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Checklist of the Belgian mayflies (Ephemeroptera)

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Abstract

In the presented checklist, 63 species of mayflies are listed for Belgium. Four species are reported here for the first time for Belgium: *Baetis (Labiobaetis) atrebatinus* Eaton, 1870, *Kageronia fuscogrisea* (Retzius, 1783), *Rhithrogena beskidensis* Albatercedor & Sowa, 1987 and *Rhithrogena hercynia* Landa, 1969. Based on their occurrence in the neighbouring countries, a few additional species may still be expected. During the last few years, 58 species could still be collected in the field. The five remaining species were not recorded for at least 30 years: *Baetis (Acentrella) sinaicus* (Bogoescu, 1931), *Choroterpes picteti* (Eaton, 1871), *Metreletus balcanicus* (Ulmer, 1920), *Raptobaetopus tenellus* (Albarda, 1878) and *Siphlonurus (Siphlonurus) lacustris* (Eaton, 1870). These species are either regionally extinct, which is almost certainly the case for *C. picteti*, while some others have probably been overlooked, which is probably the case for *S. lacustris*. An overview is given of the literature dealing with the Belgian mayflies.

Keywords: *Baetis (Labiobaetis) atrebatinus*; *Kageronia fuscogrisea*; macroinvertebrates; *Rhithrogena beskidensis*; *Rhithrogena hercynia*.

Samenvatting

In deze soortenlijst worden 63 soorten gemeld voor België. Vier soorten worden voor het eerst gerapporteerd voor België: *Baetis (Labiobaetis) atrebatinus* Eaton, 1870, *Kageronia fuscogrisea* (Retzius, 1783), *Rhithrogena beskidensis* Albatercedor & Sowa, 1987 en *Rhithrogena hercynia* Landa, 1969. Gebaseerd op hun verspreiding in de naburige landen worden echter nog enkele soorten verwacht. Gedurende de laatste jaren konden nog 58 soorten worden waargenomen. De vijf resterende soorten werden al meer dan 30 jaar niet meer waargenomen: *Baetis (Acentrella) sinaicus* (Bogoescu, 1931), *Choroterpes picteti* (Eaton, 1871), *Metreletus balcanicus* (Ulmer, 1920), *Raptobaetopus tenellus* (Albarda, 1878) en *Siphlonurus (Siphlonurus) lacustris* (Eaton, 1870). Deze soorten zijn ofwel regionaal uitgestorven, wat vrijwel zeker het geval is voor *C. picteti*, terwijl andere soorten waarschijnlijk over het hoofd gezien zijn, wat waarschijnlijk het geval is voor *S. lacustris*. Er wordt een overzicht gegeven van de literatuur die handelt over de Belgische haften.

Résumé

Dans la présente liste, 63 espèces d'Ephéméroptères sont mentionnées pour la Belgique. Quatre espèces sont rapportées ici pour la première fois de Belgique: *Baetis (Labiobaetis) atrebatinus* Eaton, 1870, *Kageronia fuscogrisea* (Retzius, 1783), *Rhithrogena beskidensis* Albatercedor & Sowa, 1987 et *Rhithrogena hercynia* Landa, 1969. Au vu de leur distribution dans les pays limitrophes, on peut s'attendre à quelques espèces additionnelles. Ces dernières années, 58 espèces ont pu encore être capturées. Par contre, cinq espèces n'ont plus été observées depuis plus de 30 ans: *Baetis (Acentrella) sinaicus* (Bogoescu, 1931), *Choroterpes picteti* (Eaton, 1871), *Metreletus balcanicus* (Ulmer, 1920), *Raptobaetopus tenellus* (Albarda, 1878) et *Siphlonurus (Siphlonurus) lacustris* (Eaton, 1870). Ces espèces ont probablement disparu de Belgique, ce qui est quasi certainement le cas pour *C. picteti*, alors que d'autres ont probablement été négligées, ce qui est probablement le cas pour *S. lacustris*. Un résumé de la littérature sur les Ephéméroptères de Belgique est donné.

Introduction

In the first study about the Belgian mayflies, MAC LACHLAN (1881) mentioned 16 species from a 15 day field trip. A few years later, DE SELYS-LONGCHAMPS (1888) already listed 27 species for Belgium. LAMEERE (1900) only listed 19 species in his 'Manuel de la faune de Belgique', apparently he neglected the previous study. NAVAS (1911) added two species to the list of DE SELYS-LONGCHAMPS (1888), but removed *Palingenia longicauda* (Olivier, 1791). LESTAGE (1928) increased the number of species in Belgium to 46 species. Based on a literature survey, STROOT & MOL (1989) listed 65 species for Belgium, but they admitted that they did not check all the material and that some material needed confirmation. Recently, LOCK & GOETHALS (2011) gave distribution maps of the 32 species encountered in Flanders.

