

MONOFREYANA GEN. N., A NEW FEATHER MITE GENUS OF THE FAMILY FREYANIDAE (ACARI: ASTIGMATA) FROM PLOVERS (CHARADRIIFORMES: CHARADRIIDAE)

MONOFREYANA GEN. N. — НОВЫЙ РОД ПЕРЬЕВЫХ КЛЕЩЕЙ СЕМЕЙСТВА FREYANIDAE (ACARI: ASTIGMATA) С ЗУЙКОВ (CHARADRIIFORMES: CHARADRIIDAE)

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ABSTRACT

A new genus of feather mites, *Monofreyana* gen. n., is established in the family Freyanidae. The genus includes three species parasitizing the plovers (Charadriiformes: Charadriidae): *Monofreyana collaris* sp. n. (type species) from *Charadrius collaris*, *M. americana* sp. n. from *Ch. wilsonia*, *M. proctorae* sp. n. from *Ch. ruficapillus*, and *M. ambigua* (Gaud, 1957) comb. n. from *Ch. alexandrinus*. Relationships and morphological peculiarities of the new genus are briefly discussed.

РЕЗЮМЕ

Новый род перьевых клещей *Monofreyana* gen. n. установлен в семействе Freyanidae. Род включает три вида, паразитирующих на зуйках (Charadriiformes: Charadriidae): *Monofreyana collaris* sp. n. (type species) с *Charadrius collaris*, *M. americana* sp. n. с *Ch. wilsonia*, *M. proctorae* sp. n. с *Ch. ruficapillus* и *M. ambigua* (Gaud, 1957) comb. n. с *Ch. alexandrinus*. Кратко обсуждаются филогенетические связи и морфологические особенности рода.

INTRODUCTION

The feather mite family Freyanidae have included up to date about 110 species and 14 genera arranged into 4 subfamilies [Gaud, Atyeo, 1981, 1982, 1985]. Mites of this family are associated with representatives of six orders of aquatic birds. As it was shown by several recent experts, this group of feather mites demonstrates a relatively

clear pattern of co-evolutionary relationships with their host [Dubinin, 1950; Gaud, Atyeo, 1979; Ehrnsberger et al., 2001].

In the course of our phylogenetic and taxonomic studies of the superfamily Freyanoidea [Mironov et al., 2001; Ehrnsberger et al., 2001], one new genus have been recovered within the family Freyanidae. This new genus described in the present paper is related to the genus *Freyanomorpha* Gaud, 1957 and restricted by its host-parasite associations to the plovers Charadriidae (Charadriiformes).

MATERIAL

The material used in present study was received from the Museum of Zoology of the University of Michigan (Ann Arbor, USA), from Australian School of Environment studies of the Griffith University (Nathan, Australia), and also found in the feather mite collection of the A. Mickiewicz University (Poznan, Poland). In the descriptions of new taxa, the nomenclature of idiosomal chaetotaxy follows that of Griffiths et al. [1990], and the leg chaetotaxy is that of Atyeo and Gaud [1966]. All measurements are given in micrometers (μ). Type specimens are deposited: AMU — A. Mickiewicz University (Poznan, Poland), ZISP — Zoological Institute (St.Petersburg, Russia), UMMZ — Museum of Zoology of the University of Michigan (Ann Arbor, USA), GU — Griffith University (Nathan, Queensland, Australia).

FREYANIDAE DUBININ, 1953

BURHINACARINAE GAUD, ATYEO, 1981

Monofreyana Mironov et Dabert gen. n.

Type species: *Monofreyana collaris* sp. n.

Both sexes. Idosoma narrowly ovate, without enlarged lateral margins. Single setae *vi* present. Epimerites I fused V- or Y-likely. Idiosomal setae *ps1* and *f2* lanceolate, other setae setiform or hair-like. Setae *si*, *se* on prodorsal shield. Hysteronotal shield entire, covering almost all dorsal surface of hysterosoma, posterior margin of shield with wide heavy sclerotized band (Fig. 1a, 2a), cupules *ia* in anterior angles of shield, surface of shield with numerous little pit-like lacunae. Lateral margins of coxal fields I, II with sclerotized bulks connecting bases of respective epimerites (Fig. 1b, 2b). Ambulacral discs large ovate; discs of tarsi II slightly smaller than discs of other legs; distal end of ambulacral disc with 2 rounded teeth. Legs I, II equal in size. Setae *p*, *q* present on tarsi III, IV (Fig. 3 a, b).

Male. Opisthosomal lobes not developed, posterior end of opisthosoma rounded, with narrow membrane-like margin. Coxal fields III, IV open. Legs III, IV equal in size, not hypertrophied, segments not modified. Genital apparatus situated between levels of trochanters III and IV. Genital apodemes absent. Anal discs absent. One form of males is present only, which conventionally considered as a homeomorph form.

Female. Opisthosoma is very similar to that in male, rounded, with narrow membranous posterior margin; main differences from that of male in position of setae *e1*, *h1*. Posterior part of hysteronotal shield without muriform structures. Epigynium present, low bow-like. Egg opening long, spreading from level of humeral shields to level of trochanters III.

Differential diagnosis. Among 4 formerly recognized genera of the subfamily Burhinacarinae, the genus *Monofreyana* is most closely related to the genus *Freyanomorpha* Gaud, 1957. The new genus is easily distinguished from that taxon by having single vertical seta *vi*, lanceolate setae *f2*, well-developed lateral bulks on coxal fields I, II, and heavy sclerotized band along the posterior margin of hysteronotal shield.

The genus includes 4 species.

