

DISTRIBUTION IN POLAND OF SPECIES OF THE *BAETIS* GROUP (EPHEMEROPTERA, BAETIDAE)

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ABSTRACT

In the present paper the regions of Poland where investigations on Ephemeroptera were carried out are shown and, against this background, the distribution of 19 species of the *Baetis* group is presented. *B. vernus*, *A. muticus*, *B. rhodani* and representatives of *B. fuscatus* group are very common, widely distributed and usually abundant species, whereas *B. pentaplebedes*, *N. digitatus* and *B. tracheatus* are rare and never abundant. Distributional maps are based on critically examined literature and the author's unpublished data; a Universal Transverse Mercator (UTM) grid was used for presentation of species distribution.

INTRODUCTION

Studies on the diversity of living organisms in the last decade are gaining more and more attention among students of biology (Ricklefs and Schluter, 1993; Hawksworth, 1996) and even among politicians, receiving official support during major international meetings (see Rio - "The Earth Summit"; Systematics Agenda 2000, Charting the Biosphere, 1994).

Studies on species distributions and their possibly universal presentation are a base for biodiversity monitoring and regional and global biogeographic considerations (Ruffo, 1996).

Depending on the level of knowledge of national faunas, the results of biodiversity studies are published as ample faunistic lists like those edited in Italy by Minelli et al. (1993-95) or in Poland by Razowski (1990-1997), or as distribution maps published by "Centre suisse de cartographie de la faune" (CSCF) in Switzerland (Lubini et al., 1996). In Poland, inventory activity is successfully realized by the Museum and Institute of Zoology, Polish Academy of Sciences (MIZ, Pol. Acad. Sci.) in Warsaw as successive volumes of *Katalog fauny Polski (Catalogus faunae Poloniae)*.

The first studies on Ephemeroptera in Poland were undertaken some 150 years ago, but only in the last four decades have these studies become intensive, covering most of the country. Sowa (1990) has published a comprehensive list of Polish mayflies that includes 120

species; out of these species 21 were placed in the genus *Baetis* Leach. However during the last decade new related genera were established in several revisions (i. e. Novikova and Kluge 1984, 1987; Waltz et al., 1994; McCafferty and Waltz, 1995). In the present paper the distribution in Poland of 19 mayfly species is presented; until recently these species were treated in Polish literature as *Baetis* Leach. Now some of them are placed in another genera *Acentrella* Bengtsson, *Alainites* Waltz and McCafferty and *Nigrobaetis* Novikova and Kluge.

Baetis larvae are very common and usually abundant freshwater animals; in Carpathian mayfly collection of Sowa (1975a) they constituted ca 54% of the material, in Mazurian collections of Lewandowski (1989) ca 77% and in Pomeranian collection of Glazaczow (1994) ca 69%. However, well known difficulties in species identification have led to the situation that many old data are not credible. The milestone in the knowledge of European *Baetis* larvae was a monograph by Müller-Liebenau (1969); only after its publication it was possible to verify part of the old information and, as a result, the knowledge of Polish *Baetis* species distinctly increased.

There are still, however, difficulties in the identification of larval stages in some species and many old data are doubtful. Therefore in this paper the distribution of very common larvae of the *Baetis fuscatus* group is presented jointly, without separation into *B. fuscatus* and *B. scambus*. Excluded are also two species of *Labiobaetis* Novikova et Kluge: *L. tricolor* (Tshern.) and *L. calcaratus* Keffermüller, because the materials available to the author indicate the necessity of further taxonomic studies on these species.

In this paper, the distribution of baetid species in Poland is presented using a Universal Transverse Mercator (UTM) grid according to the system propagated by the Faunistic Documentation Centre of MIZ, Pol. Acad. Sci. in Warsaw and widely used in Europe (Van Goethem and Grootaert, 1992). Critically verified literature information, as well as the author's unpublished data, were used.

