FOLIA PARASITOLOGICA (PRAHA) 16: 1—17, 1969.

Generic Revision of the Myobiid Mites (Acarina: Myobiidae) Parasitic on Bats

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Abstract. In this paper a revision is made of the genera belonging to the family Myobiidae parasitic on bats. The genera *Binuncus* Radf., 1954, *Calcarmyobia* Radf., 1948, *Acanthophthirius* Perkins. 1925, *Neomyobia* Radf., 1948, *Ugandobia* Dusb., 1968, *Jamesonia* Dusb., 1967, *Ewingana* Radf., 1948, *Pteracarus* Jameson et Chow, 1952 and *Hipposiderobia* Dusb., 1968 are considered to be valid. A characterisation of the mentioned genera is given, including a survey of species belonging to these genera. The paper is suplemented by a key to the genera of the family Myobiidae parasitic on bats.

In his paper on North American species belonging to the new subfamily *Myobiinae*, EWING (1938) divided the only existing genus *Myobia* von Heyden, 1826 into four separate genera: *Myobia* von Heyden, 1826, *Protomyobia* Ewing, 1938, *Radfordia* Ewing, 1938 and *Amorphacarus* Ewing, 1938. As generic criteria he used mainly the variability in the number of segments of legs I, the presence of claws on tarsus I, the number and shape of claws on tarsus II—IV and the symmetry or asymmetry of legs I and gnathosoma. Similar criteria for the characterization of new genera were also used by RADFORD (1948—1953) who, after revising the family Myobiidae, completed the generic characterization with data on the shape of body and dorsal setae which EWING (1938) regarded as mere specific features.

RADFORD's (1948—1953) revision of the family was published subsequently in fifteen parts during six years. In spite of the fact that already in his first part (1948) RADFORD erected four new genera (*Calcarmyobia* Radf., 1948, *Neomyobia* Radf., 1948, *Ewingana* Radf., 1948 and *Foliomyobia* Radf., 1948), which he characterized concisely in the form of a key, the more detailed characteristics and descriptions of type species were published as late as in 1952 and 1953. At that time many new species were also described by other authors (JAMESON 1948, 1949, DE MEILLON, LAVOIPIERRE 1944, JAMESON, CHOW 1952, LAWRENCE 1951, 1954) who erected new genera *Eadiea* Jameson, 1948, *Eutalpacarus* Jameson, 1949, *Pteracarus* Jameson et Chow, 1952 and *Austromyobia* Lawrence, 1954 and whose views of the systematics of the family and of the generic criteria did not always agree. Therefore, RADFORD (1954) tried to specify the generic listing of known species and erected three additional new genera: *Binuncus* Radf., 1954, *Afromyobia* Radf., 1954 and *Cryptomyobia* Radf., 1954. JAMESON (1955) and DUBININ (1957) were prompted by the same motives in their generic revisions of the family.

JAMESON (1955) divided the family into thirteen genera. He included the genera *Foliomyobia* Radf., 1948 and *Binuncus* Radf., 1954 as synonyms in the genus *Neomyobia* Radf., 1948 and considered the genus *Ewingana* Radf., 1948, to be the synonym of the genus *Acanthophthirius* Perkins, 1925. He proved that the genera *Cryptomyobia* Radf., 1954 and *Austromyobia* Lawrence, 1954 have been erected for the nymphal stages belonging to the genus *Radfordia* Ewing, 1938 and therefore he made these genera synonymous with the genus *Radfordia* Ewing, 1938. Then he erected another two new genera, *Archemyobia* Jameson, 1955 and *Blarinobia* Jameson, 1955. Apart from generic character already stated by RADFORD (1948—1953) and EWING (1938), he also used as characteristics of genera the shape of penis and the host specificity.

In his new classification of mites of the superfamily Cheyletoidea, DUBININ (1957), unaware of Jameson's division, also made a new classification of genera belonging to the family Myobiidae, which in many respects differed from Jameson's concept. The genera *Austromyobia* Lawrence, 1954, *Foliomyobia* Radf., 1948, *Ewingana* Radf., 1948 and *Binuncus* Radf., 1954 are regarded by him as valid genera and on the other hand, the genera *Acanthophthirius* Perkins, 1925, *Archeomyobia* Jameson, 1955 and *Blarinobia* Jameson, 1955 are omitted in his classification. DUBININ separated from the genus *Radfordia* Ewing, 1938 a new genus *Pseudoradfordia* Dubinin, 1957 on the basis of the shape of dorsal setae only, but this is not a sufficient basis for the erection of a separate genus and the genus *Pseudoradfordia* Dubinin, 1957 must be therefore considered to be the synonym of the genus *Radfordia* Ewing, 1938. In the concept of other genera both authors agree on the whole, except for the generic relevance of some species (*Myobia phillipsi* Turk, 1945, *M. longa* Ewing, 1948, *M. ceylonica* Radf., 1948, *Acanthophthirius etheldredae* Perkins, 1925 etc.). Another genus, *Lavoimyobia*, was erected by PAHAN (1966b) and three other genera (*Jamesonia*, *Ugandobia* and *Hipposiderobia*) were erected by DUSBÁBEK (1967a, 1968b).

Despite the fact that JAMESON and DUBININ based their classifications on rich factual material, their data on genera and species parasitic on bats were mainly based on literary data or on other authors' observations which were rather inaccurate. Therefore, most errors occurred in the classification of genera parasitic on bats. New data on mites of this family and the opportunity of studying a large material, including the representatives of all known genera, have made it possible for me to clarify the views upon the concept of genera parasitic on bats.

It becomes clear that the number of segments and the presence or absence of terminal claws on legs I, the number and shape of claws on tarsi II—IV, the shape of body, of dorsal setae and of penis as the only criteria for the determination of the genera of the family Myobiidae in the modern systematics are no longer sufficient. It is also necessary to consider the results obtained by a detailed study of the structure of legs I, of gnathosoma and vulva, the morphological characters in nymphal stages and last but not least the host specificity, which is likely conditioned phylogenetically and which seems to be more distinct than as supposed up to now.

SYSTEMATICAL REMARKS

The species *Acanthophthirius etheldredae* Perkins, 1925 was described on the basis of a single male specimen, for which PERKINS (1925) erected a separate genus *Acanthophthirius* within the order Anoplura. JAMESON (1955) therefore based his characteristics of the genus *Acanthophthirius* Perkins, 1925 on a better known species *Myobia longa* Ewing, 1938, which he regarded as representative of the same genus on the basis of seemingly corresponding formula of claws on tarsus II—IV : 2,1,1. The holotype of the species *A. etheldredae* Perkins, 1925 mounted in the Canadian balsam was in poor condition and consequently the clarification was not perfect and many details were visible with difficulty, as pointed out by RADFORD (1941). After its re-mounting, as Dr. G. O. EVANS kindly informed me, the actual formula

of claws on legs II—IV in *A. etheldredae* Perkins, 1925 however proved to be 2,2,2 and this species closely related to the species *Myobia poppei* Trouessart, 1895, which JAMESON (1955) listed in the genus *Neomyobia* Radf., 1948. After studying further material of the species *A. etheldredae* Perkins, 1925, which had been compared with the holotype (3 ♀♀ 2 ♂♂ from *Pipistrellus pipistrellus* Schreb., Jenkinstown, Co. Kilkenny, Eire, England, 17. 7. 1964, lgt. F. O'Gorman, det. G.O.E., K.H.H., 2/65) kindly loaned to me by Dr. G. O. EVANS from the collection of British Museum (Nat. Hist.), this view proved to be correct.

It also turned out that JAMESON's characteristics (1955) of the genus *Acanthophthirius* Perkins, 1925, based on *Myobia longa*, Ewing, 1938, was actually the characteristics of the genus *Ewingana* Radf., 1948, to which the species *Myobia longa* Ewing, 1938 belongs (DUSBÁBEK 1968a).