During the present study, most available material from collections of Belgian Ephemeroptera was identified. In addition, field work was carried out in order to get an idea of which species are still present in Belgium. Furthermore, an overview is given about the literature dealing with Ephemeroptera in Belgium. Based on these data, a checklist of the Belgian species is presented and four additional species are reported here for the first time for Belgium.

Materials and methods

During the present study, all the available material, adults as well as larvae, from the Royal Belgian Institute of Natural Sciences (KBIN-IRSNB), the University Faculty of Agronomic Sciences in Gembloux (FSAG), the Flemish Environmental Agency (VMM), the University of Antwerp (UA), the University of Mons (UMons) and the University of Liège (ULG) was identified.

Belgian larval as well as adult mayflies can be identified with BAUERNFEIND & HUMPESCH (2001), which only misses *Baetis atrebatinus* Eaton, 1870. The larvae can also be identified with the key of EISELER (2005), which also lacks *B. atrebatinus*. The latter species can for example be identified using MÜLLER-LIEBENAUAE (1969). It is strongly discouraged to use to key of GYSELS (1991), which is incomplete and contains a lot of errors.

Results

In total, 63 species of mayflies (Ephemeroptera) have been found in Belgium (Table 1). For each family, the occurring species are discussed and an overview is given of the Belgian literature.

Siphlonuridae

Siphlonurus (Siphlonurus) aestivalis (Eaton, 1903) was first reported by LESTAGE (1924) and later mentioned by LESTAGE (1928), STROOT & MOL (1989) and GYSELS (1991). Although the species is not common, it is by far the most encountered species of the Siphlonuridae and a lot of misidentified material also belonged to this species. *Siphlonurus (Siphlonurus) armatus* (Eaton, 1870) was reported from the river Roer (GHYSELS, 1969; GYSELS *et al.*, 1976), however, this material was identified as *S. aestivalis* by MOL (STROOT & MOL, 1989). LESTAGE (1920b, 1928) and HOFFMANN (1951) reported *Siphlonurus (Siphlonurus) lacustris* (Eaton, 1870) from several rivers, however, this material all turned out to be *S. aestivalis*. GHYSELS (1969) and GYSELS *et al.* (1976) reported *S. lacustris* from the river Roer, however, also this material was almost certainly wrongly identified, since *S. aestivalis* is known to occur in that stream and this habitat is not suitable for *S. lacustris*. Despite these misidentifications, material of *S. lacustris* collected in 1973 in the river Rulles was present in the collection of the Royal Belgium Institute of Natural Sciences. LESTAGE (1928) reported that DELPERÉE found larvae of *Siphlonurus (Siphlurella) alternatus* (Say, 1824) and that ULMER found this species in the collection of DE SELYS-LONGCHAMPS. This occurrence was cited by LESTAGE (1931a) and STROOT & MOL (1989), however, the presence of this species in Belgium could not be confirmed during the present study and in addition, no locations were mentioned. Therefore, *S. alternatus* was not included in the present checklist.

Ameletidae

LESTAGE (1928) first mentioned a species, which he later described as *Metretopus goetghebueri* (LESTAGE, 1938). DEMOULIN (1951) argued that this species belonged to the genus *Metreletus* and now the species name is considered as a synonym of *Metreletus balcanicus* (Ulmer, 1920). The species was only

Table 1. Checklist of the Belgian Ephemeroptera. Species still present in Belgium are indicated with a sphere (•); if species were not found since 2000, the last year the species was observed is indicated.

