

## The status of some taxa related to *Miramella irena* (Fruhstorfer) and the type of *Kisella* Harz (Caelifera: Acrididae: Melanoplinae)

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**The status of some taxa related to *Miramella irena* (Fruhstorfer) and the type of *Kisella* Harz (Caelifera: Acrididae: Melanoplinae).** - The present paper provides taxonomic notes on four taxa of the genus *Miramella* Dovnar-Zapolskij, 1933. Two species, *M. irena* (Fruhstorfer) and *M. carinthiaca* (Obenberger), which have often been confused are keyed out and illustrated. A neotype is designated for *M. carinthiaca* to provide a firm basis for the application of this name. We also show that this name has wrongly been attributed to Puschnig, 1910 (instead of Obenberger, 1926) by all subsequent authors. The currently accepted interpretation of the two taxa furthermore requires the designation of a lectotype for *Pezotettix alpinus collinus* Brunner von Wattenwyl in K nstler, 1864, which is thus fixed as a junior synonym of *M. alpina* (Kollar, 1833). Finally, the type species of the subgenus *Kisella* Harz, 1973 of *Miramella*, *M. carinthiaca* (Obenberger) [= *Podisma alpina carinthiaca* Obenberger, 1926], had been misidentified by Harz. We therefore validly fix the taxonomic taxon involved in the misidentification, *M. irena* (Fruhstorfer) [= *Podisma alpina irena* Fruhstorfer, 1921], as the type species of *Kisella*.

**Keywords:** *Miramella carinthiaca* - *Pezotettix alpinus collinus* - lectotype designation - neotype designation - type species fixation - taxonomy.

### INTRODUCTION

In the course of a taxonomic revision of the Caelifera described by H. Fruhstorfer (Baur & Coray, 2004, this volume) we encountered a complex taxonomic problem which is related to one of the revised taxa, *Miramella irena* (Fruhstorfer) [= *Podisma alpina irena* Fruhstorfer, 1921]. In the past this species had been confounded by several authors with *M. carinthiaca* (Obenberger) [= *Podisma alpina carinthiaca* Obenberger, 1926a] (see Galvagni, 1986a) which, in turn, led to the misidentification of *M. carinthiaca* as the type species of the subgenus *Kisella* Harz of *Miramella* and to a general instability in the application of these names (Galvagni, 1986b; Nadig, 1989). Here, we address the problems associated with those taxa. The two species, *M. irena* and *M. carinthiaca*, are keyed out and illustrated in order to

facilitate their recognition. We also designate a neotype for *M. carinthiaca* and show that this name had hitherto been attributed to the wrong author and date. Furthermore, we select a lectotype for *Pezotettix alpinus collinus* Brunner von Wattenwyl in Künstler, 1864, a nominal taxon with an ambiguous status (Galvagni, 1986a). Finally, we validly fix the type species of *Kisella* Harz in accordance with Art. 70.3 of the *International Code of Zoological Nomenclature* (Fourth edition, 1999, ICZN). For information concerning material and methods and abbreviations of depositories we refer to Baur & Coray (2004, this volume).

### *Podisma alpina carinthiaca* Obenberger

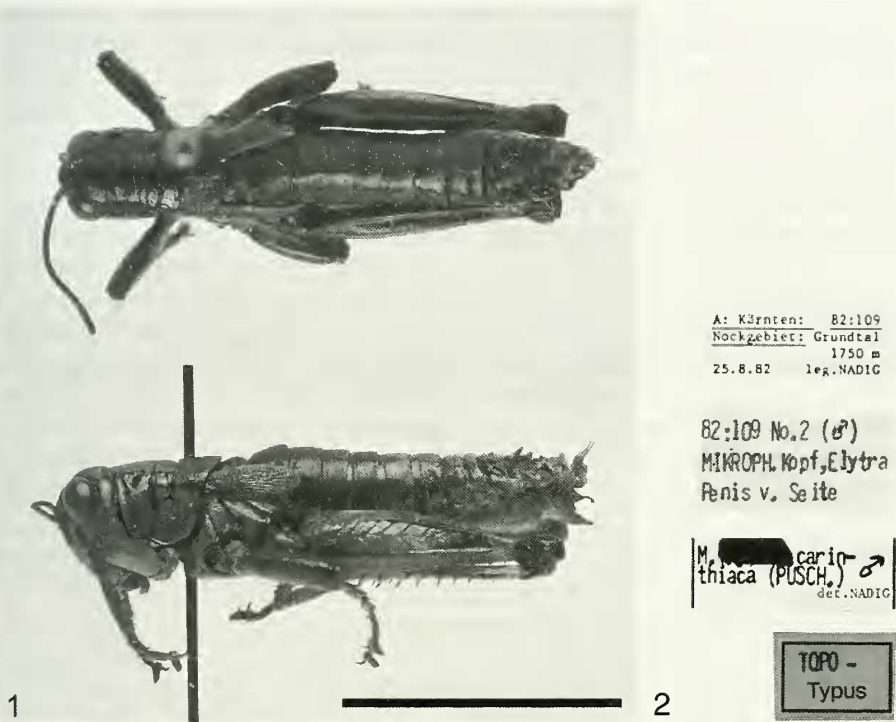
*Podisma alpinum* var. *carinthiacum* [sic<sup>1</sup>] Obenberger, 1926a: 179, first available use of *Podisma alpina* var. *alpina* subvar. *carinthiaca* Puschnig, 1910: 27, 28, unavailable name. **Neotype** ♂, Austria, Carinthia: Nockberge, Grundtal-Grundalm, here designated (CAN [examined]).