While comparing the species *A. etheldredae* Perkins, 1925 with the species *Myobia rollinati* Poppe, 1908, which is the type species of the genus *Neomyobia* Radf., 1948, great differences have been demonstrated in the structure of legs I, especially in the posture and shape of the hooklike clasping tubercle (Fig. 2A, B), shape of dorsal setae and in other features given in the generic characteristics, which exclude any possible synonymy of the genus *Neomyobia* Radf., 1948 with the genus *Acanthophthirius* Perkins, 1925. Only the species *Myobia chiropteralis* Michael, 1884, *M. jacksoni* Radf., 1940, *Neomyobia africana* Lawrence, 1951, *N. tulsi* Hiregaudar et Bal, 1956 and *N. africanoides* Kellmann, 1964, all of them found on the representatives of the family Rhinolophidae, fully agree with *Myobia rollinati* Poppe, 1908 in the mentioned characters. This is the reason why only these species may be included in the genus *Neomyobia* Radf., 1948, while the other species which were previously included in this genus and which agree with *A. etheldredae* Perkins, 1925 in the structure of legs I and were found on the representatives of the family Vespertilionidae, must be transferred to the genus *Acanthophthirius* Perkins, 1925.

JAMESON (1955) added also the genus *Binuncus* Radf., 1954 to the genus *Neomyobia* Radf., 1948 as a synonym. The structure of legs I (Fig. 1A, 2A), the shape of dorsal setae, the structure of gnathosoma and vulva in female of the species *Myobia magna* Radf., 1934 and of *Myobia rollinati* Poppe, 1908, the type species of the genus *Neomyobia* Radf., 1948 are absolutely different (Fig. 6A, C). Likewise the asymmetry of legs I in nymphal stages of *M. magna* Radf., 1934 and the host specificity of this species to the flying foxes of the family Pteropidae demonstrate that this is the case of representatives of two quite different genera, and therefore JAMESON's synonymy of the genus *Binuncus* Radf., 1954 with the genus *Neomyobia* Radf., 1948 cannot be accepted.

CHARACTERISTICS OF GENERA KNOWN FROM BATS

Binuncus Radford, 1954

Binuncus Radford, 1954—Ann. Mus. Congo Tervuren, in —4°, Zool. 1: 242.
Type species: *Myobia magna* Radford, 1934—North West. Nat. 9: 46.

Body elongated, slender. Legs I consisting of four segments, without terminal claws (Fig. 1A). The basal segment of boat-like shape, broad, completely overlapping segment II ventrally; with slightly chitinized protrusion anteriorly, reaching the tip of gnathosoma. Segment II narrower than segment I or III, laterally with bilobular striated leaf-like formation, at the base of which there is a thickened thorn-like sensory seta. Segment III with a striated clasping tubercle curved in a spiral shape. Tarsus II with two subequal straight claws. Tarsus III and IV with two unequal straight claws. Dorsal setae slightly expanded and striated, not barbed. Ventral setae slightly expanded, not striated. The vulva plain, without vulvar valves or genital hooks (Fig. 6A). Genital opening of male at the level of coxa II. The penis very short, straight. Legs I in nymphal stages asymmetric, tarsus II with two claws, tarsus III and IV with one claw. Parasitic on flying foxes of the family Pteropidae.

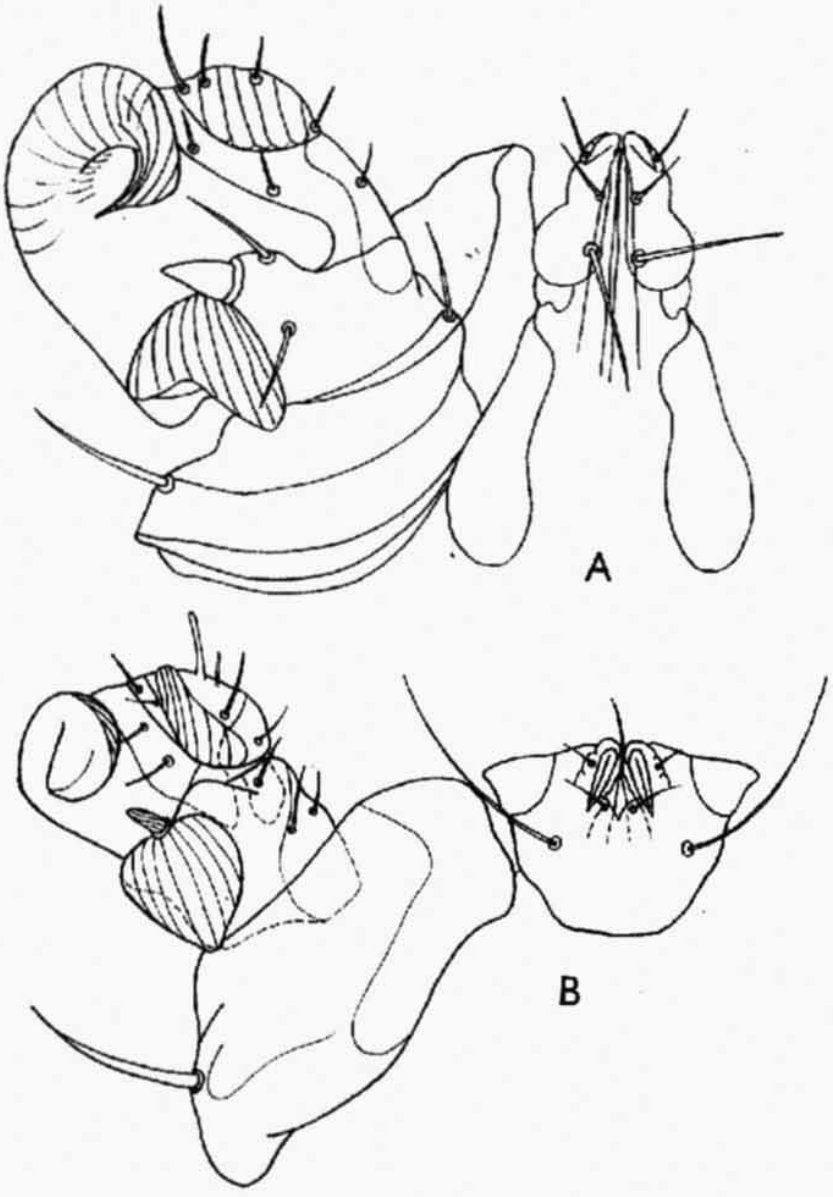

Fig. 1. Leg I and gnathosoma of females, ventral view. A — *Binuncus magnus* (Radf., 1934); B — *Calcarmyobia rhinolophia* (Radf., 1940).

Species included: *Myobia magna* Radf., 1934 from *Pteropus giganteus* Brunnich, Zoological Gardens, Belle Vue, Manchester, England; *Foliomyobia jamesoni* Hiregaudar et Bal, 1956 from *Rousettus leschenaulti* (Desm.), Kanheri Cave, Bombay, India.

Calcarmyobia Radford, 1948

Calcarmyobia Radford, 1948—Bull. Mus. Ntl. Hist. Nat., Paris 20, 5: 459; 1952—ibidem 24, 4: 371.

Type species: *Myobia rhinolophia* Radford, 1940—Parasitology 32, 1: 91 (= *Myobia miniopteris* Womersley, 1941—Rec. S. Austr. Mus. 7: 52).

Body stout, elongated. Legs I consisting of four segments, without terminal claws (Fig. 1B). Segment I nearly three times wider than segment II, with an anterior stout striated projection dorsally. Segment II narrower than segment III, ventrally with a broad leaf-like striated formation, near the anterior part of which a thickened finger-like sensory seta is developed. A small shell-like striated formation is developed dorsally. Segment III with a spiral-shaped clasping tubercle, which is not striated. Segment IV with a shell-like striated formation ventrally. Legs II with two strong curved equal claws, tarsus III and IV with two straight equal claws. Dorsal setae widely expanded and striated, not barbed. The vulva plain, without vulvar valves or genital hooks (Fig. 6B). The penis short, bent. Gnathosoma with anterolateral flap-like formations and stout palpal hooks. Nymphal formula of claws on tarsi II—IV is 2,1,1. Parasitic on bats of the family Vespertilionidae.

