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Non-biting midges from Continental France: new records, faunal and biogeographical outline [Diptera, Chironomidae]

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Material recently collected in Continental France has allowed me to generate a list of 163 chironomid taxa, of which 40 species are new for the fauna of this country. 721 chironomid species are hitherto known from France. Continental France is parcelled into ten major regions and subregions on the basis of both faunal and biogeographic potential of localized species. The taxonomy and geographic distribution of the species listed are based on the last version of the section on Chironomidae (SAETHER & SPIES 2004) in Fauna Europaea, on recent revisions of genera and other recent publications relevant to taxonomy and nomenclature.

Citations de Chironomes nouvelles pour la faune de France Continentale. Aperçu faunistique et biogéographique [Diptera, Chironomidae]

Mots-clés : Chironomidae, citations nouvelles, France Continentale, biogéographie.

De récentes récoltes de Diptères Chironomidae en France Continentale nous ont permis d'établir une liste de 163 taxa, dont 40 espèces sont nouvelles pour la faune de ce pays et portent à 721 le nombre d'espèces actuellement connues du territoire français. Un découpage de la France continentale en dix régions et sous-régions est effectué selon les potentialités faunistiques et biogéographiques d'éléments à répartition étroite. La taxonomie et la distribution géographique des espèces recensées ont été réalisées en prenant en compte la dernière version de la Fauna Europaea sur les Chironomidae (SAETHER & SPIES 2004), les récentes révisions de genres et enfin de récentes publications se rapportant à la taxonomie et la nouvelle nomenclature.

1. Introduction

French regions include one of a large variety of European aquatic ecosystems with respect to physiography and hydrography. Data in literature on the chironomid fauna of France show some regions better sampled than others. The best sampled areas are (see § 2): the Alps, the Northern (5a) and Southern Regions (5b); the Pyrenees, including the Western (6), Central (7) and Eastern Regions (8); South-Central France, including inland and coastal rivers (9a and 9b). The remaining regions located in the North, the Middle and the South-East of France have received little attention and are unfortunately still partially explored: they need to be more prospected in the years to come.

Published data accumulated since 1991 allow us to generate a list of 681 registered species from France (SERRA-TOSIO & LAVILLE 1991, LAVILLE & SERRA-TOSIO 1996, MOUBAYED et al. 2000, GARCIA & LAVILLE 2000, DELETTRE 2001, SÆTHER & SPIES 2004).

Field work carried out during the last two decades through Continental France including high altitude and lower reaches of peat pits, springs and streams, mountain and lowland lakes, ponds and reservoirs, temporary streams and pools allowed us to sample fully developed pharates, adults, pupae, pupal exuviae and larvae from chironomid populations throughout various geographic regions. In the current paper, a complementary checklist of both new records and some other already listed species from France is provided as well as a faunal and biogeographic outline.

2. Sites and methodology

The identification of slide mounted (in polyvinyl lactophenol solution) specimens was aided by recent taxonomic revisions and keys to adults or pupal exuviae (REISS & SÄWEDAL 1981; TUISKUNEN 1986; SERRA-TOSIO 1989; SÆTHER 1990; SOPONIS 1990; LANGTON 1991; SÆTHER & WANG 1995; KYEREMATEN & SÆTHER 2000; MICHIELS & SPIES 2002; VÅRDAL et al. 2002; LANGTON & WISSER 2003; SÆTHER & SPIES 2004; STUR & EKREM 2006; EKREM 2006, 2007; LANGTON & PINDER 2007), incorporating recent general recommendations on taxonomy and nomenclature (SÆTHER & FERRINGTON 2003; SPIES & SÆTHER 2004).

Previous known geographical distribution of the species listed was based on the last version of the section on Chironomidae in Fauna Europaea (SÆTHER & SPIES 2004), on the latest unpublished data for Fauna Europaea (SÆTHER et SPIES, pers. comm.), as well as on the taxonomic publications listed above.