*Material.* Neotype ♂ (Fig. 1, directly pinned, right antenna and left mid tarsus lacking, genital complex exposed) labelled “A: Kärnten: 82:109 Nockgebiet; Grundtal 1750 m 25.8.82 leg. NADIG [print]; 82: 109 No. 2 ([print] ♂ [hand]) MIKROPH. Kopf,Elytra Penis v. Seite [print, yellow label]; M. ...[deleted word] carin-thiaca [sic] (PUSCH.) [print] ♂ [hand] det. NADIG [print]; TOPO-Typus [print, red label with black border]” (Fig. 2).

*Discussion.* The name *carinthiaca* has consistently been attributed to Puschnig (1910) by subsequent authors (e.g. Ramme, 1941, 1951; Galvagni, 1954, 1986a, 1986b, 1987; Hölzel, 1955; Harz, 1973, 1975; Nadig 1987, 1989; Otte, 1995; Ingrisch & Köhler, 1998; Heller *et al.*, 1998; among others), which is wrong. Puschnig (1910: 27) introduced “*Podisma alpina* var. *alpina* subvar. *carinthiaca*” as the fourth name in addition to a trinomen. Art. 45.5.1 of the *Code* (ICZN) says that such a name is infra-specific and cannot be made available from its original publication by any subsequent action. Following this article, the first author using the same word in a manner that satisfies the provisions of the *Code* has thus established a new name with its own authorship and date. This first author was Obenberger (1926a: 179) who used the name in a trinomen as “*Podisma alpinum* var. *carinthiacum* [sic]”. Though the name was published as “var.” it has subspecific status (ICZN, Art. 45.6.4) and is deemed to have been published in the form *Podisma alpina carinthiaca* Obenberger.

Obenberger (1926a, in Czech) published *P. a. carinthiaca* in a book on Orthoptera and allied insects from Czechoslovakia and adjacent countries of which a shorter edition (Obenberger, 1926b) appeared in French in the same year. We have no further information as to the exact date of publication of these works which is why both are to be considered as being published simultaneously (December 31, 1926). However, in the French edition Obenberger referred to his Czech book as “...mon travail original tchèque” (1926b: 117; compare also his remarks under “N. B.” on p. 233 where he gave the exact quotation and paging of the Czech work). Therefore, we give precedence to *P. a. carinthiaca* as published in this Czech edition (Obenberger, 1926a). It might be informative for the reader that the French edition was also published as a separate reprint with its own paging (1-121). Several authors, for instance Mistshenko (1952) or Otte (1995), quoted from this reprint.

<sup>1</sup> *Podisma* is actually feminine.



FIGS 1-2

Neotype ♂ of *Miramella carinthiaca*: (1) habitus in lateral and in dorsal view. Scale 1 cm. Photographs L. Schäublin. (2) labels, original size.

It is important to address the question which specimen(s) constitute the name-bearing type of *P. a. carinthiaca*. Usually, the author who establishes a new name is also responsible for the name-bearing type but here this is not evident. For instance, Obenberger failed to specify any data with regard to the origin and composition of his material. Apparently, he had not the intention to establish a new taxon, because he (1926a: 179) quoted the name as "*Podisma alpinum* var. *carinthiacum* [sic] Puschnig". Yet, an unambiguous bibliographic reference to Puschnig (1910) is missing although Obenberger (1926a: 24) listed Puschnig among those authors whose work he considered important. On the other hand, we have found a striking resemblance in the respective descriptions which are quoted verbatim below:

"Die kurzflügelige *alpina*-Form zeigt im Vergleich zu niederösterreichischen Exemplaren noch kürzere, das dritte Hinterleibssegment nicht überragende Elytrenschuppen, welche ähnlich wie bei *Pod. Fieberi* Scudd. und *Schmidti* Fieb. stark seitlich gerückt sind, ihre ovoide und relativ breite Form jedoch beibehalten haben (subvar. *carinthiaca* m.)" (Puschnig, 1910: 27, 28).

"Krovky krátké, kratší než u typické formy [= *alpina*], avšak široké a ovální, silně na strany posunutě" (Obenberger, 1926a: 179).

If we allow for certain discrepancies in the wording due to natural constraints of language (German versus Czech) and context (diagnosis versus key) then both authors describe essentially the same character. In short, they consider the elytra to be shorter than in *alpina*, ovoid, broad, and strongly confined laterally. Evidently, Obenberger did not mention any additional character. Couplet 9" of his key rather looks like a mere translation and adaptation of the German text. A similar close match of descriptions is also present in all other cases where Obenberger (1926a) attributed a taxon to Puschnig, e.g. *Chrysochraon brachypterus* var. *subcoeruleus* (p. 141), *Podisma pedestre* var. *maius* [= *major* in Puschnig, 1910] (p. 178), *Caloptenus italicus* ab. *bilineatus* (p. 181), among others. Coincidence can hardly be the cause for such a high degree of congruence. Rather it suggests that Obenberger used Puschnig's diagnoses as a template for the respective paragraphs of his key. Because we do not know of any other publication containing the name let alone a description of *P. a. carinthiaca* prior to Obenberger (1926a), Obenberger's mentioning of Puschnig in combination with a taxon is actually a reference to that particular work of Puschnig (1910). Following Art. 72.4.4 of the *Code*, the specimens cited by Puschnig (1910) from Carinthia are thus to be considered as the name-bearing type of *P. a. carinthiaca* Obenberger. This may look bewildering at first glance but it is convenient, because the type remains the same with regard to previous works where the authorship had erroneously been attributed to Puschnig (see above).

