

A Classification of the Orchesellinae with a Key to the Tribes, Genera and Subgenera (Collembola: Entomobryidae)¹

JOSÉ A. MARI MUTT

Department of Biology, University of Puerto Rico, Mayagüez, Puerto Rico 00708

ABSTRACT

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A formal classification of the subfamily Orchesellinae is presented for the first time. The tribe Orchesellini houses *Orchesella*, *Neorchesella*, *Pseudodicranocentrus* and *Dicranocentrus*. The tribe Corynotrichini includes *Corynotrix* and *Orchesellides*. The new tribe HETEROMURINI houses *Heteromurus* and *Indoscopus*, and the new tribe MASTIGOCERINI is erected for *Mastigoceras*. Complete synonymy is presented for all the genera and references to literature discussing their taxonomic status is included. The taxonomic status of *Verhoeffiella*, *Typhlopodura* and *Heteromurodes* is discussed. The former is regarded as a subgenus of *Heteromurus* and the latter two are treated as synonyms of that same genus. It is concluded that the presence or absence of antennal annulations is not a character of generic importance in this subfamily. A key to the tribes, genera and subgenera of the Orchesellinae is included.

For the last five years I have been studying the taxonomy of the Orchesellinae. Several papers describing and revising taxa of all levels from subspecies to tribe have been published or are in press (see references cited). This paper integrates the most important results obtained so far through the presentation of a formal classification and a key to the tribes, genera and subgenera.

The tribe (now subfamily) Orchesellini was erected by Börner (1906) for springtails with the first or first and second antennal segments subdivided (resulting in 5- or 6-segment antennae). The following genera agreed with his diagnosis: *Orchesella* Templeton 1835, *Heteromurus* Wankel 1860 (with subgenera *Alloscopus* Börner 1906 and *Verhoeffiella* Absolon 1900a) and *Dicranocentrus* Schött 1893. Börner (1913) added *Heteromuricus* Imms 1912, a taxon for which Imms had created the subfamily Heteromuricinae.

The next listing of orcheselline genera was provided, in the form of a key, by Womersley (1939): *Orchesella* Templeton 1835, *Heteromurus* Wankel 1860 (with subgenus *Verhoeffiella* Absolon 1900a), *Dicranocentrus* Schött 1893, *Strongylonotus* MacGillivray 1894, *Typhlopodura* Absolon 1900a, *Alloscopus* Börner 1906, *Heteromuricus* Imms 1912 and *Mastigoceras* Handschin 1924. The last genus, and *Typhlopodura*, were included although their descriptions stated that the antennae were 4-segmented. It seems that, for Womersley, the relative length of Abd. 3 and Abd. 4 was more important in defining the tribe than the subsegmentation of the basal antennal segments as proposed by Börner.

The next and most complete list of orcheselline genera was presented, also in key form, by Salmon (1951) and included: *Orchesella* Templeton 1835, *Heteromurus* Wankel 1860 (as *Ptenura*), *Dicranocentrus* Schött 1893, *Strongylonotus* MacGillivray 1894, *Typhlopodura* Absolon 1900a, *Verhoeffiella* Absolon 1900a, *Heteromurodes* Absolon 1901, *Alloscopus* Börner 1906, *Heteromuricus* Imms 1912, *Mastigoceras* Handschin 1924 and *Orchesellides* Bonet 1930.

My studies have modified this list substantially, *Strongylonotus* and *Heteromuricus* are considered synonyms of *Lepidocyrtus* Bourlet (Entomobryinae) and *Dicranocentrus* (Mari Mutt 1980a), respectively. *Alloscopus* is regarded as a subgenus of *Heteromurus* (Mari Mutt 1978a). The following genera have been added to the list: *Dicranorchesella* Mari Mutt (1977), *Neorchesella* Mari Mutt (1980b), *Pseudodicranocentrus* Mari Mutt (1980c) and *Corynotrix* Tullberg 1876 (Mari Mutt 1980d). Prabhoo (1971) added the genus *Indoscopus*.

The taxonomic status of three other names in Salmon's list is discussed below. No discussion is presented for other names, either because their status has already been settled (see references in the classification) or because it has never been challenged.

Verhoeffiella Absolon 1900a

This taxon was proposed as a subgenus of *Heteromurus* for *H. (Verhoeffiella) cavicola*, a Yugoslavian cave species. Subsequent authors treated *Verhoeffiella* as a subgenus until Denis (1935:330) used the binomen *Verhoeffiella cavicola*. Gisin (1944, 1960) and Loksa & Bogojevic (1967) considered *Verhoeffiella* a subgenus. Salmon (1951, 1964) Prabhoo (1971), Thibaud & Massoud (1973) and Massoud & Thibaud (1973) treated *Verhoeffiella* as a generic name.