Species included: *Myobia rhinolophia* Radf., 1940 (= *M. miniopteris* Womersley, 1941) from *Rhinolophus lobaltus* Peters (= *R. landeri*, Martin), Kapretwa, Mt. Elgon, Kenya, also from *Miniopterus schreibersi blepotis* (Temminck) and *Chalinolobus gouldi* (Gray), found in South Australia (Womersley 1941—as *M. miniopteris* Womersley, 1941; Domrow 1958), from *Miniopterus natalensis* (A. Smith) [= *M. schreibersi natalensis* (A. Smith)] Transvaal, South Africa (Lavoipierre 1946—as *M. miniopteris* Womersley, 1941) and Natal (Lawrence 1951) and from *Miniopterus schreibersi schreibersi* (Kuhl), found in Czechoslovakia (Dusbábek 1963) and in Azerbaijan, USSR (Dubovchenko 1966).

Neomyobia Radford, 1948

Neomyobia Radford, 1948—Bull. Mus. Ntl. Hist. Nat., Paris 20, 5: 459; 1952—ibidem 24, 4: 374.

Type species: *Myobia rollinati* Poppe, 1908—in: Fahrenholz (1908), Abh. nat. Ver., Bremen, 19, 3: 363.

Body slender, elongated. Legs I consisting of four segments, with or without terminal claws (Fig. 2A). Segment II only slightly narrower than segment I and III, with a lateral projection, which is partly overlaid ventrally by a wide leaf-like striated formation; at its anterior margin there is a thickened finger-like sensory seta. The clasping tubercle on segment III is stout, straight, posteriorly directed. Tarsus II with two shorter straight equal claws, tarsus III and IV each with two straight long equal claws. Dorsal setae expanded and striated, not barbed. Lateral I always widely expanded and relatively short; in female they are situated on a level with submedian I. Some perigenital setae barbed. The vulva with two primitive vulvar valves, without genital hooks (Fig. 6C). The penis short, straight. Gnathosoma coneshaped, without lateral flap-like formations. Palpal hooks well developed. The nymphal formula of claws on tarsi II—IV is 2,1,1. Parasitic on bats of the family Rhinolophidae.

Species included: *Myobia rollinati* Poppe, 1908 from *Rhinolophus ferrumequinum* (Schreb.), Germany, Great Britain (Radford 1954) and Japan (Honshu, Kyoto Pref., Hanase, 3. 10. 1952 coll. Y. Shogaki and J. McClendon—Jameson, in litt.—new record) and from *Rhinolophus blassii* Peters from Bulgaria (Kolebinova 1967); *Myobia chiropteralis* Michael, 1884 from *Rhinolophus*

hipposideros (Bechst.), found in England and from the same host, found in Czechoslovakia (DUSBÁBEK 1963). The finding on *Pipistrellus pipistrellus* (Schreb.) recorded by MICHAEL (1884) must be regarded as accidental or unverified; *Myobia jacksoni* Radf., 1940 from an unidentified bat in Kenya; *Neomyobia africana* Lawrence, 1951 from *Rhinolophus geoffroyi zuluensis* K. Andersen (= *R. augur zuluensis* K. Andersen = *R. clivosus zuluensis* K. Andersen), Natal, South Africa, also known from *Rhinolophus capensis* Licht., found in Cape Town, South Africa (ZUMPT et al. 1961); *Neomyobia tulsi* Hiregaudar et Bal, 1956 (the nymph was described as female), from *Rhinolophus rouxi* (Temm.) Bombay, India; *Neomyobia africanoides* Kellmann, 1964 from *Rhinolophus blasii* Peters, Rooiberg, Transvaal, South Africa; *Neomyobia slovenica* Dusb., 1968 from *Rhinolophus euryale* Blas., Stará Domica, Czechoslovakia; *Calcarmyobia parenzani* Lombardini, 1956 from an unidentified bat from Italy.

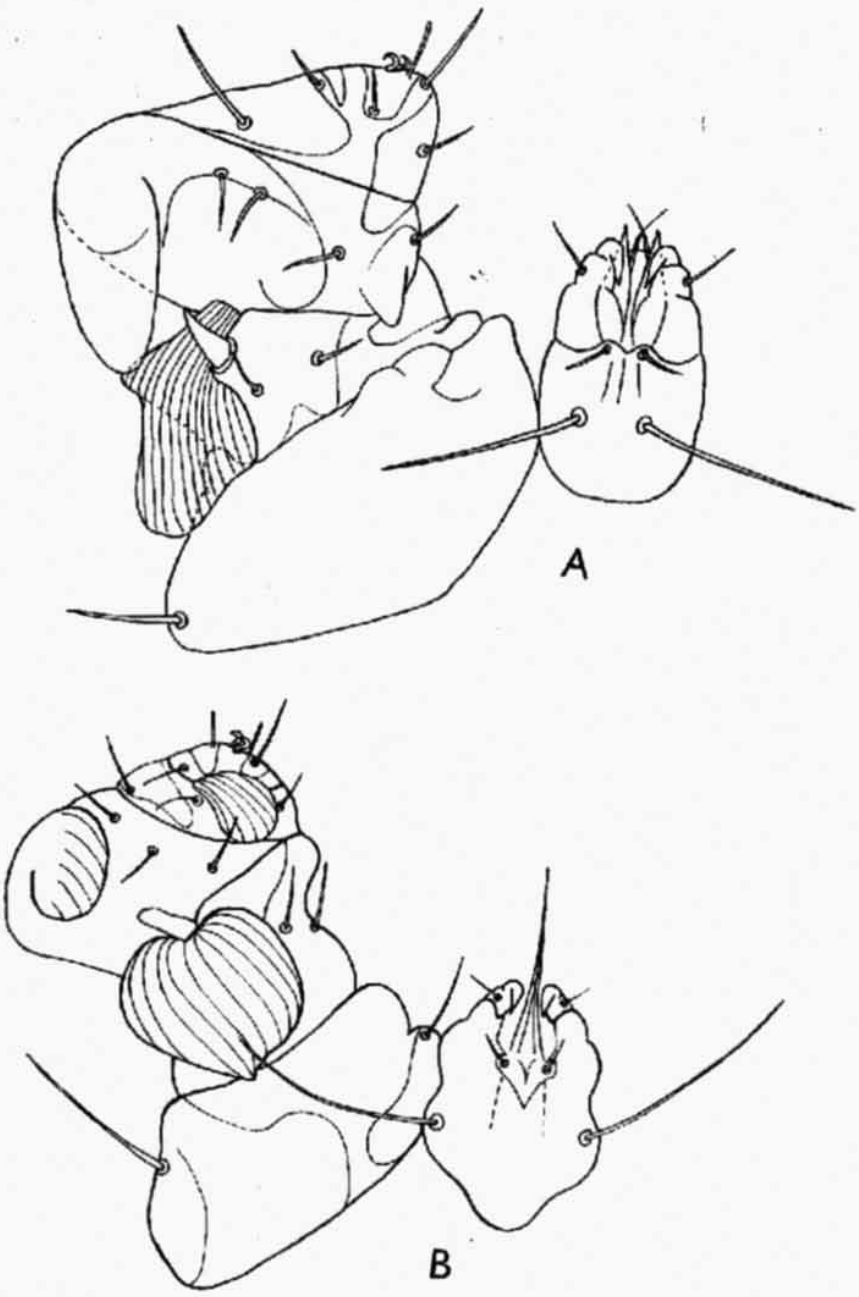

Fig. 2. Leg 1 and gnathosoma of females, ventral view. A — *Neomyobia rollinati* (Poppe, 1908) B — *Acanthophthirius etheldredae* Perkins, 1925.