The collection sites were located in the ten major physiographic and biogeographic regions and sub-regions of France (Corsica not included) delimited in Figure 1). The habitats sampled include springs, permanent and temporary streams and pools, peat pits, rhithral and potamal of rivers, estuaries, lakes and ponds. An informative map on the biogeographic regions of France is also given by SERRA-TOSIO & LAVILLE (1991). Within the ten prospected regions, two are located in Northern France (1 and 2), three in Central-South and Central France (3, 5 and 4) and five (6, 7, 8, 9 and 10) in Southern France. The geographic delimitation of these regions and sub-regions is:

- **1**, North-West France (Continental), including both the Channel and the North Sea coastal streams (1a), and potamic parts of the Seine river basin (1b).

- **2**, North-East France (Continental), rivers located in the plain and piedmont including the upper stream of the Seine river basin.

- **3**, Central-South-West France (Atlantic), including both the Atlantic coastal rivers from the Northern part (3a) to the Southern part (3b).

- **4**, Central-France, including the upper stream and rhithral of the Sioule river basin, located in the volcanic region of Auvergne (4a); the upper streams of both the Allier and the Loire river basins, and surrounding piedmont and lowland wetland areas including ponds, peat pools and marshes located below 1000 m (4b).

- **5**, Central-East France, including the upper stream of the Rhône river basin (5a) and the Alps (especially located in high and middle mountain areas, 5b).

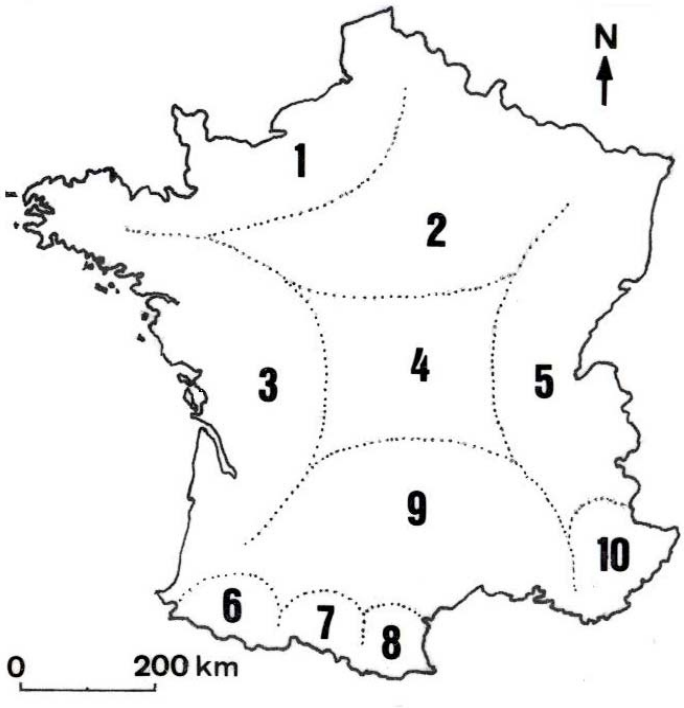

Figure 1. The ten major regions and sub-regions of Continental France after the current study.

Figure 1. Les dix régions et sous régions majeures de France Continentale selon la présente étude.

- **6**, **7** and **8**, the French part of the Pyrenees and Pre-Pyrenees, including Western-Pyrenees (6), Central-Pyrenees (7) and Eastern-Pyrenees (8). The Pyrenees possess both mountain and high mountain rivers (6a, 7a, 8a), the Pre-Pyrenees have only piedmont and mountain rivers (6b, 7b, 8b).

- **9**, South-Central France (Mediterranean), including the inland rivers, streams and lakes of the Northern part (9a); the coastal rivers, swamps, pools, marches, ponds, and rice fields of the Southern part (9b). Nevertheless, with respect to the chironomid fauna, three geographical zones of biogeographical significance have been identified in the Mediterranean region between the Spanish and the Italian borders (MOUBAYED et al. 2000).