According to Nadig (1989: 179) no type material of *P. a. carinthiaca* is preserved in the Museums of Klagenfurt and Vienna where Puschnig's collection is assumed to be deposited. Nadig's statement is confirmed by the curators of the respective Museums, Drs P. Mildner and A. Kaltenbach (pers. comm.), and our own search in the NHMW. Furthermore, the "neotypes" erected by Harz (1975: 290) and Nadig (1989: 179) are invalid because their actions were in clear violation of the regulations of the *Code* (ICZN, Art. 75.3). For instance, both authors selected a pair of "neotypes" which they kept in their private collection (note: contrary to his claim, Nadig actually did not designate any specimens of his collection as "neotypes", but he labelled a series of 23 ♂, 27 ♀ from Grundtal-Grundalm as "TOPO-typus"). Therefore, the name-bearing type of *P. a. carinthiaca* is definitely no more in existence.

This situation is rather unfortunate, in particular with regard to the complicated taxonomic history of *P. a. carinthiaca*. Ramme (1941) was the first to use the name in the current combination with *Miramella* as "*Miramella alpina collina* f. *carinthiaca* Puschnig". He (1941: 128) apparently misinterpreted the taxon, because the elytra were said to be intermediate in length with regard to *M. alpina alpina* with short and *M. a. collina* with long elytra. A respective specimen was figured later by him (Ramme, 1951, plate 4, figure 1b). Ramme's interpretation was thus in clear contradiction to Puschnig's (1910) description and this probably caused much of the later confusion. The name *carinthiaca* has subsequently been adopted for a species of *Miramella* by Galvagni (1954) but thereby was confounded with *M. irena* (Fruhstorfer) (see also Hölzel, 1955: 60). This, in turn, led to the misidentification of *P. a. carinthiaca* as the type species of the subgenus *Kisella* Harz of *Miramella* (see below). Only the studies by Galvagni (1986a) and Nadig (1989) have shed some light on these problems and provide a more satisfying delimitation of the species. With regard to the apparent

difficulties in separating these taxa, however, we think it is justified to designate a neotype for *P. a. carinthiaca*. This provides a firm basis for subsequent investigations and furthermore allows selection of a type locality among several distant places in Carinthia [Puschig (1910: 27) mentioned "Grundlalm [*sic*]-Schiestlnock [*sic*]", "Sausalpe-Weite Alpe", "Metnitztal (Oberhof, Mödringgraben, Pachlergraben, ...)" as the origin of his material]. We thus propose for a neotype a male from Grundtal-Grundlalm in CAN (see above). This selection ensures that the application of the name will rest on Obenberger (1926a) as well as on Galvagni's and Nadig's major contributions to the taxonomy of *Miramella*.

As mentioned above, the differences between *M. carinthiaca* and *M. irena* are subtle. Although Nadig (1989) thoroughly studied both species, he failed to provide a synthesis in form of a short diagnosis. Below, the most important diagnostic characters are presented in a key which is based on a re-examination of material from many collections (see Appendix):

- Elytra (Figs 3, 5) squamipterous, always widely separated medially. Dark markings on pronotum (Figs 3, 5) usually less extensive, median keel often only slightly darkened. Penis (Fig. 7) in lateral view with dorsal valves slender and uniformly narrowing; ventral valves elongate, at most as broad as dorsal valves basally . . . . . *M. carinthiaca*
- Elytra (Figs 4, 6) longer, squamipterous to subbrachypterous, usually touching medially. Dark markings on pronotum (Figs 4, 6) rather more extensive, median keel and some of the transverse sulci usually strongly darkened. Penis (Fig. 8) in lateral view with dorsal valves less slender, abruptly narrowing in apical third; ventral valves stouter, broader than dorsal valves basally . . . . . *M. irena*

The two species occur in the south-eastern part of the Alps where they are largely parapatric in distribution. Their ranges have been investigated by Galvagni (1986a) and Nadig (1989) who found occasional hybrid populations between *M. carinthiaca* and *M. irena* or *M. alpina* (Kollar). Yet, the status of these taxa is currently not under debate.

