sylviidae	*Cettia fortipes*	1	0	3	0	1	5	
	Orthotomus cucullatus	1	1	0	0	0	2	
	O. sutorius	0	1	0	0	1	2	
	Phylloscopus spp.	18	12	6	10	13	59	
	Prinia atrogularis	0	2	0	0	2	4	
	P. inornata	0	0	0	0	1	1	
	Seicercus spp.	16	1	13	11	5	46	
	Tesia cyaniventer	5	0	0	0	0	5	
	Urosphena squameiceps	5	0	0	0	0	5	
Timaliidae	*Alcippe chrysotis*	0	0	8	1	0	9	
	A. dubia	0	0	0	0	1	1	
	A. morrisonia	18	5	20	4 (1)	36	83	*[1]
	Babax lanceolatus	0	0	0	5 (1)	0	5	*[2]
	Garrulax canorus	0	1	0	0	0	1	
	G. chinensis	2	1	0	0	0	3	
	G. cineraceus	0	0	5 (1)	0	4	9	*[1]
	G. maesi	2	4	0	0	0	6	
	G. milnei	2	0	11 (2)	0	0	13	*[1]
	G. ocellatus	0	0	0	1 (1)	0	1	*[1]
	G. pectoralis	0	0	2	0	0	2	
	G. poecilorhynchus	0	0	3 (2)	0	0	3	*[1]
	G. sannio	0	0	3	0	1	4	
	Leiothrix argentarus	0	3	0	0	0	3	
	L. lutea	4	0	22 (4)	21 (1)	2	49	*[1]
	Liocichla phoenicea	1	0	0	0	0	1	
	Minla cyanouroptera	0	0	6	1	0	7	
	M. ignotincta	0	0	1	2	0	3	

Table 2. Continued.

Order/Family	Avian Species	J.X.	Shiw.	K.K.	Dash.	Shui.	Total	Fleas
	Napothera brevicaudata	3	2	0	0	0	5	
	Pellorneum albiventre	3	2	0	0	0	5	
	P. tickelli	1	0	0	0	0	1	
	Pomatorhinus ruficollis	7	6	9 (2)	6 (1)	14	42	*[1]
	Pteruthius flaviscapis	5	0	0	0	0	5	
	Spelaeornis chocolatinus	4	0	0	0	0	4	
	Stachyris nigriceps	11	0	0	0	0	11	
	S. ruficeps	1	10	9 (2)	1 (1)	17	38	*[1]
	S. striolata	17	2	0	0	0	19	
	Stachyris sp.	10	0	0	0	0	10	
	Yuhina castaniceps	0	6	0	0	4	10	
	Y. diademata	0	0	1	0	0	1	
	Y. nigrimenta	3	0	2	1	1	7	
	Y. zantholeuca	4	3	0	0	2	9	
Turdidae	*Turdus dissimilis*	0	0	0	0	2	2	
	Turdus sp.	1	0	0	0	0	1	
Zosteropidae	*Zosterops japonicus*	0	0	2	0	12	14	
Capitonidae	*Megalaima asiatica*	0	2	0	0	0	2	
	Megalaima franklinii	0	3	0	0	0	3	
	Megalaima virens	1	0	0	0	0	1	
Piciformes								
Picidae	*Blythipicus pyrrhotis*	1	0	0	0	0	1	
	Dendrocopos canicapillus	0	0	1	0	1	2	
	D. hyperythrus	1	0	0	0	0	1	
	Picumnus innominatus	0	0	1	1	5	7	
	Picus canus	0	0	2 (1)	0	0	2	*[1]
	Sasia ochracea	5	5	0	0	5	15	
Podicipediformes								
Podicipedidae	*Tachybaptus ruficollis*	0	0	1	0	0	1	
Stigiformes								
Strigidae	*Glaucidium brodiei*	1	0	0	0	1	2	
	G. cuculoides	1	0	0	0	2	3	
	Ninox scutulata	0	0	0	0	1	1	
	Otus letti	1	0	0	0	0	1	
	O. spilocephalus	3	0	0	0	0	3	
	O. sunia	0	0	0	0	2	2	
Trogoniformes								
Trogonidae	*Harpactes erythrocephalus*	2	0	0	0	0	2	
	Total species	87	59	38	30	73	174	
	Total individuals	317	188	224	134	359	1222	

[1] *Lentistivalius insolli*.
[2] *Dasypsyllus gallinulae gallinulae*.

infested. Of particular interest among the two bird fleas reported herein was *Lentistivalius insolli* (Traub 1950), a pygiopsyllid bird flea, which was widely distributed on passerine birds.