Fig. 1 shows the distribution of the mayfly research effort in Poland against the background of basic physiographical units of this country according to Dylikowa (1973). These regions are approximately latitudinal belts running more or less parallel to the Baltic Sea coast in the north and to the Carpathian Mts in the south; altitude generally increases from the north to the south. The regions are: Pomerania and Mazuria, belt of Central Polish Lowlands (Great Poland, Mazovia and Silesia lowlands), belt of old mountains and uplands (Sudety Mts, Silesian Upland, Little Poland Upland with Swietokrzyskie Mts, Lublin Upland with Roztocze), belt of submontane lowlands (Oswiecim basin, Sandomierz basin) and the Carpathian Mts. In Figs. 2-11 the distribution of successive species is presented.

RESULTS AND DISCUSSION

Despite rather intensive searching for Ephemeroptera in Poland some regions remain understudied, for instance Mazovia and Silesia lowlands (Fig. 1).

The most common species, occurring in the whole country were *B. vernus*, *B. rhodani*, *A. muticus* and *B. fuscatus* group (Fig. 2, 3, 4 and 5). *B. vernus* (in some papers as *B. tenax*) in many studies appeared to be the most abundant *Baetis* species. The densest network of *B. rhodani* and *A. muticus* localities occurred in southern Poland. *B. rhodani* was often the most abundant baetid species there. On the other hand, its comparatively rare occurrence in the otherwise well studied western part of the Central Lowlands, is striking. Larvae of *Baetis rhodani* and *B. vernus* were also collected outside running waters, namely in springs (Dratnal, 1976).

Baetis fuscatus group is formally represented in Polish fauna by three species: *B. fuscatus*, *B. scambus* and *B. beskidensis*. Larvae of two first species were noted in many regions; they occurred often in common or in neighbouring localities. Considering the difficulties in the discrimination between these species many authors have treated them combined as *B. fuscatus* and *B. scambus*. If we might trust all published information *B. fuscatus* is more common and abundant than *B. scambus* in the regions north of the sub-

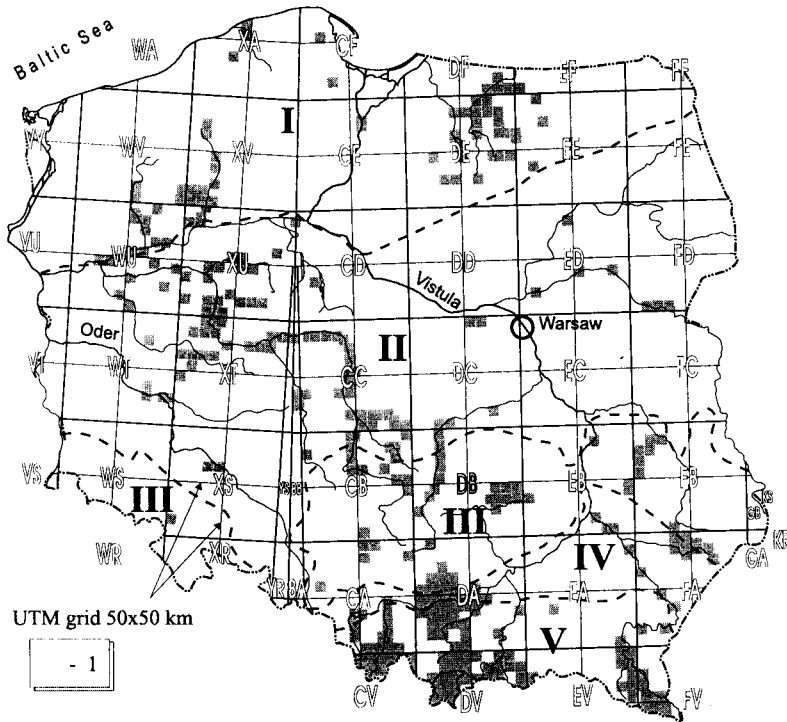


Fig. 1. Distribution of collecting locations for Ephemeroptera in Poland against the background of the main physiographic regions of this country [1-75].