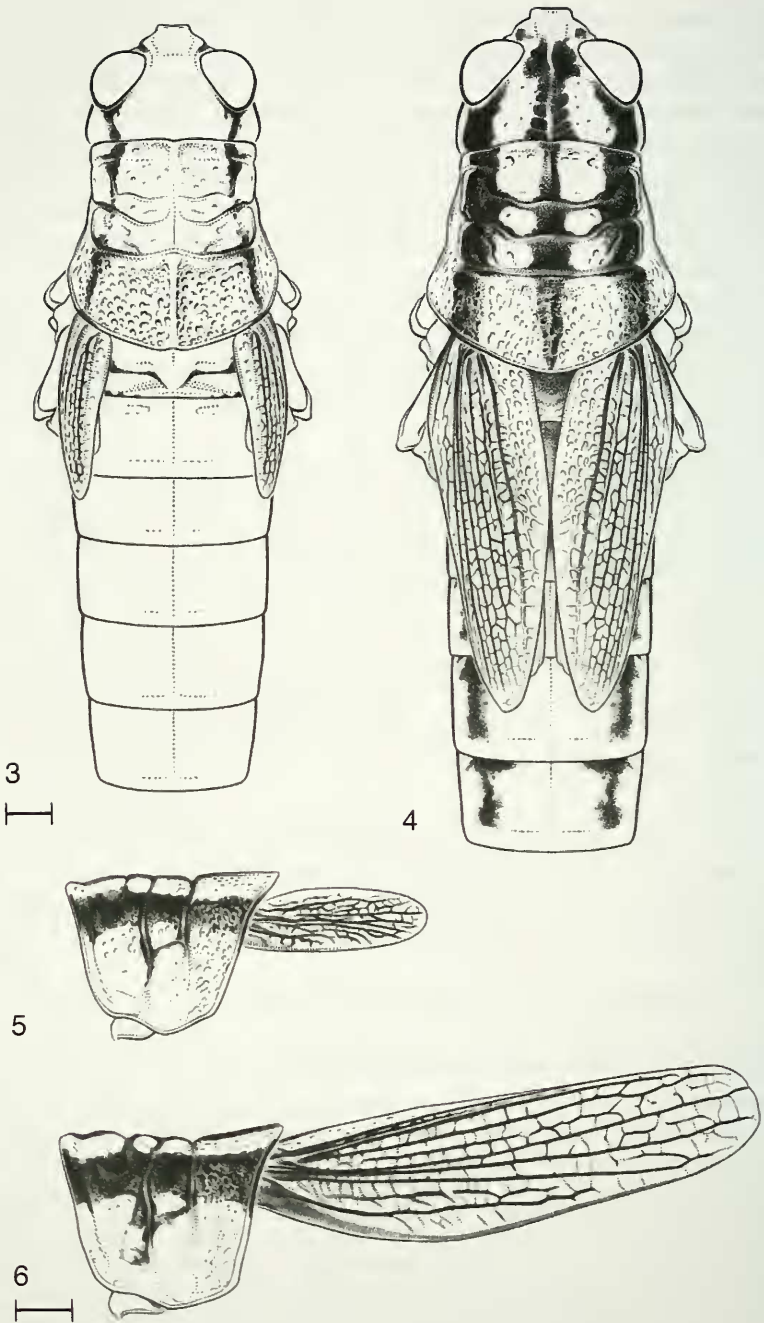
*Status. Miramella (Kisella) carinthiaca* (Obenberger, 1926a) **stat. rev.**

### *Pezotettix alpinus collinus* Brunner von Wattenwyl

*Pezotettix alpina* var. *collina* [*sic*<sup>2</sup>] Brunner von Wattenwyl in Künstler, 1864: 773. **Lectotype** ♂, Slovakia: Pressburg [= Bratislava], here designated (NHMW [examined]).

*Material.* Lectotype ♂ (directly pinned, remounted by H. Baur; genital complex exposed; tip of left ventral valve (Fig. 9) lacking, however, the missing part was restored in the drawing according to the intact right ventral valve) labelled "Coll. Br.v.W [print] Pressburg Seyffert leg. [hand]; det. Br. v. W [print] Podisma alpina Koll. [hand]; 4345. [hand, label with double border]". The first two labels are not from Brunner's hand and probably have been added later. The number "4345" refers to Brunner's collection index. The respective page shows an entry of the year "1864" on the top left. Lines 4334-4359 are headed by a note that reads "... [?, illegible] Seyffert im August u. Sept. Pressburg. ...". On line 4345 is finally stated "... collina".

<sup>2</sup> *Pezotettix* is actually masculine.



FIGS 3-6

Head and thorax of ♀ in dorsal view: (3) *Miramella carinthiaca* (from type locality), (4) *M. irena* (from South Tyrol: Mendelkamm, Felixeralm). Pronotum and wings of ♂ in lateral view: (5) *M. carinthiaca* (neotype), (6) *M. irena* (same locality as ♀). Scale 1 mm. Drawings A. Coray.

Paralectotypes, 1 ♂, 1 ♀ (directly pinned) labelled: "Coll. Br.v.W [print] Pressburg Seyffert leg. [hand]; det. Br. v. W [print] *Podisma alpina* Koll. [hand]; *Miramella alpina* (KOLLAR) det. A. Galvagni, 1961 [print; this label on ♀ only]". Both specimens stood beside lectotype under a bottom label "4345. Pressburg [hand, label with double border]" and are considered as part of the type series.

The true extent of the type series is unknown. We have examined further specimens from Vienna and surroundings, Mehadia, and some other localities which might belong to the type series, but lack any positive evidence such as unambiguous determination labels by Brunner or a respective entry in the above-mentioned collection index. Thus, they can not be considered as part of the type series with certainty. This material is summarily listed in the Appendix under *M. alpina* and *M. irena*.

