The mayflies (Ephemeroptera) of Utsjoki, northernmost Finland

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SOLDÁN, TOMÁŠ. The mayflies (Ephemeroptera) of Utsjoki, northernmost Finland. Rep. Kevo Subarctic Res. Stat. 17: 81–85. 1981. – Based on material consisting of 3843 specimens collected from 41 sites in July 1981, a study was made of the mayflies of Utsjoki (basin of the Teno river). Of the 24 species collected (50 % of Finnish species), five are recorded for the first time from Inari Lapland in addition to two species new for Utsjoki commune. The most frequent and abundant species are *Baetis rhodani, B. muticus, Siphlonurus aestivalis* and *Ameletus inopinatus* (more than 60 % of specimens collected). No particular life cycle adaptations were observed, although life cycles of both "winter and summer" species showed some modification (e.g. shifting of flight period).

KEY WORDS: – faunistics – abundance – life cycles – Ephemeroptera – Lapland

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Introduction

In July 1981 I had an opportunity to investigate several dozen localities situated near the Kevo Subarctic Research Station of the University of Turku in Utsjoki, in the northernmost part of Finnish Lapland. Since the Ephemeroptera fauna of this area have been studied before (Tiensuu 1939, Bagge 1965, 1968), the purpose of this paper is to complete the list of mayflies occurring here. Although no quantitative sampling method was used and the coverage of the collection throughout the whole area was rather uneven, a relatively high number of specimens (over 3 500) collected at 41 localities, representing all types of subarctic aquatic biotopes makes it possible to compare the frequency and abundance of individual species and to comment on their life cycles.

Material and methods

The material studied comprises 3843 specimens of 24 species, collected at 41 localities in the Teno river basin in Utsjoki, in the InL (Inari Lapland) biological province. For the general features of study area, see Linnaluoto & Koponen (1980); and for the hydrographic and physical characteristics of the surface waters in Utsjoki, see Bagge (1965). The classification of aquatic habitats follows that by Savolainen & Saaristo (1981). Except for collection site No. 30 (Pâdjeseävtteg), where electrofishing apparatus was used, the specimens were collected by normal techniques (nymphs hand-picked from stones or collected by metal cup with a screen bottom and a long handle, and adults netted). The place-names used in the following list of sampling are taken from the Topographic Map of Finland (the corresponding place-names from the Economic Map of Finland can be mostly found in the list by Linnaluoto & Koponen (1980); coordinates according to the uniform grid system, Finnish Grid 27°E):

A. Lakes (over 1 km long): 1. Pulmankijärvi (15 m, 7766:537); 2. Maddajavri (74 m, 7754:500); 3. Keavojavri (Kevojärvi) (75 m, 7742:499); 4. Keavojavri (Kevojärvi) (75 m, 7740:501); 5. Pikku Keavo-

javri (84 m, 7738:497); 6. Vuoskojavri (145 m, 7740: 498); 7. Širrajavri (208 m, 7742:496); 8. Vuolimuš Tsieskuljavri (269 m, 7739:504); 9. Koahppelašavdšejavri (276 m, 7752:491).

B. Ponds (under 1 km long): 10. Pavvalladdu (75 m, 7744:500); 11. two small ponds W of Kevojoki (80 m, 7740:499); 12. two small ponds W of Jesnalvarri (150 m, 7743:497); 13. pond E of Mielketšohkka (200 m, 7747:496); 14. pond W of Utsjoki church (236 m, 7754:497); 15. Lasse Ladjojavri (255 m, 7742:503); 16. Koahppelašavdšejavrreluobbal (272 m, 7753:490); 17. Sirddaluobbal (285 m, 7749:492); 18. pond E of Uhtsa Erttegvarri (320 m, 7747:490); 19. Skallovarladdok (361 m, 7742: 507).

C. Rivers (over 4–5 m wide): 20. Kalddasjohka (20 m, 7767:537); 21. Teno, Kiviniemi (50 m, 7768: 514); 22. Teno, Kaava (70 m, 7763:494); 23. Utsjoki (80 m, 7738:502); 24. Keävvu (Kevojoki) (80 m, 7739:499); 25. Tšarsejohka (95 m, 7742:498); 26. Tšarsejohka (195 m, 7745:494).

D. Brooks (under 4–5 m wide): 27. Kuovdšajohka (30 m, 7766:537); 28. Stalojohka (80 m, 7762:494); 29. brook E of Kevojärvi (80 m, 7741:500); 30. Pâdjeseävtteg (105 m, 7753:500); 31. Uhtsaskaiddašjohka (120 m, 7739:497); 32. Rassejohka (140 m, 7743:501); 33. Mielkejohka (160 m, 7748:496); 34. Širrajohka (200 m, 7742:496); 35. Vuolleseävtteg (220 m, 7754:497); 36. Kidešjohka (220 m, 7746: 503); 37. Koahppelašavdšejohka (260 m, 7753:490); 38. Sirdda-avdši (260 m, 7748:492); 39. Erttegvarjohka (280 m, 7746:491); 40. small brook E of Sirdda-avdši (290 m, 7747:494); 41. Skallovarjohka (350 m, 7743:507).