KEY TO SPECIES OF *MONOFREYANA*

1. In females, setae *h1* adjacent and situated on posterior margin of hysteronotal shield between bases of setae *ps1* (Fig. 4 b, 6 c) 2

— In females, setae *h1* widely separated and situated near bases of macrochaetae *h2* (Fig. 2 a) ... 3
 2. In females, setae *ps1* with hair-like apex, about 45–52 in length; distance between setae *h1* less than half distance between setae *ps1* (Fig. 4 b). In males, setae *h1* widely separated and situated at level of setae *f2*, slightly median from their bases (Fig. 5 a) *M. americana* sp. n.
 — In females setae *ps1* without hair-like apex, 30–35 in length; distance between setae *h1* more than half distance between setae *ps1* (Fig. 6 c). In males, setae *h1* situated posterior to level of setae *f2*, between bases of macrochaetae *h2* and *h3* (Fig. 6 a) *M. proctorae* sp. n.
 3. Hysteronotal shield without network pattern. In males, genital apparatus with posterior tips extending lateral, setae *e1*, *e2* situated at the same transversal level or *e1* slightly posteriad (Fig. 1a, b). In female setae *h1* about one third of setae *f2* length (Fig. 2 a) *M. collaris* sp. n.
 — Posterior part of hysteronotal shield with faint network pattern. In male, genital apparatus with parallel lateral sides, without extending posterior tips; setae *e1* anterior to setae *e2* (Fig. 3c, d). In females, setae *h1* and *f2* almost equal in length (Fig. 4 a) *M. ambigua* (Gaud, 1957)

1. *Monofreyana collaris* Mironov et Dabert sp.n.

Fig. 1, 2, 3 a, b.

Male (holotype). Length of idiosoma 325, width of idiosoma 194 (idiosomal size in 8 paratypes 320–330 × 185–197). Prodorsal shield 63 in length, 107 in width, setae *se* separated by 79. Hysteronotal shield 242 in length, 180 in width. Setae *d1* slightly posterior to level of cupules *im*, setae *e1*, *e2* at the same transversal level, setae *h1* situated near to bases of macrochaetae *h2* and *h3*. Distances between setae and openings: *d1–gl* 38, *gl–e1* 36, *d1–d2* 17, *d2–e2* 97, *h1–h1* 54, *ps1–ps1* 21. Length of setae: *ps1* 35, *f2* 36. Genital apparatus with posterior tips extending lateral, length excluding basal ring-like sclerite 20, width at base 20 (Fig. 1 b). Little bow-like epiandrium present.

Female (paratype). Length of idiosoma 355, width of idiosoma 202 (idiosomal size in 3 other paratypes 355–375 × 210–225). Prodorsal shield as in male, 73 in length, 104 in width, setae *se* separated by 74. Hysteronotal shield 246 in length, 184 in width. Setae *d1* situated approximately at level of cupules *im*; setae *e1* slightly posterior to *e2*; setae *h1* near bases of macrochaetae *h2* and *h3*. Distances between setae and openings: *d1–gl* 32,

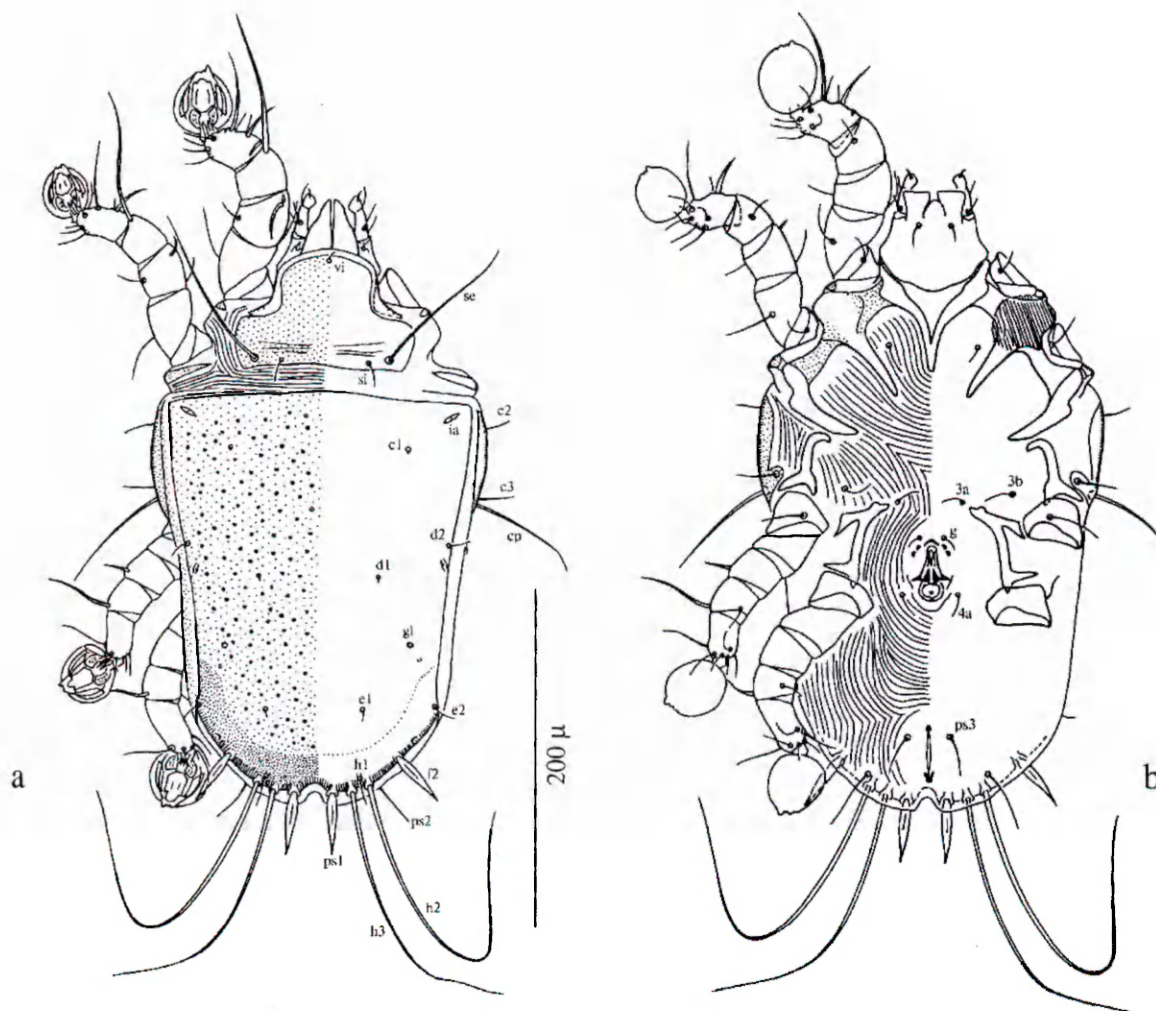


Fig. 1. *Monofreyana collaris*, male: a — dorsal view, b — ventral view.