ORDER EPHEMEROPTERA	
Family Siphlonuridae	
1. *Siphlonurus (Siphlonurus) aestivalis* (Eaton, 1903)	•
2. *Siphlonurus (Siphlonurus) lacustris* (Eaton, 1870)	1973
Family Ameletidae	
3. *Metreletus balcanicus* (Ulmer, 1920)	1953
Family Baetidae	
4. *Baetis alpinus* (Pictet, 1843)	•
5. *Baetis buceratus* Eaton, 1870	•
6. *Baetis fuscatus* (Linnaeus, 1761)	•
7. *Baetis liebenauae* Keffermüller, 1974	•
8. *Baetis lutheri* Müller-Liebenau, 1967	•
9. *Baetis melanonyx* (Pictet, 1843)	•
10. *Baetis scambus* Eaton, 1870	•
11. *Baetis vardarensis* Ikonomov, 1962	•
12. *Baetis vernus* (Curtis, 1834)	•
13. *Baetis (Acentrella) sinaicus* (Bogoescu, 1931)	1952
14. *Baetis (Labiobaetis) atrebatinus* Eaton, 1870	•
15. *Baetis (Nigrobaetis) muticus* (Linnaeus, 1758)	•
16. *Baetis (Nigrobaetis) niger* (Linnaeus, 1761)	•
17. *Baetis (Rhodobaetis) rhodani* (Pictet, 1843)	•
18. *Raptobaetopus tenellus* (Albarda, 1878)	1980
19. *Centroptilum luteolum* (Müller, 1776)	•
20. *Cloeon dipterum* (Linnaeus, 1761)	•
21. *Cloeon (Simelecloeon) simile* Eaton, 1870	•
22. *Procloeon bifidum* (Bengtsson, 1912)	•
23. *Procloeon pennulatum* (Eaton, 1870)	•
Family Oligoneuriidae	
24. *Oligoneuriella rhenana* (Imhoff, 1852)	•
Family Heptageniidae	
25. *Ecdyonurus dispar* (Curtis, 1834)	•
26. *Ecdyonurus insignis* (Eaton, 1870)	•
27. *Ecdyonurus torrentis* Kimmins, 1942	•
28. *Ecdyonurus venosus* (Fabricius, 1775)	•
29. *Electrogena ujhelyii* (Sowa, 1981)	•
30. *Kageronia fuscogrisea* (Retzius, 1783)	•
31. *Heptagenia flava* Rostock, 1878	•
32. *Heptagenia sulphurea* Müller, 1776	•
33. *Epeorus (Epeorus) assimilis* (Eaton, 1871)	•
34. *Rhithrogena beskidensis* Albatercedor & Sowa, 1987	•
35. *Rhithrogena hercynia* Landa, 1969	•
36. *Rhithrogena picteti* Sowa, 1971	•
37. *Rhithrogena semicolorata* (Curtis, 1834)	•
Family Leptophlebiidae	
38. *Choroterpes picteti* (Eaton, 1871)	1918
39. *Habroleptoides confusa* Sartori & Jacob, 1986	•
40. *Habrophlebia fusca* (Curtis, 1834)	•
41. *Habrophlebia lauta* Eaton, 1884	•
42. *Leptophlebia (Leptophlebia) marginata* (Linnaeus, 1767)	•
43. *Leptophlebia (Leptophlebia) vespertina* (Linnaeus, 1758)	•
44. *Leptophlebia (Paraleptophlebia) cincta* (Retzius, 1783)	•
45. *Leptophlebia (Paraleptophlebia) submarginata* (Stephens, 1835)	•
46. *Leptophlebia (Paraleptophlebia) werneri* Ulmer, 1920	•
Family Potamanthidae	
47. *Potamanthus luteus* (Linnaeus, 1767)	•
Family Polymitarcidae	
48. *Ephoron virgo* (Olivier, 1791)	•
Family Ephemeridae	
49. *Ephemera danica* Müller, 1764	•
50. *Ephemera glaucops* Pictet, 1843	•
51. *Ephemera lineata* Eaton, 1870	•
52. *Ephemera vulgata* Linnaeus, 1758	•
Family Ephemerellidae	
53. *Serratella ignita* (Poda, 1761)	•
54. *Torleya major* (Klapalek, 1905)	•
Family Caenidae	
55. *Brachycercus harrisella* Curtis, 1834	•
56. *Caenis beskidensis* Sowa, 1973	•
57. *Caenis horaria* (Linnaeus, 1758)	•
58. *Caenis lactea* (Burmeister, 1839)	•
59. *Caenis luctuosa* (Burmeister, 1839)	•
60. *Caenis macrura* Stephens, 1835	•
61. *Caenis pseudorivulorum* Keffermüller, 1960	•
62. *Caenis rivulorum* Eaton, 1884	•
63. *Caenis robusta* Eaton, 1884	•

found in a few streams south of Ghent until 1953, where the species is now considered extinct (DEMOULIN, 1951, 1953a; GYSELS, 1991; LESTAGE, 1928, 1938; LOCK & GOETHALS, 2011; STOOT & MOL, 1989).

Baetidae

Although *Baetis alpinus* (Pictet, 1843) is not rare in the south of Belgium, it has only been reported by MÜLLER-LIEBENAU (1980) and STROOT & MOL (1989). *Baetis buceratus* Eaton, 1870 has only been found in the river Ourthe and the river Semois (MÜLLER-LIEBENAU, 1980; STROOT & MOL, 1980). *Baetis fuscatus* (Linnaeus, 1761) is common in watercourses that are not to small (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; LESTAGE, 1928; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MOL, 1987; MÜLLER-LIEBENAU, 1980; NAVAS, 1910, 1911, 1913, 1914, 1924; STROOT & MOL, 1989). Recently, *Baetis liebenauae* Keffermüller, 1974 was discovered in the river Semois by COPPA (2004), however, the species also occurs in other larger rivers such as the river Lesse, the river Viroin, the river Alleines and the river Amblève. *Baetis lutheri* Müller-Liebenau, 1967 is not rare in the southern part of Belgium, but is probably extinct in Flanders (LOCK & GOETHALS, 2011; MÜLLER-LIEBENAU, 1980; STROOT & MOL, 1989). *Baetis melanonyx* (Pictet, 1843) has only been found in Ruisseau de Belvaux, a stream discharging in the river Hermeton (MÜLLER-LIEBENAU, 1980; STROOT & MOL, 1989). *Baetis scambus* Eaton, 1870 is not rare is unpolluted streams (LESTAGE, 1919d, 1920b, 1928; LOCK & GOETHALS, 2011; MÜLLER-LIEBENAU, 1980; ROSILLON, 1985a, 1986a; STROOT & MOL,