I) Pomerania and Mazuria. II) Central Polish Lowlands. III) Old Mountains and Uplands. IV) Submontane Lowlands. V) Carpathians. 1) Collecting location.

montane lowlands. Winged forms were comparatively rarely reported. Imagines of *B. fuscatus* were collected in the Carpathians at the Raba river and Poprad river as well as in northern Poland at the Vistula river and in the basins of the Warta and Gwda rivers (Mikulski 1929; Keffermüller 1960; Wójcik 1963; Sowa 1975a, 1975b; Glazaczow 1964). Winged forms of *B. scambus* were caught in the Carpathians by Sowa (1975a) and in western Pomerania by Glazaczow (1994).

The third species - *B. beskidensis* Sowa (Fig. 5) was described from Polish Carpathians by Sowa (1973) on the basis of larval material only. Besides the different colour pattern, other morphological features differentiating these larvae from akin species are not clear. All Polish localities of *B. beskidensis*, were reported by the author of this species or by his collaborators and are located in Polish Carpathians. The species is much less common and abundant than other species of *B. fuscatus* group. Further studies are needed to clarify the proper systematic position of this form.

Localities of *B. buceratus* and *N. niger* are scattered over the whole country; however these species are distinctly less common than other baetids and their abundances are usually low. *B. buceratus* was recorded mainly in large rivers: San, Vistula, Pilica and Warta.

NOTE:

Captions to illustrations: Numbers in brackets indicate papers used in preparation of particular maps; see "References".

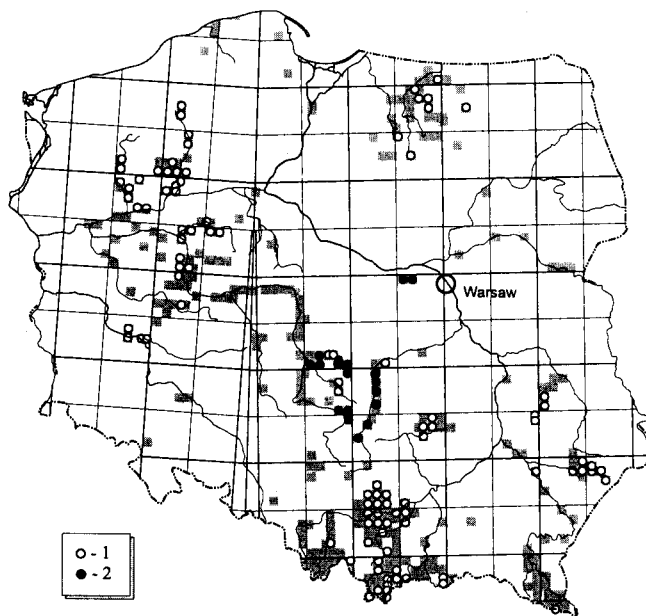


Fig. 2. Distribution of *Baetis vernus* Curtis [1, 2, 4, 5, 7, 9, 11, 15, 16, 17, 18, 19, 23, 33, 35, 37, 44, 45, 46, 48, 52, 53, 56, 62, 66, 70].

1) Literature data. 2) New author's data.

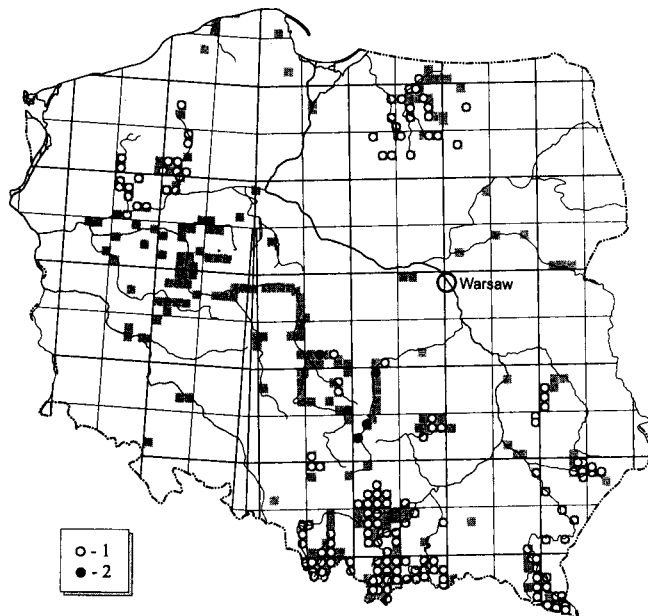


Fig. 3. Distribution of *Baetis rhodani* Pictet [1, 3, 4, 5, 6, 7, 9, 11, 15, 16, 17, 18, 30, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 48, 51, 52, 56, 57, 60, 62, 66, 69, 70, 71, 73, 74, 75].