gl-e1 49, *d1-d2* 25, *d2-e2* 95, *h1-h1* 61, *ps1-ps1* 27. Length of setae: *ps1* 30, *f2* 32. Setae *e1*, *h1* about 1/3 of setae *f2* length (Fig. 2 a). Epigynum bowl-like, 14 in length, 48 in width (in other paratypes 13–15 × 46–52).

Differential diagnosis. The new species is most closely related to *Monofreyana ambigua* (Gaud, 1957). Both sexes of *M. collaris* differ from that species by the absence of network pattern on hysteronotal shield, the males are distinguished by the position of setae *e1*, *e2* at the same level (Fig. 1 b), females are characterized by relatively short setae *h1* (Fig. 2 a). In *M. ambigua* the hysteronotal shield has a faint network pattern in central part, in the males setae *e1* are anterior to setae *e2*, in the females, setae *h1* are subequal to lanceolate setae *f2*, *ps1* (Fig. 4a, b).

Material. Holotype male, 7 male and 4 female paratypes from *Charadrius collaris*, Paraguay Concepcion, 2 km S Hermosa, E. Bank Rio Paraguay, 18 September 1988, S.M. Goodman coll. (SMG

2456, UMMZ 226 449). Holotype, paratype — UMMZ, paratypes — ZISP, AMU.

2. *Monofreyana ambigua* (Gaud, 1957) comb. n.

Fig. 3 c, d, 4 a.

This species was originally described from *Charadrius alexandrinus* from Cameroon (Gaud, 1957) and further it was recorded from *Ch. marginatus* and *Calidris minutus* in South Africa (Gaud, 1972). The host association with the sandpiper *C. minutus* is considered as an accidental contamination.

Material. 4 males, 4 females, 1 PN, from *Ch. alexandrinus*, Poland, Janowice Wielkie, 7 October 1852, Hildebrand coll. (AMU 01090/3).

3. *Monofreyana americana* Mironov et Dabert sp.n.

Fig. 4 b, 5.

Male (holotype). Length of idiosoma 350, width of idiosoma 185 (idiosomal size in 2 paratypes 350–364 × 190–197). Prodorsal shield 60 in

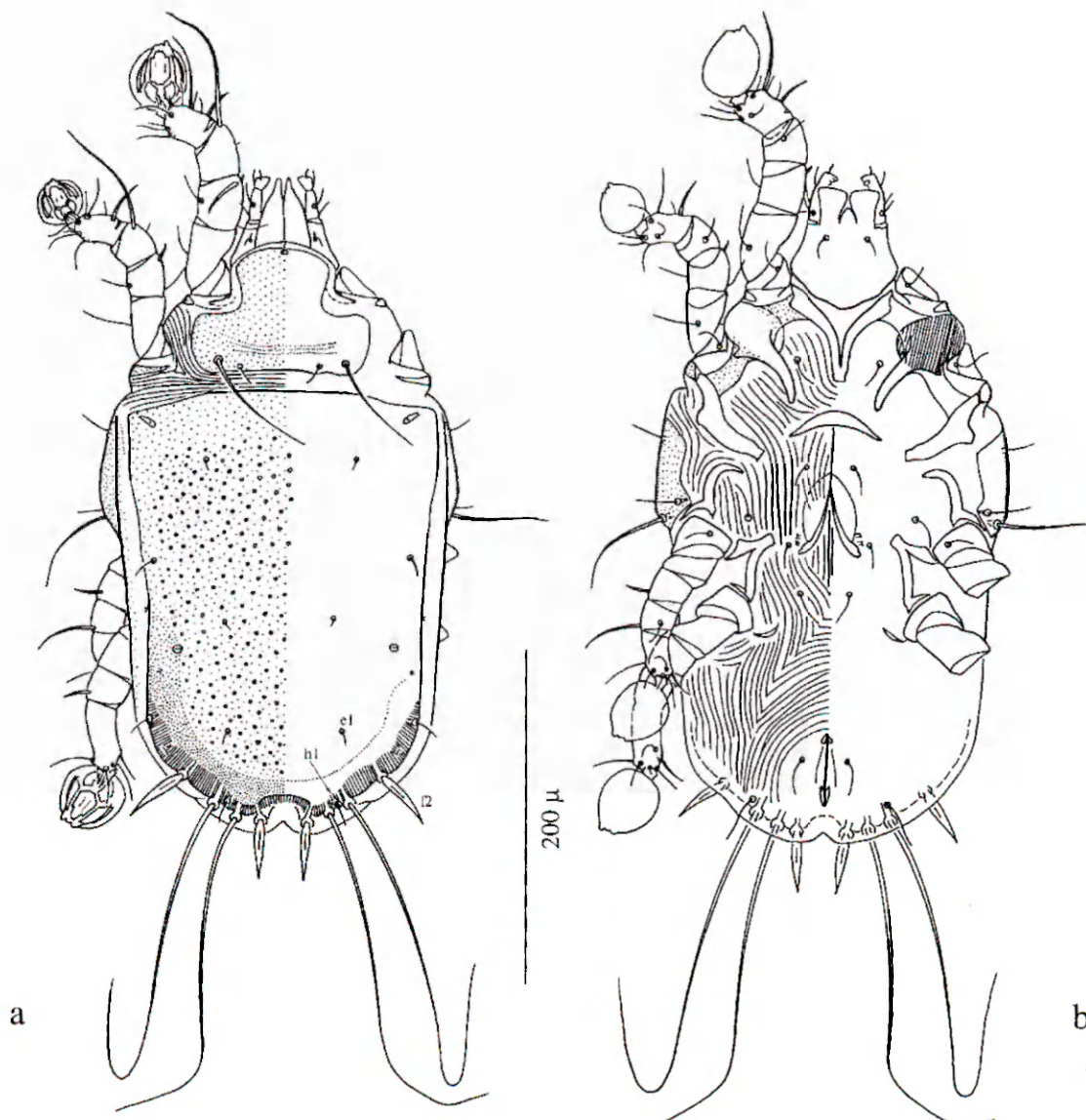


Fig. 2. *Monofreyana collaris*, female: a — dorsal view, b — ventral view.

