

New records and new species of mites of the subfamily Harpirhynchinae (Acariformes: Harpirhynchidae) infesting birds in Manitoba, Canada

Andre V. Bochkov^{1*} and Terry D. Galloway²

¹Zoological Institute, Russian Academy of Sciences, Universitetskaya Emb. 1, Saint Petersburg, 199034, Russia;

²Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2

Abstract

Five new species and one new genus of the subfamily Harpirhynchinae (Acariformes: Harpirhynchidae) are described from birds in Canada: *Harpyrhynchoides heatherae* sp. nov. from *Junco hyemalis* (Passeriformes: Emberizidae), *H. botaurus* sp. nov. from *Botaurus lentiginosus* (Pelecaniformes: Ardeidae), *H. phalaropus* sp. nov. from *Phalaropus lobatus* (Charadriiformes: Scolopacidae), *Neharpyrhynchus loxia* sp. nov. from *Loxia curvirostra* (Passeriformes: Fringillidae), and *Fainharpyrhynchus contopus* gen. nov., sp. nov. from *Contopus cooperi* (Passeriformes: Tyrannidae). Additionally, 3 species were recorded in Canada (Manitoba) for the first time: *Harpyrhynchoides tracheatus* (Fritsch, 1954) from *Buteo jamaicensis* (Accipitriformes: Accipitridae) (new host), *H. modestus* (Fain, 1976) from *Columba livia* (Columbiformes: Columbidae) (new host), and *Neharpyrhynchus pilirostris* (Berlese et Trouessart, 1889) from *Passer domesticus* (Passeriformes: Passeridae).

Keywords

Harpirhynchinae, mites, birds, ectoparasites, Canada, systematics

Introduction

The subfamily Harpirhynchinae (Acariformes: Cheyletoidea: Harpirhynchidae) includes permanent parasites inhabiting the skin or intradermal layers of various birds. A checklist of this subfamily was recently published by Skoracki *et al.* (2012) – it includes about 65 species of 10 genera known from birds of 16 orders. In North America, these mites are poorly explored (Bochkov and Mertins 2010; Bochkov and O'Connor 2013). Galloway and Danks (1991) identified parasitic mites in Canada as being particularly poorly known and recommended further study. Only three harpirhynchine species have been recorded in Canada to date: *Harpyrhynchoides herodius* (Boyd, 1968) from *Ardea herodias* Linnaeus, 1758 (Pelecaniformes: Ardeidae) (Boyd 1968), *Harpyrhynchoides zumpti* (Fain, 1972) from *Quiscalus quiscula* (Linnaeus, 1758) (Passeriformes: Icteridae) and *Junco hyemalis* (Linnaeus, 1758) (Passeriformes: Emberizidae), and *Harpyrhynchoides vulgaris* Bochkov et Gal-

loway, 2004 from *Carpodacus purpureus* (Gmelin, 1789) (Passeriformes: Fringillidae) and *Setophaga ruticilla* (Linnaeus, 1758) (Bochkov and Galloway 2001, 2004). Additionally, a *Harpirhynchus* sp. recorded from *Molothrus ater* (Boddaert, 1783) (Passeriformes: Icteridae) by Karstad (1970), is probably *Harpirhynchus quasimodo* Bochkov et Mertins, 2010, described recently from the same host from Florida (Bochkov and Mertins 2010). Smith and Lindquist (1979) estimated there to be 20 undescribed species of Harpirhynchidae in Canada.

A long-term study to expand our knowledge of the ectoparasites of birds from Canada was initiated in 1994 in collaboration with the Manitoba Wildlife Rehabilitation Organization (MWRO, now Wildlife Haven), the Prairie Wildlife Rehabilitation Centre, Manitoba Conservation, and the Canadian Wildlife Service.

In this paper, we describe five new species and provide three new records of harpirhynchines from birds in Canada (Manitoba) examined during this study.

*Corresponding author: andrevbochkov@gmail.com

Material and Methods

Birds for the collection of mites were obtained from the Manitoba Wildlife Rehabilitation Organization, Glenlea, Manitoba, and were held under scientific permits issued by the Canadian Wildlife Service (CWS99-M023; 13-MB-SC001). All birds in this study were the casualties of various accidents or infections and had died or were euthanized at the rehabilitation hospital.

Each bird specimen was individually bagged and frozen as soon after death as possible. Birds were frozen for at least 48 h to kill all the ectoparasites. Birds were thawed and vigorously washed twice in warm soapy water and once in warm water. After each wash the water was passed through a 90 μm mesh sieve. All ectoparasites were then rinsed with

70% ethanol into a petri dish, removed from the sample by hand under a stereomicroscope, and preserved in 70% ethanol.

Mites were mounted in Hoyer's medium. Specimens were studied using a Leica microscope with phase contrast optics. Drawings were made with a camera lucida and measurements taken using a calibrated ocular micrometer. The leg and idiosomal setation follow Grandjean (1939, 1944) as adapted by Kethley (1990); palpal setation follows Bochkov (2008).

All measurements are given in micrometres (μm) and were taken as follows: body length = maximum length of the body up to the anterior extremity of the palpal tibia; body width = maximum width taken at whatever level it occurs; gnathosomal length = length taken ventrally from the gnathosomal base

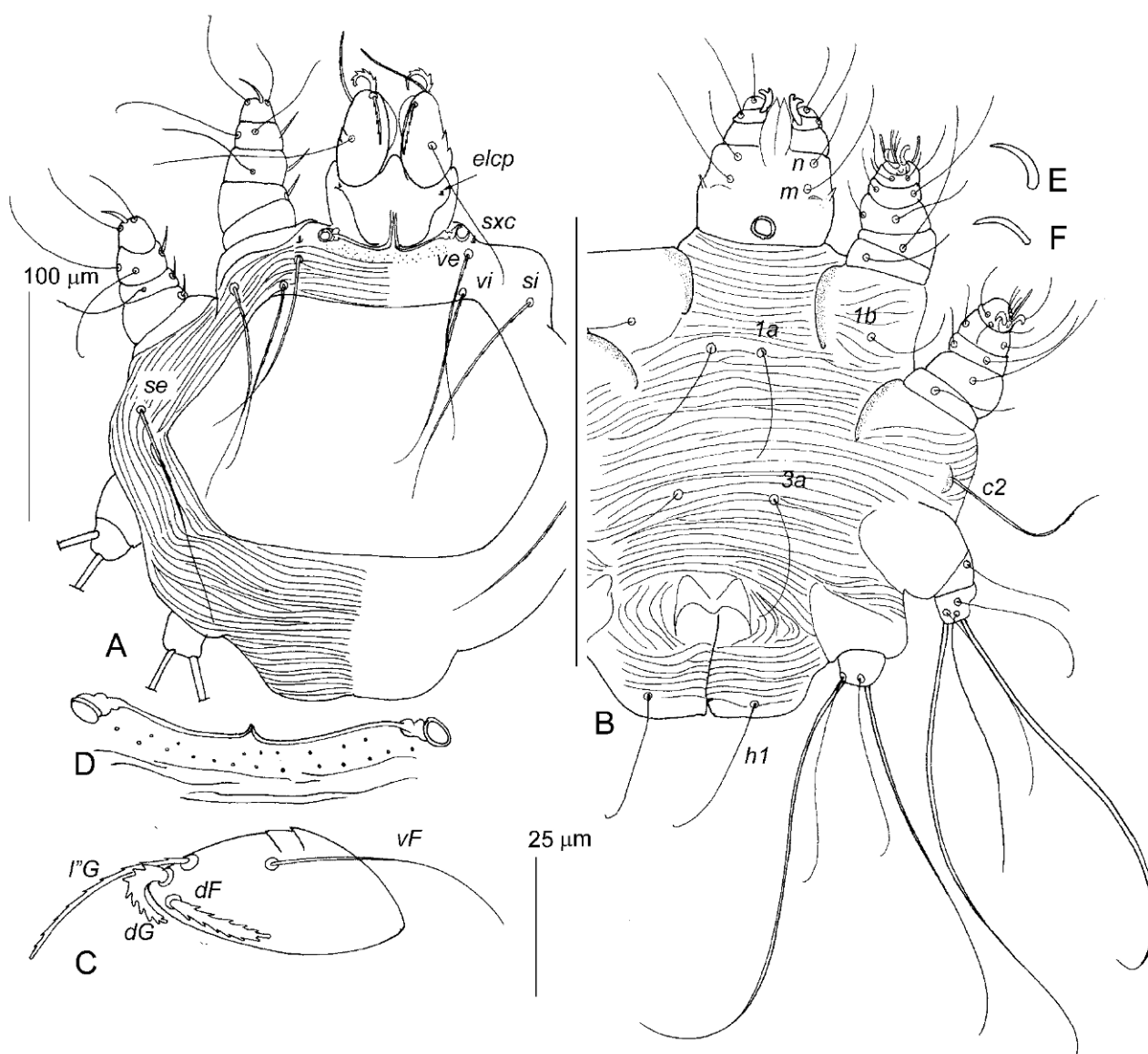


Fig. 1. *Harpyrhynchoides heatherae* sp. nov., female. **A** – dorsal view; **B** – ventral view; **C** – palp dorsally; **D** – anterior propodonotum; **E** – solenidion ωII ; **F** – solenidion ωIII . Scale bars: **A**, **B** = 100 μm , **C**–**F** = 25 μm

to the anterior extremity of the palpal tibia; gnathosomal width = maximum width taken at whatever level it occurs; length of propodonotal shield = maximum length, measured in the median line of the shield; width of propodonotal shield = maximum width taken at whatever level it occurs. Host nomenclature follows Clements *et al.* (2012).

