



The first survey of chewing lice (Insecta: Phthiraptera) of Chinese birds 中国鸟类体表寄生羽虱（昆虫纲：虱毛目）的首次调查

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Introduction

Chewing lice (Phthiraptera: Amblycera, Ischnocera) are wingless obligate parasites of birds (and some mammals) that live their entire lifecycle on their host, and lack a free-living stage. Most species are host-specific, meaning that they only parasitize a single host species or subspecies. Moreover, each host species is normally parasitized by 3–5 different species of chewing lice. However, it is very rare that any given host specimen is parasitized by all chewing lice known from that host species, and some louse species are known to have a geographical distribution that is different from that of their host. For instance, lice may be absent from drier parts of the host's range (Bush *et al.* 2009).

About 4300 species of chewing lice are known, divided into two suborders, seven families, and over 200 genera. The true diversity is probably much larger than that, as most birds outside Europe and North America have never been adequately studied. A recent estimate suggested that the genus *Brueelia* may comprise over 1300 species only in Africa (Gustafsson *et al.* 2019a). Our knowledge of chewing lice is thus very patchy. Few recent regional or national checklists have been published; however, estimates of diversity in these regions suggest that even in Europe and North America, the majority of the true louse fauna is unknown (Table 1).

As can be seen in Table 1, the chewing louse fauna of Chinese birds is severely understudied. The Chinese avifauna includes around 1300 species, which suggests that the Chinese chewing louse fauna should include at least 3–4000 species. Prior to 2012, only 92 species of chewing lice had been recorded from China (see appendix paper), suggesting that as much as 96% of the true chewing louse fauna of China is unknown today.

Material and methods

Since 2012, we have been collecting chewing lice from wild birds across South China, as well as looking through published records in Chinese and overseas journals, and some overseas collections at museums. Research has been carried out both at the University of Utah (USA) and at the Guangdong Institute of Applied Biological Resources (GIABR; China).

In our fieldwork, birds have been caught by mist-netting and then fumigated in plastic zip-lock bags, using ethyl acetate as a fumigant (Fig. 1). This kills any ectoparasites, without harming the bird. The lice can be collected in the bag, and additional lice can be obtained by gently ruffling the birds' feathers over a white paper surface. Lice are stored in 95% ethanol in a -80°C freezer. Permanent slide mounts are made by making a small incision in the pterothorax of the lice, then placing them in KOH for 24 hours, followed by 10% acetic acid, 95% ethanol, absolute ethanol, and oil of cloves, before being mounted on slides in Canada balsam. Lice have then been examined in light microscopy, and identified to genus and species level, as far as possible.

Fig. 1. Two Huet's Alcippe *Alcippe hueti* (David, 1874) being fumigated. The head is kept outside the bag at all times, to make sure that the ethyl acetate does not affect the birds. This method can be used to collect any group of ectoparasite on birds (mites, lice, hippoboscids, fleas, etc.)



Table 1. Comparison of the known and unknown louse fauna of countries and regions with recently (after 2000) updated checklists. Estimated number of lice in a region is calculated as "number of birds recorded * 3", as the typical number of louse species per bird species is 3–5. This estimate should therefore be considered a lower estimate of the true louse diversity, and the true diversity may be much higher. Data on bird diversity in the countries is taken from www.wikipedia.org.

Country	#Birds	Est. #Lice	#Lice	Est. Unknown	Source
Bulgaria	400	1200	282	918 (76%)	Ilieva (2009)
Canada	685	2055	463	1592 (77%)	Galloway (2019)
China	1314	3942	170	3772 (96%)	This study
Faroe Islands	260	780	239	541 (69%)	Palma & Jensen (2016)
Galapagos	185	555	99	456 (82%)	Palma & Peck (2013)
Hungary	424	1272	279	993 (78%)	Vas <i>et al.</i> (2012)
Mexico	1119	3357	262	3095 (92%)	Sanchez-Montes <i>et al.</i> (2018)
New Zealand	435	1305	338	967 (74%)	Palma (2017)
Sweden	530	1590	318	1272 (80%)	Gustafsson <i>et al.</i> (2019d)

Results and discussion

Since 2012, we have published new records of 56 species of chewing lice from China (*e.g.* Chu *et al.* 2019; Gustafsson *et al.* 2018a, b, 2019b; Figs 4, 7, 9, 11, 13), and Mey (2017) have reported 6 species. These records, as well as older published records, have been summarized in the appendix to this poster. In addition, we here present new records of 22 species of chewing lice from Chinese birds, based on our own collections and specimens deposited at the Natural History Museum, London (UK) (Fig. 2, 10). With these new records, the number of chewing louse species known from China is 170.

In addition, we here include records of 20 species we are in the process of describing, some of which are illustrated to the right (Figs 3, 5–6, 8, 12); when published, the list of chewing louse species recorded from China will include 190 species. However, even with these new records, the known Chinese fauna constitutes less than 5% of the estimated true diversity, and any conclusions based on the published data are premature. For instance, almost no lice are known in China from hosts in the orders Accipitriformes, Anseriformes, Charadriiformes, Columbiformes, Gruiformes, Piciformes, and Strigiformes, as well as for the majority of passeriform birds in China. Moreover, almost no records have been published from North and West China.