- **10**, South-East France (Mediterranean): including both the lower Alps (lakes, reservoirs and rivers) and Mediterranean coastal rivers especially located in the Alpes-de-Haute-Provence, Var and Alpes-Maritimes departments. The Western limit of region 10 is restricted to the Eastern part of Var department including : permanent and temporary springs and streams located in Massif des Maures, extending westward to Hyères city; the Argens river basin which includes permanent and temporary springs, pools and streams extending to Fréjus city.

Sampling methods mainly used were: Surber net for benthos; Brundin drift net for pharates, pupae and pupal exuviae; troubleau net for individuals floating on the surface of the water; sweep net for adults.

3. List of species

In total, material of 163 chironomid taxa was collected throughout the ten biogeographical areas in Continental France since 1980 (Table 1). Among these taxa there were: 15 Tanypodinae, 9 Diamesinae, 77 Orthocladiinae and 62 Chironominae (27 Chironomini and 35 Tanytarsini). Based on recent published data (SERRA-TOSIO & LAVILLE 1991, FRANQUET 1996, LAVILLE & SERRA-TOSIO 1996, ANGELIBERT et al. (1999), GARCIA & LAVILLE 2000, MOUBAYED et al. 2000, VALA et al. 2000, DELETTRE 2001, SÆTHER & SPIES 2004), 40 species are new records for France (*), and 20 species are belonging to new undescribed species (**). The remaining species (P) are considered as new records for some regions or subregions of France.

Therefore, 721 chironomid species are hitherto known from France, including the already listed 40 new records, which represent 5.6 % of the French chironomid fauna. Of the European total diversity of 1200 listed and updated species in the new version of Fauna Europaea for Chironomidae by SÆTHER & SPIES (2004), 60.1 % are actually recorded from France. In the current study, the highest regional diversity (85 and 74 species respectively) was encountered in two areas located in Southern France: South-Central France (region 9: 52.2%), and the Eastern Pyrenees (subregion 8: 45.4 %).

Table 1. List and geographical distribution of species.
* = new record for France; ** = undescribed species; P = previous record.
Im = imago; N = nymph or pharate ; Pe = pupal exuviae ; L = larva.

Tableau I. Liste des espèces et leur répartition géographique.
* = citation nouvelle pour la France ; ** = espèce non décrite ; P = citation antérieure.
Im = imago ; N = nymphe ou pharate ; Pe = exuvie nymphale ; L = larve.

SPECIES	Record	Stage	Distribution
Subfamily Tanypodinae, 15 species:			
Arctopelopia barbitarsis (Zetterstedt, 1850)	P	Pe	9b
A. griseipennis (van der Wulp, 1859)	P	Pe	7b, 8b, 9b
Arctopelopia sp. 1	**	Pe	8b, 9a
Conchapelopia hittmairorum Michiels & Spies, 2002	P	Pe	2, 5a, 8b, 9, 10
Larsia atrocincta (Goetghebuer, 1942)	P	N, Pe	8b
L. curticalcar (Kieffer, 1918)	P	N, Pe	8b, 10
Pentaneurella katterjokki Fittkau & Murray, 1983	P	N, Pe, L	6a, 7a, 8a
Procladius crassinervis (Zetterstedt, 1838)	P	N, Pe	1b, 2
P. lugens Kieffer, 1915	*	Im, N, Pe	2, 4b, 5, 9
P. rufovittatus (van der Wulp, 1874)	*	Pe	2, 4b
P. (Psilotanypus) flavifrons Edwards, 1929	P	Im	4b
Procladius sp. 1 (= *P.* sp, from Norway, in Fittkau & Murray)	**	Pe	8a
Thienemannimyia carnea (Fabricius, 1805)	P	Pe	8b
T. pseudocarnea Murray, 1976	P	Pe	9b, 10
Zavrelimyia signatipennis (Kieffer, 1924)	P	Pe	10
Subfamily Diamesinae, 9 species:			
Boreoheptagyia rugosa (Saunders, 1930)	P	Im, Pe	8b, 10
Boreoheptagyia sp. 1 (near *rotunda* Serra-Tosio)	**	Im	10
Diamesa aberrata Lundbeck, 1889	P	Im, N, Pe	7a, 8a
D. bertrami Edwards, 1935		Im, N, Pe	8a