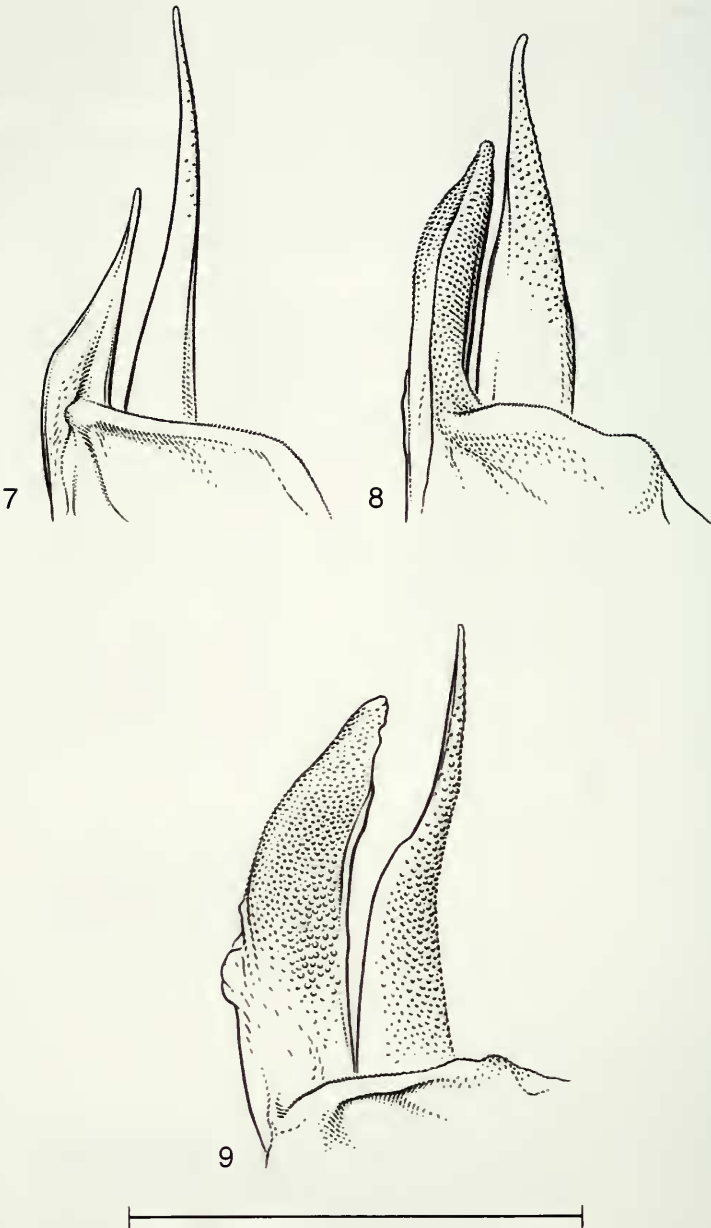
*Discussion.* Brunner first mentioned a brachypterous form of "*Pezotettix alpina* [sic]" from "Wienerwald" and "Krain" in his "Orthopterologische Studien" (1861: 222), but without giving a name. Brunner's description of *Pezotettix alpinus collinus* was then published in a paper by Künstler (1864) (see Mistshenko, 1952) on an outbreak of *M. alpina* and not first in the "Prodrömus" (Brunner, 1882), as stated by many authors (e.g. Harz, 1975; Galvagni, 1986a, Nadig, 1989; among others). Brunner (in Künstler, 1864: 773) indicated a rather large distribution of his new taxon by noting "Die letztere [= *collinus*] tritt zuerst in der Gegend von Wien auf, breitet sich südlich in die Krain und östlich bis Mehadia aus, (südlich von Laibach [= Ljubljana] ist sie mir unbekannt, ebenso wenig in Serbien und Siebenbürgen). Sie findet sich nur im Hügelland (weder in der ungarischen Ebene, noch im Hochgebirge der Krain und Serbien's)". In other words, *collinus* is said to occur from Vienna to Mehadia (near Baile Herculane, Romania) in the East and Krain (i. e. the region North of Ljubljana, Slovenia) in the South, where it is confined to hilly areas. Naturally, this large and vaguely defined distribution does also include the specimens from Bratislava in Brunner's collection.

Clearly, the distribution of *collinus* as indicated by Brunner includes several taxa. For instance, we have seen specimens of *M. alpina* as well as *M. irena* in Brunner's material from Mehadia (Appendix). Galvagni (1986a: 27) also reported both species from this locality. Furthermore, the distribution of *collinus* may even comprise part of the range of *M. carinthiaca* (see distribution map in Galvagni, 1986a: 35). As a consequence, *M. irena* and *M. carinthiaca* could possibly be regarded as junior synonyms of *collinus*. In fact, these three taxa have often been interpreted very differently in the past, for instance by Mistshenko (1952) and Harz (1975). Therefore, a lectotype of *collinus* is designated to ensure stability in the application of this name (ICZN, Art. 74.7.3), which thus becomes a junior synonym of *M. alpina*. With this interpretation, we follow the seminal and now widely accepted work of Galvagni (1954, 1986a) and Nadig (1989) who considered *collinus* as the brachypterous form of *M. alpina*. The best character to separate this form from the very similar *M. irena* are the male genitalia (see Nadig, 1989). The penis valves of the lectotype (Fig. 9) very nicely fit Nadig's figure (1989: 257, figure 37) of a *M. alpina* ♂ from "Wiener Wald".

*Status.* Junior synonym of *Miramella (Kisella) alpina* (Kollar, 1833) (Galvagni, 1986a: 26, 27).

### *Kisella* Harz

*Kisella* Harz, 1973: 403 (subgenus of *Miramella*). Type species: *Miramella irena* (Fruhstorfer) [= *Podisma alpina irena* Fruhstorfer, 1921], here designated.



FIGS 7-9

Male genitalia of (7) *Miramella carinthiaca* (neotype), (8) *M. irena* (same specimen as in Fig. 6) and (9) *Pezotettix alpinus collinus* (lectotype; the tip of the left ventral valve is actually lacking, however, the missing part was restored in the drawing according to the intact right ventral valve). Scale 1 mm. Drawings A. Coray.



