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A review of the mite subfamily Harpirhynchinae (Acariformes: Harpirhynchidae)—parasites of New World birds (Aves: Neognathae)

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Abstract

Mites of the subfamily Harpirhynchinae (Acariformes: Cheyletoidea: Harpirhynchidae) associated with neognathous birds (Aves: Neognathae) in the New World are revised. In all, 68 species in 8 genera are recorded. Among them, 27 new species and 1 new genus are described as new for science: *Harpyrhynchoides gallowayi* Bochkov, OConnor and Klompen **sp. nov.** from *Columba livia* (Columbiformes: Columbidae) from Canada (Manitoba), *H. zenaida* Bochkov, OConnor and Klompen **sp. nov.** from *Zenaida macroura* (Columbiformes: Columbidae) from USA (Michigan), *H. calidris* Bochkov, OConnor and Klompen **sp. nov.** from *Calidris minutilla* (Charadriiformes: Scolopacidae) from USA (Kansas), *H. actitis* Bochkov, OConnor and Klompen **sp. nov.** from *Actitis macularius* (Charadriiformes: Scolopacidae) from Canada (British Columbia), *H. charadrius* Bochkov, OConnor and Klompen **sp. nov.** from *Charadrius vociferus* (Charadriiformes: Charadriidae) from USA (Texas), *H. pluvialis* Bochkov, OConnor and Klompen **sp. nov.** from *Pluvialis dominica* (Charadriiformes: Charadriidae) from USA (Ohio), *H. bubulcus* Bochkov, OConnor and Klompen **sp. nov.** from *Bubulcus ibis* (Pelecaniformes: Ardeidae) from USA (Florida), *H. ixobrychus* Bochkov, OConnor and Klompen **sp. nov.** from *Ixobrychus exilis* (Pelecaniformes: Ardeidae) from USA (Michigan), *H. puffinus* Mertins **sp. nov.** from *Puffinus gravis* (Procellariiformes: Procellariidae) from USA (Florida), *H. megascops* Bochkov, OConnor and Klompen **sp. nov.** from *Megascops asio* (Strigiformes: Strigidae) from USA (Michigan), *H. athene* Bochkov, OConnor and Klompen **sp. nov.** from *Athene canicularia* (Strigiformes: Strigidae) from USA (Texas), *H. coccyzus* Bochkov, OConnor and Klompen **sp. nov.** from *Coccyzus americanus* (Cuculiformes: Cuculidae) from USA (Michigan), *H. crotophaga* Bochkov, OConnor and Klompen **sp. nov.** from *Crotophaga ani* (Cuculiformes: Cuculidae) from Suriname; *Crassacarus* Bochkov, OConnor and Klompen, **gen. nov.**: *Crassacarus alexfaini* Bochkov, OConnor and Klompen **sp. nov.** (type of genus) from *Cardinalis cardinalis* (type host) from USA (Michigan), *Passerina ciris* (unknown locality in North America) (Passeriformes: Cardinalidae), and *Setophaga petechia* (Passeriformes: Parulidae) from USA (Michigan), *C. tinae* Bochkov, OConnor and Klompen **sp. nov.** from *Carduelis tristis* (Passeriformes: Fringillidae) from USA (Wyoming), *C. fritschi* Bochkov, OConnor and Klompen **sp. nov.** from *Bombycilla cedrorum* (Passeriformes: Bombycillidae) from USA (Michigan), *C. sialia* Bochkov, OConnor and Klompen **sp. nov.** from *Sialia currucoides* (Passeriformes: Turdidae) from USA (Wyoming), *C. melanerpes* Bochkov, OConnor and Klompen **sp. nov.** from *Melanerpes formicivorus* (Piciformes: Picidae) from USA (Kansas); *Neharpyrhynchus turdus* Bochkov, OConnor and Klompen **sp. nov.** from *Turdus migratorius* (Passeriformes: Turdidae) from USA (Michigan), *N. campylorhynchus* Bochkov, OConnor and Klompen **sp. nov.** from *Campylorhynchus brunneicapillus* (Passeriformes: Troglodytidae) from USA (unknown locality), *N. spizella* Bochkov, OConnor and Klompen **sp. nov.** from *Spizella passerina* (Passeriformes: Emberizidae) from USA (various localities), *N. quisculus* Bochkov, OConnor and Klompen **sp. nov.** from *Quisculus quiscula* (Passeriformes: Icteridae) from USA (Michigan), *N. agelaius* Bochkov, OConnor and Klompen **sp. nov.**