D. bohemani Goetghebuer, 1932	*	Im, N, Pe	8a
D. thomasi Serra-Tosio, 1970	P	Im, N, Pe, L	7a, 8a
D. veletensis Serra-Tosio, 1971	*	Im, N, Pe, L	8a
Potthastia sp. 1	**	Pe	4b
Syndiamesa edwardsi (Pagast, 1947)	P	Im, N, Pe, L	8a
Subfamily Orthocladiinae, 77 species:			
Brillia pudorosa Cobo, Gonzales & Vieira-Lanero, 1995	*	Im, N, Pe	3b
Bryophaenocladius aestivus (Brundin, 1947)	P	Im	8b
B. muscicola (Kieffer, 1906)	P	Im, Pe	10
B. nidorum (Edwards, 1929)	P	Im, Pe	9b
B. propinquus (Brundin, 1947)	P	Im	4b
B. scanicus (Brundin, 1947)	*	Im	4, 8b, 9a
Bryophaenocladius sp. 1	**	Im	9b
Chaetocladius algericus Moubayed, 1989	P	Pe	10
C. gracilis Brundin, 1956	P	Im	8a, 8b
C. suecicus (Kieffer, 1916)	P	Im, N, Pe	6a, 7a, 8a
Corynoneura arctica Kieffer, 1923	P	Pe	8a
C. fittkaui Schlee, 1968	P	Pe	8a, 8b, 9a
C. gratias Schlee, 1968	P	N, Pe	1a, 3, 8a, 8b
C. lacustris Edwards, 1924	P	N, Pe	2, 3, 8, 9, 10
Cricotopus algarum (Kieffer, 1911)	P	Im, N, Pe	1a, 1b, 2, 3
C. beckeri Hirvenoja, 1973	P	Im, N, P	8b, 9b, 10
C. caducus Hirvenoja, 1973	P	Im, N, Pe	1a, 3, 9b
Cricotopus sp. 1 (near *levantinus* Moubayed & Hirvenoja)	**	N, Pe	9b, 10
Epoicocladius ephemerae (Kieffer, 1924)	P	N, Pe, L	1, 2, 8b, 9a
Eukiefferiella bedmari Vilchez-Quero & Laville, 1987	*	Im, Pe	1a, 3b
E. brehmi Gouin, 1943	*	Pe	8a, 8b, 9a, 10
Eurycnemus crassipes (Meigen, 1810)	P	N, Pe, L	1a
*Euryhapsis fusciprope*s Sæther & Wang, 1992	*	N, Pe	6b, 9b
Georthocladius luteicornis (Goetghebuer, 1941)	P	Pe	7a, 7b
Georthocladius sp. 1	**	Pe	8a
Heterotrissocladius grimshawi (Edwards, 1929)	*	N, Pe	2, 5a, 10
H. subpilosus (Kieffer, 1911)	P	Im, Pe	8a
Heterotrissocladius sp. 1	**	Pe	9b
Hydrobaenus conformis (Holmgren, 1869)	P	Im, N, Pe	9b
H. distylus (Kieffer, 1915)	P	Im, Pe, L	9b
H. pilipes (Malloch, 1915)	P	Im, Pe	4b, 8b
Krenosmittia hispanica Wüelker, 1957	*	Im, Pe	8a, 8b
Limnophyes bidumus Sæther, 1990	*	Im, N, Pe	5b, 8a, 9, 10
L. difficilis Brundin, 1947	P	Im	9b, 10
L. edwardsi Sæther, 1990	P	Im	8b, 9b
L. gelasinus Sæther, 1990	*	Im, N, Pe	9b, 10
L. inanispatina Langton & Moubayed, 2001	P	Im, N, Pe	9b
L. roquehautensis Langton & Moubayed, 2001	P	Im, N, Pe	9b
L. ninae Saether, 1975	P	Im, Pe	8b, 9b, 10
L. punctipennis (Goetghebuer, 1919)	P	Im	9b
L. spinigus Sæther, 1990	*	Im, Pe	7a, 8a
Mesosmittia flexuella (Edwards, 1929)	P	Im	9b
Metriocnemus atriclavus Kieffer, 1921	P	Im	9b
M. corticalis Strenzke, 1950	P	Im	8a
Orthocladius calvus Pinder, 1985	P	Im, N, Pe	4b, 9b
O. holsatus Goetghebuer, 1937	*	Pe	7b, 9b