Remarks: The genus consists of two morphologically different groups of species. The first group, including the species *N. rollinati*, *N. jacksoni*, *N. africana* and *N. africanoides* is characterized by the presence of four pairs of ventral needle-like setae in female and only one pair of expanded and striated submedian setae near the genital plate in male. The second group including the species *N. chiropteralis*, *N. tulsi*, *N. slovenica* and *N. parenzani* is characterized by the presence of only three pairs of ventral needle-like setae in female and by the presence of two pairs of expanded and striated submedian setae near the genital plate in male. The morphological differences among species within the groups are minimal and therefore some of them might be identical. In view of the fact that they have been found on different hosts, some of them cannot be synonymized at the moment.

Acanthophthirius Perkins, 1925

Acanthophthirius Perkins, 1925 — Ann. Mag. Nat. Hist. 9, 16: 175.

Type species: *Acanthophthirius etheldredae* Perkins, 1925 — Ann. Mag. Nat. Hist. 9, 16: 175.

Body elongated, slender. Legs I consisting of five segments, with two terminal claws (Fig. 2B). Segment II narrower than segment I or III, with a stout striated formation dorsally; at its anterior margin there is a finger-like thickened sensory seta. A small shell-like formation is situated ventrally. A similar shell-like formation is developed on the venter of segment IV. Segment III with a short, clasping tubercle coiled in the spiral shape. Legs II with two equal short bent claws, legs III and IV with two straight long subequal claws. Dorsal setae expanded and striated, not barbed. Submedian I smaller and situated lower than lateral I. The vulva with two vulvar valves, without genital hooks (Fig. 6D). The penis straight. Gnathosoma coneshaped, without lateral flap-like formations. Palpal hooks well developed. The nymphal formula of claws on tarsi II—IV is 2,1,1. Parasitic on bats of the family Vespertilionidae.

Species included: *Acanthophthirius etheldredae* Perkins, 1925 from *Pipistrellus pipistrellus* (Schreb.), Ely Cathedral, England and from the same host, found in Holland (VAN EYNDHOVEN 1950) and in Czechoslovakia [DUSBÁBEK 1963—as *Neomyobia poppei* (Trouess., 1895)]; *Myobia poppei* Trouess., 1895 from *Pipistrellus nathusii* (Keys. et Blasius), Marseilles, France and from the same host found in Hungary (RADFORD 1952); *Neomyobia luzonensis* Womersley, 1957 from an unidentified bat, Luzon, Philippines; *Neomyobia radfordi* Benoit, 1959 from *Pipistrellus nanus* (Peters), Kivu, Congo Belge; *Myobia plecotia* Radf., 1938 from *Plecotus auritus* L., England and from the same host found in Czechoslovakia (DUSBÁBEK 1963) and from *Pipistrellus pipistrellus* (Schreb.), England (RADFORD 1938); *Neomyobia bohemica* Dusbábek, 1963 (stat. n.) from *Plecotus* sp. [? *austriacus* (Fischer)] Czechoslovakia; *Myobia pantopus* Poppet et Trouess., 1895 from *Barbastella barbastellus* (Schreb.), France, and from the same host found in England (RADFORD 1952) and in Czechoslovakia (DUSBÁBEK 1963); *Neomyobia myoti* Dusbábek, 1963 from *Myotis myotis* (Borkh.) Czechoslovakia, from *Miniopterus schreibersi* (Kuhl), Hungary (BERON 1965) and from *Myotis blythi oxygnathus* (Montic.) Bulgaria (KOLEBINOVA 1967); *Neomyobia klapaleki* Dusbábek, 1963 from *Myotis myotis* (Borkh.), Czechoslovakia; *Neomyobia emarginata* Dusbábek, 1963 from *Myotis emarginatus* (Geoffr.), Czechoslovakia; *Foliomyobia mystacinalis* Radf., 1935 from *Myotis mystacinus* (Kuhl), England; *Myobia noctulia* Radf., 1938 from *Nyctalus noctula* (Schreb.), England; *Myobia capensis* de Meillon et Lavoipierre, 1944 from *Eptesicus capensis gracilior* Thomas et Schwan, Cape Province, South Africa (also DE MEILLON, LAVOIPIERRE 1945) and from *Pipistrellus nanus* (Peters), Pietermaritzburg, Natal, South Africa (ZUMPT et al. 1961); *Myobia clara* Womersley, 1941 from an unidentified bat, South Australia; *Myobia caudata* Banks, 1909 (= *M. canadensis* Banks, 1909) from "little brown bat", Ontario, Canada, also known from *Myotis lucifugus lucifugus* (Le Conte) and *Pipistrellus subflavus* (Cuvier), Maryland, USA (YUNKER 1958) and from *Eptesicus fuscus dutertreus* (Gervais), Cuba and Isla de Pinos (Cueva Colón, Mayajigua, Prov. Las Villas, 9. 6. 1965; Sierra Colombo, I. de Pinos, 24. 6. 1965; lgt. F. Dusbábek and J. de la Cruz—new records); *Neomyobia natalensis* Lawrence, 1951 from *Myotis tricolor* (Temm.), Pietermaritzburg, Natal, South Africa; *Radfordia unciger* Lawrence 1951 (nymph described as female) from *Scotophilus nigrita* (A. Smith), Pietermaritzburg, Natal, South Africa; *Neomyobia fortuitous* Radf., 1952 from *Scotophilus wroughtoni* Tomas, (= *S. temmincki wroughtoni* Thomas) Manipur State, India.

Remarks: Likewise in this genus there are groups of morphologically related species parasitic on systematically related hosts. The species *A. poppei*, *A. etheldredae*, *A. noctulius*, *A. radfordi* and *A. luzonensis* make up a distinct group. They are mainly characterized by the presence of a pair of enormously thickened ventral setae at the level of coxa IV and by the presence of stout thorns on legs II—IV in males; they parasitize various bat species belonging to the genera *Pipistrellus* and *Nyctalus*. *A. poppei* and *A. etheldredae* may be identical, but due to some small morphological differences, mainly in the shape and length of submedian III and IV in male, evident between the

material of *A. etheldredae* studied by me and RADFORD's (1952) description and drawing of *A. poppei* and also in findings on different host species, these two species cannot be synonymized as yet. A similar group is composed by the species *A. plecotius*, *A. bohemicus* (stat. n.) and *A. pantopus*, found on the genera *Plecotus* and *Barbastella* and characterized by the presence of long and stout ventral setae at the level of coxa III in males. In the group of species parasitic on the members of the genus *Myotis (A. myoti*, *A. klapaleki*, *A. mystacinalis*, *A. emarginatus*, *A. natalensis*, *A. caudatus)* no essential characteristic feature is noted except the harmony in the presence of 3 pairs of expanded and striated submedian setae in males, unless the similar dorsal chaetotaxy in females which also exists in species from various groups, is taken into consideration.