Ceratophyllidae

Dasypsyllus gallinulae gallinulae (Dale)

Material examined.—Dashahe: ex *Babax lanceolatus* (Verreaux) (BWB-

975) (1♂ DNA voucher F-272), 29 IV 06, S.E. Bush.

Remarks.—This flea occurs commonly in Europe on many species of birds. This bird flea virtually parasitizes any bird (or mammal) for which it comes into contact. The species is less documented in Eastern Asia but has been reported in China, Japan, the Philippine Islands and the Himalayas (Sikkim) (Haddow et al. 1983).

Macrostylophora jiangkouensis Li and Huang
(Figs. 2A–E)

Material examined.—Kuan Kuoshui: ex *Tamiops swinhoei* (Milne-Edwards) (Swinhoe's Striped Squirrel), F-47640, 26 IV 06, S.E. Bush and D.H. Clayton (7♂, 3♀).

Remarks.—The genus ranges from Pakistan through China, Indonesia, and the Philippine Islands occurring primarily on squirrels, especially members of the Genus *Callosciurus* Gray. Li and Traub (1998) erected the subgenus *Songshupsylla*, and assigned *M. jiangkouensis* to the *euteles* group (southern China) of that subgenus, opposed to the *hebeiensis* group (northern China). Specialists continue to describe new species and subspecies without developing and publishing identification keys. The genus has 44 species including 12 subspecies and is in need of revision. Within the genus *Macrostylophora*, the anatomy of the aedeagus provides important characters on which to distinguish species. Combined with both the complexity and the difficulty of viewing the aedeagus (often hidden beneath other structures), it is often omitted from discussion or illustration. Such is the case with *M. jiangkouensis*. Illustrations (Figs. 2A–E) of the male genitalia of *M. jiangkouensis* are therefore provided to supplement those included in the original description and to further validate the identification of this taxon.

Ctenophthalmidae
Palaeopsylla incurva Jordan

Material examined.—Kuan Kuoshui: ex *Crocidura dracula* = *Crocidura fuliginosa* (Blyth) (Southeast Asian Shrew), F-47633, F-47642, 25, 27 IV 06, S.E. Bush and D.H. Clayton (1♂ DNA voucher F-271, BYU; 1♂).

Remarks.—*Palaeopsylla incurva* has been collected infrequently and the preferred host is uncertain. Guo et al. (2000) found it statistically in very low numbers on *Crocidura attenuata* Milne-Edwards in neighboring Yunnan Province. If the host preference of this flea is to be determined, future collections might focus on the nests of various species of *Crocidura* in the known range of *P. incurva* (northern Myanmar and the southern Chinese Provinces of Yunnan and Guangxi).

Palaeopsylla remota Jordan

Materials examined.—Kuan Kuoshui: ex *Anourosorex squamipes* Milne-Edwards (Chinese Mole Shrew) F-47579, F-47587, 16, 18 IV 06, S.E. Bush and D.H. Clayton (4♂, 2♀).

Remarks.—It is not surprising to find *P. remota* on *A. squamipes*. Hopkins and Rothschild (1966) reported this flea from northeastern India and Myanmar from *A. squamipes* and Guo et al. (2000) found *A. squamipes* to be the dominant host of *P. remota* in their study in Yunnan Province, China.