length, 100 in width, setae *se* separated by 73. Hysteronotal shield 242 in length, 165 in width. Setae *dl* situated between levels of cupules *im* and openings *gl*; setae *e1* slightly anterior to *e2*; setae *h1* near to bases of setae *f2*, slightly anterior to their level (Fig. 5 a). Distances between setae and openings: *d1-gl* 10–18, *gl-e1* 36, *d1-d2* 30, *e1-e2* 7, *d2-e2* 79, *h1-h1* 90, *ps1-ps1* 17. Length of setae: *ps1* 30, *f2* 32. Genital apparatus narrow, 24 × 12. Little bow-like epiandrium present.

Female (paratype). Length of idiosoma 394, width of idiosoma 212 (idiosomal size in 2 other paratypes 400–402 × 205–210). Prodorsal shield 75 in length, 112 in width, setae *se* separated by 80. Hysteronotal shield 295 in length, 192 in width. Setae *dl* situated approximately at level of openings *gl*; setae *e1* anterior to setae *f2*; bases of setae

h1 adjacent and situated on posterior margin of hysteronotal shield between bases of setae *ps1*. Distances between setae and openings: *gl-e1* 78, *d1-d2* 60, *d2-e2* 107, *e2-e1* 27, *h1-h1* 10, *ps1-ps1* 30. Length of setae: *ps1* 51, *f2* 36. Setae *e1* subequal to setae *f2*, setae *h1* about 1/2 of their length. Epigynum bow-like, 15 in length, 51 in width (in other paratypes 13–15 × 46–51).

Differential diagnosis. Females of *Monofreyana americana* are clearly distinguished from two species mentioned above by the position of setae *h1* on the posterior margin of hysteronotal shield between lanceolate setae *ps1* (Fig. 4 b). In the females of *M. ambigua* these setae are widely separated and situated at level of setae *f2* (Fig. 4 a), while and *M. collaris* they are set between bases of macrochaetae *h2*, *h3* (Fig. 2 a). The males of *M. americana* are

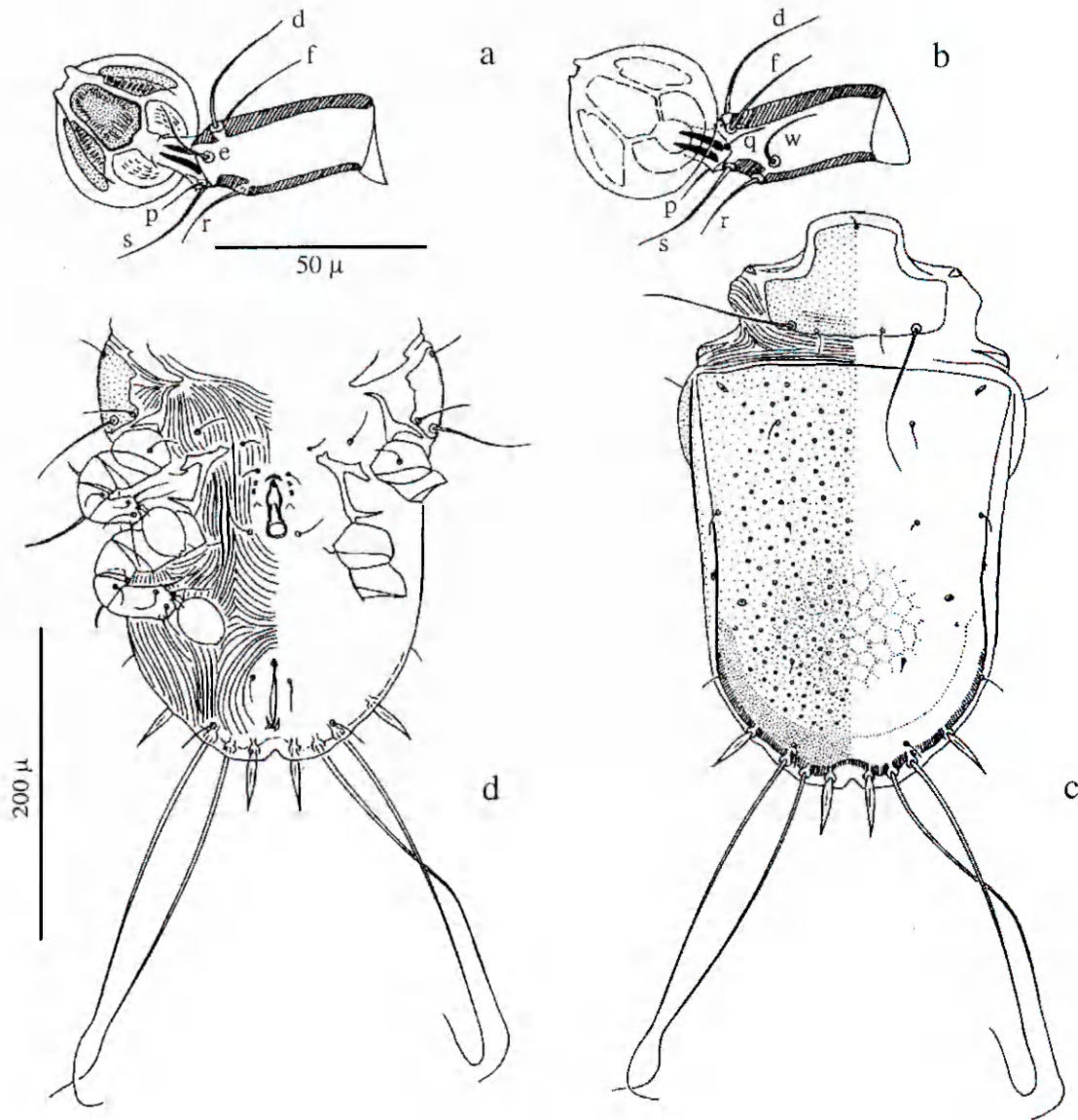


Fig. 3. Mites of the genus *Monofreyana*: a — Tarsus IV *Monofreyana collaris* female, dorsal view, b — same, ventral view, c — *M. ambigua*, dorsal view of male hysterosoma, d — same, ventral view of male hysterosoma.