Specimen depositories are cited using the following abbreviations:

CNCI – Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Eastern Cereal and Oilseeds Research Centre, Ottawa, Ontario, Canada;

JBWM – J.B. Wallis/R.E. Roughley Museum of Entomology, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada;

ZISP – Zoological Institute, Russian Academy of Sciences, Saint-Petersburg, Russia.

Systematics

Family Harpirhynchidae Dubinin, 1957

Subfamily Harpirhynchinae Dubinin, 1957

Genus *Harpirhynchoides* Fain, 1972

Harpirhynchoides heatherae sp. nov. (Figs 1 and 2)

Harpirhynchoides zumpti, Bochkov and Galloway 2004: 31 partly (missidentification).

Female (holotype). Body, including gnathosoma, 290 long (280–320 in 10 paratypes) and 240 wide (230–250) (Fig. 1A, B). Gnathosoma 70 long (65–70) and 57 wide (50–55). Palps 55 long (55–60) with 2 distinct outer lateral notches at level of seta *vF* bases. Palpalae *dF* and *dG* thickened and distinctly pectinate with 5–8 pairs of tines, subequal in length, 20 long (18–22) (Fig. 1C); palpalae *l''G* rod-like 35–37 long, about 2 times longer than other palpalae. Setae *vF* 50 long (48–55), smooth. Subcapitulum ventrally with setae *n*, *m*; 1–2 pairs of lateral teeth situated at level of seta *m* bases. Peritremal branch 25 long (25–30). Idiosoma rounded in outline, 220 long (210–250). Smooth cuticle of propodonotum punctated between peritremal branch and transverse striations (Fig. 1D). Dorsal shield 110 long (95–120) and 170 wide (170–185). Ventral surface of idiosoma entirely covered with distinct transverse striations, without verrucosities or scales (Fig. 1B). Setae *g* and genital apodemes absent. Lateral borders of vulvar fold not elongated. Setae *vi*, *ve*, *si*, *se*, and *c2* – all slightly serrate, 85–100 long; *h1* smooth, 55–60 long. All tactile setae of legs I and II filiform, except *p* I and *p* II eupathidia. Genua I and II with 4 setae (*d*, *l'*, *v'* and *v''*); femora I and II with 2 setae (*d* and *v*). Solenidia *ω*I and *ω*II strongly curved, pointed apically, about 12 long (Fig. 1E, F). Empodium of tarsi I and II not elongated, only slightly longer or subequal to respective tarsus. Legs III with 2 segments; basal segment with 1 ventral seta; apical segment with 5 setae. Legs IV with 1 segment bearing 4 setae.

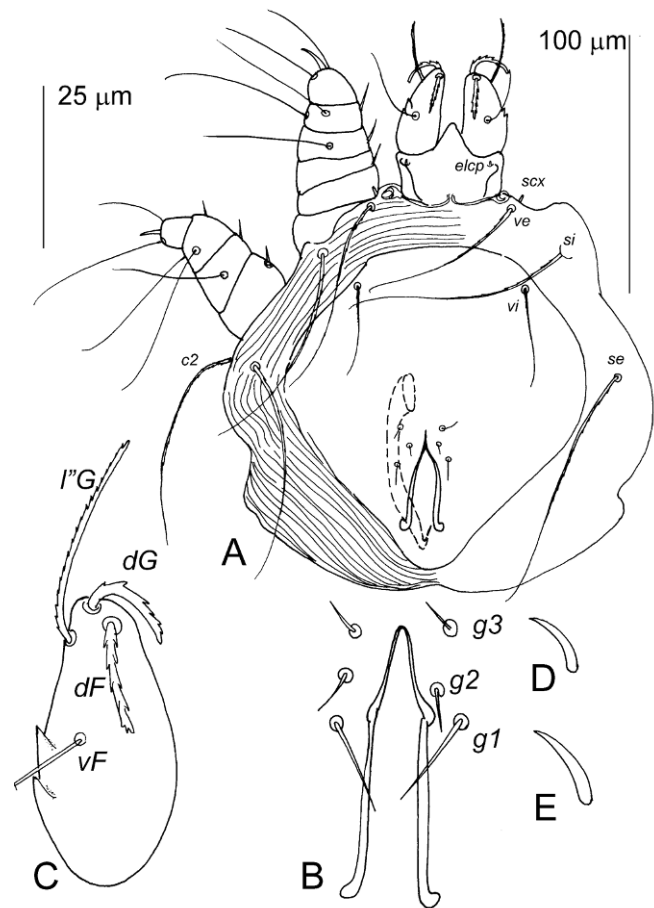


Fig. 2. *Harpirhynchoides heatherae* sp. nov., male. A – dorsal view; B – genital region; C – palp dorsally; D – solenidium *ω*II; E – solenidium *ω*III. Scale bars: A = 100 μ m; B–E = 25 μ m

Male (5 paratypes). Body, including gnathosoma, 230–250 long and 180–195 wide. Gnathosoma 60–65 long and 35–40 wide (Fig. 2A). Palps 40–45 long with 2 distinct outer lateral notches at level of seta *vF* bases. Palpalae *dF* and *dG* thickened and distinctly pectinate with 5–6 pairs of teeth, subequal in length, 15–17 long; palpalae *l''G* rod-like, 33–35 long, about 2 times longer than other palpalae (Fig. 2C). Setae *vF* 28–33 long, smooth. Subcapitulum ventrally with setae *n* and *m*, and 1–2 pairs of lateral teeth situated at level of seta *m* bases. Idiosoma rounded in outline, 170–190 long. Propodonotal shield 135–150 long and 160–170 wide; posterior margin slightly attenuated in median part (Fig. 2A). Aedeagus only slightly curved, about 60 long. Genital setae, *g2* and *g3* minute, 5–7 long, setae *g1* 12–14 long. Distance between *g1*–*g1* about 18, *g2*–*g2* and *g3*–*g3* 11–13. Distances between levels of bases *g1*–*g2* and *g2*–*g3* subequal. Genital arch about 40 long (Fig. 2B). Setae *vi* 50–60 long, *ve*, *si*, *se*, and *c2* 75–100 long; all propodonotal setae slightly serrate. Ventral surface of idiosoma without scales or verrucosities, distinctly striated. Setation of legs I and II as in female; solenidia *ω*I and *ω*II strongly curved, pointed apically, about 12 long (Fig. 2D, E). Empodium of tarsi I and II not

elongated, only slightly longer than or subequal to respective tarsus. Legs III with 2 segments, basal segment with 1 ventral seta; apical segment with 5 setae. Legs IV with 1 segment bearing 4 setae.

Type material: Holotype female (CNCI), 25 female and 5 male paratypes (AVB ZISP 13-0325-008, 1-30) from *Junco hyemalis* (Linnaeus, 1758) (Passeriformes: Emberizidae), Manitoba, Winnipeg, Summerland, 04 October 2003 coll. T.D. Galloway and D. Holder (field number SM 1169 #4); 10 female paratypes (AVB ZISP 13-0325-009, 1-10) from same host and locality, 04 October 2003, coll. T.D. Galloway and D. Holder (field number SM 1170 #3); 12 female paratypes (AVB ZISP 13-0325-010, 1-12) from same host and locality, 07 April 2004, coll. T.D. Galloway and D. Holder (field number SM 1302).

Type depositions: Holotype in CNCI, 5 female and 1 male paratypes in JBWM, other paratypes in ZISP.

Etymology: This species is dedicated to the well known Canadian acarologist, Dr. Heather C. Proctor (University of Alberta, Edmonton, Canada).

Differential diagnosis: This species belongs to the *zumpti* species group with five species included: *H. zumpti* (Fain, 1972), *H. alaudinus* Bochkov, 2000, *H. kirgizorum* Fain, Bochkov et Mironov, 1999, *H. rubeculinus* (Cerny et Sixl, 1971), and *H. vulgaris* Bochkov et Galloway, 2004 (Bochkov and Galloway 2004). Among species of this group, *H. heatherae* sp. nov. is most similar to *H. kirgizorum*. In females of both of these species, the body is 280–330 long, the palpal femur has with two distinct outer lateral notches at