1989;). *Baetis vardarensis* Ikonomov, 1962 has only been collected in the river Ourthe, the river Amblève and the river Viroin (MÜLLER-LIEBENAU, 1980; STROOT & MOL, 1989). *Baetis vernus* (Curtis, 1834) is a common species, especially in Flanders, where the recent improvement of the water quality has led to an increased prevalence (COPPA, 2004; DOPAGNE & DETHIER, 2000; GYSELS, 1991; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; MARLIER, 1951; MOL, 1987; MÜLLER-LIEBENAU, 1980; STROOT & MOL, 1989). *Baetis (Acentrella) sinaicus* (Bogoescu, 1931) has only been observed in the river Lomme in 1952 (MÜLLER-LIEBENAU, 1980; STROOT & MOL, 1989) and in Liège in 1919. *Baetis (Labiobaetis) atrebatinus* Eaton, 1870 is reported here for the first time from Belgium. Larvae of this species were found on 3.VI.2010 in the river Meuse in Heer-sur-Meuse. *Baetis (Nigrobaetis) muticus* (Linnaeus, 1758) is not rare in unpolluted streams in the south of the country (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1928; LOCK & GOETHALS, 2011; MAC MACHLAN, 1881; MÜLLER-LIEBENAU, 1980; NAVAS, 1911; STROOT & MOL, 1989). *Baetis (Nigrobaetis) niger* (Linnaeus, 1761) has been found in several streams in the Ardennes region (GYSELS *et al.*, 1976; LESTAGE, 1919d, 1920b, 1928; MÜLLER-LIEBENAU, 1980; NAVAS, 1911; STROOT & MOL, 1989). *Baetis (Rhodobaetis) rhodani* (Pictet, 1843) is a very common species, especially in the southern part of the country (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; DETHIER *et al.* 2008; GYSELS, 1969,1991; GYSELS *et al.*, 1976; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1935c; LITT, 1989a; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MAQUET, 1983; MAQUET & ROSILLON, 1985; MOL, 1987; MÜLLER-LIEBENAU, 1980; NAVAS, 1911, 1921; ROSILLON, 1985a,b, 1986a; STROOT & MOL, 1989). *Raptobaetopus tenellus* (Albarda, 1878) has been found in larger rivers such as the river Meuse, the river Amblève and the river Ourthe (GYSELS, 1991; LESTAGE, 1919d, 1928; MOL, 1987; STROOT & MOL, 1989), however, the species has not been observed since 1980. *Centroptilum luteolum* (Müller, 1776) can be found in unpolluted streams and rivers (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1935c; LITT, 1989a, 1992; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MAQUET, 1983; NAVAS, 1911; ROSILLON, 1985a; STROOT & MOL, 1989). In Belgium, *Cloeon dipterum* (Linnaeus, 1761) is the most common species of stagnant waters and slow flowing watercourses (CORS *et al.*, 2004; DEMOULIN, 1953b; DE SELYS-LONGCHAMPS, 1888; DE SMET & DAS, 1981; DETHIER *et al.*, 2008; DOPAGNE & DETHIER, 2000; DUMONT & GYSELS, 1971; GOETGHEBUER, 1930; GYSELS, 1972a,b, 1991; GYSELS *et al.*, 1976; LAMEERE, 1900; LESTAGE, 1920b,c, 1928, 1931b; LITT, 1989a, 1992, 1996; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MOL, 1987; NAVAS, 1911, 1913, 1914, 1924; STROOT & MOL, 1989). *Cloeon (Simelecloeon) simile* Eaton, 1870 also occurs in stagnant waters, but is much less common than *C. dipterum* (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1972a,b, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1936; LITT, 1992; LOCK & GOETHALS, 2011; NAVAS, 1911; STROOT & MOL, 1989). *Cloeon inscriptum* Bengtsson, 1914 and *Cloeon praetextum* Bengtsson, 1914 have also been cited for Belgium, but these are no longer considered as separate species (BAUERNFEIND & HUMPESCH, 2001). *Procloeon bifidum* (Bengtsson, 1912) occurs in unpolluted streams and rivers (GYSELS, 1991; LOCK & GOETHALS, 2011; STROOT & MOL, 1989). *Procloeon pennulatum* (Eaton, 1870) had been reported by several authors (GYSELS, 1991; LESTAGE, 1928; STROOT & MOL, 1989), but no material of this species was conserved and the records from Flanders were almost certainly wrongly identified. However, larvae of *P. pennulatum* were encountered on 3.VI.2010 in the river Meuse in Heer-sur-Meuse.