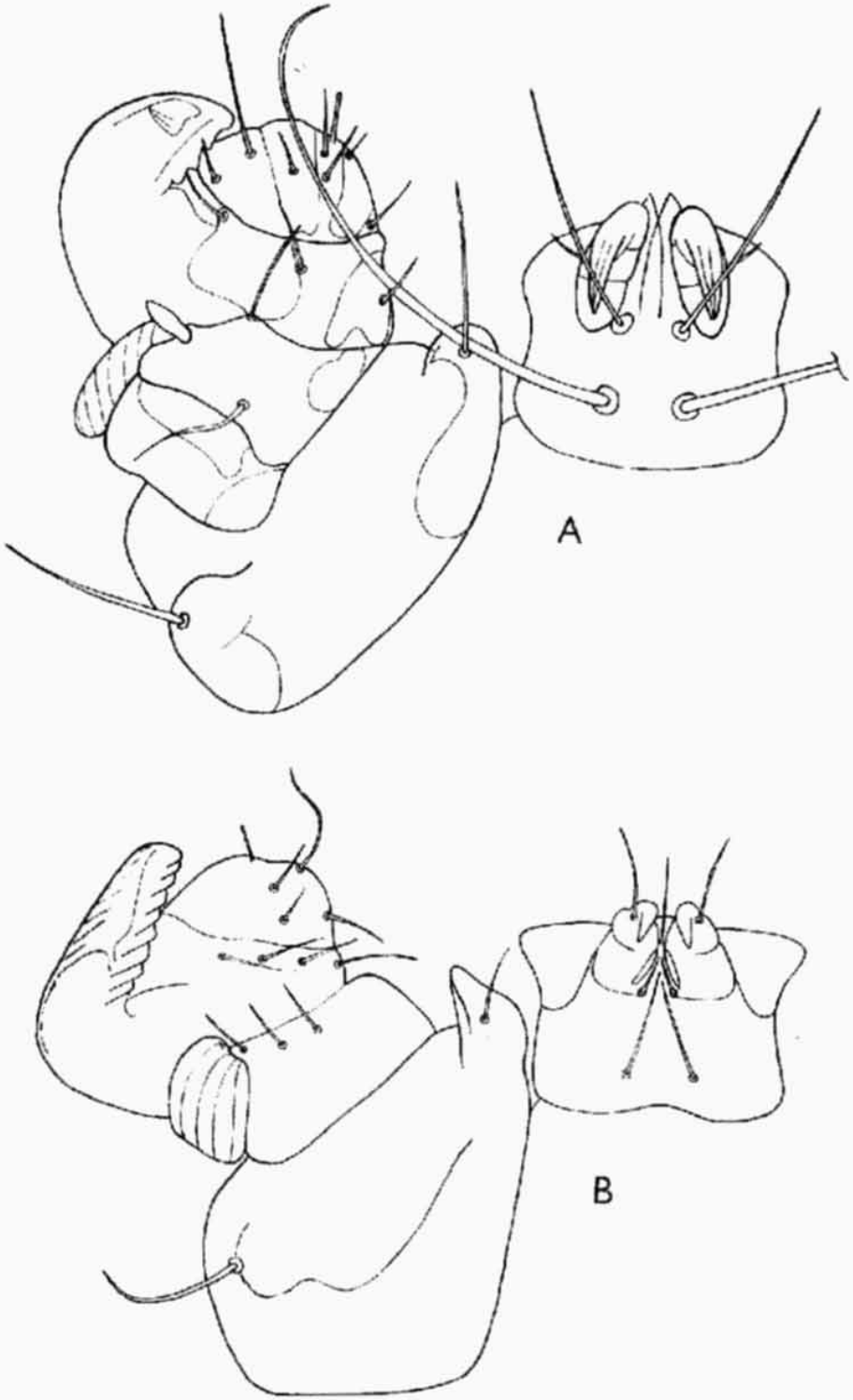

Fig. 3. Leg I and gnathosoma of females of the genus *Ewingana* Radf., 1948 (s. lat.), ventral view. A — *Ewingana (Doreyana) inaequalis* (Ewing, 1938); B — *Ewingana (Ewingana) bispinosa* Radf., 1948.

Ugandobia Dusbábek, 1968

Ugandobia Dusbábek, 1968—Folia parasit. (Praha) 15: 361.
Type species: *Foliomyobia barnleyi* Radford, 1951—Parasitology 41: 101.

Detailed characteristics of the genus are given in the paper by DUSBÁBEK (1968b).

Species included: *Foliomyobia barnleyi* Radf., 1951 from an unidentified bat. Uganda, also known from *Taphozous longimanus* Hardwicke, Bombay, India (HIREGAUDAR, BAL 1956).

Jamesonia Dusbábek, 1967

Jamesonia Dusbábek, 1967 — Folia parasit. (Praha) 14: 247.
Type species: *Jamesonia danieli* Dusbábek, 1967—Folia parasit. (Praha) 14: 248.

Body short, stout. Legs I consisting of four segments, without terminal claws (Fig. 5A). Segment II distinctly narrower than segment I or III, with lateral striated tubercle which is fusing with the wide shell-like formation ventrally.

Segment III laterally with a stout comb-like anteriorly directed hooklike clasping tubercle. Segment IV with a small shell-like formation ventrally. Tarsus II—IV each with one long straight claw. Lateral I always expanded and striated, lateral II and III slender or expanded, frequently with a blunt tip or bifurcated at point. Some submedian setae barbed or with lateral bulbous protrusion. Vulva with two vulvar valves, without genital hooks (Fig. 6E). Penis short, straight. Gnathosoma in the shape of a rectangle or a cone, mostly without lateral

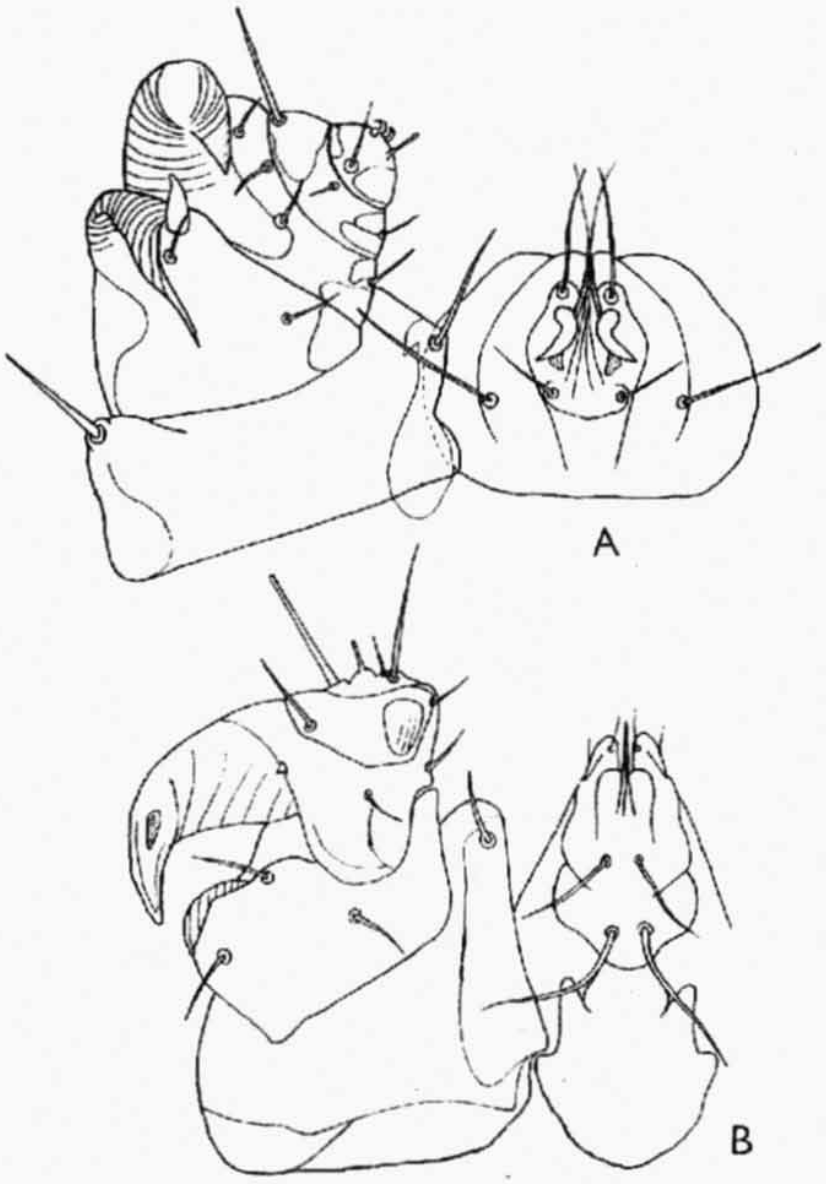

Fig. 4. Leg 1 and gnathosoma of females, ventral view. A — *Pteracarus chalinolobus* (Womersley, 1941); B — *Hipposiderobia heteronycha* (Berl. et Trouess., 1889).

flap-like formations. Palpal hooks well developed, very fine. Nymphal stages unknown. Parasitic on bats of the family Phyllostomatidae and Chilonycteridae.