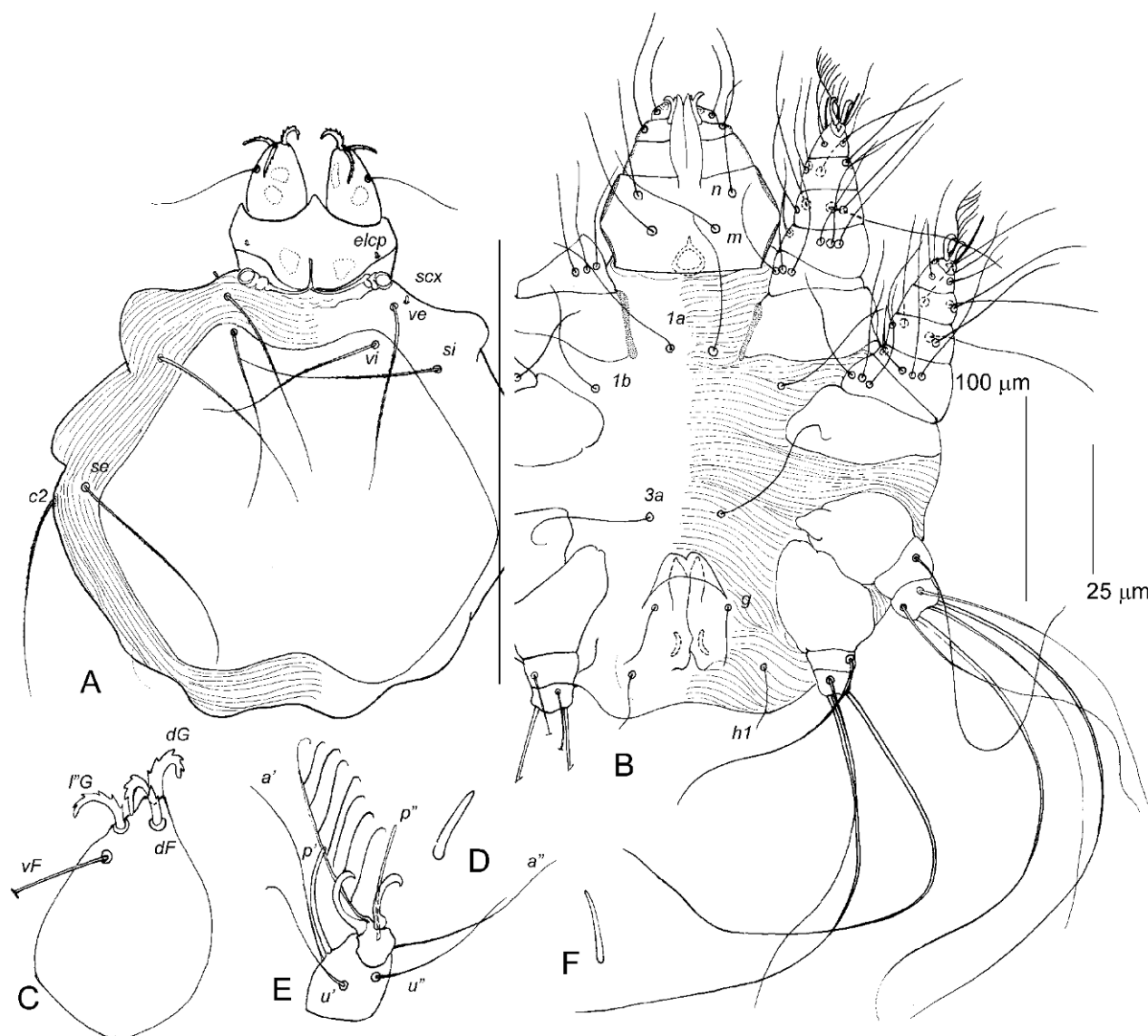


Fig. 3. *Harpyrhynchoides botaurus* sp. nov., female. **A** – dorsal view; **B** – ventral view; **C** – palp dorsally; **D** – solenidion ω I; **E** – tarsus I ventrally; **F** – solenidion ω III. Scale bars: A, B = 100 μ m, C–F = 25 μ m

the level of seta *vF* bases, the subcapitulum has a small ventro-lateral spur, and setae *hl* are 130–160 long. These species differs by the following characters. In females of *H. heatherae* sp. nov., palpal setae *dF* and *dG* are about half the length of *l''G*, and the idiosoma between the peritremes and striated cuticle is punctated. In females of *H. kirgizorum*, palpal setae *dF* and *dG* are subequal in length to *l''G*, and the idiosoma between the peritremes and striated cuticle is devoid of punctuation.

Remark: This species was previously recorded on *Junco hyemalis* from Manitoba but mistakenly determined as

Harpyrhynchoides zumpti by Bochkov and Galloway (2004).

***Harpyrhynchoides botaurus* sp. nov.** (Figs 3 and 4)

Female (holotype). Body, including gnathosoma, 265 long (260–280 in 10 paratypes) and 230 wide (225–240) (Fig. 3A and B). Gnathosomal length and width subequal, about 85. Palps 45 long (40–45) without lateral notches. All palpalae thickened and distinctly pectinate with 5–6 pairs of tines, *dF* and *dG* subequal in length, 19–22 long; *l''G* about 15 long (Fig. 3C). Setae *vF* about 50 long, smooth. Subcapitulum ven-

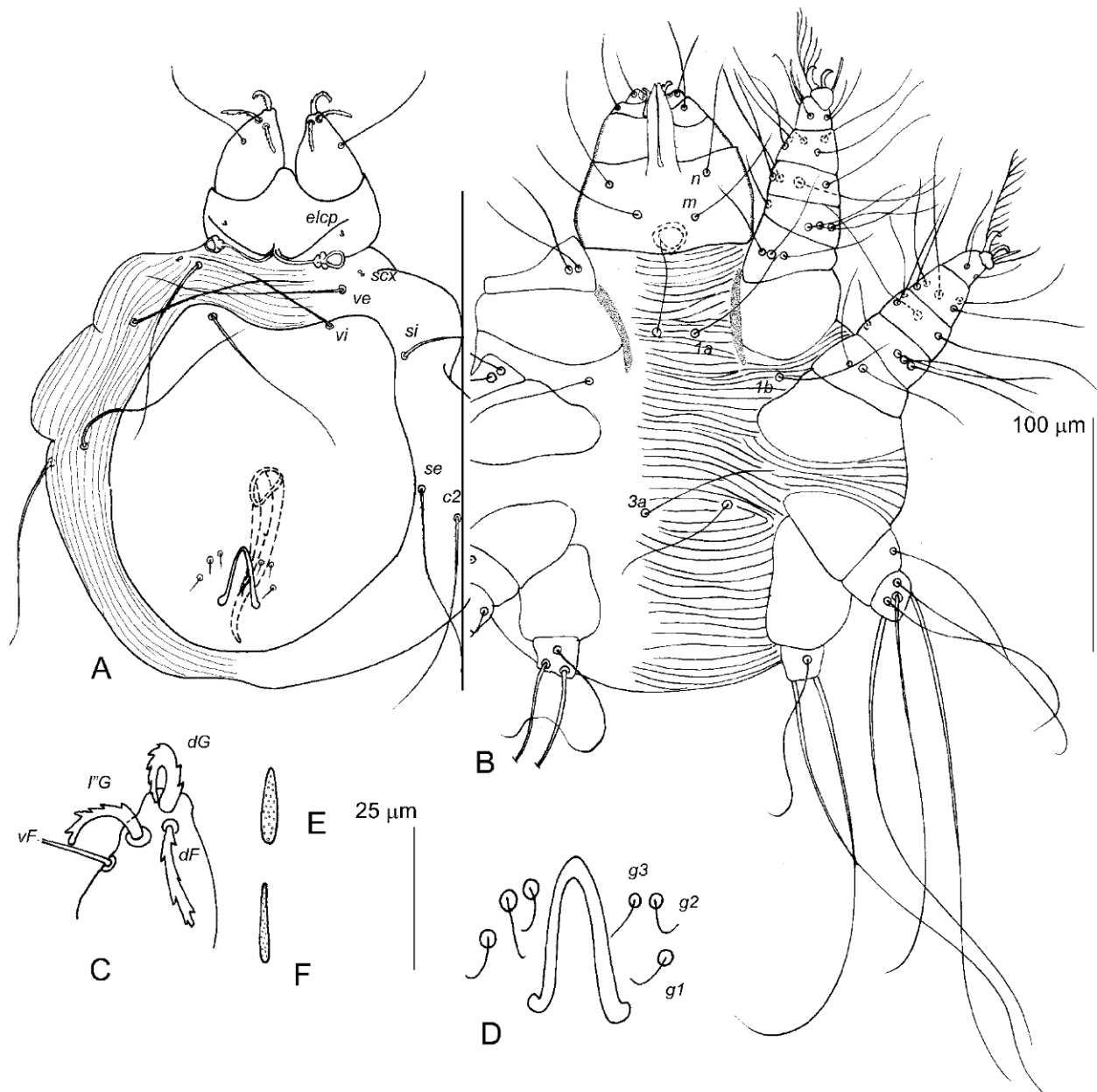


Fig. 4. *Harpyrhynchoides botaurus* sp. nov., male. **A** – dorsal view; **B** – ventral view; **C** – palpal apex dorsally; **D** – genital region; **E** – solenidion ω I; **F** – solenidion ω III. Scale bars: A, B = 100 μ m, C–F = 25 μ m

trally with setae *n*, *m*; without lateral teeth. Peritremal branch about 35 long. Idiosoma rounded in outline, 200 long (195–220). Smooth cuticle of propodotum without punctuation between peritremal branch and transverse striations. Dorsal shield 165 long (160–175) and 200 wide (190–205). Ventral surface of idiosoma entirely covered with distinct transverse striations, without verrucosities or scales (Fig. 3B). Setae *g* present, about 35 long; genital apodemes present. Lateral borders of vulvar fold not elongated. Setae *vi*, *ve*, *si*, *se*, and *c2* – all slightly serrate, 100–116 long; *h1* smooth, about 35 long. All tactile setae of legs I and II filiform, except *p* I and *p* II eupathidia (Fig. 3E). Genua I and II with 4 setae (*d*, *l'*, *v'* and *v''*); femora I and II with 4 setae (*d* and 3 *v* neotrichial) with adjoining bases, trochanters I and II each with 3 neotrichial setae with adjoining bases. Solenidia ω II and ω III straight subconical, rounded apically, about 12 long (Fig. 3D and F). Empodium of tarsi I and II elongated, their tenet hairs at least 2 times longer than respective tarsus (Fig. 3E). Legs III with 2 segments; basal segment with 1 ventral seta; apical segment with 5 setae. Legs IV with 2 segments; basal segment with 1 ventral seta; apical segment with 3 setae.