Results

List of specimens collected at different localities, number of specimens in parentheses (n = nymphs, s = subimagos, a = adults):

1. *Ameletus inopinatus* Eaton (*A. alpinus:* Tiensuu 1939:109, Bagge 1965:104, 1968: 49): 1 (1n), 5 (15n), 6 (5n), 7 (1n), 8 (5n), 11 (20n), 13 (3n), 14 (2n), 18 (1n), 19 (4n), 20 (6n), 21 (40n, 1s), 22 (2n), 23 (2n), 24 (9n), 25 (85n), 26 (25n), 28 (7n), 30 (3n), 31 (2n), 32 (2n), 33 (12n), 34 (3n), 35 (11n), 36 (44n), 37 (5n), 38 (50n, 2s), 39 (18n), 40 (8n), 41 (30n).

2. *Parameletus chelifer* Bengtsson: 5 (14n), 12 (6n), 22 (2a), 38 (3n).

3. *Parameletus minor* Bengtsson: 5 (2n).

4. *Siphlonurus aestivalis* Eaton: 2 (1n), 3 (18n), 4 (5n), 5 (70n), 10 (43n), 11 (8n), 20 (5n), 21 (15n), 22 (5n), 23 (13n), 24 (58n), 25 (82n), 26 (23n), 34 (4n), 36 (2n), 37 (30n), 38 (55n, 2s), 40 (25n).

5. *Siphlonurus alternatus* (Say) (*Siphlurella linnaeana:* Tiensuu 1939:108): 5 (2n), 25 (4n).

6. *Siphlonurus lacustris* Eaton (*S. zetterstedti:* Tiensuu 1939:107, Bagge 1965:103) 5 (8n), 23 (2n).

7. *Metretopus borealis* Eaton: 12 (10n), 20 (6n), 25 (1n).

8. *Acentrella lapponica* Bengtsson: 20 (12n), 23 (16n), 25 (1n), 26 (263n), 30 (54n), 31 (1n).

9. *Baetis macani* Kimmins: 26 (2n), 36 (19n).

10. *Baetis muticus* (Linné) (*B. pumilus:* Bagge 1965:104, 1968:49), 20 (45n, 50a), 21 (4n), 23 (15n), 24 (58n), 25 (101n), 26 (70n), 27 (14n), 28 (2n), 29 (6n), 30 (92n), 31 (2n), 32 (4n), 33 (16n), 38 (35n).

11. *Baetis niger* (Linné): 21 (1n), 25 (1n), 37 (4n), 38 (120n), 39 (13n).

12. *Baetis rhodani* (Pictet) (*B. wallengreni:* Tiensuu 1939:111): 20 (86n), 21 (6n), 22 (11n), 23 (40n), 24 (72n), 25 (201n), 26 (98n), 27 (20n), 28 (4n), 29 (25n), 30 (256n), 31 (99n), 32 (25n), 33 (15n), 34 (18n), 36 (150n), 38 (41n), 39 (2n).

13. *Baetis subalpinus* Bengtsson: 26 (3n).

14. *Centroptilum luteolum* (Müller) (*C. diaphanum:* Tiensuu 1939:114, Bagge 1965: 104, 1968:49): 4 (1n), 5 (4n), 21 (3n), 22 (20n).

15. *Arthroplea congener* Bengtsson: 5 (1n).

16. *Heptagenia dalecarlica* Bengtsson: 1 (3n), 20 (11n), 22 (3n), 23 (30n), 24 (38n), 25 (75n), 26 (44n, 1s), 30 (20n).

17. *Heptagenia fuscogrisea* (Retzius): 5 (3n), 26 (1n).

18. *Ephemerella aurivillii* (Bengtsson) (*Chitonophora aurivillii:* Tiensuu 1939:121, Bagge 1968:49; *E. notata:* Bagge 1965:106): 21 (5n), 22 (12n), 23 (3n), 25 (34n, 2s, 1a), 26 (9n), 30 (3n), 32 (1n), 36 (23n), 38 (5n).

19. *Ephemerella ignita* (Poda): 21 (3n), 22 (6n).

20. *Ephemerella mucronata* (Bengtsson) (*Chitonophora mucronata:* Tiensuu 1939:121): 21 (4n), 24 (7n).

21. *Leptophlebia marginata* (Linné): 2 (4n), 5 (5a), 8 (4n), 9 (19a), 10 (9a), 11 (11n), 15 (10a), 16 (5a), 17 (150n), 19 (55n), 22 (2n), 35 (1n), 38 (3n, 1s), 40 (18n), 41 (4n).