Isonchyiidae

LITT (1989b) reported *Isonychia ignota* (Walker, 1853) from the river Roer on multiple occasions. However, no material was conserved and despite intensive sampling, the species could not be detected in the river Roer. In addition, it is unlikely that this potamal species was found in such a small stream. STROOT & MOL (1989) cited the observation of LITT (1989b), but no other studies mention this species for Belgium. In the collection of the Royal Belgian Institute of Natural Sciences, one male is presented in the Belgian collection, which was collected by LESTAGE, but no locality is indicated and this individual was probably caught abroad. Therefore, *I. ignota*

was not included in the presented checklist.

Oligoneuriidae

Oligoneuriella rhenana (Imhoff, 1852) is known from big rivers such as the river Lesse, the river Ourthe, the river Amblève, the river Lomme and the river Meuse (GYSELS, 1991; LESTAGE 1919a,b,c, 1920b, 1928, 1935b,c; MICHA, 1970; STROOT & MOL, 1989).

Heptageniidae

Ecdyonurus dispar (Curtis, 1834) can be found in larger rivers in the southern part of Belgium (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1969, 1991; GYSELS *et al.*, 1976; LAMEERE, 1900; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; NAVAS, 1911; STROOT & MOL, 1989). *Ecdyonurus forcipula* (Pictet, 1843) is a mountainous species that was reported by GYSELS *et al.* (1976) and GYSELS (1991), but the material was almost certainly wrongly identified and therefore, this species was not included in the checklist. Also *Ecdyonurus helveticus* (Eaton, 1883) was reported by several authors (DETHIER *et al.*, 2008; GYSELS, 1991; LESTAGE, 1928; STROOT & MOL, 1989). However, also this Alpine species, which was almost certainly wrongly identified, was rejected from the checklist. *Ecdyonurus insignis* (Eaton, 1870) can be found in big rivers such as the river Meuse, the river Lesse, the river Semois, the river Néblon, the river Amblève and the river Ourthe (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1920b, 1928, 1935c; MAC LACHLAN, 1881; NAVAS, 1911; STROOT & MOL, 1989). *Ecdyonurus torrentis* Kimmins 1942 (GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1920b; LITT, 1989a; STROOT & MOL, 1989) as well as *Ecdyonurus venosus* (Fabricius, 1775) (COPPA, 2004; DETHIER *et al.*, 2008; DE SELYS-LONGCHAMPS, 1888; FREDERICQ, 1904; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1935a,c; MOL, 1987; NAVAS, 1909, 1911; ROSILLON, 1985a; STROOT & MOL, 1989) can both be found in unpolluted streams in the south of the country. All records of *Electrogena lateralis* (Curtis, 1824) in Belgium that could be verified actually belong to the recently described *Electrogena ujhelyii* (Sowa, 1981), which can be found in unpolluted streams (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1928; LITT, 1989a, 1992; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MAQUET, 1983; NAVAS, 1911; STROOT & MOL, 1989). *Kageronia fuscogrisea* (Retzius, 1783) was reported from Comblain-la-Tour by GYSELS (1991), however, this material turned out to be *Heptagenia sulphurea* Müller, 1776. However, a *K. fuscogrisea* was found for the first time in Belgium in Heer-sur-Meuse on 26.IV.2010. *Heptagenia coerulans* Rostock, 1878 was reported by LESTAGE (1920b) although the species was not included in the checklist of Lestage (1928) and the presence of this species in Belgium could not be confirmed. Therefore, *H. coerulans* was not retained for the checklist. *Heptagenia flava* Rostock 1878 has been observed in the river Meuse and larger unpolluted streams in the Campine region (DEMOULIN, 1954; GYSELS, 1991; LOCK & GOETHALS, 2011; STROOT & MOL, 1989). The presence of *Heptagenia longicauda* (Stephens, 1835) was reported by several authors (GYSELS, 1991; LESTAGE, 1928; MAC LACHLAN, 1881; STROOT & MOL, 1989). Nonetheless, the presence of this species could not be confirmed and the material that could be checked turned out to be *E. ujhelyii*. *H. longicauda* was therefore not included in the Belgian checklist. *Heptagenia sulphurea* Müller, 1776 can be found in larger rivers in Wallonia, but the species became extinct in Flanders (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; DOPAGNE & DETHIER, 2000; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MOL, 1987; NAVAS, 1911, 1913, 1914; STROOT & MOL, 1989). *Epeorus (Epeorus) assimilis* (Eaton, 1871) can be found in unpolluted streams in the south of the country (CORS *et al.*, 2004a,b; DEPIERIEUX *et al.*, 1983; DE SELYS-LONGCHAMPS, 1888; DETHIER *et al.*, 2008; GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1928, 1935a,c; LITT, 1989a; MAQUET, 1983; NAVAS, 1911; ROSILLON, 1985a; STROOT & MOL, 1989). *Rhithrogena beskidensis* Albatercedor & Sowa, 1987 is reported here for the first time for Belgium. Larvae of this species were found in the river Lomme in Eprave on 8.VII.2010. *Rhithrogenia ferruginea* Navas, 1905 was reported by STROOT & MOL (1989) and GYSELS (1991), however, the presence of this species in Belgium could not be confirmed and therefore, the species was not enlisted on the presented checklist. *Rhithrogena hercynia* Landa, 1969 is another new addition for the