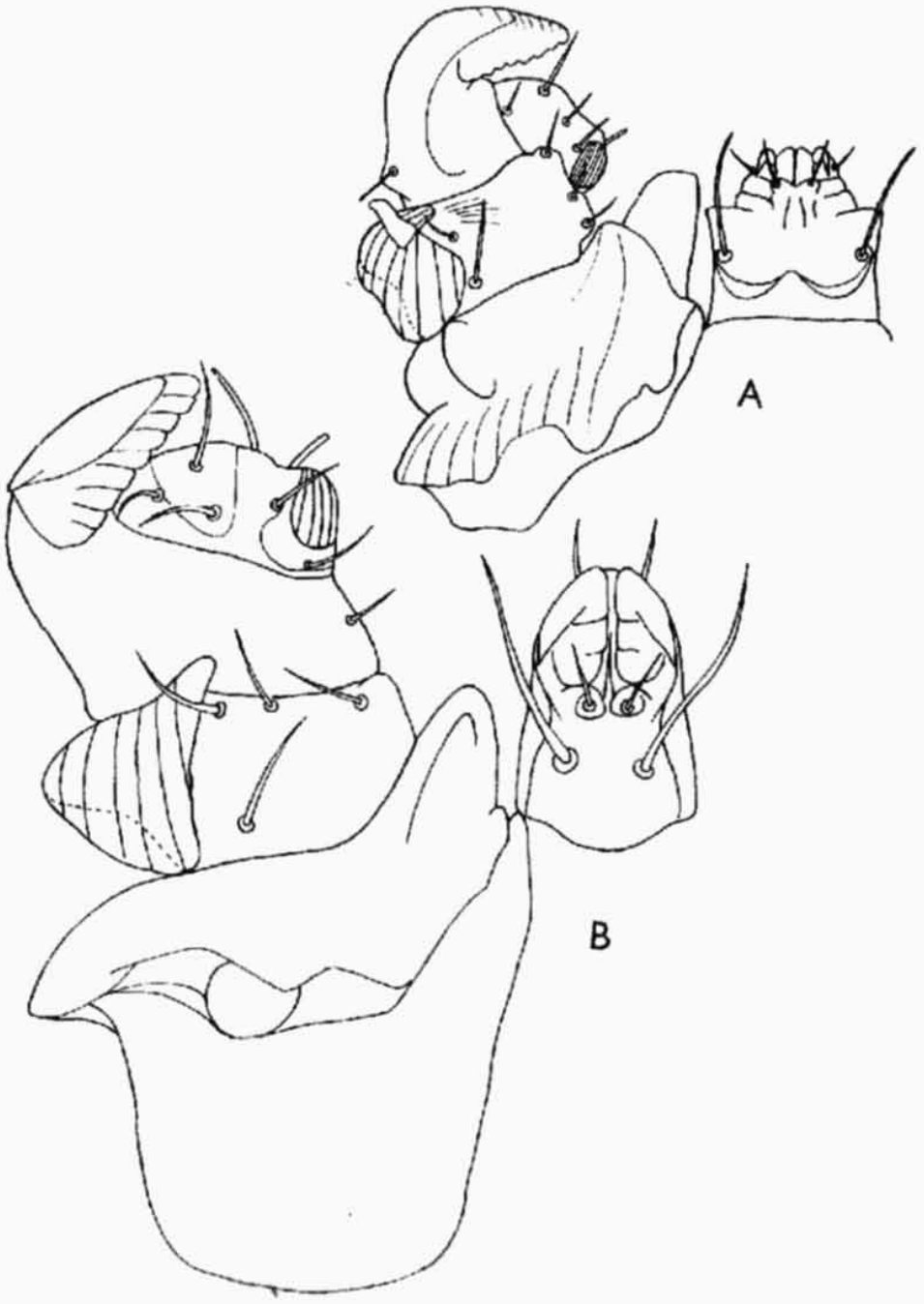

Fig. 5. Leg I and gnathosoma of females, ventral view. A – *Jamesonia danieli* Dusbábek, 1967; B – *Ugandobia barnleyi* (Radf., 1951).

Species included: *Jamesonia danieli* Dusbábek, 1967 from *Phyllonycteris poeyi* Gundlach and *Erophylla sezekorni sezekorni* (Gundlach). Cuba; *Jamesonia cernyi* Dusbábek, 1967 from *Brachyphylla nana nana* Miller, Cuba; *Jamesonia samsinaki* Dusbábek, 1967 from *Macrotus waterhousei minor* Gundlach, Isla de Pinos; *Jamesonia rosickyi* Dusbábek, 1967 from *Monophyllus cubanus cubanus* Miller, Cuba; *Jamesonia saguei* Dusbábek, 1967 from *Chilonycteris macleayi macleayi* Gray and *Ch. fuliginosa torrei* Gray, Cuba; *Jamesonia jimenezi* Dusbábek, 1967 from *Chilonycteris parnelli boothi* Gundlach, Cuba and *Jamesonia viguerasi* Dusbábek, 1967 from *Artibeus jamaicensis parvipes* Rehn, Isla de Pinos and Cuba.

Remarks: Groups of morphologically closely related species do not occur in this genus, but there are certain similarities in the species *J. saguei* and *J. jimenezi* which parasitize different species of the genus *Chilonycteris*.

Ewingana Radford, 1948 (s. lat.)

Ewingana Radford, 1948 – Bull. Mus. Ntl. Hist. Nat., Paris 20: 459; 1952 – ibidem 24: 545.
Type species: *Ewingana bispinosa* Radford, 1948 – Bull. Mus. Ntl. Hist. Nat., Paris 20: 459; described by Radford, 1952 – ibidem 24: 545.

Legs I consisting of four segments, without terminal claws (Fig. 3A, B). Segment II narrower than segment I or III, with a lateral shell-like striated formation with or without the thickened finger-like sensory seta. Segment III with forward directed dentate hook-like clasping tubercle. Segment IV without shell-like formation. Tarsus II—IV with one long straight claw and one claw which is either slightly, considerably or completely reduced. The degree of reduction of the second claw varies from an imperceptible modification or complete reduction on tarsi III and IV to its disappearance on tarsus II. Tarsal formula of claws therefore may be 2,2,2; 2,1,1 or 1,1,1. When the formula is 2,2,2 both claws are never equivalent. Dorsal setae expanded and striated, barbed or not barbed. Submedian I subequal with lateral I, situated at a level with them. Vulva without vulvar valves, with a pair of stout genital hooks (Fig. 7D, E). Penis short, straight. Gnathosoma of rectangular shape. Palpal hooks stout. Nymphal formula of claws on tarsi II—IV: 1,1,1. Parasitic on bats of the family Molossidae. The genus is subdivided into two subgenera: *Ewingana* Radf., 1948 (s. str.) and *Doreyana* Dusbábek, 1968.

Subgenus *Ewingana* Radf., 1948 (s. str.)

Ewingana Radford, 1948 – Bull. Mus. Ntl. Hist. Nat., Paris 20: 459; 1952 – ibidem 24: 545.
Type species: *Ewingana bispinosa* Radf., 1948 – Bull. Mus. Ntl. Hist. Nat., Paris 20: 459; described by Radford, 1952 – ibidem 24: 545.

The characteristics of the subgenus are given in the paper by DUSBÁBEK (1968b).

Species included: *Ewingana bispinosa* Radf., 1948 from *Nyctinomus cisturus* Thomas [according to LAWRENCE (in: ZUMPT et al. 1961), apparently *Tadarida limbata cristata* (J. Allen)] from Uganda; *Neomyobia lavoipierrei* Paran, 1966 from *Tadarida johorensis* (Dobson), Malaya; *Ewingana yaguajayensis* Dusbábek, 1968 from *Tadarida laticaudata yucatanica* (Miller), Cuba; *Ewingana molossi* Dusbábek, 1968 from *Molossus major tropidorhynchus* Gray, Cuba.

Subgenus *Doreyana* Dusbábek, 1968

Doreyana Dusbábek, 1968 – Folia parasit. (Praha) 15: 365.
Type species: *Radfordia inaequalis* Ewing, 1938 – Proc. Entomol. Soc. Wash. 40: 189.

Characteristics of the subgenus are given in the paper by DUSBÁBEK (1968b).