22. *Leptophlebia vespertina* (Linné): 23 (3n), 36 (2n).

23. *Paraleptophlebia strandii* Eaton: 29 (1s).

24. *Ephemera vulgata* Linné: 4 (2a).

Table 1. Frequency and abundance of mayfly species collected in Utsjoki (A = lakes, B = ponds, C = rivers, D = brooks).

Species	Frequency (number of localities)	Abundance (%)
Ameletus inopinatus	A(5) B(5) C(7) D(13)	424 (11.0)
Parameletus chelifer	A(1) B(1) C(1) D(1)	25 (0.7)
Siphlonurus aestivalis	A(4) B(2) C(7) D(5)	464 (12.0)
Metretopus borealis	B(1) C(2)	17 (0.5)
Acentrella lapponica	C(4) D(2)	347 (9.0)
Baetis macani	C(1) D(1)	21 (0.6)
Baetis muticus	C(6) D(8)	514 (13.3)
Baetis niger	C(2) D(3)	139 (3.6)
Baetis rhodani	C(7) D(11)	1169 (30.4)
Centroptilum luteolum	A(2) C(2)	28 (0.7)
Heptagenia dalecarlica	A(1) C(7) D(1)	241 (6.3)
Ephemerella aurivillii	C(5) D(4)	98 (2.6)
Ephemerella mucronata	C(2)	11 (0.3)
Leptophlebia marginata	A(4) B(6) C(1) D(4)	299 (7.8)
Remaining species	–	46 (1.2)
Total		3843 (100.0)

Notes on the abundance and life cycles of the species collected:

As is apparent from Table 1, the most frequently occurring species among the Utsjoki aquatic biotopes is *Ameletus inopinatus,* a species with very wide ecological range (30 localities), the nymphs of which inhabit lakes, ponds, and rivers as well as small brooks in all zones. Other very common species also include *Siphlonurus eastivalis* (18 localities) and *Leptophlebia marginata* (15 localities), the former clearly preferring lotic habitats, and the latter, lakes and ponds in the alpine zone. *Baetis rhodani* (18 localities), *B. muticus* (14 localities) and *Ephemerella aurivillii* and *Heptagenia dalecarlica* (both 9 localities) belong to common species but their nymphs are apparently restricted to lotic habitats, and those of *H. dalecarlica* even to larger brooks and rivers. The remaining species occur less frequently, those not presented in Table 1 occurring rarely and only at 1–2 localities, although some of them are common in Central and Southern Finland (e.g. *Siphlonurus alternatus, Heptagenia fuscogrisea* and *Ephemera vulgata*).

The most adundant species are *Baetis rhodani* (30.4 % of specimens collected), *B. muticus* (13.3 %), *Siphlonurus aestivalis* (12.0 %), and *Ameletus inopinatus* (11.0 %). Other locally abundant species also include *Acentrella lapponica, Leptophlebia marginata, Heptagenia dalecarlica* and *B. niger* (e.g. sites No. 26 – *A. lapponica* or 38 – *B. niger*). The remaining species are rather few in number (0.3 – 2.6 % of specimens collected), those not included in Table 1 being very rare.

Judging from the specimens collected during electrofishing at sampling site No. 30, the abundance of nymphs of the dominant species can be estimated as follows: *Baetis rhodani* 200–400 ind./m^2, *B. muticus* 100–200, *Acentrella lapponica* 50–150, *Heptagenia dalecarlica* and *Ephemerella aurivillii* 20–80.

Except for *Ephemera vulgata* (with at least a two-year life cycle) all the species are univoltine in Utsjoki, although some of them have two generations a year in southern Scandinavia (e.g. *B. rhodani* and *B. muticus*). The flight period is shifted to July and the main growth of nymphs occurs in June and July in the "winter" species too (cf. Landa 1968), with overwintering probably in the nymphal stage (*B. rhodani, H. dalecarlica* and others). *A. lapponica, Metretopus borealis* and *Arthroplea congener* constitute the groups of true "summer" species (hatching of eggs in June, flight period shifted to August and the beginning of September). In some species (especially *S. aestivalis, L. marginata* and *H. dalecarlica*) the nymphal development seems to be very uneven, so that the flight period is relatively very long, lasting at least several weeks.