Belgian fauna. Larvae of *R. hercynia* were first sampled in the river Ourthe near Wibrin and in Houffalize on 7.III.2009, but have since then also been sampled on several other occasions in streams in the Ardennes region. *Rhithrogena iridina* (Kolenati, 1839) was reported by STROOT & MOL (1989), however, this species was not included in the checklist because the presence of this species in Belgium could not be confirmed. *Rhithrogena picteti* Sowa, 1971 was only reported by LOCK & GOETHALS (2011), however, identification of the material present in the collection of the Royal Belgian Institute of Natural Sciences indicated that it is the most common species of the genus in Belgium. The species is quite common in unpolluted streams in the south of the country, but it became extinct in Flanders. *Rhithrogena savoiensis* Alba-Tercedor & Sowa, 1987 has often been reported for Belgium (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LESTAGE, 1920b, 1928; NAVAS, 1911; STROOT & MOL, 1989), however, this species was not included in the checklist because it could not be confirmed for Belgium. Although *Rhithrogena semicolorata* (Curtis, 1834) has often been confused with the *R. picteti*, it is not rare in unpolluted streams in the southern part of Belgium (CORS *et al.*, 2004; DE SELYS-LONGCHAMPS, 1888; DETHIER *et al.*, 2008; FREDERICQ, 1904; GOETGHEBUER, 1930; GYSELS, 1969, 1991; GYSELS *et al.*, 1976; LAMEERE, 1900; LESTAGE, 1920b, 1928; LITT, 1989a; MAC LACHLAN, 1881; MAQUET, 1983; NAVAS, 1911; ROSILLON, 1985a; STROOT & MOL, 1989).

Lepthophlebiidae

Choroterpes picteti (Eaton, 1871) has only been found in the river Meuse and the river Semois, but it has not been observed in Belgium since 1918 (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LESTAGE, 1920b, 1928; MAC LACHLAN, 1881; NAVAS, 1911; STROOT & MOL, 1989). *Hebroleptoides confusa* Sartori & Jacob, 1986 is quite common in unpolluted streams in the southern part of the country (DETHIER & HUBART, 2003; DETHIER *et al.*, 2008, GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1929a; LITT, 1989a; MAQUET, 1983; ROSILLON, 1985a; STROOT & MOL, 1989). *Habrophlebia fusca* (Curtis, 1834) has a scattered distribution and has only been found in a few unpolluted streams in Zedelgem, Brakel, Melle, Schelderode, Grandmenil, Nismes, Ombret and Dalhem (DEMOULIN, 1953a; GYSELS, 1969, 1991; GYSELS *et al.*, 1976; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; NAVAS, 1911; STROOT & MOL, 1989). *Habrophlebia lauta* Eaton, 1884 is quite common in unpolluted streams in the southern part of the country (CORS *et al.*, 2004; DE SELYS-LONGCHAMPS, 1888; LESTAGE, 1928; GYSELS, 1969, 1991; GYSELS *et al.*, 1976; MAQUET, 1983; NAVAS, 1911; ROSILLON, 1985a; STROOT & MOL, 1989). *Leptophlebia marginata* (Linnaeus, 1767) has be found in a few unpolluted streams in Lanaken, Bruxelles, Hockai, Soulme, Duzo-Moupes, Baraque Michel, Vielsalm and Halloy (DE SELYS-LONGCHAMPS, 1888; FREDERICQ, 1904; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; NAVAS, 1911; STROOT & MOL, 1989). *Leptophlebia vespertina* (Linnaeus, 1758) has been observed in Averbode, Brasschaat, Genk, Drongen, Kalmthout, Lanaken, Mol, Overmeire and Basseilles, mainly in fens (GOETGHEBUER, 1930; GYSELS, 1991; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; STROOT & MOL, 1989). *Leptophlebia (Paraleptophlebia) cincta* (Retzius, 1783) could only be confirmed from Rendeux and Liège, but was also reported from several other locations, although at least some of these records belonged to other species of this family (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LESTAGE, 1920b, 1928; MAC LACHLAN, 1881; NAVAS, 1911; STROOT & MOL, 1989). *Leptophlebia (Paraleptophlebia) submarginata* (Stephens, 1835) is quite common in unpolluted streams in the southern part of the country (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928; LITT, 1989a; MAQUET, 1983; MARLIER, 1951; NAVAS, 1911; ROSILLON, 1985a; STROOT & MOL, 1989, LOCK & GOETHALS, 2011). *Leptophlebia (Paraleptophlebia) werneri* Ulmer, 1920 has a scattered distribution and has only been found in a few unpolluted streams in Lanaken, Dikkebus, Melle, Loenhout, Genk, Postel, Rotselaar, Houyet, Raeren and Hatrival (GYSELS, 1991; LESTAGE, 1928; LOCK & GOETHALS, 2011; STROOT & MOL, 1989). *Thraulus bellus* Eaton, 1881 was reported by NAVAS (1910), however, LESTAGE (1928) indicated that this species was erroneously mentioned from Belgium.