Species included: *Radfordia inaequalis* Ewing, 1938 from *Tadarida cynocephala* (Le Conte) [= *Tadarida brasiliensis cynocephala* (Le Conte)], Florida and from *Tadarida brasiliensis muscula* (Gundlach), Cuba (Cueva del Circulo, Cairije, Sierra Cubitas, Prov. Camagüey, 26. 10. 1965, lgt.

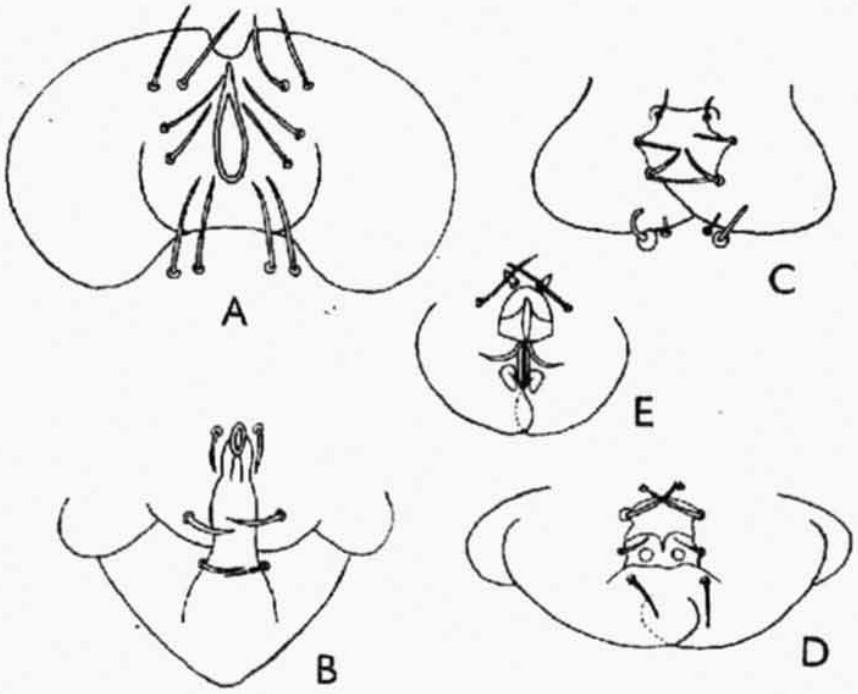

Fig. 6. Vulva of female. A—*Binuncus magnus* (Radf., 1934); B—*Calcarmyobia rhinolophia* (Radf., 1940); C—*Neomyobia rollinati* (Poppe, 1908); D—*Acanthophthirius etheldredae* Perkins, 1925; E—*Jamesonia danieli* Dusbábek, 1967.

F. Dusbábek and J. de la Cruz—new record); *Ewingana (Doreyana) doreyae* Dusb., 1968 from *Tadarida macrotis* (Gray), Cuba; *Ewingana (Doreyana) isabellae* Dusb., 1968 from *Tadarida minuta* (Miller) from Cuba; *Myobia longa* Ewing, 1938 from *Tadarida mexicana* (Saussure) [= *Tadarida brasiliensis mexicana* (Saussure)], California, U.S.A. and from *Tadarida brasiliensi* ssp., Cuba (Cueva del Circulo, Cairije, Sierra Cubitas, Prov. Camagüey, 26. 10. 1965, lgt. F. Dusbábek and J. de la Cruz—new record) and Texas, U.S.A. (D. K. Jameson 1959).

Pteracarus Jameson et Chow, 1952

Pteracarus Jameson et Chow, 1952—J. Parasit. 38: 1.
Type species: *Myobia chalinolobus* Womersley, 1941—Rec. South Austr. Mus. 6: 55.

Body short, stout. Legs I consisting of five segments, with a pair of terminal claws (Fig. 4A). Segment II narrower than segment I, but approximately as wide as segment III, with anterolateral, sharply pointed striated tubercle turning towards venter of body; ventrally near it there is a finger-like thickened sensory seta. Segment III with a sharply pointed striated clasping tubercle turning towards venter of body. Segment IV and V plain. Tarsus II—IV each with two equally short curved claws. Dorsal setae setiform, barbed. Submedian setae rudimental. Between coxa II and III a transverse row of three pairs of ventral setae. The vulva plain, without vulvar valves or genital hooks (Fig. 7A). Penis bent in S-form. Gnathosoma rounded, palpal hooks well-developed. Nymphal formula of claws on tarsi II—IV: 2,1,1. Parasitic on bats of the family Vespertilionidae.

Species included: *Myobia chalinolobus* Womersley, 1941 from *Chalinolobus gouldi* (Gray), South Australia, also known from *Myotis volans* (H. Allen), *M. thysanodes* Miller and *Eptisicus fuscus* (Beauvois), California, U.S.A. (JAMESON, CHOW 1952), from *Corynorhynus (= Plecotus) rafinesqui* Lesson), Nevada, U.S.A. (JAMESON, CHOW 1952), Texas, U.S.A. (GEORGE, STRANDTMANN 1960),

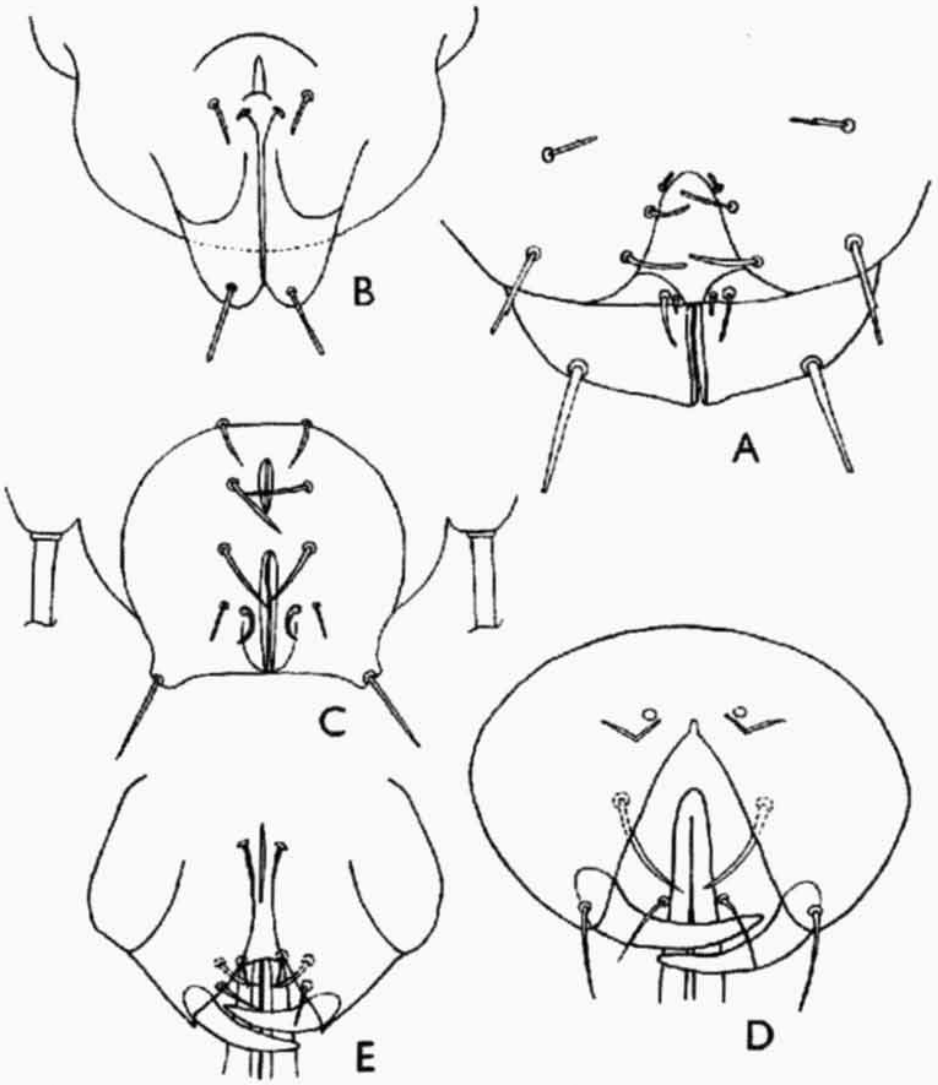

Fig. 7. Vulva of female. A—*Pteracarus chalinolobus* (Womerley, 1941); B—*Hipposiderobia heteronycha* (Berl. et Trouess., 1889); C—*Ugandobia barnleyi* (Radf., 1951); D—*Ewingana* (*Ewingana*) *bispinosa* Radf., 1948; E—*Ewingana* (*Doreyana*) *inaequalis* (Ewing, 1938).