differentiated by the position of setae *h1* near bases of lanceolate setae *f2* (Fig. 5a). In males all other species of the genus *Monofreyana* these setae are disposed between the bases of macrochaetae *h2*, *h3* (Fig. 1 a, 3 c, 6 a).

Material. Holotype male, 2 male and 3 female paratypes from *Charadrius wilsonia*, Panama, Canal Zone, Amador Beach, 12 December 1972, V.G. Strauch (UMMZ 225 391). Holotype, paratypes, UMMZ, paratypes ZISP.

**4. *Monofreyana proctorae*
Mironov et Dabert sp.n.**

Fig. 6 a–c.

Male (holotype). Length of idiosoma 330, width of idiosoma 190 (idiosomal size in 7 para-

types 320–350 × 185–202). Prodorsal shield 70 in length, 112 in width, setae *se* separated by 78. Hysteronotal shield 236 in length, 180 in width. Setae *d1* situated between levels of setae *d2* and cupules *im*, setae *e1* between levels of setae *e2* and *f2*, setae *h1* near bases of setae *h2* and *h3*. Distances between setae and openings: *d1–gl*, 43, *gl–e1* 52, *d1–d2* 21, *d2–e2* 98, *e2–e1* 11, *h1–h1* 60, *ps1–ps1* 22. Length of setae: *ps1* 36, *f2* 32. Genital apparatus with posterior tips extending laterad, 24 × 18. Little bow-like epiandrium present.

Female (paratype). Length of idiosoma 380, width of idiosoma 207 (idiosomal size in 12 other paratypes 370–382 × 198–210). Prodorsal shield as in male, 78 in length, 120 in width, setae *se* separat-

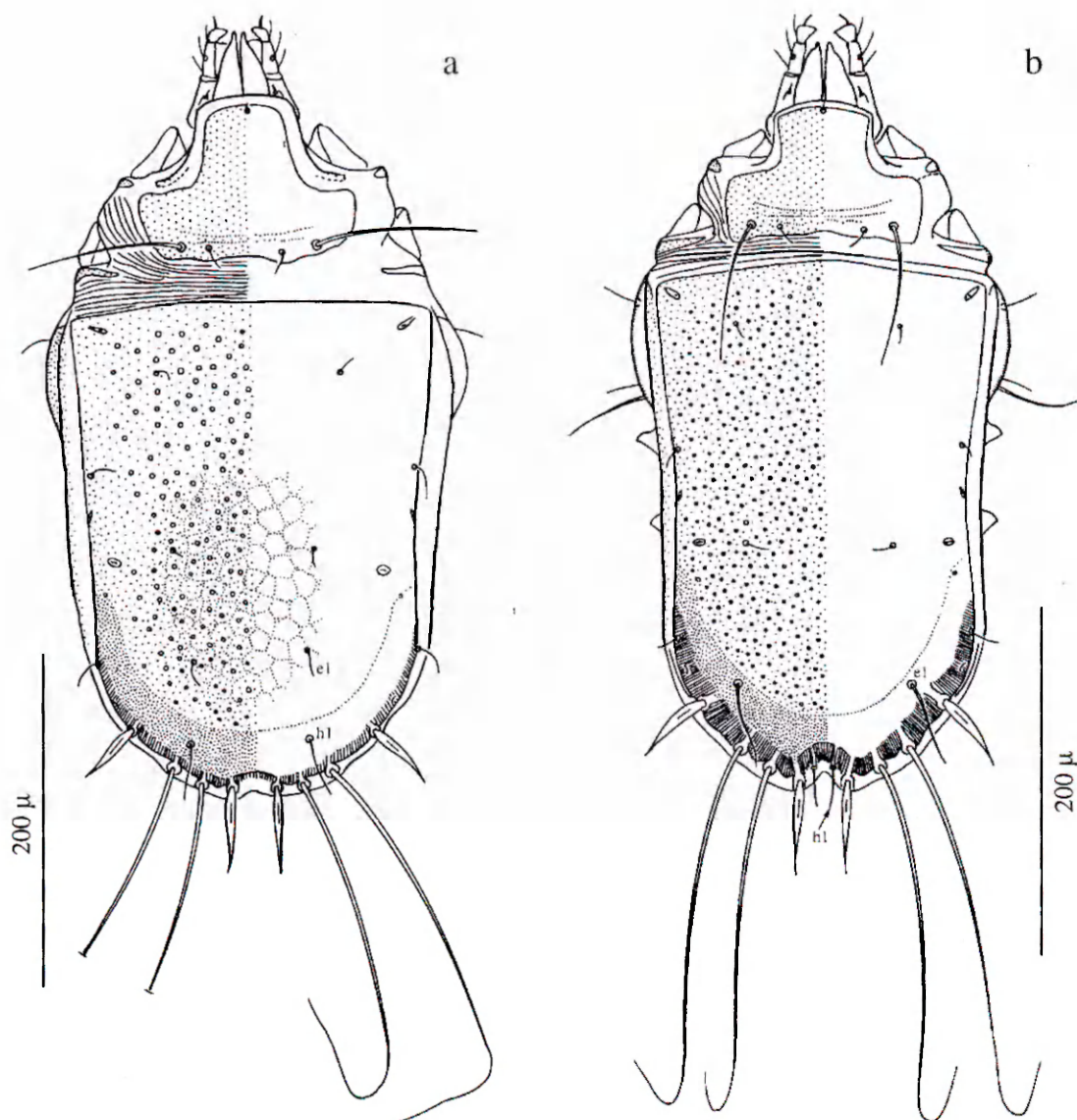


Fig 4. Females of the genus *Monofreyana*: a — *Monofreyana ambigua*, dorsal view, b — *M. americana*, dorsal view.