1) Literature data. 2) New author's data.

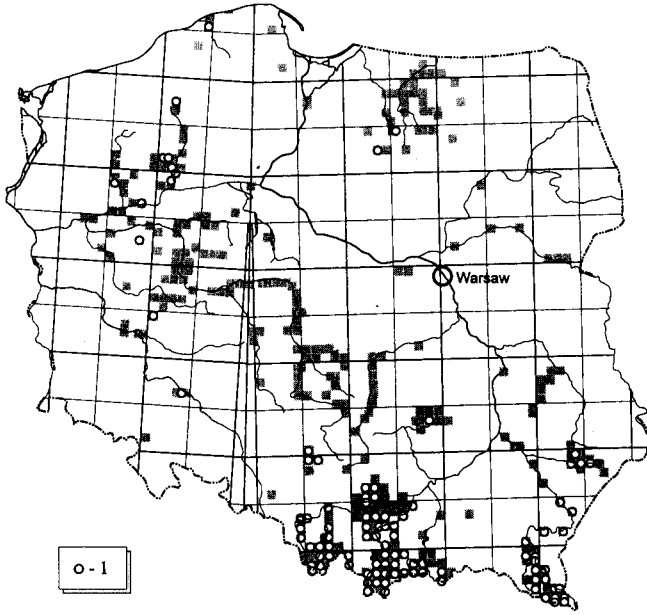


Fig. 4. Distribution of *Alainites muticus* (L.) [1, 4, 6, 7, 9, 15, 18, 29, 33-35, 37, 38, 40, 42-44, 51, 52, 56, 57, 60, 62, 66, 70, 74, 75].
1) Literature data.

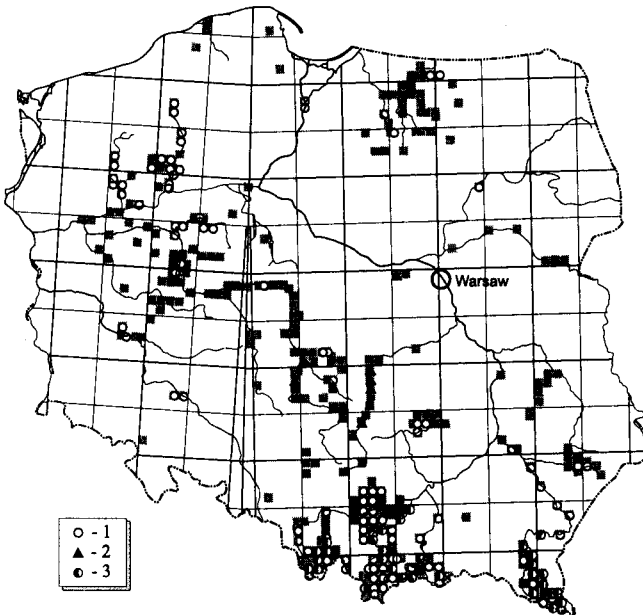


Fig. 5. Distribution of *Baetis fuscatus* and/or *Baetis scambus* [1, 4, 6-8, 11, 15-18, 20, 22, 33-35, 38, 43-45, 48, 52-54, 62, 66, 70, 72, 73] and *Baetis beskidensis* [4, 33, 65, 66, 70].
1) Distribution of *Baetis fuscatus* (L.) and/or *Baetis scambus* Eaton, literature data. 2) Distribution of *Baetis fuscatus* (L.) and/or *Baetis scambus* Eaton, new author's data. 3) Co-occurrence of *Baetis fuscatus* (L.) and/or *Baetis scambus* Eaton and *Baetis beskidensis* Sowa.