also from *Myotis myotis* (Borkh.), *M. daubentoni* (Kuhl) and *M. emarginatus* (Geoffr.), Czechoslovakia (DUSBÁBEK 1963); *Pteracarus tenax* Jameson et Chow, 1952 from unidentified bat, Taiwan (Formosa); *Pteracarus submedianus* Dusbábek, 1963 from *Plecotus auritus* (L.) and *Myotis myotis* (Borkh.), Czechoslovakia; *Myobia pipistrellia* Radf., 1938 from *Pipistrellus pipistrellus* (Schreb.), England; *Mybia minuta* Radf., 1940 from unidentified bat, Kapretwa, Kenya and from *Scotophilus nigrita* (A. Smith), Kivu, Congo Belge (BENOIT 1959); *Neomyobia pusillus* Lawrence, 1951 from *Scotophilus nigrita* (A. Smith), Pietermaritzburg, Natal, South Africa.

Hipposiderobia Dusbábek, 1968

Hipposiderobia Dusbábek, 1968 — Folia parasit. (Praha) 15: 359.
Type species: *Myobia heteronycha* Berlese et Trouessart, 1889—Bull. Bibl. Sci. l'Oest 9: 141.

Characteristics of the genus are given in detail in the paper by DUSBÁBEK (1968b).

Species included: *Myobia heteronycha* Berlese et Troness., 1889 from *Asellia tridens* Geoffr., Egypt; *Radfordia ceylonica* Radf., 1951 from *Hipposideros brachyatus* Dobson (= *H. galeritus brachyotus*), Ceylon.

Another three species have been described from bats, but they cannot be placed in the genera included in the survey. The placement of the species *Radfordia fioridensis* Ewing, 1938, described from *Tadarida brasiliensis cynocephala* (Le Conte), Florida, U.S.A., in the genus *Radfordia* was regarded to be correct after the revision of this genus (Howell, Elzinga 1962). This has been also confirmed by my studies of the holotype of this species, kindly loaned to me by Dr. R. E. Crabill and Dr. R. L. Smiley from the collections of the U.S. National Museum. As the representatives of the genus *Radfordia* are specific ectoparasites of rodents, the host *Tadarida brasiliensis cynocephala* (Le Conte) given by Ewing (1938) must be considered as accidental. Similar situation must be also anticipated in the case of the species *Radfordia sicula* Willmann, 1955 which was found by Willmann (1955) only as single specimen on *Myotis myotis* (Borkh.) in Sicily, and whose affinity to the genus *Radfordia* cannot be doubted.

The description of the species *Myobia minima* Womersley, 1941, found on *Chalinolobus gouldi* (Gray) in South Australia, is based on the deutonymph incerti generis (Radford 1954).

KEY TO THE GENERA OF THE FAMILY MYOBIIDAE PARASITIC ON BATS

1. Clasping tubercle on third segment of legs I directed backwards 2
— Clasping tubercle on third segment of legs I directed forwards, straight or coiled in spiral shape towards venter 3
2. Legs I consisting of four segments, frequently with two terminal claws. Lateral projection on the second segment of legs I overlaid ventrally by a broad striated formation, at the base of which a thickened sensory seta is developed. Tarsus II—IV with two straight claws, without adhesive transparent appendix. Parasitic on bats of the family Rhinolophidae . . . . . *Neomyobia*
— Legs I consisting of five segments, without terminal claws. Segment IV dorsally overlaid by segment III, segment V rudimental. Lateral projection on second segment of legs I rudimental, the thickened sensory seta is missing. On the dorsal side of same segment there is a two-fold striated formation with a furrow in centre, similar to that in the genus *Myobia* or *Radfordia*. Tarsus II—IV with two strongly curved claws, with well-defined adhesive transparent appendices. Parasitic on bats of the family Hipposideridae . . . . . *Hipposiderobia*
3. Legs I consisting of five segments, with two terminal claws. Tarsus II—IV each with two claws 4
— Legs I consisting of four segments without terminal claws. Tarsal formula of claws is 2,2,2; 2,1,1 or 1,1,1 5
4. Body slender, elongated, dorsal setae expanded and striated, not barbed. Vulva with a pair of vulvar valves. The hooklike clasping tubercle on the third segment of legs I coiled in a spiral shape and with a blunt end. Parasitic on bats of the family Vespertilionidae . . . . . *Acanthophthirius*
— Body short, stout, dorsal setae setiform, not barbed. Vulva without vulvar valves. The hook-like clasping tubercle on the third segment of legs I bent ventrally, pointed, but not coiled in a spiral form. Parasitic on bats of the family Vespertilionidae . . . . . *Pteracarus*

5. Clasping tubercle on the third segment of legs I coiled in a spiral shape. Tarsus II—IV with two equal claws 6
— Clasping tubercle on the third segment of legs I comb-like, straight, directed forwards. The second claw on tarsi III and IV partly or completely reduced 7
6. Dorsal setae in proximal part enormously expanded and striated, posteriorly tapering to a whip-like projection. Gnathosoma with antero-lateral flap-like formations. First segment of legs I dorsally with a peg-like projection. Legs I of nymphal stages symmetric. Parasitic on bats of the subfamily Miniopterinae . . . . . *Calcarmyobia*
— Dorsal setae slightly expanded, striated, equally tapering backwards. Gnathosoma of conical shape, without anterolateral flap-like formations. The first segment of legs I of boat-like shape, without dorsal peg-like projection. Legs I of nymphal stages asymmetrical. Parasitic on bats of the family Pteropidae . . . . . *Binuncus*
7. Vulva of female with a pair of strong genital hooks. Submedian I in female expanded and striated, situated at the level of lateral I. The fourth segment of legs I without ventral striated formation. Parasitic on bats of the family Molossidae . . . . . *Ewingana* (s. lato) . . . 8
— Vulva of female without genital hooks. Submedian I in female rudimental. The fourth segment of legs I in female with a shell-like formation ventrally . . . 9
8. Dorsal setae barbed. Ventral and gnathosomal setae extremely long. Tarsus II—IV with one long and one partly or totally reduced claw . . sg. *Doreyana*
— Dorsal setae not barbed. Ventral and gnathosomal setae normal. Tarsus II with one long and one short claw, tarsus III and IV with one claw only . . . . . sg. *Ewingana* (s. str.)
9. Body short, stout. Many dorsal setae setiform. Vulva with two vulvar valves. Tarsus II—IV each with one straight claw. Parasitic on bats of the family Phyllostomatidae and Chilonycteridae . . . . . *Jamesonia*
— Body slender, elongated. All dorsal setae expanded and striated. Vulva without vulvar valves. Tarsus II with two claws, tarsus III and IV each with one claw. Parasitic on bats of the family Emballonuridae . . . . . *Ugandobia*

Acknowledgement. I am grateful to Dr. E. W. Jameson (University of California, Davis), Dr. G. O. Evans and Dr. K. H. Hyatt [British Museum (Natural History), London], Dr. C. D. Radford (Manchester), Dr. C. E. Yunker (Rocky Mountain Laboratory, Hamilton), Dr. D. E. Johnston (Institute of Acarology, Wooster), Dr. R. E. Crabill Jr. and Dr. R. L. Smiley (U.S. National Museum, Washington) and Dr. E. W. Baker (U.S. Department of Agriculture, Washington), who kindly loaned or arranged the loan of type specimens or other comparative material.

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Received 17 October 1967.

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