ed by 75. Hysteronotal shield 285 in length, 194 in width. Setae *e1*, *e2* situated approximately at same level. Setae *d1* between levels of cupules *im* and openings *gl*; setae *e1* slightly anterior to level of setae *f2* (Fig. 6 c); bases of setae *h1* adjacent and set on posterior margin of hysteronotal shield between bases of setae *ps1*. Distances between setae and openings: *d1–gl* 16, *gl–e1* 89, *d2–d1* 44, *d2–e2* 112, *h1–h1* 20, *ps1–ps1* 28. Length of setae: *ps1* 32, *f2* 34. Setae *e1* subequal to setae *f2*, setae *h1* about 1/2 of their length. Epigynum bow-like, 15 in length, 46 in width (in other paratypes 15–19 × 46–51).

Differential diagnosis. The females of *Monofreyana proctorae* are closely related to *M. americana* by the position of setae *h1* and *e1*. The females *M. proctorae* differ from the latter species by the larger distance between setae *h1* (18–22) and short-

er setae *ps1* (28–30) (Fig. 6 c). At the same time, the males of *M. proctorae* are quite similar to *M. collaris* and differ by the position of setae *d1* anterior to cupules *im* and narrow base of genital apparatus (Fig. 6 a, b).

Material. Holotype male, 7 male and 13 female paratypes from *Charadrius ruficapillus*, Australia, WA, Broome, 24 February 1998, P. Battley. Holotype — GU, paratypes — ZISP, AMU.

Etymology. The species is named in a honor of Dr. Heather Proctor (Griffith University, Nathan, Queensland, Australia).

DISCUSSION

Within the phylogenetic system of the family Freyanidae the new genus *Monofreyana* is a sister clade of the genus *Freyanamorpha* [Ehrensberger et

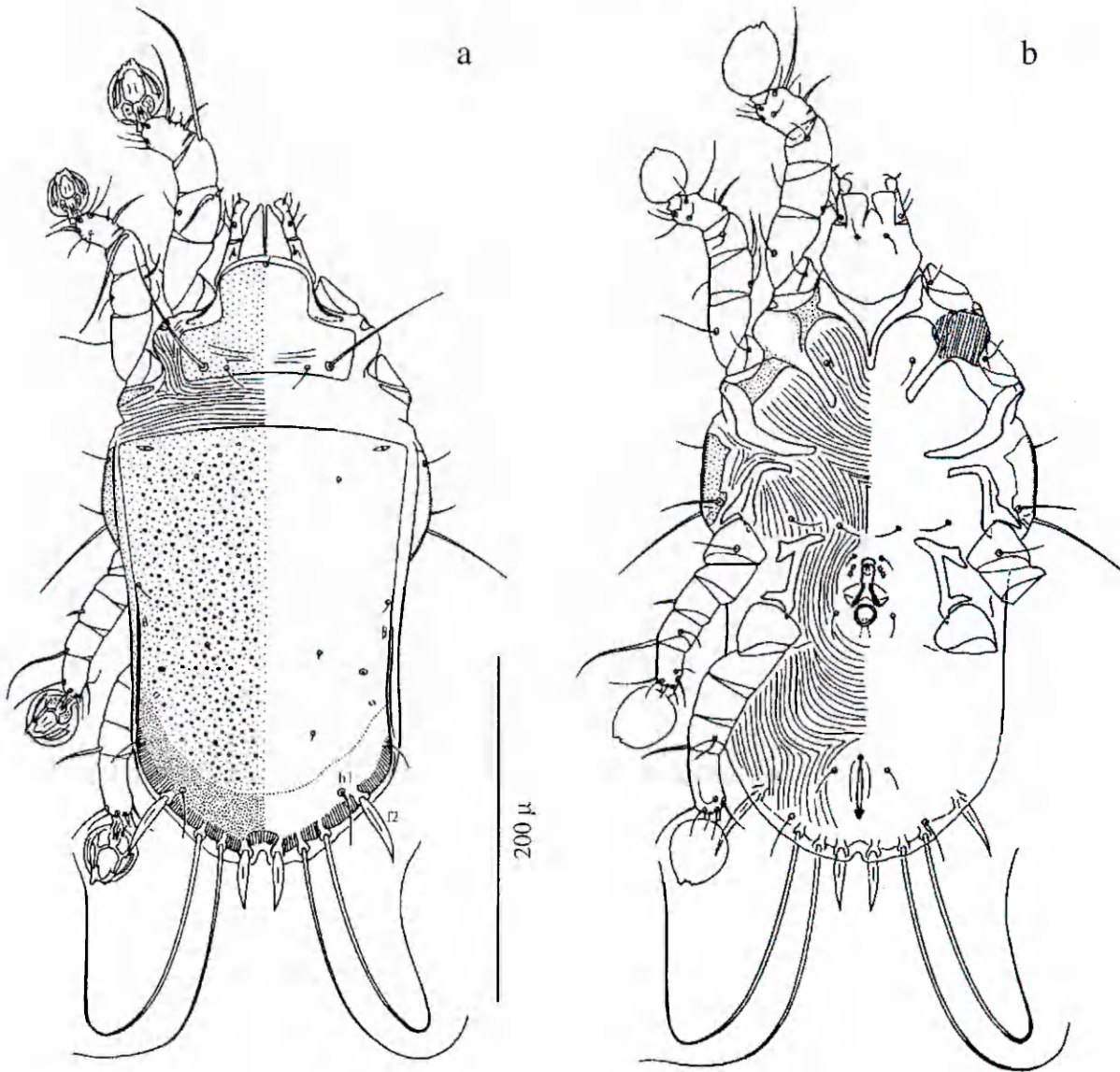


Fig. 5. *Monofreyana americana*, male: a — dorsal view, b — ventral view.