Separate group includes species clearly associated with montane regions. These are *B. beskidensis*, *B. alpinus*, *B. lutheri*, *B. vardarensis*, *B. melanonyx*, *N. gracilis* and *A. sinaica* (Figs. 5, 7, 8, 9, 10 and 11). The most common of them, *B. alpinus* (sometimes cited as *B. carpathica*), was also collected in lakes in the highest Carpathians (Tatra Mts). Larvae of *B. lutheri* (before 1968 known as *B. venustus*), *B. vardarensis* and *B. melanonyx* were often very abundant. *A. sinaica*, *B. beskidensis* and *N. gracilis* were usually rare and not numerous. Localities of *A. gracilis* are concentrated in the eastern part of the Polish Carpathians, in the San river basin; this distribution is related to the south-east European range of this species.

A much smaller group of species is restricted to the lowlands. These are *B. pentaplebodes*, *B. liebenauae*, *B. tracheatus*, and *N. digitatus* (Figs. 6, 7, 9 and 10). Rather recent descriptions of these species may be the reason for their still poorly recognized distribution. Identification of *N. digitatus* and *B. pentaplebodes* is rather difficult and their reported localities in Poland are not numerous.

The richest area in *Baetis* species appears to be the Carpathian montane running waters; rather rich in species were also swift Pomeranian streams in north-western Poland running down the morainic hills. Such a tendency is in accordance with the well known altitudinal and habitat preferences of this mayfly group.

The present survey is a rather preliminary step; however this summarized state of knowledge allows us to indicate rare and possibly endangered species as well as the regions where studies on mayflies should be undertaken.

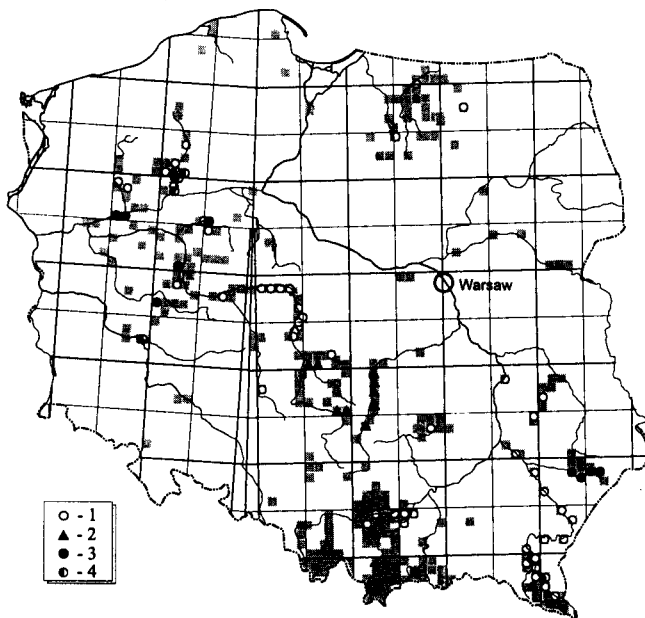


Fig. 6. Distribution of *Baetis buceratus* Eaton [5, 7, 9, 15, 17, 25, 44, 45, 53, 56, 61, 66] and *Baetis pentaplebodes* Ujhelyi [7, 18, 27, 45].

1) Distribution of *Baetis buceratus* Eaton, literature data. 2) Distribution of *Baetis buceratus* Eaton, new author's data. 3) Distribution of *Baetis pentaplebodes*, literature data. 4) Co-occurrence of both species.