*Discussion.* Harz (1973) established the new subgenus *Kisella* of *Miramella* Dovnar-Zapolskij with "*K. c. carinthiaca* Puschnig" as the type species by original designation. As we argued above, he wrongly attributed the authorship of the type species to Puschnig (1910) instead of Obenberger (1926a). According to Art. 67.7 of the *Code* (ICZN) Harz is nevertheless to be considered as having validly fixed the type species as *Miramella carinthiaca* (Obenberger). However, this species had been misidentified by Harz, since he (1973: 403) quoted Hermagor, Carinthia (Austria) as the origin of his material. Galvagni (1986a) and Nadig (1989) demonstrated that specimens from this locality undoubtedly belong to *M. irena* (Fruhstorfer). Moreover, Harz (1973) actually described the true *M. carinthiaca* as *M. carinthiaca puschnigi*, thus establishing a junior synonym of the former (Galvagni, 1986a: 22; Nadig, 1989: 179). A re-examination of the respective specimens fully confirms these views (see Appendix). Concerning the selection of a type species, the respective species are obviously very closely related and probably would be equally eligible as type species of *Kisella*. But because Harz connected the type species so clearly with some particular specimens, we feel that the taxonomic species actually involved in the misidentification, *M. irena*, would best serve stability and universality here. Probably for similar reasons, Galvagni (1986b: 70) listed the same taxon as the type species of *Kisella*. However, Galvagni's action was invalid with regard to the *Code* then in force (see Coray & Lehmann, 1998: 107) and no valid type fixation has hitherto been made. In accordance with Art. 70.3 of the *Code* (ICZN) we now fix the taxonomic species involved in the misidentification, *M. irena* (Fruhstorfer) [= *Podisma alpina irena* Fruhstorfer, 1921], misidentified as *M. carinthiaca* (Obenberger) [= *Podisma alpina carinthiaca* Obenberger, 1926a] in the original designation by Harz (1973, sub "*K. c. carinthiaca* Puschnig"), as the type species of *Kisella*.

The taxonomic status of *Kisella* is not yet settled. Galvagni (1986b, 1987) has elevated all previous subgenera to generic level but there is also a tendency to regard *Miramella* as a single unit and to ignore subgenera such as *Kisella* (Heller *et al.*, 1998; Coray & Thorens, 2001). The split of *Miramella* into several taxa by Harz (1973) and Galvagni (1986b) may indeed not withstand a rigorous cladistic analysis. Here, we simply follow the last comprehensive study on *Miramella* by Nadig (1989) who treated *Kisella* as a subgenus (see also Coray & Lehmann, 1998; Ingrisch & Köhler, 1998).

*Status.* Subgenus of *Miramella* Dovnar-Zapolskij, 1933 (Nadig, 1989: 106).

## ACKNOWLEDGEMENTS

We are indebted to Otto Kraus (Hamburg, Germany) for his help concerning the authorship of *Podisma alpina carinthiaca*. We thank Elsa Obrecht (NMBE), Christian Kropf (NMBE) and an anonymous reviewer for critical reading of the manuscript and many useful suggestions. We are also grateful to Lisa Schäublin (NMBE) for taking photographs. For the loan of or information on specimens we thank J. Constant (Institut royal des Sciences naturelles de Belgique, Bruxelles), Alfred P. Kaltenbach and Ulrike Aspöck (NHMW), Charles Lienhard (MHNG), Paul Mildner (Landesmuseum Kärnten, Klagenfurt, Austria), Andreas Müller (ETHZ), Michael Ohl (ZMB), and Klaus Schönitzer (ZSM).