Potamanthidae

Potamanthus luteus (Linnaeus, 1767) has been observed in larger rivers such as the river

Meuse, the river Lesse, the river Semois and the river Ourthe (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1935c; NAVAS, 1911; STROOT & MOL, 1989). In Flanders, where *P. luteus* only occurred in the river Meuse, the species became regionally extinct (LOCK & GOETHALS, 2011).

Polymitarcyidae

Ephoron virgo (Olivier, 1791) has only been found along the river Meuse (DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928; MOL, 1987; NAVAS, 1911; STROOT & MOL, 1989).

Ephemeridae

Ephemera danica Müller, 1764 is a common species in unpolluted watercourses (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; DOPAGNE, 1985; EVRARD & MICHA, 1995; GYSELS, 1991; GYSELS *et al.*, 1976; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1935c; LITT, 1989a; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MAQUET, 1983; MARLIER, 1951; MOL, 1987; NAVAS, 1909, 1911; ROSILLON, 1985a; STROOT & MOL, 1989). *Ephemera glaucops* Pictet, 1843 was only recently discovered in the Campine region (LOCK & GOETHALS, 2011). *Ephemera lineata* Eaton, 1870 can be found in larger rivers such as the river Meuse, the river Ourthe and the river Vesdre (GYSELS, 1991; LESTAGE, 1919d, 1928; MOL, 1987; STROOT & MOL, 1989). *Ephemera vulgata* Linnaeus 1758 is quite common in unpolluted watercourses (COPPA, 2004; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; GYSELS *et al.*, 1976; LAMEERE, 1900; LESTAGE, 1920b, 1928; LOCK & GOETHALS, 2011; NAVAS, 1911, 1921; STROOT & MOL, 1989).

Palingeniidae

The only record of the enigmatic *Palingenia longicauda* (Olivier, 1791) consists of an observation by TENNSTEDT on the river Demer near Diest in 1879 (DE SELYS-LONGCHAMPS, 1888; LAMEERE, 1900; LESTAGE, 1928, 1929a, 1937; STROOT & MOL, 1989). However, since no material was conserved or even seen by one of these authors, this species was omitted from the checklist.

Ephemerellidae

Ephemerella mucronata (Bengtsson, 1909) was reported from Destelbergen (GOETGHEBUER, 1930; LESTAGE, 1928, 1929a; STROOT & MOL, 1989), however, this species was not included in the checklist as no material was conserved. All conserved material identified as *Ephemerella notata* Eaton, 1887 (GYSELS, 1991; GYSELS *et al.*, 1976; LESTAGE, 1928, 1931a, 1935a; STROOT & MOL, 1989) turned out to be *Serratella ignita* (Poda, 1761). The latter species is quite common in watercourses containing higher plants (COPPA, 2004; DEMOULIN, 1955; DEPIEREUX *et al.*, 1983; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1931a, 1935c, 1940; LITT, 1989a; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; MAQUET, 1983; MARLIER, 1951; MOL, 1987; NAVAS, 1909, 1910, 1911, 1913, 1914; ROSILLON, 1985a,b, 1986a; STROOT & MOL, 1989). *Torleya major* (Klapalek, 1905) is common in watercourses in the southern part of the country (DELPÉRÉE, 1919; DEPIEREUX *et al.*, 1983; GILTAY, 1935; GYSELS, 1991; GYSELS *et al.*, 1976; LAMEERE, 1919a,b; LESTAGE, 1920a,b, 1923, 1925, 1928, 1929b, 1934, 1938, 1940; MAQUET, 1983; MOL, 1987; ROSILLON, 1985a,b, 1986a,b; STROOT & MOL, 1989).