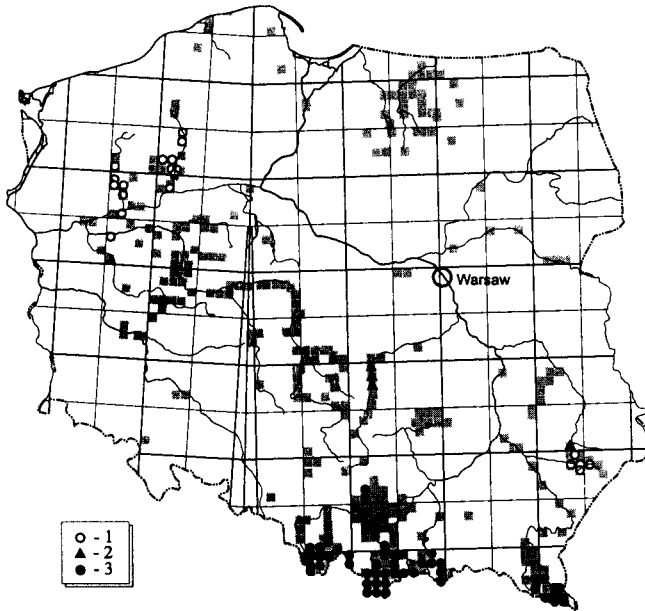


Fig. 7. Distribution of *Baetis liebenauae* Keffermüller [7, 18, 28] and *Baetis alpinus* Pictet [4, 9, 20, 22, 34-38, 43, 48, 50-52, 56, 62, 66, 69, 70, 73].

1) Distribution of *Baetis liebenauae* Keffermüller, literature data. 2) Distribution of *Baetis liebenauae* Keffermüller, new author's data. 3) Distribution of *Baetis alpinus*, literature data.

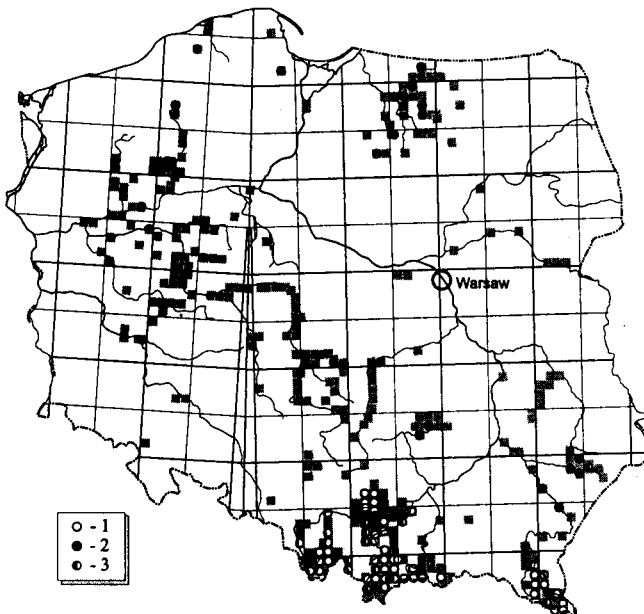


Fig. 8. Distribution of *Baetis lutheri* Müller-Liebenau [1, 4, 6, 9, 18, 33, 35, 38, 40, 43, 52, 56, 57, 62, 66, 70] and *Nigrobaetis niger* (Linnaeus) [7, 9, 15, 18, 19, 24, 44, 56, 61, 66].

1) Distribution of *Baetis lutheri* Müller-Liebenau, literature data. 2) Distribution of *Nigrobaetis niger* (Linnaeus), literature data. 3) Co-occurrence of both species.

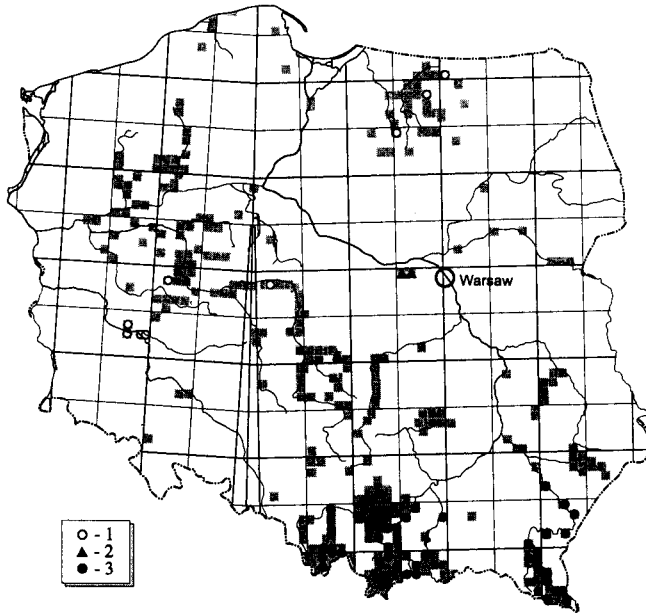


Fig. 9. Distribution of *Baetis tracheatus* Keffermüller et Machel [30, 44, 45] and *Baetis vardarensis* Ikonov [4, 6, 32, 56, 66].