## REFERENCES

- BAUR, H. & CORAY, A. 2004. A revision of the Blattodea, Ensifera and Caelifera described by H. Fruhstorfer. *Revue suisse de Zoologie* 111(3): 611-630.
- BRUNNER VON WATTENWYL, C. 1861. Orthopterologische Studien. I. Beiträge zu Darwin's Theorie über die Entstehung der Arten. *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien* 11: 221-228.
- BRUNNER VON WATTENWYL, C. 1882. Prodrömus der europäischen Orthopteren. *Wilhelm Engelmann, Leipzig*, XXXII + 466 pp. + 11 pls + 1 map.
- BURR, M. 1913. Collections zoologiques du Baron Edm. de Selys Longchamps – Catalogue systématique et descriptif, Fasc. II: Orthoptères. *Hayez, Impr. des Académies, Bruxelles*, 35 pp.
- CORAY, A. & LEHMANN, A. W. 1998. Taxonomie der Heuschrecken Deutschlands (Orthoptera): Formale Aspekte der wissenschaftlichen Namen. *Articulata*, Beiheft 7: 63-152.
- CORAY, A. & THORENS, P. 2001. Heuschrecken der Schweiz: Bestimmungsschlüssel / Orthoptères de Suisse: clé de détermination / Ortoteri della Svizzera: chiave di determinazione. *Fauna Helvetica* 5. *Centre suisse de cartographie de la faune, Neuchâtel*, 235 pp.
- GALVAGNI, A. 1954. Studio ecologico-sistemático sugli Ortoteroidi di un'alta valle alpina (Val di Genova - Trentino). *Studi Trentini di Scienze Naturale* 31: 61-102.
- GALVAGNI, A. 1986a. La situazione del genere *Miramella* Dovnar-Zapolskij, 1933, nelle regioni Balcanica e Carpatica (Insecta: Caelifera: Catantopidae). *Studi Trentini di Scienze Naturale* 62: 13-42.
- GALVAGNI, A. 1986b. Attuale struttura sistemática del genere *Miramella* Dovnar-Zapolskij, 1933, e proposta per una sua scomposizione in più generi (Insecta: Caelifera: Catantopidae: Catantopinae). *Atti dell'Accademia Roveretana degli Agiati*, a. 235, serie VI 25(B): 67-84.
- GALVAGNI, A. 1987. The genus *Miramella* Dovnar-Zapolskij, 1933, in the Balkan and the Carpathian regions (Pp. 208-218). In: BACCETTI, B. M. (ed.). Evolutionary biology of orthopteroid insects. *Ellis Horwood, Chichester*, 612 pp.
- HARZ, K. 1973. Orthopterologische Beiträge XIII. *Atalanta* 4: 403-407.
- HARZ, K. 1975. Die Orthopteren Europas/The Orthoptera of Europe. Vol. II. *W. Junk, The Hague*, 939 pp.
- HELLER, K.-G., KORSUNOVSKAYA, O., RAGGE, D. R., VEDENNA, V., WILLEMSE, F., ZHANTIEV, R. D. & FRANTSEVICH, L. 1998. Check-list of European Orthoptera. *Articulata*, Beiheft 7: 1-61.
- HÖLZEL, E. 1955. Heuschrecken und Grillen Kärntens. *Carinthia* II, 19. Sonderheft: 1-112.
- INGRISCH, S. & KÖHLER, G. 1998. Die Heuschrecken Mitteleuropas. *Die neue Brehm Bücherei*, 629. *Westarp-Wissenschaften, Magdeburg*, 460 pp.
- KÜNSTLER, G. A. 1864. Ueber Heuschreckenfrass. *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien* 14: 769-746 [recte 776].
- MISTSHENKO, L. L. 1952. Fauna of the U.S.S.R. Orthoptera, Vol. 4(2): Locusts and grasshoppers: Catantopinae. In: Keys to the Fauna of the U.S.S.R., New series No. 54. *Akademiï Nauk SSSR, Moskva, Leningrad*, 610 pp. [English translation of Russian text: Israel programm for Scientific Translations, Jerusalem, 1965].
- NADIG, A. 1987. On the taxonomy and geonomy of the genus *Miramella* in the Alps, the Jura, the Vosges, the Schwarzwald, and the Pfälzerwald (pp. 373-376). In: BACCETTI, B. M. (ed.). Evolutionary biology of orthopteroid insects. *Ellis Horwood, Chichester*, 612 pp.
- NADIG, A. 1989. Die in den Alpen, im Jura, in den Vogesen und im Schwarzwald lebenden Arten und Unterarten von *Miramella* Dovnar-Zap. (Orthoptera, Catantopidae) auf Grund populationsanalytischer Untersuchungen. *Atti dell'Accademia Roveretana degli Agiati*, a. 238, serie VI 28(B): 101-262 + pls. 6-9 in fine.
- OBERBERGER, J. 1926a. Rovnokřídly hmýz (Orthoptera a Dermaptera) republiky Československé (se 4 tabulemi a 25 obrázy v textu) [In Czech]. *Fauna et flora Cechoslovenica*. I. *Nákladem české Akademie Věd a Umění, Praha*, VIII + 234 + 4 pls.

- OBERBERGER, J. 1926b. Orthoptères et dermaptères de la République Tschécoslovaque. *Bulletin international de l'académie tchèque des sciences* 27: 113-238 + 4 pls.
- OTTE, D. 1995. Orthoptera Species File 4: Grasshoppers [Acridomorpha] C. *Orthopterists' Society and the Academy of Natural Sciences of Philadelphia*, 518 pp.
- PUSCHNIG, R. 1910. Beiträge zur Kenntnis der Orthopterenfauna von Kärnten. *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien* 60: 1-60.
- RAMME, W. 1941. Die Orthopterenfauna von Kärnten. *Carinthia II*, 131: 121-131.
- RAMME, W. 1951. Zur Systematik, Faunistik und Biologie der Orthopteren von Südost-Europa und Vorderasien. *Mitteilungen aus dem Zoologischen Museum in Berlin* (1950) 27: 1-431 + 39 pls.

## APPENDIX

Material of *Miramella* species examined in this study. For abbreviations of depositories, see Baur & Coray (2004, this volume).

***Miramella alpina***: INSTITUT royal des Sciences naturelles de Belgique, coll. de Selys Longchamps: "B. W. Pezott. [sic] alpina Var. Vienne [hand]" 1 ♂, 1 ♀; "Var. alata [hand]; B. W. Pezott. [sic] alpina Var. Vienne [hand]" 1 ♀. The 3 specimens are listed in Burr's (1913: 21) catalogue on the de Selys Longchamps collection under "Podisma alpinum Var. collinum [sic]".

NHMW: AUSTRIA, coll. Brunner, leg. Schiesser: Kaltleitgeben [near Vienna], vii.1858, 4 ♂, 3 ♀, 25.ix.1858, 2 ♂, 1 ♀, and a pair in copula; leg. Brunner: Mauer [near Vienna], 15.vii.1862, 1 ♀, Ober St. Veit [near Vienna] x.1863, 1 ♂, 1 ♀.