O. lignicola Kieffer, 1914	P	Im, N, Pe, L	1a, 2, 4, 8b, 9
Parachaetocladius sp. 1	**	Im	8a
Parakiefferiella pyrenaica Moubayed, 1991	P	Im, N, Pe	6, 7, 8, 9b, 10
Parakiefferiella sp. 1	**	Im, N, Pe	1a, 9a
Paralimnophyes longiseta (Thienemann, 1919)	P	1m, Pe	3, 4b, 5a
Paraphaenocladius intercedens Brundin, 1947	*	Pe	8a
Paratrichocladius lanzavecchiae Rossaro, 1990	*	Im, N, Pe	8b, 9a, 9b, 10
P. veronicae Rossaro, 1991	*	Im	8b, 9b
Psectrocladius platypus (Edwards, 1929)	P	Pe	9b
Pseudorthocladius berthelemyi Moubayed, 1989	P	Im, Pe	7b, 8b, 9b, 10
Pseudorthocladius sp. 1	**	Pe	8a, 8b
Pseudosmittia angusta Edwards, 1929	P	Im	1a, 1b, 2, 3a, 5a
P. baueri Strenzke, 1960	P	Im	9b, 10
P. forcipata (Goetghebuer, 1921)	P	Im	8a
P. holsata Thienemann & Strenzke, 1940	P	Im, Pe	8b, 9b, 10
P. nanseni (Kieffer, 1926)	*	Im	3b, 6b
Rheocricotopus tirolus Lehmann, 1969	P	Pe	8b
Smittia aquatilis Goetghebuer, 1940	*	Im	1b, 2
S. betuletorum Edwards, 1941	*	Im	2
S. foliacea (Kieffer, 1921)	P	Im	1a, 2, 3a, 5, 9, 10
S. paranudipennis Brundin, 1947	*	Im	7a, 8a
S. reissi Rossaro & Orendt, 2001	*	Im	9b
S. rupicola (Kieffer, 1923)	P	Im	9b
S. scutellosaetosa Caspers, 1988	P	Im	1, 2, 8b, 9b
S. superata Goetghebuer, 1939	P	Im	9b
S. vesparum Goetghebuer, 1921	P	Im	9b
Smittia sp. 1	**	Im	1b, 2
Thienemannia fulvofasciata (Kieffer, 1921)	P	N, Pe	8b
T. libanica Laville & Moubayed, 1985	P	Pe	5b, 10
Thienemanniella flavescens (Edwards, 1929)	P	Im, N, Pe, L	1, 2, 3
Tvetenia discoloripes (Goetghebuer, 1936)	P	Im, N, Pe, L	1a, 2, 3, 6b
Subfamily Chironominae, 62 species:			
Chironomini, 27 species:			
Chironomus lacunarius Wülker, 1973	P	Im, Pe	2, 8
Chironomus sp. 1	**	Im, N, Pe, L	1b, 2
Cryptotendipes nigronitens (Edwards, 1929)	*	Im, N, Pe	2, 3b, 9a
C. usmaensis (Pagast, 1931)	P	N, Pe	1b, 2, 4b, 9b
Demicryptochironomus neglectus Reiss, 1988	P	Im, N, Pe	6b, 7b, 8b
Dicrotendipes fusconotatus (Kieffer, 1922)	P	Im, Pe	9b
D. lobiger (Kieffer, 1921)	P	Im, Pe	2, 8
D. pallidicornis (Goetghebuer, 1934)	*	Im, Pe	1b, 2
D. peringueyanus Kieffer, 1924	P	Im	9b
Glyptotendipes signatus (Kieffer, 1909)	P	Im, N, Pe	1b, 2, 5, 9b
Kloosia pusilla (Linnaeus, 1767)	P	Pe	9b
Microchironomus deribae (Freeman, 1957)	P	Im, N, Pe, L	1b, 2, 3, 9b
Parachironomus digitalis (Edwards, 1929)	*	Im, N, Pe	9a, 9b
P. parilis (Walker, 1856)	P	Im, Pe	9b
Parachironomus sp. 1	**	Im, N, Pe, L	1b, 2
Paralauterborniella nigrohalteralis (Malloch, 1915)	P	Im, Pe, L	1a, 2, 9, 10
Polypedilum acutum Kieffer, 1915	P	Im, N, Pe, L	8a, 8b, 9b
P. arundineti (Goetghebuer, 1921)	P	Im, N, Pe	2, 8, 9