al., 2001]. This pair of genera is associated with typical charadriiform birds, the plovers Charadriidae and pratincoles Glareolidae respectively. The mites from two other related genera of the subfamily Burhinacarinae, *Burhinacarus* Dubinin, 1955 and *Cernyella* Gaud, 1968, also live on charadriiform birds, the stone-curlews Burhinidae. The most deviate genus of the subfamily, *Cauralicola* Gaud et Atyeo, 1981 is restricted to the sunbitterns Eurypygidae (Gruiformes). As it was recovered by the phylogenetic analysis of the family Freyanidae, the branch representing this subfamily displays most clear pattern of phylogenetic parallelism with the Charadriiformes-Gruiformes branch of Aves. It proves an ancient origin of host-associations of the family Freyanidae with this phylum of birds. Thus,

the mites of the subfamily Burhinacarinae represent an archaic component of feather mite fauna recently inhabiting these birds.

In relation to this conclusion, it is quite interesting to point out to a noticeable convergence in general appearance and some morphological structures between the genus *Monofreyana* and the genus *Bychovskiata* Dubinin, 1951 (Analgoidea: Avenzoariidae), which is also restricted to the plovers Charadriidae. As well as the *Monofreyana*, the latter genus shows clear co-evolutionary trends with their hosts and represents another ancient group of feather mite fauna being specific to Charadriiformes [Mironov, Dabert, 1999]. Both *Monofreyana* and *Bychovskiata* are characterized by having an ovate and relatively short body, large

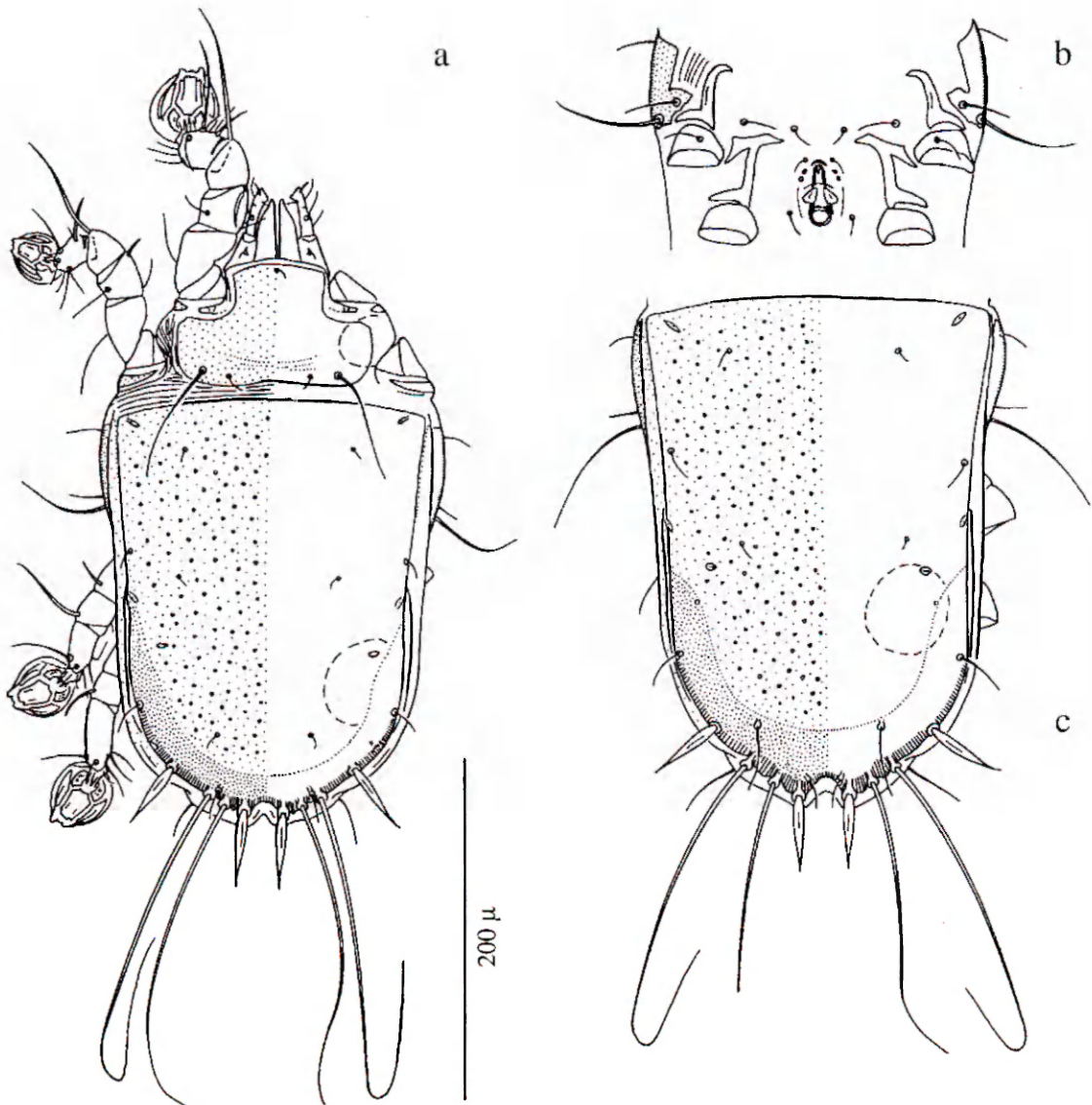


Fig. 6. *Monofreyana proctorae*: a — male, dorsal view, b — male, genital apparatus and adjacent coxal fields, c — female, dorsal view.

well-sclerotized hysteronotal shield covering almost dorsum of hysterosoma, sclerotized bulks connecting epimerites on coxal fields I, II, and relatively short legs. It is reasonable to suggest that the similar morphological characters have been developed as adaptations to the same ecological conditions as far the representatives of the genera *Monofreyana* and *Bychovskiata* occupy the same locations on their hosts, the primary and secondary flight feathers.