NMBE: ROMANIA: Mehadia [near Baile Herculane], coll. Brunner 1 ♂, 1 ♀.

***Miramella carinthiaca***: CAN: AUSTRIA, Carinthia: Nockgebiet, Grundtal 4 ♂, 3 ♀; Schiestelnock, Windeben 2 ♂; Innerkrams, Grünleitennock 2 ♀; Wöllanernock, Kaisershügel 4 ♂; Haidnerhöhe, Hirnkopf 4 ♂, 2 ♀; Saualpe, Klipitztörl, W side 1 ♂; Styria: Murau, Frauenalm 4 ♂, 2 ♀; Saualpe, Schwarzkogel 2 ♂, 3 ♀; Salzburg: Mautendorf, Speiereck 4 ♂.

CKH: AUSTRIA, Carinthia: Gurkentaleralpen, Haidnerhöhe, viii. 1958, leg. Hölzel, coll. Ebner, paratypes 1 ♂, 1 ♀ of *M. carinthiaca puschnigi* Harz, 1973.

LANDESMUSEUM für Kärnten, Klagenfurt, Austria: AUSTRIA, Carinthia: Gurkentaleralpen, Haidnerhöhe, leg. Hölzel 11 ♂, 9 ♀.

NHMW: AUSTRIA, Carinthia: Gurkentaleralpen, Haidnerhöhe, viii. 1958, leg. Hölzel, coll. Ebner, holotype ♂, paratypes 1 ♂, 1 ♀ of *M. carinthiaca puschnigi* Harz, 1973.

***Miramella irena***: CAN: AUSTRIA, Carinthia: Plöckenpass 1 ♂; ITALY, South Tyrol: Mendelkamm, Felixeralm 4 ♂, 3 ♀; Gampenjoch, N-side 3 ♂; Ultental, over Gamperalm 2 ♂; Province Trento: V. di Non, V. della Forma 1 ♂, 2 ♀; Madonna di Campiglio: Meledrio 3 ♂, 3 ♀; V. Nambrone: Adamello 1 ♂, 1 ♀; Adamello, V. di Fumo 2 ♂; Passo Croce Domini: South 2 ♂, 2 ♀; Rifugio Bazzena 1 ♂, 1 ♀; Dolomiten: Passo Giau, S-side 2 ♂, 2 ♀; Province Brescia: C. Tombea 3 ♂, 3 ♀.

CKH: AUSTRIA, Carinthia: Karnischer Hauptkamm, Hermagor, 2.8.1953, 1 ♂, 1 ♀ labelled by Harz as "neotypes" of *M. carinthiaca* (see text); same, 1 ♂; Oberdrauburg, 26.vi.1962, leg. R. Hess 1 ♂, 1 ♀; ITALY, South Tyrol: Dolomiten, St. Ulrich, Anf. ix.1962, leg. Engel 1 ♂, 1 ♀; BOSNIA-HERZEGOVINA: Kupres, 2.viii.1966, leg. Eitschberger 1 ♂; Sarajevo, Trebevic, 7.viii.1966, leg. Eitschberger 4 ♂, 4 ♀. All specimens identified by Harz as *M. carinthiaca*.

ETHZ: AUSTRIA, Carinthia: Obir, Eisenkappelhütte-Hoffmannsalpe, 1400-1700 m, 29.vii.1987, leg. Ingrisch 2 ♂; ITALY, Trentino: Dosso Sabion, Pinzolo, 1700 m, 31.vii.1947, leg. Galvagni 1 ♂; 1400 m, 30.vii.1947, leg. Galvagni 3 ♂; Passo, Mendola, 1400 m, 7.ix.1946, leg. Galvagni 1 ♂; Concei-M. Cadria, Vies, 1800-1850 m, 6.ix.1958, leg. Galvagni 2 ♂, 1 ♀; M. Tremalzo, 1700-1900 m, 28.viii.1959, leg. Galvagni 2 ♀; Paganella: Becco del Corno, 2000 m, 7.ix.1946, leg. Galvagni 1 ♂.

NHMW: ROMANIA: Mehadia [near Baile Herculane], leg. Brunner, 23.7.1862, 1 ♀, 20.7.1864, 3 ♀; SLOVENIA: Steiner Alpen [North of Ljubljana], 1859, leg. Hoffmann 1 ♀.

ZMB, coll. W. Ramme: AUSTRIA, Carinthia: Plöckenpass, 1200-1300 m, viii.1929, 1 ♂; Mauthen, viii.1929, 1 ♂; ITALY, South Tyrol: St. Vigil, 7.vii.-8.viii.1913, 2 ♂, 3 ♀;

vii.1913, 2 ♂; St. Vigil, Enneberg, vii.-viii.1913, 1 ♂, 2 ♀; Klausen, 17.vi.-3.viii.1910, 1 ♂; Krain: Planina, 26.viii.-5.ix.1912, 2 ♂, 2 ♀; Seiseralpe: Schlern, 26.viii.1921, 1 ♂; Monte Spinale, 14.viii.1921, 1 ♂; Val di Genova, 1500 m, 9.viii.1921, 2 ♂, 2 ♀; KROATIA, Plitvitka: Jesera, 400-500 m, viii.1929, 2 ♀.

ZSM: ITALY, South Tyrol: St. Vigil, 7.vii.-8.viii.1913, leg. W. Ramme 1 ♂, 1 ♀.