Notably, the comparison in Table 1 indicate that even in countries with a higher historical research effort for finding chewing lice than China, all examined countries have significant gaps in the knowledge of louse diversity. Moreover, even in island groups like the Faroes and the Galapagos, less than 40% of the estimated true diversity is known. This may indicate that many louse species have more limited geographical ranges, and thus cannot be expected to occur everywhere in their host's range. More national and regional checklists based on extensive sampling are needed to establish whether chewing lice generally occur across the range of their hosts, or whether other factors limit their geographical range [as suggested by *e.g.* Bush *et al.* (2009)].

Our collections include many additional new species and new records from China, which will be published over the next few years. This includes a large amount of previously unknown species. Moreover, several new genera also occur in China; we have previously published the genus *Vinceopterus* based on Chinese specimens (Gustafsson *et al.* 2019c; Fig. 13), and several manuscripts describing additional new genera are in review, based on specimens from piciform and galliform hosts (Figs 3, 5). However, our sampling is largely limited to forest birds in South China, and specimens from other groups of birds and from other parts of China are sorely needed. In particular, we would be interested in collaborating with researchers who regularly handle or catch larger birds (pheasants, cranes, all shorebirds, raptors, owls, etc.)

诚邀合作

目的: 为了收集全国各地的羽虱, 加强对中国鸟类羽虱的了解。

合作对象: 全国各地从事野生动物救援、巢箱、雾网、家禽或动物园鸟类护理、给候鸟安装追踪器, 或任何涉及接触鸟类的其他人员。

重点关注: 难以用雾网捕捉的大型鸟类、中国南方以外的鸟类, 以及各种海鸟和鸮鹛类等。

合作内容: 羽虱收集和保存, 羽虱物种的鉴定和描述、共同发表研究结果、编写中国鸟类羽虱名录和检索表, 等等。

Examples of new species or new records of chewing lice based on Chinese specimens

Fig. 2. *Actornithophilus hoplopteri* (Mjöberg, 1910) from Gray-headed Lapwing *Vanellus cinereus* (Blyth, 1842) new record for China (in review)

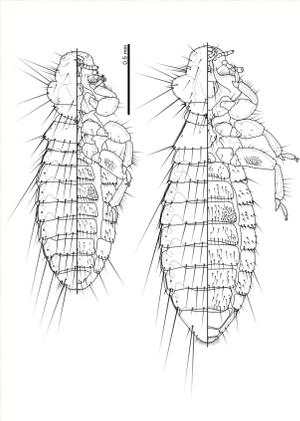


Fig. 3. *Bhupkisharia laimolaema* Gustafsson *et al.*, in prep. from Great Barbet *Ptilopogon virens* (Boddaert, 1783) new species and new genus described from China

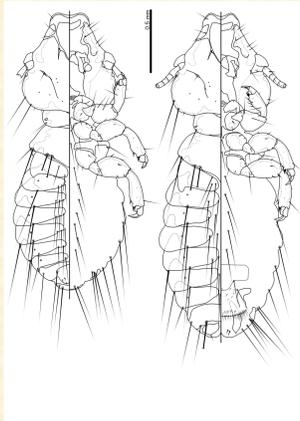


Fig. 4. *Brueelia oxyrhyncha* Gustafsson *et al.* 2018 from *Sitta nagaensis* Godwin-Austen, 1874 new species described from China

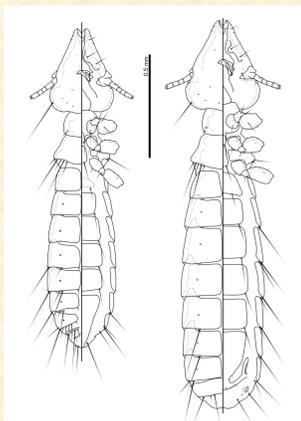


Fig. 5. *Cataphractomimus impervius* Gustafsson *et al.*, in review, from Sclater's Monal *Lophophorus sclateri* Jerdon, 1870 new genus and new species described from China

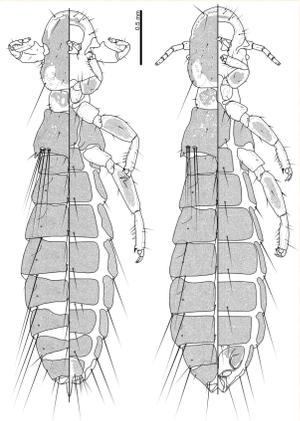


Fig. 6. *Gúmaroesiella latitemporalis* Gustafsson & Bush, in prep. from Hair-crested Drongo *Dicurus hottentottus* (Linnaeus, 1766) new species described from China