Discussion and conclusions

Although local mayfly fauna have been little studied in Finland, the mayflies of Utsjoki are repeatedly mentioned. Tiensuu (1939) records data concerning the distribution of 20 species in the Inari Lapland province including 13 species from Utsjoki. Bagge (1965, 1968), in a study of the ecology of subarctic aquatic insects, mentions 13 species (of which 5 for the first time) from Utsjoki. Müller-Liebenau & Savolainen (1975) record 7 species of the genus *Baetis* from Inari Lapland. I found 24 species in Utsjoki in July 1981; of these, five (*Parameletus chelifer, P. minor, Baetis subalpinus, Ephemerella mucronata,* and *Paraleptophlebia strandii*) were recorded from Inari Lapland for the first time and two (*B. niger* and *Arthroplea congener*) are new for Utsjoki (previously known only from Inari and Ivalo (Tiensuu 1939, Müller-Liebenau & Savolainen 1975).

With the exception of *Metretopus alter, Baetis vernus* and *Paraleptophlebia submarginata* all the previously known species were collected. *M. alter* Bengtsson, an extremely rare North European species originally known only from Norway (Finnmark Prov.) was collected in Outakoski by U. Saalas in 1905 (Tiensuu 1939). Dr. Savolainen (pers. comm.) has collected several adults near Ivalo. This species probably also occurs in Kuusamo (cf. Savolainen & Saaristo 1981). Some adults of *B. tenax* (now conspecific with *B. vernus*) recorded from Utsjoki by Tiensuu might in fact belong to the closely related species *B. macani* or *B. subalpinus,* and the material of *B. gemellus* and *B. vernus* from Petsamo (Tiensuu 1939) also actually seems to belong to different species of *Baetis.* On the other hand the occurrence of *Procloeon bifidum* and *Cloeon praetextum* (known from Petsamo: Tiensuu 1939) and *B. digitatus, B. fuscatus, B. scambus* and *Caenis horaria* (known from Inari: Tiensuu 1939, Müller-Liebenau & Savolainen 1975, Savolainen & Saaristo 1980) cannot be excluded in Utsjoki either. A nymph of *Paraleptophlebia submarginata* has been collected in Utsjoki (Karigasniemi, 7702:463) by Savolainen (1980), in a sample from a broad stony brook in a bog (current rapid, depth of 1–2 m).

As far as the frequency and abundance of individual species is concerned, contrary to Bagge (1965, 1968) and Müller-Liebenau & Savolainen (1975), I found *B. macani* to be very rare. It did not occur at all in the *Carex* zone of the alpine lakes investigated (cf. Bagge 1965). Bagge (1968) states that "the most eurytopic species in subarctic waters seem to be *Leptophlebia vespertina* and *L. marginata...*" According to results obtained in July 1981, *L. vespertina* was very rare and *L. marginata,* despite its frequent occurrence, was mainly distributed in the alpine zone. The absence of *L. marginata* and *L. vespertina* from some localities might be caused by the termination of metamorphosis at lower altitudes, since for the most part only nymphs were collected.

The life cycles of Ephemeroptera in Utsjoki do not show any particular adaptations to subarctic conditions except shifting of the flight period and limitation to one generation even in usually bivoltine species. The differences in the life cycle of "winter" and "summer" species are not so pronounced as in Central Europe (cf. Landa 1968) but quite definite, "summer" species in fact flying during the arctic autumn. Unsynchronized nymphal development and a prolonged flight period, usually occurring in early spring species in Central Europe, was observed in many species collected in Utsjoki.

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References

BAGGE, P. 1965: Observations on some mayfly and stonefly nymphs (Ephemeroptera and Plecoptera) in Utsjoki, Finnish Lapland. – Ann. Ent. Fenn. 31: 102–108.

BAGGE, P. 1968: Ecological studies on the fauna of subarctic waters in Finnish Lapland. – Rep. Kevo Subarctic Res. Stat. 4: 28–79.

LINNALUOTO, E. T. & KOPONEN, S. 1980: Lepidoptera of Utsjoki, northernmost Finland. – Kevo Notes 5: 1–68.

LANDA, V. 1968: Developmental cycles of Central European Ephemeroptera and their interrelations. – Acta ent. bohemoslov. 66 : 288–316.

MÜLLER-LIEBENAU, I. & SAVOLAINEN, E. 1975: Baetis species from Kuopio Museum, Finland (Ephemeroptera, Baetidae). – Not. Ent. 55: 93–96.

SAVOLAINEN, E. 1980: First records of Paraleptophlebia submarginata (Ephemeroptera, Leptophlebiidae) within the present boundaries of Finland. – Not. Ent. 60: 105–106.

SAVOLAINEN, E. & SAARISTO, M. I. 1980: Baetis digitatus Bengtsson (Ephemeroptera) found in Finland. – Not. Ent. 60: 195–196.

SAVOLAINEN, E. & SAARISTO, M. I. 1981: Distribution of mayflies (Ephemeroptera) in the biological province of Kuusamo (KS), Finland. – Not. Ent. 61: 117–124.

TIENSUU, L. 1939: A survey of the distribution of mayflies (Ephemerida) in Finland. – Ann. Ent. Fenn. 5: 97–124.

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