1) Distribution of *Baetis tracheatus* Keffermüller et Machel, literature data. 2) Distribution of *Baetis tracheatus* Keffermüller et Machel, new author's data. 3) Distribution of *Baetis vardarensis* Ikonov, literature data.

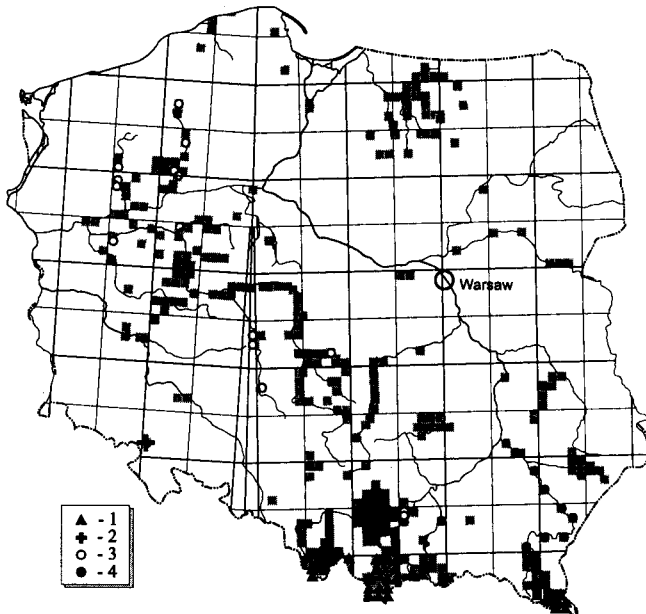


Fig. 10. Distribution of *Baetis melanonyx* (Pictet) [4, 20, 33, 34, 43, 52, 66], *Nigrobaetis digitatus* (Bengtsson) [7, 17, 19, 24, 29, 66] and *Nigrobaetis gracilis* (Bogoescu et Tabacaru) [61, 66].

1) Distribution of *Baetis melanonyx* (Pictet), literature data. 2) Distribution of *Baetis melanonyx* (Pictet), new author's data. 3) Distribution of *Nigrobaetis digitatus* (Bengtsson), literature data. 4) Distribution of *Nigrobaetis gracilis* (Bogoescu et Tabacaru), literature data.

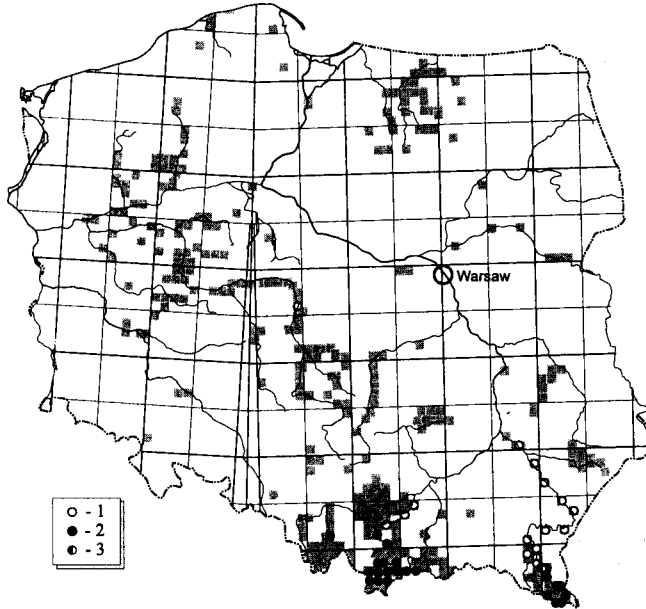


Fig. 11. Distribution of *Baetis inexpectatus* (Tshernova) [24, 61, 66] and *Acentrella sinaica* Bogoescu [4, 33-35, 43, 52, 61, 66].

1) Distribution of *Baetis inexpectatus* (Tshernova), literature data. 2) Distribution of *Acentrella sinaica* Bogoescu, literature data. 3) Co-occurrence of both species.

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