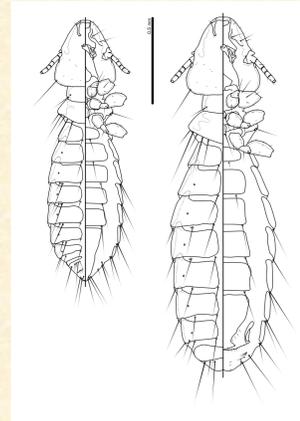


Fig. 7. *Maculinirius ljosaifor* Gustafsson & Bush, 2017, from Black-naped Oriole *Oriolus chinensis* Linnaeus, 1766 new record for China (Chu *et al.*, 2019)

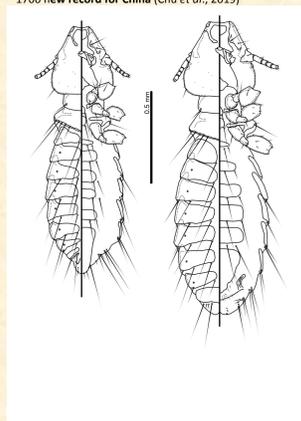


Fig. 8. *Philopteroides guangxiensis* Gustafsson & Bush, in prep. from Mountain Bulbul *Ixos mcclellandii* (Horsfield, 1840) new species described from China

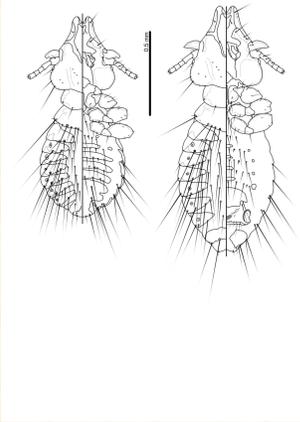


Fig. 9. *Priciella ornata* Gustafsson *et al.* 2018b from Gray-headed Parrotbill *Ptiliparus galaris* (Gray, 1845) new species described from China

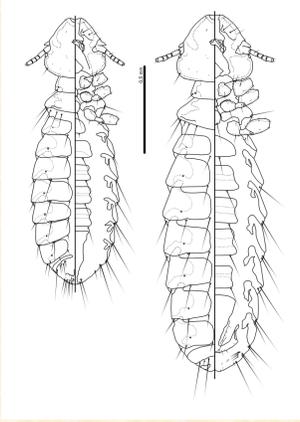


Fig. 10. *Quadriceps sinensis* Timmermann, 1954 from Gray-headed Lapwing *Vanellus cinereus* (Blyth, 1842) new record for China (in review)

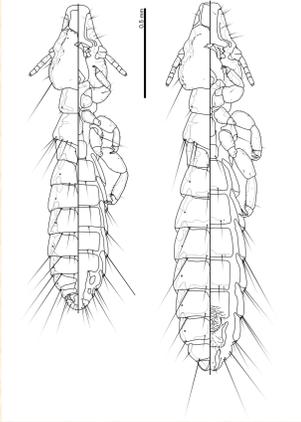


Fig. 11. *Resartor aterrimus* Gustafsson *et al.* 2018b from Red-tailed Minli *Minli ignotincta* Hodgson, 1837 new species described from China

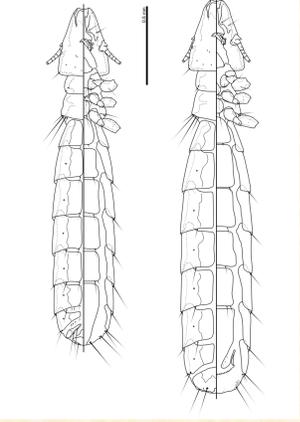


Fig. 14. *Turdinirmoides vespertilliformis* Gustafsson *et al.* in prep. from Striated Yuhina *Yuhina castaneiceps* (Moore, 1854) new species described from China

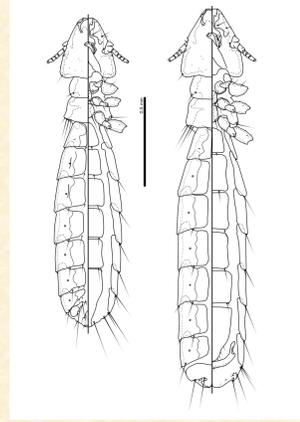
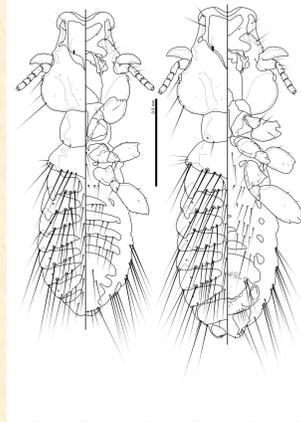


Fig. 13. *Vinceopterus erythrocephali* Gustafsson *et al.* 2019c from Red-headed Trogon *Harpactes erythrocephalus* (Gould, 1834) new genus and new species described from China



Disclaimer

This poster is not issued for permanent scientific record or purposes of zoological nomenclature, and is not regarded as published within the meaning of the International Code for Zoological Nomenclature (ICZN), Ed. 4, Article 8.2 and 8.3.

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