The representatives of these two genera are apparently in mutually antagonistic relations as far they have to compete for the same resources and favorable conditions. This suggestion is well supported by the distribution of mite species among plover species. According to reliable host-parasite

association data [Gaud, 1972; Mironov, Dabert, 1997] and our field observations, species of the genus *Monofreyana* and *Bychovskiata* do not coexist on the same species of plovers. Single exception is noted for the Kentish plover *Ch. alexandrinus* widely distributed throughout the World and represented by a number of subspecies. However, in this case the mite species belonging to different genera have not been recorded simultaneously on the same specimens of this plover. Therefore, in the recent distribution of mite species of the genera *Monofreyana* and *Bychovskiata* among the plover species of the Charadriidae, we probably observe a result of long-term competition between representatives of two ancient and far related phylogenetic lines of mites during the process of their co-evolution with the

Charadriidae. As it is well seen, the mites of the genus *Bychovskiata* were more successful in this competition. Within the genus *Bychovskiata*, 20 of 26 recently known species are recorded from 27 species of the family Charadriidae [Mironov, 1997; Mironov, Dabert, 1997], while the genus *Monofreyana* is represented by four species from five plover species. An alternative result of such competition between mites of the families Freyanidae and Avenzoariidae may be demonstrated on the pratincoles Galreolidae, the nearest charadriiform family to Charadriidae. The subfamily Burhinacarinae (Freyanidae) absolutely dominates on these hosts. Five species of the genus *Freyanomorpha* occur on 9 species of the pratincoles and cursors (genera *Glareola*, *Galachrysa*, *Rhinoptilus*, *Pluvianus*), while representatives of the family Avenzoariidae are absent.

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CORRECTION NOTICE

In the result of editor's mistake the Fig. 4a in the paper of S.V. Mironov entitled «Description of four new genera of the feather mite family Pteronyssidae Oudemans 1941 (Astigmata: Analgoidea) with notes on systematics of the family» (Acarina. 2001. Vol. 9. No. 1. P.3–22.) illustrated another species than it was stated by the author. The correct version of the Fig. 4 is displayed hereafter.

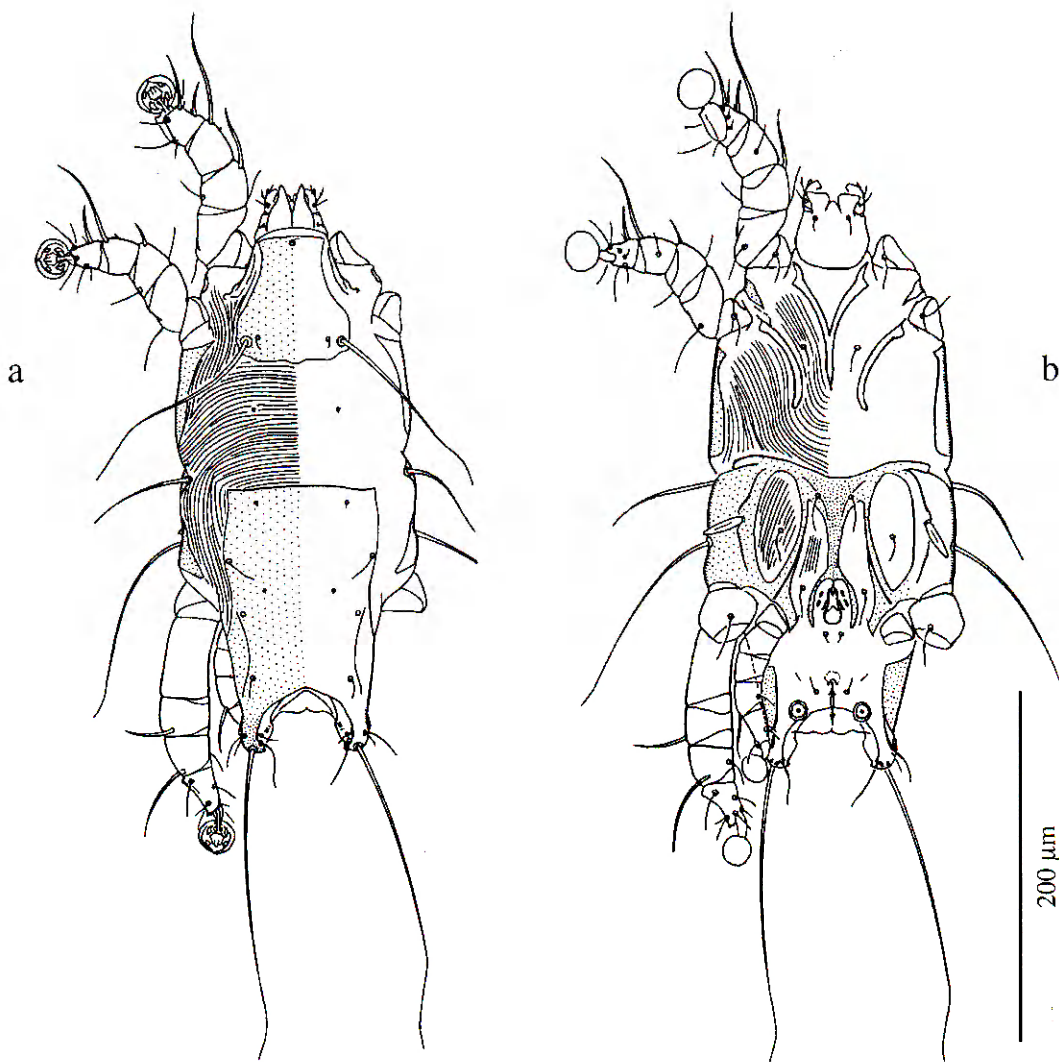


Fig. 4. *Micropteroherpus benoiti*, male: a — dorsal view, b — ventral view.