Male (4 paratypes). Body, including gnathosoma, 240–250 long and 190–210 wide. Gnathosomal length and width subequal, 60–65 (Fig. 4A and B). Palps 35–38 long, without lateral notches. Palpalae *dF*, *dG*, and *l''G* thickened and distinctly pectinate with 5–6 pairs of teeth; subequal in length, 16–18 long. Setae *vF* 35–37 long, smooth (Fig. 4C). Subcapitulum ventrally with setae *n* and *m*, and devoid of lateral teeth. Idiosoma rounded outline, 175–180 long. Propodotal shield with widely rounded posterior margin, its length and width subequal, about 130 (Fig. 4A). Aedeagus only slightly curved, about 75 long. Genital setae subequal, about 8 long. Setae *g2* located very close and almost at same level with setae *g3*. Genital arch about 30 long (Fig. 4D). Setae *vi* 60–65 long, *ve*, *si*, *se*, and *c2* about 75 long; all propodotal setae slightly serrate. Ventral surface of idiosoma without scales or verrucosities, distinctly striated. Setation of legs I and II as in female but trochanter II with 2 setae; solenidia ω II and ω III straight subconical, rounded apically, about 12–14 long (Fig. 4E and F). Empodium of tarsi I and II elongated, their tenet hairs at least twice 2 times longer than respective tarsus. Legs III with 2 segments; basal segment with 1 ventral seta; apical segment with 5 setae. Legs IV with 1 segment bearing 3 setae.

Type material: Female holotype (CNCI), 11 female and 4 male paratypes (AVB 13-0325-001, 1-15) from *Botaurus lentiginosus* (Rackett, 1813) (Pelecaniformes: Ardeidae) (AMBI/1533/CEN/09), Manitoba, Winnipeg, 14 November 2009, coll. T.D. Galloway and C. Dugal (field number SM-1984).

Type depositions: Holotype in CNCI, 3 female and 1 male paratypes in JBWM, other paratypes in ZISP.

Etymology: The species name is derived from the generic name of the host and is a noun in apposition.

Differential diagnosis: This new species is closest to *Harpyrhynchoides herodius* (Boyd, 1968) from *Ardea herodias* from Canada (Boyd 1968). In females of both of these species, the palpalae are subequal, tibiae III and IV have four setae each, femora I and II have 2–3 adjoined ventral setae, leg IV has two segments, the basal segment of legs III and IV bears one seta, the apical segments of tarsi III and IV have five and three setae, respectively, the genital setae and apodemes are present, the empodia on tarsi I and II are strongly elongated, and their tenet hairs are at least list twice the length of the respective tarsi. These species differ by the following characteristics. In both sexes of *H. botaurus* sp. nov., on femora I, II and trochanters I, there are three ventral setae, trochanter II bears three setae in females and two setae in males, and in females, solenidia ω II and ω III are subconical. In both sexes of *H. herodius*, on femora I, II, there are two ventral setae and there is one seta on each of trochanters I, II; in females, solenidia ω II and ω III are distinctly inflated.

Harpyrhynchoides phalaropus sp. nov. (Fig. 5)

Female (holotype). Body, including gnathosoma, 220 long (220–240 in 10 paratypes) and 170 wide (170–180) (Fig. 5A and B). Gnathosomal length and width subequal, about 60. Palps about 40 long without lateral notches. Palpalae, *dF* about 8 long, with 5–6 pairs of tines, *l''G* about 4 long, slightly serrate; *dG* 3–4 times wider than other palpalae, about 12 long, with 7–8 pairs of tines (Fig. 5C). Setae *vF* about 50 long, smooth. Subcapitulum ventrally with setae *n*, *m*, and with 2 pairs of small folds situated between levels of seta *n* and *m* bases. Peritremal branch about 30 long. Idiosoma rounded in outline, 160 long (160–170). Smooth cuticle of propodotum between peritremal branch and transverse striations without punctuation. Dorsal shield 120 long (120–130) and about 170 wide. Ventral surface of idiosoma covered with distinct transverse striations in lateral parts, without verrucosities or scales, ventro-median part of idiosoma devoid of striae (Fig. 5A). Setae *g* present, about 10 long; genital apodemes present. Lateral borders of vulvar fold not elongated. Setae *vi* very short, about 10 and smooth, *ve*, *si*, *se*, and *c2* – all slightly serrate, 80–100 long, *h1* smooth, about 10 long. All tactile setae of legs I and II filiform, except *p* I and *p* II eupathidia (Fig. 5E and G). Genua I and II with 3 setae (*d*, *l'*, and *v'*); femora I and II with 2 setae (*d* and *v*). Solenidia ω II and ω III fine slightly curved, about 17 long (Fig. 5D and F). Empodium of tarsi I and II not elongated, its tenet hairs slightly longer or subequal to respective tarsus. Legs III with 2 segments; basal segment with 1 ventral and 1 dorsal setae; apical segment with 5 setae. Legs IV with 2 segments; basal segment with 1 ventral seta; apical segment with 4 setae.

Type material: Female holotype (CNCI) and 4 female paratypes (AVB 13-0325-013, 1–4) from *Phalaropus lobatus*

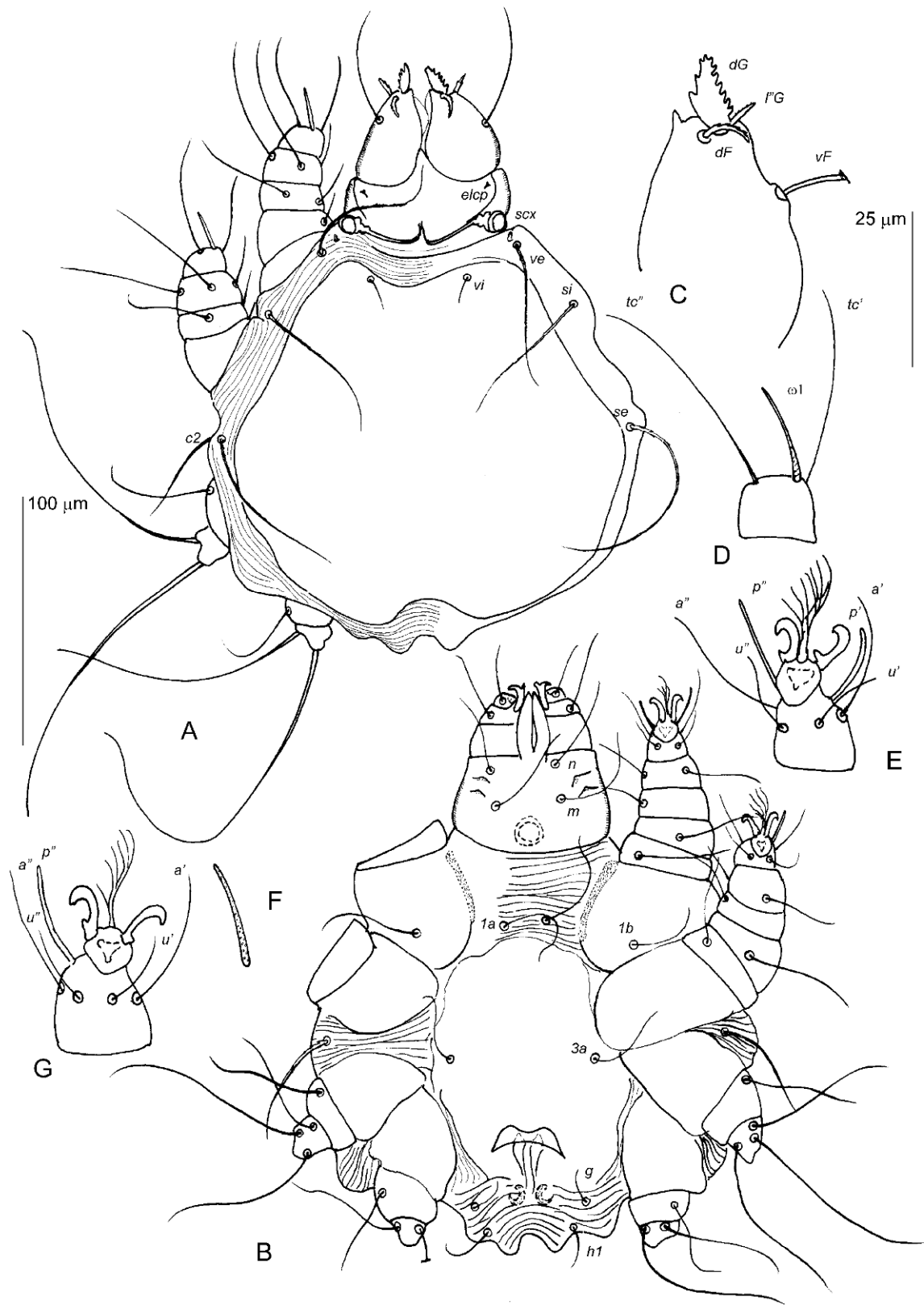


Fig. 5. *Harpyrhynchoides phalaropus* sp. nov., female. **A** – dorsal view; **B** – ventral view; **C** – palp dorsally; **D** – tarsus I dorsally; **E** – tarsus I ventrally; **F** – solenidion ω /II; **G** – tarsus II ventrally. Scale bars: A, B = 100 μ m, C–G = 25 μ m

(Linnaeus, 1758) (Charadriiformes: Scolopacidae) (WIPH1465/CEN/03), Manitoba, Winnipeg, 24 August 2003, coll. T.D. Galloway and D. Holder (field number SM-1224).

Type deposition: Holotype in CNCI, 1 female paratype in JBWM, other paratypes in ZISP.

Etymology: The species name is derived from the generic name of the host and is a noun in apposition.

Differential diagnosis: This new species is closest to *Harpyrhynchoides capellae* (Fritsch, 1954) from *Gallinago gallinago* (Linnaeus, 1758) (Charadriiformes: Scolopacidae) from Germany (Fritsch 1954). In females of both of these species, the palpalae are thickened, distinctly pectinate, and relatively short, the median part of the idiosoma is not ventrally striated, legs III are two-segmented, setae *g* and the gen-

ital apodemes are present, genua II and III bear three setae each, the basal segment of legs III and IV bear two and one setae, respectively. These species differ by the following characters. In females of *H. phalaropus* sp. nov., setae *vi* are much shorter than other propodonotal setae, about 10 long, palpalae *dG* are three to four times thicker and distinctly longer than *dF* and *l''G*. In females of *H. capellae*, setae *vi* are long, subequal in length to other propodonotal setae (about 80 long), and the palpalae are subequal.