Ischnopsyllidae (Ischnopsyllinae)
Nycteridopsylla iae Beaucournu and Kock

Material examined.—Shuipu: ex *Har-*

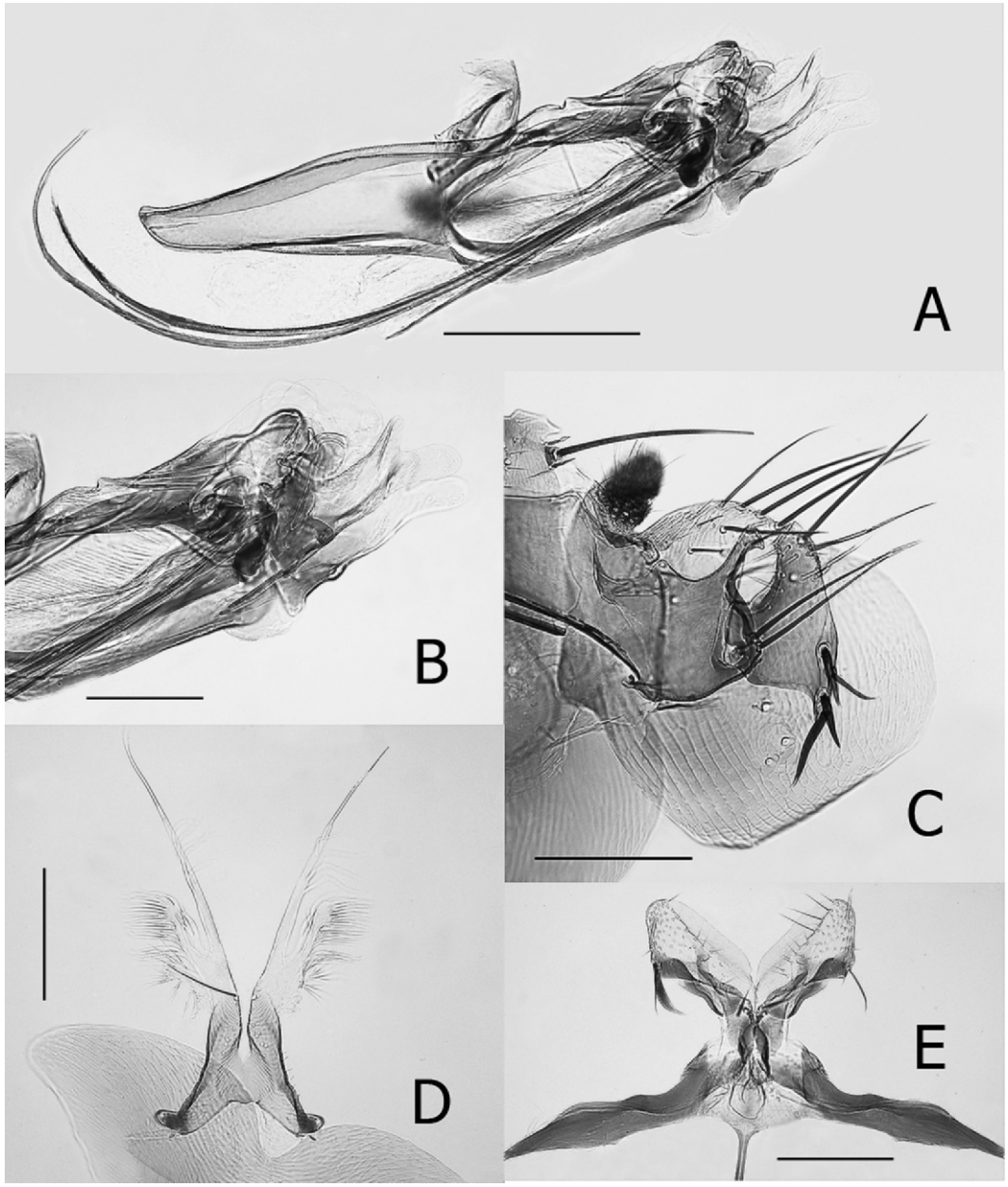

Fig. 2. *Macrostylophora jiangkouensis*, male. A. Aedeagus. B. Apex of aedeagus. C. Tergite eight and clasper (basimere and telomere). D. Sternites seven and eight, ventral view. E. Proximal and distal arms of ninth sternite, ventral view. Scale A, C–E = 200 μ, B = 100 μ.

piocephalus harpia (Temminck) (Hairy-winged Bat, F-47763), 2 IV 07, S.E. Bush (1♀); same data except ex *Ia io* Thomas (F-47871), 15 IV 07 (1♂, 2♀).

Remarks.—This flea has been collected exclusively on *I. io* with the exception of this sole record on *H. harpia* (see Hastriter et al. 2009).

Thaumapsyllinae
Thaumapsylla breviceps Rothschild

Material examined.—Jing Xi: ex *Rousettus leschenaulti* (Desmarest) (Leschenault's Rousette) F-47412, 6 X 04, S.E. Bush (3♀, DNA voucher, BYU; 1♂, 1♀); same data except ex *R. leschenaulti*, F-47437, F-47442, F-47443, 8 X 04 (1♂, 2♀).

Remarks.—A common parasite of fruit bats of the genus *Rousettus* Gray (Pteropidae), it is restricted to tropical and semitropical habitats of South Africa, Southeast Asia and Wallacea. Beaucournu and Kock (1994) provided excellent pictorial details of the distribution of this species. This flea record represents the northern fringe of the species and the authors are not aware of any records of *T. breviceps* heretofore reported from China.