The status of this taxon rests on the emphasis placed on the annulated Ant. 4 and Ant. 5 of *Verhoeffiella* vs. only of Ant. 5 of *Heteromurus*. Almost all opinions have been based on the literature since four of the five species in this subgenus have not been collected since their description, the extant material is unavailable, and the types of *cavicola* seem to be lost.

My opinion on the taxonomic importance of antennal annulations is detailed under the discussion of *Heteromurodes*. My decision to consider *Verhoeffiella* as a subgenus of *Heteromurus* is based on the macrochaetotaxy of *H. (V.) medius* Loksa & Bogojevic 1967. Body chaetotaxy of this species is identical to that of *H. (Heteromurus) nitidus* while head chaetotaxy is somewhat different; *medius* possesses seta S_0 , and groups A and M are different. Loksa & Bogojevic (op. cit.) do not

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figure the antennae but state (p. 145): "Die beiden letzten Antennenglieder geringelt".

A final decision about the status of *Verhoeffiella* awaits the study of types and fresh specimens of as many species as possible. The head and body chaetotaxy should be studied and the chaetotaxy of *medius* confirmed for various specimens. The degree to which Ant. 4 and Ant. 5 are annulated should be carefully noted; it may be significant if they are as conspicuously annulated as figured by Absolon (1900a: 429, 430).

Typhlopodura Absolon 1900a

This genus was proposed for *T. longicornis*, a Yugoslavian cave species, and differed from *Heteromurus* by the 4-segmented antennae which are longer than the head and body combined, and by the conspicuously annulated Ant. 4 (see Absolon 1900a: 429, Fig. 1)

Kseneman (1937), working with additional specimens, noted that what Absolon had called Ant. 1 was a basal subdivision of that segment and that Ant. 4 was Ant. 4 and Ant. 5 combined (Absolon's figure (loc. cit.) supports this opinion). Kseneman (op. cit.) used *Verhoeffiella longicornis*. Gisin (1944, 1960) used *Heteromurus* (*Verhoeffiella longicornis*). Thibaud & Massoud (1973) and Massoud & Thibaud (1973) excluded *Typhlopodura* from their list of European cave genera.

Salmon (1951, 1964) considered *Typhlopodura* a good generic name. In his "Index to the Collembola" (1964: 132) the author states: "Gisin (1960) places this subgenus as a synonym of *Ptenura*" (*Heteromurus*) "but after studying the relevant literature I can not accept this. Handschin's" (should read Absolon's) "figure is quite definite in illustrating the unusual form of the antennae which distinguishes it from *Ptenura*".

The only difference between *Typhlopodura* and *Heteromurus* seems to be the length of the antennae and *Typhlopodura* is herein considered, following Kseneman as first reviser, a synonym of *Heteromurus*.

Heteromurodes Absolon 1901

This taxon was proposed as a subgenus of *Heteromurus* for the Californian *Templetonia quadrioculata* Schött 1896 (called *Heteromurus 4 ocellatus* by Absolon). *Heteromurodes* was separated from the other subgenera by the absence of antennal annulations (Ant. 5 annulated in *Heteromurus* s. str., Ant. 4 and Ant. 5 not so constructed in *Verhoeffiella*).

Dr. Kenneth A. Christiansen, Grinnell College, Iowa, has kindly forwarded seven specimens of a *Heteromurus* from near St. Helena, Cal., a locality about 55 km from Berkeley, the type locality of Schött's species. The specimens were received cleared and stained, and since the number of eyes cannot be discerned, it is impossible to determine if they belong to Schött's species. They are definitely not *H. nitidus* (for many a senior synonym of *T. quadrioculata*) as they differ from that species in many ways (e.g., labral papillae of type II, base of labium with ciliated setae, tibiotarsi without smooth setae). These specimens are important, however, because Ant. 5 is clearly not annulated. Most of the setae on this segment are, however, arranged in whorls as in conspicuously annulated antennae and at low magnifications the antennae appear to be so constructed. Head and body

macrochaetotaxy of these specimens is identical to the pattern shared by all *Heteromurus* s. str. This finding supports the opinion that presence or absence of antennal annulations is not a character of generic importance. *Heteromurodes* is treated herein as a synonym of *Heteromurus*.