***Harpyrhynchoides tracheatus* (Fritsch, 1954)**

Harpyrhynchus tracheatus Fritsch, 1954: 187, fig. 6

Harpyrhynchus (*Harpyrhynchoides*) *tracheatus*, Fain 1994: 120

Material. 16 females and 4 males (AVB 13-0402-001) from *Buteo jamaicensis* (Gmelin, 1788) (Accipitriformes: Accipitridae) (RTHA/1724/CEN/03) [new host], Manitoba, Shoal

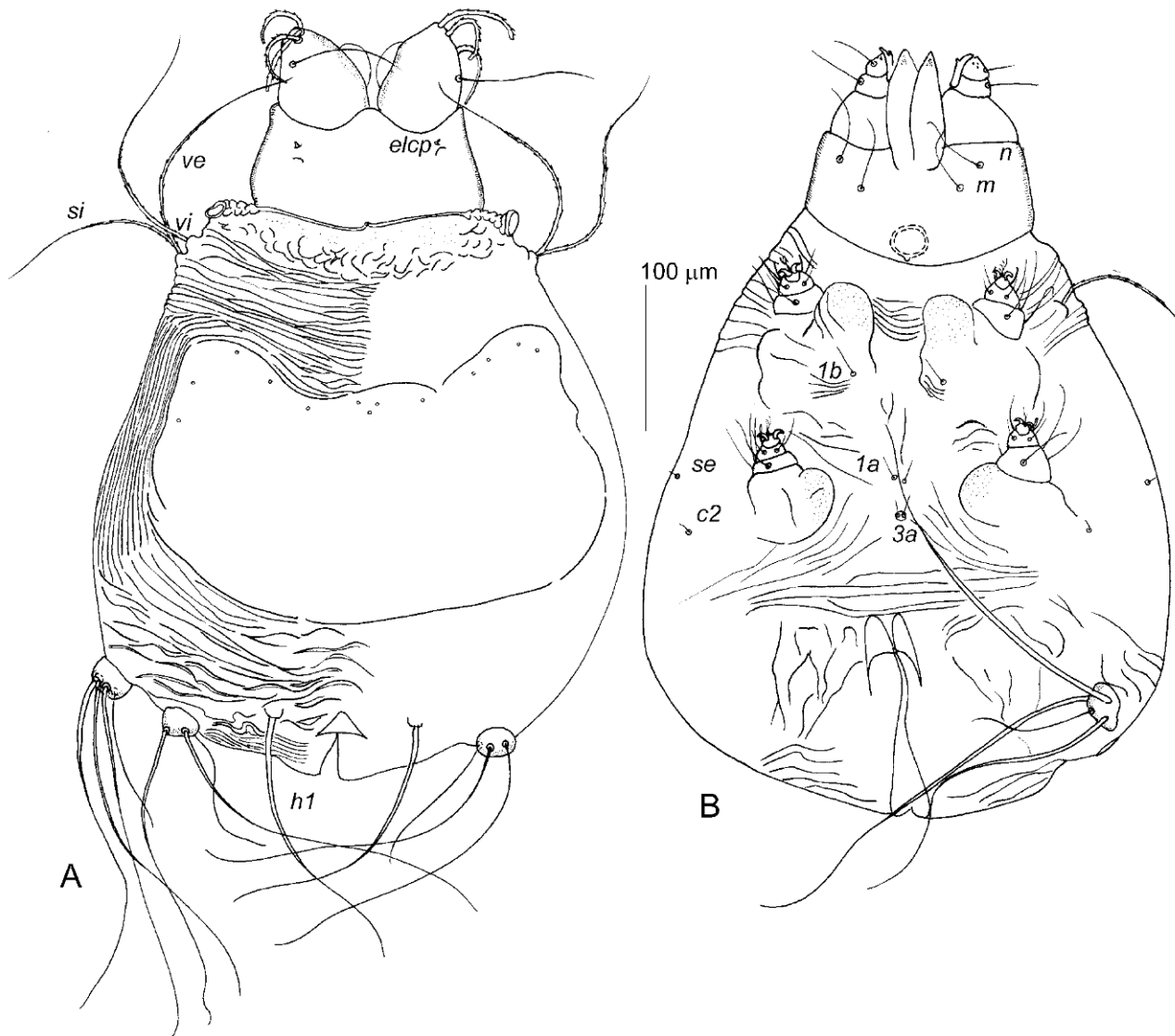


Fig. 6. *Neharpyrhynchus loxia* sp. nov., female. A – dorsal view; B – ventral view

Lake, 27 April 2004, coll. T.D. Galloway (field number SM-1299). One male and one female in JBWM, other specimens in ZISP.

Hosts and distribution: This species is associated with hosts of the genus *Buteo* (Accipitriformes: Accipitridae), *Buteo buteo* (Linnaeus, 1758) [type host] from Germany (Fritsch 1954) and Luxembourg (Fain 1994); *Buteo lineatus* (Gmelin, 1788) from USA (Michigan) (Bochkov and OConnor 2013); *Buteo jamaicensis* from Canada (Manitoba) (present paper).

***Harpyrhynchoides modestus* (Fain, 1976)**

Harpyrhynchus (*Harpyrhynchoides*) *modestus* Fain, 1976: 126, figs 1–8.

Harpirhynchus (*Harpyrhynchoides*) *modestus*, Fain 1994: 134.

Material. Six females (AVB 13-0325-003) from *Columba livia* (Gmelin, 1789) (Columbiformes: Columbidae) (RODO/77/CEN/04) [new host], Manitoba, Winnipeg, 17 February 2004, coll. T.D. Galloway and D. Holder (field number SM-1232); 7 females (AVB 13-0325-005) from same host (RODO/1988/CEN/03) and locality, 27 November 2003, coll. T.D. Galloway and D. Holder (field number SM-1239). Two females in JBWM, other specimens in ZISP.

Hosts and distribution: This species is associated with various columbiform birds, *Metriopelia caeciliae* (Lesson, 1845) (Columbiformes: Columbidae) from the Zoo of Antwerp (Fain 1976) [died during its quarantine, type host]; *Columba livia* from Canada (Manitoba) (present paper).

Genus *Neharpyrhynchus* Fain, 1972

Neharpyrhynchus loxia sp. nov. (Figs 6–8)

Female (holotype). Body, including gnathosoma, 550 long (520–560 in 3 paratypes), 400 wide (400–420) (Fig. 6). Gnathosomal length and width subequal about 150. Palps about 75 long and 50 wide, moderately inflated dorsally. All palpalae distinctly pectinate (Fig. 7A). Palpalae *dF* about 35 long, *dG* about 30 long, and *l''G* about 20 long. Setae *vF* about 100 long, smooth. Subcapitulum ventrally with setae *n* and *m*. Peritremal branch about 125 long. Idiosoma 400 long (390–430). Anterior region of propodonotum covered by strongly curved irregular striations in posterior half (Fig. 7B). Dorsal shield entire, 200 long (190–210), 300 wide (300–320), without pattern. Anterior margin of dorsal shield widely concave, posterior margin convex (Fig. 6A). Ventral surface of idiosoma with indistinct transverse striations, without scales or verrucosities (Fig. 6B). Setae: *vi*, *ve*, and *si* – all distinctly barbed, subequal in length, about 200; *se*, *c2*, and *la* – all smooth, 4–6 long; *hl*