Pygiopsyllidae
Aviostivalius klossi (Jordan and Rothschild)

Material examined.—Shiwandashan: ex *Niviventer confucianus* (Milne-Edwards) (Chinese White-bellied Rat), F-47469, 18 IV 05, S.E. Bush (1♂, DNA voucher F-255, BYU; 1♂); same data except ex *N. confucianus*, (F-47548), 30 IV 05 (1♀). Shuipu: ex *Niviventer fulvescens* (Gray) (F-47774), 20 II 07, S.E. Bush (1♂DNA voucher F-280, BYU).

Remarks.—A common lowland species wide spread throughout Southeast Asia on murid rodents.

Lentistivalius insolli (Traub)

Material examined.—Kuan Kuoshui: ex *Cyornis hainanus* (Ogilvie-Grant) (Hainan Blue-Fly Catcher) KU-97520, 24 IV 06 (1♀); ex *Enicurus leschenaultii* (White-Crowned Fork-Tail) KU-97548, 25 IV 06 (2♂, 6♀); ex *Garrulax cineraceus* (Godwin-Austen) (Moustached Laughing Thrush), KU-97590, 22 IV 06 (1♂, 1♀); ex *Garrulax milnei*, (David) (Red-Tailed Laughing Thrush), KU-97564, 18 IV 06, S.E. Bush and D.H. Clayton (1♂, 1♀); ex *G. milnei*, KU-97559, 23 IV 06 (1♂); ex *Garrulax poecilerhynchus* (Rusty Laughing Thrush), KU-97553, 20 IV 06 (1♀); ex *G. poecilerhynchus*, KU-97522, 23 IV 2006 (2♂); ex *Leiothrix lutea* (Scopoli) (Red-Billed Leiothrix), SEB-510, SEB-5112, 19 IV 06 (2♀); ex *L. lutea*, BWB-922, 21 IV 06 (1♂); ex *L lutea*, RLB-867, 22 IV 06 (1♀); ex *Myiomela leucura* (Hodgson) (White-Tailed Robin), KU-97551, 21 IV 06 (2♀); ex *M. leucura*, KU-97550, 27 IV 2006 (1♂, 1♀); ex *Myophonus caeruleus* (Scopoli) (Blue-Whistling Thrush), KU-97521, 23 IV 06 (1♂); ex *Niltava davidi* (Fujian Niltava), SEB-518, 24 IV 06 (1♂); ex *Parus monticolus* Vigors (Green-Backed Tit), KU-97597, 25 IV 06 (1♂); ex *Picus canus* J.F. Gmelin (Gray-Headed Woodpecker), KU-97408, 21 IV 06 (2♀); ex *Pomatorhinus ruficollis* (Streak-Breasted Scimitar Babbler), KU-97577, 20 IV 06 (2♂); ex *P. ruficollis*, KU-97578, 23 IV 06 (1♀); ex *Stachyris ruficeps* Blyth (Rufous-Capped Babbler), KU-97454, 20 IV 06 (1♂); ex *S. ruficeps*, KU-97602, 24 IV 06 (1♀); ex *M. leucura*, 27 IV 2006 (1♂, 1♀). Dashahe: ex *Alcippe morrisonia* Swinhoe (Gray-Cheeked Fulvetta), BWB-985, 30 IV 06 (2♀); ex *Emberiza spodocephala* (Black-Faced Bunting), BWB-994, 1 V 06 (1♀); ex *Garrulax ocellatus* (Vigors) (Spotted Laughing Thrush), KU-97504, 5 V 06 (1♂); ex *L. lutea*, SEB-534, 1 V 06 (1♀); ex *Paradoxornis webbianus* (Gould) (Vinous-Throated Parrot Bill), KU-97482, 1 V 06 (1♀); ex *P. webbianus*, KU-97483, 2 V 2006 (1♂); ex *Rhyacornis fuliginosus* (Vigors) (Plumbeous Water-Redstart), KU-

97479, 1 V 06 (1♀); ex *P. ruficollis*, KU-97513, 5 V 06 (2♀); and ex *S. ruficeps*, SEB-567, 5 V 06 (1♂).