Classification of the Orchesellinae²

- Family Entomobryidae Tomosvary 1882 (about 1400)
- Subfamily Orchesellinae Börner 1906:162 (as a tribe) (about 155)
- =Heteromuricinae Imms 1912: 91
- Tribe Orchesellini Börner 1906: 162 (about 119)
- Genus *Orchesella* Templeton 1835: 92 (about 85). ICZN (1954).
- Heterotoma* Bourlet 1839: 392
- Aetheocerus* Bourlet 1842: 40
- Genus *Neorchesella* Mari Mutt 1980b (1)
- Genus *Dicranorchesella* Mari Mutt 1977: 377 (2)
- Genus *Dicranocentrus* Schött 1893: 21 (39) Mari Mutt (1979b).
- Dicranocentrella* Wray 1953: 140. Salmon (1964) Mari Mutt (1976).
- Tribe Corynotrichini Mari Mutt 1980d (7)
- Genus *Corynothrix* Tullberg 1876: 33 (1). Yosii (1942, 1966), Martynova (1970), Mari Mutt (1980d).
- Genus *Orchesellides* Bonet 1930: 251 (6). Yosii (1942, 1966), Martynova (1970), Mari Mutt (1980d).
- =*Orchezelandia* Salmon 1937: 356. Bonet (1942), Salmon 1964).
- Tribe Heteromurini NEW (29)
- Genus *Heteromurus* Wankel 1860: 203 (26)
- =*Ptenura* Templeton 1842: 206. Bellinger & Ellis (1972), ICZN (1976).
- Templetonia* Lubbock 1862: 595. Absolon (1900b)
- Heteromuroder* Absolon 1901: 12.
- Euheteromurus* Börner 1901. Proposed for *Heteromurus* s. str.
- Propemesira* Salmon 1942:59. Salmon (1945).
- Typhlopodura* Absolon 1900a: 428. Kseneman (1937).
- Subgenus *Heteromurus* s. str. (7)
- Subgenus *Verhoeffiella* Absolon 1900a: 429 (5)
- Subgenus *Alloscopus* Börner 1906: 177 (2). Mari Mutt (1978a).
- Subgenus *Heteromurtrella* Mari Mutt 1979a: 214 (12)
- Genus *Indoscopus* Prabho 1971: 33 (3)
- Tribe Mastigocerini NEW (1)
- Genus *Mastigoceras* Handschin 1924: 22 (1). Mari Mutt (1978), Szeptycki (1979).

Diagnoses and Remarks.

The subfamily Orchesellinae (=Heteromuricinae Imms 1912) is differentiated from the other subfamilies (Entomobryinae, Paronellinae, Cyphoderinae, Microfalcu-

² The numbers in parentheses correspond to the approximate or exact number of species in each taxon. References following this figure refer to papers in which the status of that taxon is discussed.

linae-some of these are treated as families by various authors) by the relative length of the third and fourth abdominal segments (Abd. 4 not over 1.5x length of Abd. 3) and the structure of the mucro (2 teeth and a basal spine). All species, except *Corynothrix borealis*, also exhibit a subsegmented Ant. 1.

The tribe Orchesellini houses species with 6-segmented antennae. *Orchesella*, *Neorchesella* and *Dicranorchesella* are very closely related as evidenced by the abundant (polychaetotic) macro- and microchaetotaxy and by, at least for *Orchesella* and *Dicranorchesella*, the presence of a complex manubrial organ in males. Species of *Dicranorchesella* have less microchaetae than those of the preceding genera but this results from the evolution of many of these setae into fusiform scales.

Pseudodicranocentrus and *Dicranocentrus* are more closely related than either is to the preceding genera. They share the presence of large, oval scales, and a very similar head macrochaetotaxy. Species of the first genus are less polychaetotic than *Dicranorchesella* and slightly more so than the hairiest *Dicranocentrus* (oriental species of the *sundanensis* group of Mari Mutt 1979b). In the latter genus, fewer macrochaetae remain in the African and South American species (*gracilis* group) and even fewer are present in Antillean and Central American forms (*marias* group). Species of the latter group can definitely be called oligochaetotic.

The tribe Corynothrichini houses polychaetotic species with 4- or 5-segmented antennae and without scales. *Corynothrix* exhibits the probable ancestral 4-segmented condition of the antennae, several setae on the corpus of the tenaculum, and a very numerous macro- and microchaetotaxy. *Orchesellides* has 5-segmented antennae and is polychaetotic.