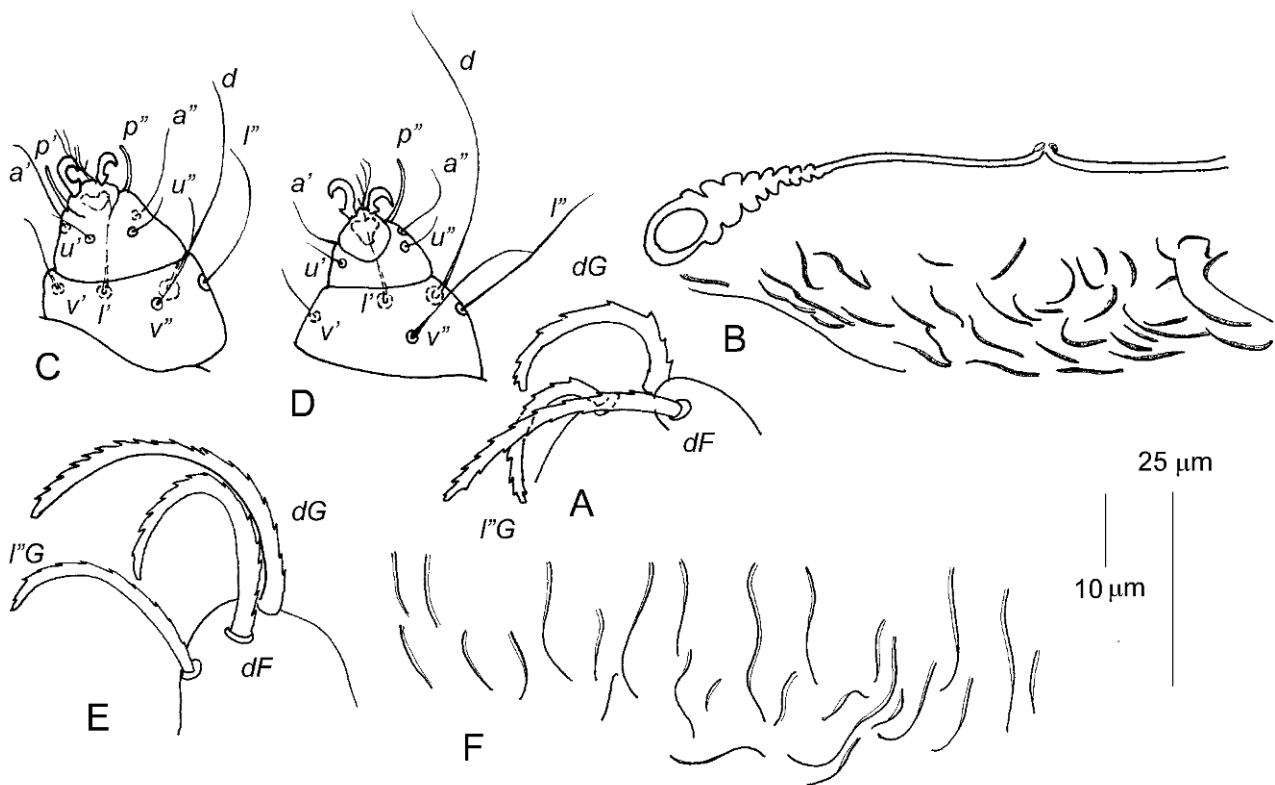


Fig. 7. *Neharpyrhynchus* spp., female details. *N. loxia* (A–D): A – palpal apex dorsally; B – anterior part of propodonotum; C – leg I ventrally; D – leg II ventrally. *N. plumaris* (Fritsch, 1954) (E and F): E – palpal apex dorsally; F – anterior part of propodonotum. Scale bars: A, E, F = 25 µm, B–D = 10 µm

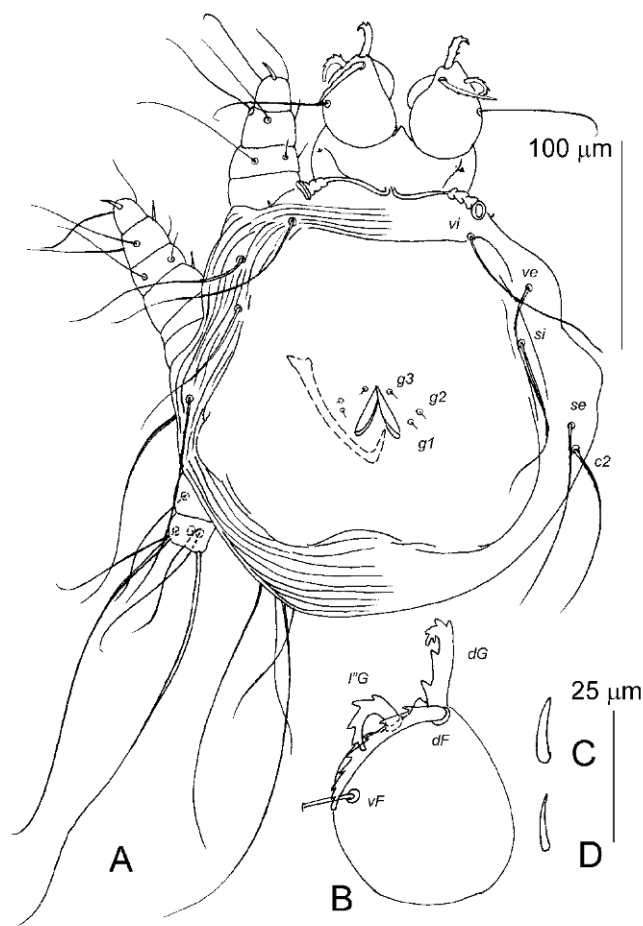


Fig. 8. *Neharpyrhynchus loxia* sp. nov., male. **A** – dorsal view; **B** – palp dorsally; **C** – solenidion ω II; **D** – solenidion ω III. Scale bars: A = 100 μ m, B–D = 25 μ m

smooth, about 200 long. Setae 3a present. Base of legs I with distinctly developed and slightly attenuated fleshy lobe; base of legs II with moderately developed rounded lobe. Legs I and II with 2 articulated segments each (Fig. 7C and D). Legs III and IV with 1 segment. Legs III bearing 4 setae; legs IV bearing 3–4 setae.

Male (2 paratypes). Body, including gnathosoma, 260–270 long and 185–190 wide. Length and width of gnathosoma subequal, about 65. Palps about 35 long. All palpalae distinctly pectinate (Fig. 8B). Palpalae dF and dG about 33 long, l'G about 16. Setae vF about 50 long, smooth. Subcapitulum ventrally with setae *n* and *m*. Idiosoma rounded in outline, about 200 long. Propodonotal shield about 135 long, 160 wide (Fig. 8A). Aedeagus curved, about 65 long. Genital opening situated in median third of propodonotal shield, surrounded by 3 pairs of genital microsetae, g1–g3 (Fig. 8A). Setae vi, ve, si, se, and c2 – all serrate, 85–110 long. Ventral surface of idiosoma without scales or verrucosities. Setation of legs I, II (respectively, including solenidia): coxal field 1 (1a, 1b), trochanter 1 (v)-1 (v), femur 2 (d, v)-2 (d, v), genu 2 (d, l')-2

(d, l'), tibia 5 (d, l', l'', v', v'')-5 (d, l', l'', v', v''), tarsus 9 (tc', tc'', p', p'', a', a'', u', u'', ω 1)-8 (tc', tc'', p'', a', a'', u', u'', ω 1). Solenidia ω I and II almost straight, 12 and 10 long, respectively (Figs 8C and D). Legs III with 2 segments. Coxal fields III bearing setae 3a. Basal segment of legs III with 1 seta. Apical segment of legs III with 4 setae. Legs IV with 1 segment bearing 4 setae.

Type material: Female holotype (CNCI), 3 female and 2 male paratypes (AVB 13-0405-001, 1–5) from *Loxia curvirostra* (Linnaeus, 1758) (Passeriformes: Fringillidae) (RECR/1483/CEN/12), Manitoba, Winnipeg, 05 December 2012, coll. T.D. Galloway and D. Holder (field number SM-2387).

Type deposition: Holotype in CNCI, 1 female paratype in JBWM, other paratypes in ZISP.

Etymology: The species name is derived from the generic name of the host and is a noun in apposition.

Differential diagnosis: This species belongs to the *plumaris* species group with four previously described species: *N. plumaris* (Fritsch, 1954), *N. chlorospingus* Bochkov et Literak, 2011, *N. novoplumaris* (Moss, Oliver et Nelson, 1968), and *N. spinus* Martinu, Dusbabek et Literak, 2008 (Bochkov and Literak 2011). Among species of this group, *N. loxia* sp. nov. is closest to *N. plumaris*. In females of both of these species, the anterior part of the propodonotum is covered by longitudinal striations only in its posterior part. In females of *N. loxia* sp. nov., the striae of the anterior part of the propodonotum are strongly curved (Fig. 7B), whereas in *N. plumaris*, these striae are almost straight (Fig. 7F).

Neharpyrhynchus pilirostris (Berlese et Trouessart, 1889)

Sarcopterus pilirostris Berlese et Trouessart, 1889: 137–138

Harpyrhynchus ovalis Fritsch, 1954: 193, fig. 10

Neharpyrhynchus pilirostris, Fain 1995: 81, Figs 24–29.

Material. Six females (AVB 13-0402-002, 1–6) from *Passer domesticus* (Linnaeus, 1758) (Passeriformes: Passeridae) (HOSP/1925/CEN/03), Manitoba, Winnipeg, 27 November 2003, coll. T.D. Galloway (field number SM-1213). Two females in JBWM, other specimens in ZISP.

Hosts and distribution: *Passer domesticus* from France (Berlese and Trouessart 1889), Germany (described as *H. ovalis*) (Fritsch 1954), South Africa (Lawrence 1959) (determined as *H. ovalis*), USA (Kansas) (Fain 1995), and Canada (Alberta and Manitoba) (Byers and Proctor personal communication; present paper).

Genus *Fainharpyrhynchus* gen. nov.