Remarks.—Traub (1950) described *L. insolli* from a large series collected from three bird nests in the Malaysian Cameron Highlands. Mardon (1981) reported a single male from a human at Fraser's Hill (a resort town near the Cameron Highlands, Pahang State, Malaysia). A single specimen (representing the same specimen reported in each report) was subsequently reported from Da Lat, South Vietnam by Suntsov and Suntsova (1999), Beaucournu and Sountsov (1999), and Adler et al. (2001). The latter two identified the host as the Chestnut White-bellied Rat (*Niviventer fulvescens*). Traub's data from the type series indicated that *L. insolli* was a bird flea, but a bird species was not associated with the sizable series taken from the three "small bird nests" (Traub 1950, 1972).

Our collections definitively associate this flea with birds. The current collection of 18 males and 28 females of *Lentistivalius insolli* were collected from 30 individual birds represented by 18 species and 6 avian families (Passeriformes: Emberizidae, Muscicapidae, Panuridae, Paridae, Timaliidae, and Piciformes: Picidae). This flea was found almost exclusively on passerines at the two sites (Kuan Kuoshui and Dashahe) where it was collected. At these sites, the flea occurred at a low prevalence and low intensity. Among the passerines at these sites, *L. insolli* occurred on 29 (8.5%) of the 343 passerines collected (Table 2). Rarely was there more than one flea for any infested host specimen. Ninety-seven percent of infested hosts had only one or two fleas; however, one bird, a White-Crowned Fork-Tail (*Enicurus leschenaulti*) was infested with eight fleas. *Lentistivalius insolli* was frequently found on Old World Babblers (Timaliidae). The flea infested 13 (12.7%) of the individual timalid hosts collected at Kuan Kuoshui and 5 (11.6%) of the individuals collected at Dashahe. Of the 13 genera of Timaliidae sampled, five (38.5%) harbored this flea. *Lentistivalius insolli* was found on only one non-passerine species: the Grey-Headed Woodpecker (*Picus canus*). This bird occupies and nests in tree cavities that may be frequented by passerine birds. It is undoubtedly an accidental host and probably plays little or no role in the propagation of *L. insolli*. In the future, examining the nests of passerine birds may be far more productive in collecting this flea than attempting to collect them from the body of their hosts, where the fleas occur in low prevalence and abundance. Additional sampling of birds and nests in Southeast Asia is necessary to elucidate flea populations and distribution of *L. insolli* on passerine bird species. Because of the low infestation rate, many passerine bird species that have not been found to harbor *L insolli* may be found in the future to harbor this flea. Elevation may be a limiting factor in the distribution of this species since all collections of *L. insolli* occurred at elevations above 1350 m, (none occurred on passerine birds at lower elevation study sites).

There are five other species within the genus *Lentistivalius* Traub. Two are parasites of ground dwelling soricids [*L. occidentayunnanus* Li, Xie and Gong, China and *L. ferinus* (Rothschild), India, Nepal, and Sri Lanka], two of non-arboreal murine rodents [*L. alienus* Smit, Africa and *L. aestivalis* (Jameson and Sakiguti), Japan], and one of scansorial tree shrews of the genus *Tupaia* Raffles (*L. vomerus* Traub, Borneo and Sarawak). *Lentistivalius vomerus* Traub is remarkably similar to *L. insolli*. Their close morphological affinity would suggest that *L. insolli*

might have been derived from *L. vomerus* and spread through Malaysia to southern China on highly mobile volant avian hosts, while *L. vomerus* remained isolated in Borneo and contiguous Sarawak. *Lentistivalius insolli* has the broadest distribution of all species of *Lentistivalius* and likely occurs on passerine birds in all countries lying between Malaysia and southern China (Cambodia, Thailand, Republic of Laos, Myanmar, and Vietnam). Its lack of preference for any one avian host species, an almost exclusive preference for passerine birds, the distinction of the only avian parasite in the genus, and the lack of morphological differentiation of characters in disjunct populations from China and those from Malaysia might suggest a rather recent switch from mammals to birds.

Acknowledgments

We thank Brett W. Benz, Roger L. Boyd, Guojun Chen, Dale H. Clayton, Tristan J. Davis, Judith Eger, Burton Lim, A. Townsend Peterson, Arpad Nyari and Mark B. Robbins for various forms of assistance, including the collection of important specimens. For the continuous support of M. F. Whiting, Curator of Insects and the staff of the Monte L. Bean Life Science Museum for providing space, equipment, and supplies needed to continue work on fleas, we are indebted. This work was supported by NSF DEB-0344430 to A. T. Peterson, R. Brown, D. H. Clayton, and B. Lim.

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