The new tribe Heteromurini houses oligochaetotic species with 5-segmented antennae and strongly striated oval scales. It includes two genera, *Heteromurus* and *Indoscopus*, which differ only in the presence or absence of the postantennal organ. The subgenus *Heteromurus* s. str. and *Verhoeffiella* are apparently very closely related as indicated by the identical body chaetotaxy of *H. (V.) medius* and the species of *Heteromurus* s. str. The tropical subgenera *Alloscopus* and *Heteromurtrella* are equally close, sharing head and body setal patterns unlike those of the holarctic *Heteromurus* and *Verhoeffiella*.

The new tribe Mastigocerini houses *Mastigoceras camponoti*, an oligochaetotic species with a unique chaetotaxy (see Mari Mutt 1978b), 5-segmented antennae that are 2-3 times longer than head and body combined; hyaline, fusiform scales that are absent from all the appendages; and a collarete reduced to 9-10 setae.

Key to the Tribes, Genera and Subgenera of Orchesellinae

- 1. Antennae 4- or 5-segmented 2
- Antennae 6-segmented tribe Orchesellini 6
- 2. Scales absent tribe Corynothrichini 3
- Scales present 4
- 3. Antennae 4-segmented; inner unguial lamellae fused basally, with a single tooth; corpus of tenaculum with

- 4 setae; prelabral and 1st 10 labral setae ciliated; apex of last antennal segment without bilobed papilla; Boreal lands and Central Asia . . . *Corynothrix*
- Antennae 5-segmented; inner unguial lamellae separate throughout their length, each with a tooth; corpus of tenaculum with 1 seta; prelabral and labral setae smooth; apex of last antennal segment with bilobed papilla; Southcentral Asia and New Zealand *Orchesellides*
- 4. Scales hyaline and fusiform, absent from antennae, legs and furcula; microchaetae abundant on body; antennae up to 3x (at least 2x) length of head and body combined . tribe Mastigocerini, *Mastigoceras*
- Scales dark, strongly striated, apically rounded or truncated, present on antennae, legs and furcula; microchaetae scarce (fairly abundant only in *Heteromurus (Heteromurus) peyerimhoffi* Denis 1937); antennae at most slightly longer than head and body combined tribe Heteromurini 5
- 5. Postantennal organ present *Indoscopus*
- Postantennal organ absent *Heteromurus* 5'
- 5' Ant. 4-5 conspicuously annulated (see Absolon 1900a: 430, Fig. 2); caves in Spain and Yugoslavia subgenus *Verhoeffiella*
- Only Ant. 5 annulated 5''
- 5'' Abd. 1 of adults without macrochaetae; S₀ absent see Mari Mutt 1979b: 41, Fig. 55); adults almost always over 2.3 mm; holarctic except for few records of *major* and *nitidus* in the tropics and 1 record of *nitidus* from New Zealand *Heteromurus* s. str.
- Abd. 1 of adults with at least 1 (most species with 3) macrochaetae; S₀ present; adults almost never over 2.1 mm; tropical 5'''
- 5''' Dental spines present; P macrochaetae absent; Southeast Asia and Hawaii . subgenus *Alloscopus*
- Dental spines absent; P macrochaetae present at least 1, most species with 3); holo-tropical subgenus *Heteromurtrella*
- 6. Scales absent 7
- Scales present 8
- 7. Eyes 8&8 on dark patches; tibiotarsi without smooth setae (with exception of seta opposite tenent hair of metathoracic legs, which is present throughout the subfamily); tenent hair apically knobbed; apex of Ant. 6 with pin seta; holarctic *Orchesella*
- Eyes 2&2 on very light orange patches; inner margin of tibiotarsi with rows of smooth setae; tenent hair apically pointed; apex of Ant. 6 without pin seta; northern Mexico *Neorchesella*
- 8. Fully developed scales fusiform, apically pointed; scales absent from antennae and legs; microchaetae abundant on body; eyes g&h very reduced or absent; Ant. 3 very well developed, nearly as long as Ant. 4; Southern Mexico *Dicranorchesella*
- Fully developed scaled apically rounded or truncated; scales present on antennae and legs; microchaetae very scarce; eyes g&h small but easily observed; Ant. 3 not as well developed, about 1/2 length of Ant. 4 9
- 9. Prelabral setae bifurcated; dental lobe with 3 groups of circularly arranged compound spines; head

macrochaeta *A*₁ present (see Mari Mutt 1979b; 41, 42; Figs. 55, 63, 64); Southern Mexico
 *Pseudodicranocentrus*
 Prelabral setae simple; dental lobe with simple ciliated setae or an occasional simple, but without circularly arranged compound spines; *A*₁ absent; holotropical *Dicranocentrus*

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