Type species: *Fainharpyrhynchus contopus* sp. nov., designated here

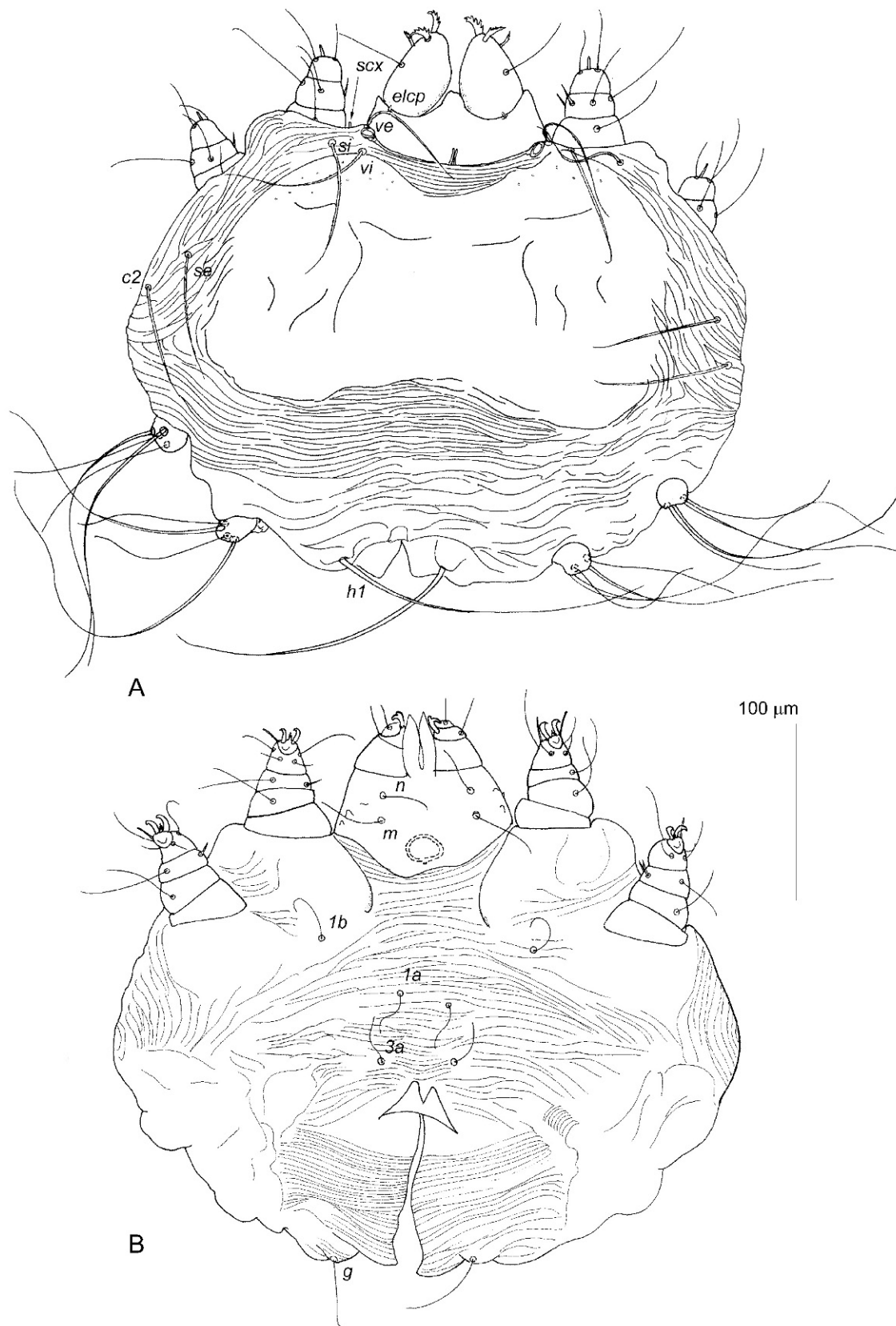


Fig. 9. *Fainharpirhynchus contopus* sp. nov., female. **A** – dorsal view; **B** – ventral view

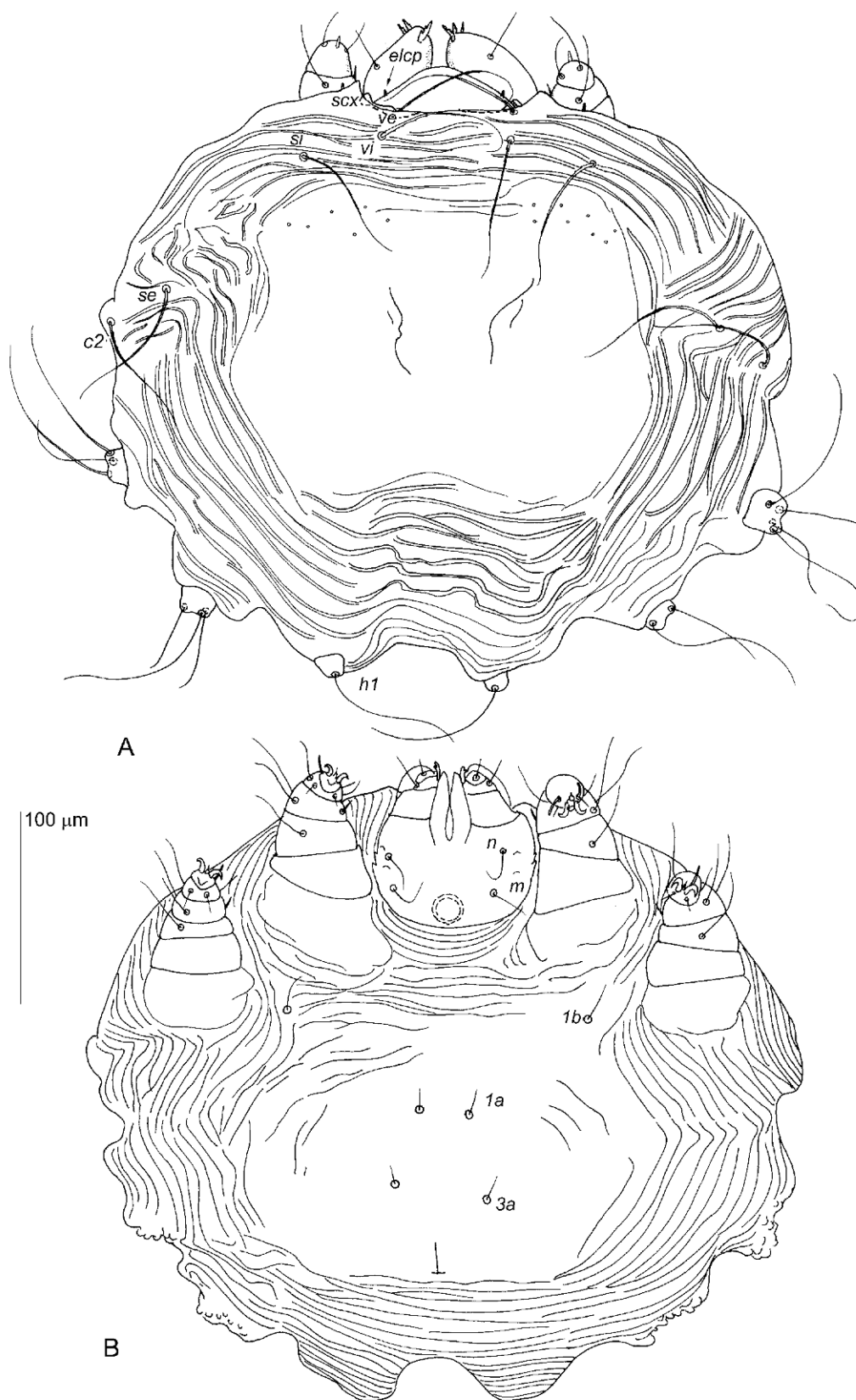


Fig. 10. *Fainharpirhynchus contopus* sp. nov., teleonymph. **A** – dorsal view; **B** – ventral view

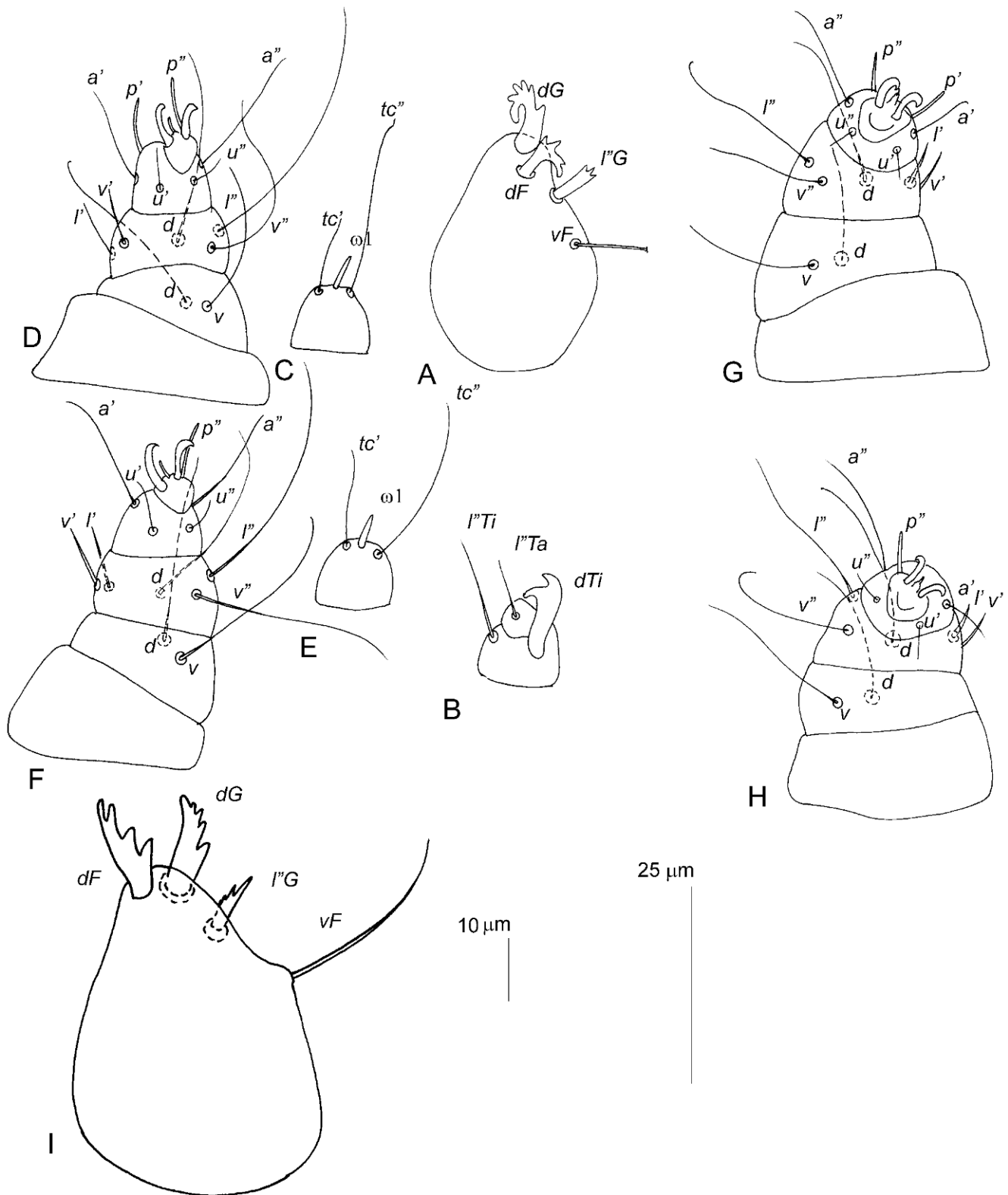


Fig. 11. *Fainharpirhynchus contopus* sp. nov., details. Female (A-F): A – palp dorsally; B – palp tibia and tarsus ventrally; C – tarsus I dorsally; D – leg I ventrally; E – tarsus II dorsally; F – tarsus II ventrally. Teleonymph (H, I): H – leg I ventrally; I – palp dorsally. Scale bars: A-F = 25 μm, H-I = 10 μm