nor and Klompen **sp. nov.** from *Agelaius phoeniceus* (Passeriformes: Icteridae) from USA (Michigan), *N. bombycilla* Bochkov, OConnor and Klompen **sp. nov.** *Bombycilla cedrorum* (Passeriformes: Bombycillidae) from USA (Michigan), *N. vireo* Bochkov, OConnor and Klompen **sp. nov.** from *Vireo olivaceus* (Passeriformes: Vireonidae) from USA (Florida), *N. picidarum* Bochkov, OConnor and Klompen **sp. nov.** from *Colaptes auratus* (type host), *Melanerpes formicivorus*, *Melanerpes uropygialis*, and *Picoides pubescens* (Piciformes: Picidae) from USA (various localities); *Perharpyrhynchus charadrius* Bochkov, OConnor and Klompen **sp. nov.** from *Charadrius vociferus* (Charadriiformes: Charadriidae) from USA (Michigan). *Harpypyrhynchoides oenae lamorali* (Fain, 1972) **syn. nov.** is synonymized with *Harpypyrhynchoides oenae* (Fain, 1972). *Harpirhynchoides agapornis* (Fain, 1972) **comb. nov.** and *Crassacarus cylindripalpus* (Fritsch, 1954) **comb. nov.** are transferred from the subgenus *Pseudoharpirhynchus* Fain, Bochkov and Mironov, 1999 (type species *Harpirhynchus agapornis* Fain, 1972) of the genus *Harpirhynchus* Megnin 1877. The subgenus *Pseudoharpirhynchus* **syn. nov.** is synonymized with the genus *Harpypyrhynchoides*. Diagnoses for the subfamily and all genera recorded in the New World (*Anharpypyrhynchus* Fain, 1972, *Crassacarus* **gen. nov.**, *Harpirhynchus*, *Harpypyrhynchoides* Fain, 1972, *Fainharpirhynchus* Bochkov and Galloway, 2013, *Neharpypyrhynchus* Fain, 1972, *Perharpypyrhynchus* Fain, 1972, *Trichorhynchiella* Fain, 1995) are provided. Keys to all harpirhynchine genera and all their species occurring in the New World are also given. A list of all harpirhynchine species and their hosts is compiled.

Key words: Acari, birds, mites, New World, parasites, systematics

Introduction

Mites of the subfamily Harpirhynchinae (Acariformes: Cheyletoidea: Harpirhynchidae) are obligate permanent parasites of neognathous birds (Aves: Neognathae) belonging to 17 orders. Members of the two other subfamilies of this family, Harpypalpinae and Ophioptinae are associated with passerine birds (Passeriformes) and colubroid snakes (Squamata: Colubroidea), respectively (Fajfer 2012; Bochkov & Klompen 2014c). The most characteristic feature of mites belonging to the subfamily Harpirhynchinae is modified legs III and IV in both sexes. These legs are short, represented by one or two segments, and bear several whip-like setae (Skoracki *et al.* 2012) (Fig. 1).

This subfamily currently includes about 90 species in ten genera. However, taking into consideration that most of these mites are highly specific to their hosts being mono- or stenoxenous parasites (Fain 1994; Skoracki *et al.* 2012), the real number of these mites could reach at least 2500 (Moss & Wojcik 1978). The data about harpirhynchine species biodiversity, morphology, host-distribution, and systematic history are summarized by Skoracki *et al.* (2012). A preliminary hypothesis on the phylogeny of the whole family Harpirhynchidae was proposed by Bochkov *et al.* (1999).

Harpirhynchines occupy different microhabitats on the bird body. The majority of species in the most specious harpirhynchine genus—*Harpypyrhynchoides* Fain, 1972—are ectoparasites on the host skin. These mites possess the most “unspecialized general morphology” with a dorso-ventrally flattened idiosoma and well developed anterior legs. Females of the genera *Neharpypyrhynchus* Fain, 1972 and *Metharpypyrhynchus* Fain, 1972 attach to the feather bases on the host head or neck. They have a saccate idiosoma with the posterior end modified into a basket-like structure serving for attachment of laid eggs. Female larvae and males of these mites have non-specialized morphology, live on the host skin and are dispersal stages. Females of the genus *Trichorhynchiella* Fain, 1995 inhabit feather follicles, whereas females of other genera, i.e. *Anharpypyrhynchus* Fain, 1972, *Fainharpirhynchus* Bochkov and Galloway, 2013, *Harpypyrhynchiella* Fain, 1972, *Harpirhynchus* Megnin, 1877, *Perharpypyrhynchus* Fain, 1972, and *Ralliharpirhynchus* Fain, 1995 live in cysts in the skin of the host body. As in the case of feather-attached harpirhynchines, males and female larvae of these genera have a non-specialized appearance, while females have a highly specialized morphology.

The life-cycle of these mites includes larva, proto- and tritonymph, and adults, female and male (Moss *et al.* 1968; Bochkov & Literak 2008). Because females of some follicle and skin inhabiting genera, *Anharpypyrhynchus*, *Harpypyrhynchiella*, *Neharpypyrhynchus*, *Metharpypyrhynchus*, and *Trichorhynchiella*, do not leave the tritonymphal exuvium after molting and even lay eggs in the exuvium (Fritsch 1954; Bochkov & OConnor 2014; Bochkov 2014b), copulation probably happens between males and female larvae or nymphs. Notably, a well formed spermatheca was detected in female larvae of *Harpypyrhynchiella apus* Bochkov, 2014. The phenomenon of ovoviviparity has been recorded in some of species belonging to the genera *Anharpirhynchus* and *Trichorychiella* (Fritsch 1954; Bochkov & OConnor 2014). Multiple larvae hatch directly inside the female body and leave it via the very long slit of the vulvar complex. It is unknown whether or not females survive after such an event (multiovoviviparity), which is probably obligate (Bochkov & OConnor 2014).