Caenidae

The first records of *Brachycercus harrisella* Curtis, 1834 in Belgium (NAVAS, 1913, 1914) were later identified as *Caenis horaria* (Linnaeus, 1758). More recently, this species has been found in streams in the Campine region (LOCK & GOETHALS, 2011; STROOT & MOL, 1989; VERCAUTEREN *et al.*, 2010). *Caenis beskidensis* Sowa, 1973 has been observed in larger rivers such as the river Meuse and the river Amblève (MOL, 1987; STROOT & MOL, 1989). *Caenis horaria* (Linnaeus, 1758) is a common species in stagnant waters (DE SELYS-LONGCHAMPS, 1888; GOETGHEBUER, 1930; GYSELS, 1991; INT PANIS *et al.*, 1995; LAMEERE, 1900; LESTAGE, 1920b, 1928, 1935c; LOCK & GOETHALS, 2011; MAC LACHLAN, 1881; NAVAS, 1911; STROOT & MOL, 1989). *Caenis lactea* (Burmeister, 1839) has only been observed in the lake Schulensmeer (LOCK & GOETHALS, 2011) and the lake Bergerven. *Caenis luctuosa* (Burmeister, 1839) can be found in stagnant and slow flowing watercourses (GYSELS, 1991; LOCK & GOETHALS, 2011; MOL, 1987; STROOT & MOL, 1989). *Caenis macrura* Stephens, 1835 can be

found in larger rivers such as the river Meuse, the river Ourthe and the river Samson (BIJ DE VAATE, 1995; DE SELYS-LONGCHAMPS, 1888; GYSELS, 1991; LAMEERE, 1900; LESTAGE, 1928; MAQUET, 1983; MOL, 1987; NAVAS, 1911; ROSILLON, 1985a; STOOT & MOL, 1989). LOCK & GOETHALS (2011) did not report *C. macrura* from Flanders, however, the species was recently captured there in the river Meuse. *Caenis pseudorivulorum* Keffermüller, 1960 was encountered in several streams and lakes in Flanders (GYSELS, 1991; LOCK & GOETHALS, 2011; STROOT & MOL, 1989). *Caenis rivulorum* Eaton, 1884 occurs in larger rivers such as the river Ourthe, the river Amblève and the river Salm (STROOT & MOL, 1989). *Caenis robusta* Eaton, 1884 is a common species in stagnant waters (GYSELS, 1972a,b, 1991; LOCK & GOETHALS, 2011; STROOT & MOL, 1989).

Discussion

During the present study, 63 species of mayflies are reported for Belgium (Table 1). During the last couple of years, 58 species could still be collected, however, five other species were not encountered for at least 30 years. Some of the latter species are most probably extinct, especially the potamal species *Choroterpes picteti*. However, *Siphlonurus lacustris* has still been reported recently in Luxembourg and the German federal states bordering Belgium (DOHET *et al.*, 2008; HAYBACH, 2006; HAYBACH & MALZACHER, 2003) and was possibly overlooked because standing waters received little attention lately. Although *Metreletus balcanicus* is considered extinct in Flanders (LOCK & GOETHALS, 2011), the species might be found in the Ardennes region, for example in streams in the Semois valley, since the species has been found not far from the border in northern France and Luxembourg (DOLISY, 2000; JACQUEMIN & COPPA, 1996).

Based on their distribution in the bordering countries, several additional species might be expected. Besides species that were only recorded more than a century ago, *Siphlonurus armatus* Eaton 1870 and *Baetis tracheatus* Keffermüller & Machel, 1987 are the only mayflies occurring in the Netherlands that have not yet been recorded in Belgium (MOL, 1985a-c). However, Ephemeroptera hardly received attention in the Netherlands since the eighties and especially the Heptageniidae should be revised based on recent literature. From the fauna of the Grand-Duchy of Luxembourg, *Ecdyonurus submontanus* Landa, 1970, *Electrogena lateralis* (Curtis, 1834) *Rhithrogena puytoraci* Sowa & Degrange, 1987 and *Ephemerella mucronata* (Bengtsson, 1909) are species that have not yet been observed in Belgium (DOLISY, 2000; DOLISY & DOHET, 2003). In the departments of northern France bordering Belgium, *Baetis pentaphlebodes* Ujhelyi, 1966, *Ecdyonorus aurantiacus* (Burmeister, 1839), *Ecdyonurus macani* Thomas & Sowa, 1970, *Electrogena affinis* (Eaton, 1883), *E. lateralis*, *Heptagenia coerulans* Rostock, 1878, *Heptagenia longicauda* (Stephens, 1835), *E. mucronata* and *Caenis pusilla* Navas, 1913 are species not yet recorded in Belgium (BRULIN, 2011). In the Bundesländer of Germany bordering Belgium, *S. armatus*, *B. pentaphlebodes*, *B. tracheatus*, *E. macani*, *E. submontanus*, *E. affinis*, *E. lateralis*, *H. longicauda*, *R. puytoraci* and *E. mucronata* are species not yet found in Belgium. It can therefore be concluded that there is still a lot to be discovered about the Belgian mayflies (HAYBACH, 2006; HAYBACH & MALZACHER, 2003).

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