Female. Gnathosoma moderately developed with full set of setae: *vF*, *dF*, *dG*, *l''G*, *dTi*, *l''Ti*, *l''Ta*, *n*, *m*, and *elcp*. Palpalae thickened and pectinate, grouped in apical part of segment. Idiosoma about 1.5 times wider than long, covered with transverse striations, devoid of scales or verrucosities. Dorsal shield distinctly developed, entire. Vulvar fold situated in posterior half of idiosoma at level of leg III insertions. Full set of idiosomal setae present: *scx*, *vi*, *ve*, *si*, *se*, *c2*, *h1*, *1a*, *1b*, *3a*, and *g*. Legs I and II consisting of 4 articulated segments (probably genu and femur fused), legs III and IV 1-segmented. Tarsi I and II with pair of well developed claws and rudimentary empodium without tenet hairs. Leg I setation: trochanter – 0, femur-tibia – *d* and *v*, tibia – *d*, *l'*, *l''*, *v'*, and *v''*, tarsus – *u'*, *u''*, *a'*, *a''*, *p'*, *p''*, *tc'*, *tc''*, and solenidion *ω1*. Leg II bearing same setae, except *p'* absent.

Male. Unknown.

Etymology: This genus is dedicated to the late, great Belgium acarologist, Prof. Alex Fain, who created the modern classification system for the family Harpirhynchidae and described most of its species.

Differential diagnosis: This genus is closest to *Ralliharpirhynchus* Fain, 1995; in females of both these genera, the vulvar fold is situated in the posterior half of the body, the full set of the palpal and idiosomal setae and all legs are present, the empodium of tarsi I and II is strongly reduced, without tenet hairs, and some segments of legs I and II are fused. Females of *Fainharpirhynchus* gen. nov. differ from those of *Ralliharpirhynchus* by the following characteristics. In *Fainharpirhynchus* gen. nov., setae *g* are present, legs II consist of four articulated segments; claws of tarsi I and II are present, tarsi I, II have the full set of setae, tibiae I, II have five setae, genua I, II have two setae, trochanters I lack setae, and the idiosoma is 1.5 times wider than long. In *Ralliharpirhynchus*, setae *g* are absent, leg I and II consist of three articulated segments, claws of tarsi I and II are absent, tarsi I, II have incomplete setation (7 setae), tibiae I, II have four and three setae, respectively, genua I, II lack setae, trochanters I have one seta, and the idiosoma is 1.2 times wider than long.

***Fainharpirhynchus contopus* sp. nov.** (Figs 9–11)

Female (holotype). Body, including gnathosoma, 300 long (290–320 in 5 paratypes) and 340 wide (330–340) (Fig. 9). Gnathosoma about 70 long and 100 wide. Palps about 50 long and 40 wide. Palpalae *dF* and *dG* thickened and distinctly pectinate, about 18 long; palpalae *l''G* thickened, pectinate only in apical part, about 12 long (Fig. 11A). Setae *vF* about 30 long, smooth. Subcapitulum ventrally with a few small lateral folds. Peritremal branch about 60 long. Idiosoma 230 long (225–240). Dorsal shield about 100 long and 260 wide, without pattern. Anterior and posterior margin of dorsal shield widely concave (Fig. 9A). Ventral surface of idiosoma with distinct

transverse striations, without scales or verrucosities (Fig. 9B). Setae *vi*, *ve*, *si*, *se*, and *c2* – all slightly serrate, 60–85 long; *h1* smooth, about 170 long, setae *g* about 50 long. Legs I and II as in Fig. 11C–F. Legs III and IV with 3–4 setae each.

Teleonymph (8 paratypes). Body, including gnathosoma, 350–370 long and 400–420 wide (Fig. 10). Similar to female but idiosoma ventrally non-striated in median part, setae *h1* significantly shorter, about 80 long, setae *g* absent, legs IV with 2–4 setae.

Type material: Female holotype (CNCI), 5 female and 8 teleonymph paratypes (AVB 13-0325-007, 1–12) from *Contopus cooperi* (Nuttall, 1831) (Passeriformes: Tyrannidae) (OSFL/1504/CEN/03), Manitoba, Winnipeg, 04 October 2003, coll. T.D. Galloway and D. Holder (field number SM-1194).

Type deposition: Holotype in CNCI, 1 female and 3 teleonymph paratypes in JBWM, other paratypes in ZISP.

Etymology: The species name is derived from the generic name of the host and is a noun in apposition.

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References

- Berlese A., Trouessart E.L. 1889. Diagnoses d'acariens nouveaux ou peu connus. *Bulletin de la Bibliotheque Scientifique de l'Ouest* 9, 2, 121–143.
- Bochkov A.V. 2008. New observations on phylogeny of cheyletoid mites (Acari: Prostigmata: Cheyletoidea). *Proceedings of the Zoological Institute RAS, St. Petersburg*, 312, 54–73.
- Bochkov A.V., Galloway T.D. 2001. The parasitic cheyletoid mites (Acari: Cheyletoidea) associated with passeriform birds (Aves: Passeriformes) from Canada. *Canadian Journal of Zoology*, 79, 2014–2028. DOI:10.1139/cjz-79-11-2014.
- Bochkov A.V., Galloway T.D. 2004. New species and records of cheyletoid mites (Acari: Cheyletoidea) from birds in Canada. *Journal of the Kansas Entomological Society*, 77, 26–44.
- Bochkov A.V., Literak I. 2011. Mites of the genus *Neharpirhynchus* Fain (Acariformes, Harpirhynchidae) from Neotropical birds. *ZooKeys*, 89, 15–31. DOI:10.3897/zookeys.89.974.
- Bochkov A.V., Mertins J.W. 2010. *Harpirhynchus quasimodo* n. sp. (Acariformes: Harpirhynchidae), a new species parasitizing *Molothrus ater* (Passeriformes: Icteridae) in Florida, USA. *International Journal of Acarology*, 36, 83–87. DOI:10.1080/01647950903520693.
- Bochkov A.V., O'Connor B.M. 2013. Mites of the subfamily Harpirhynchinae (Acariformes: Harpirhynchidae) from North American birds. *Journal of Medical Entomology*, 50, 501–509. DOI: <http://dx.doi.org/10.1603/ME12237>.

- Boyd E.M. 1968. Two new species of *Harpyrhynchus* from herons in North America (Acarina, Trombidiformes, Harpyrhynchidae). *Proceedings of the Helminthological Society Washington*, 35, 18–24.
- Clements J.F., Schulenberg T.S., Iliff M.J., Sullivan B.L., Wood C.L., Roberson D. 2012. The Clements checklist of birds of the world: Version 6.7. The Cornell Lab Ornithology, Ithaca, New York [Available online at <http://www.birds.cornell.edu/clementschecklist/downloadable-clements-checklist>; accessed 12 April 2013].
- Fain A. 1976. Notes sur les Harpyrhynchidae. Description de quatre espèces nouvelles (Acarina: Prostigmata). *Acarologia*, 18, 124–132.
- Fain A. 1994. New observations on the Harpirhynchidae Dubinin, 1957 (Acari: Prostigmata). I. The subgenus *Harpirhynchus* (*Harpyrhynchoides*) Fain, 1972. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Entomologie*, 64, 109–144.
- Fain A. 1995. New observations on the Harpirhynchidae Dubinin, 1957 (Acari: Prostigmata). II. On some new or little-known taxa in the Harpirhynchinae. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Entomologie*, 65, 73–100.
- Fritsch W. 1954. Die Milbengattung *Harpyrhynchus* Mégnin, 1878 (Subordo Trombidiformes, Fam. Myobiidae Megn. 1877). *Zoologischer Anzeiger*, 152, 177–198.
- Galloway T.D., Danks H.V. 1991. Arthropod ectoparasites of vertebrates in Canada. A brief prepared by the Biological Survey of Canada. *Bulletin of the Entomological Society*, 23, 11 pp.
- Grandjean F. 1939. Les segments postlarvaires de l'hysterosoma chez les oribates (Acariens). *Bulletin de la Société Zoologiques de France*, 64, 273–284.
- Grandjean F. 1944. Observations sur les Acariens de la famille des Stigmaeidae. *Archives des Sciences Physiques et Naturelles*, 26, 103–131.
- Karstad L. 1970. Diseases diagnosed in free-living birds. *Ontario Bird Banding*, 6, 6–17.
- Kethley J.B. 1990. Acarina: Prostigmata (Actinedida). In: (Ed. D.L. Dindal). *Soil Biology Guide*. Wiley, New York, 667–756.
- Lawrence R.F. 1959. New mites parasites of African birds (Myobiidae, Cheyletidae). *Parasitology*, 49, 416–438.
- Skoracki M., Zabłudovskaya S., Bochkov A.V. 2012. A review of Prostigmata (Acariformes: Trombidiformes) permanently associated with birds. *Acarina*, 20, 67–107 + i45.
- Smith I.M., Lindquist E.E. 1979. Acari Acariformes (Actinotrichida). Prostigmata. In: (Ed. H.V. Danks). *Canada and its Insect Fauna. Memoirs of the Entomological Society of Canada*, 108, 267–277.

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