P. bicrenatum Kieffer, 1929	P	Im, N, Pe	3a, 3b, 9b, 10
P. nubens (Edwards, 1929)	P	Im, N, Pe, L	8a, 8b, 9
P. nubifer (Skuse, 1889)	P	Im, N, Pe, L	9b
P. tetracrenatum Hirvenoja, 1962	*	Im, N, Pe	1b, 2
P. (Cerobregma) lotensis Moubayed-Breil, 2007	P	Im, N, Pe	9a
P. (C.) saetheri Moubayed-Breil, 2007	P	Im, N, Pe	4a, 4b, 9a
Polypedilum (Tripodura) sp. 1	**	Pe	8b, 9b
Sergentia coracina (Zetterstedt, 1850)	*	Im, Pe	1b, 2, 4b, 9
Zavreliella marmorata (van der Wulp, 1859)	P	Im, L	9b
Tanytarsini, 35 species:			
Cladotanytarsus conversus Johannsen, 1932	P	Im, N, Pe, L	1b, 2
C. nigrovitattus (Goetghebuer, 1922)	P	Im, Pe	1b, 2, 8a, 8b
Constempellina brevicosta (Edwards, 1937)	*	Im, N, Pe	5b, 9a
Constempellina sp. 1	**	Pe	1b, 2
Krenopsectra nohedensis (Moubayed & Langton, 1996)	P	Im, N, Pe	8a
Micropsectra aristata Pinder, 1976	*	Im, N, Pe	1a, 3a, 3b, 8b
M. auvergnensis Reiss, 1969	P	Im, N, Pe	4, 8a
M. bavarica Stur & Ekrem, 2006	*	Im, N, Pe	4a, 4b, 5, 8, 9, 10
M. schrankelae Stur & Ekrem, 2006	*	Im, N, Pe	1, 2, 3, 4, 5a, 8b, 9, 10
M. sofiae Stur & Ekrem, 2006	*	Im, N, Pe	1, 2, 4, 5a, 8, 9, 10
Micropsectra sp. 1	**	Im, N, Pe, L	8a
Neozavrelia cuneipennis (Edwards, 1929)	*	Im, N, Pe	1a, 2, 8a, 9a
N. luteola Goetghebuer, 1941	*	Im, N, Pe	9a, 9b
Parapsectra uliginosa Reiss, 1969	*	Im, N, Pe	8a
Paratanytarsus grimmii (Schneider, 1885)	P	Im, Pe	8, 9
P. laccophilus (Edwards, 1929)	P	Im, Pe	4, 8a, 9a
Rheotanytarsus sp. 1	**	Im, N, Pe, L	8a, 8b
Stempellina almi Brundin, 1947	P	Im, N, Pe, L	1b, 2, 5b, 9b, 10
S. subglabripennis (Brundin, 1947)	P	N, Pe	9a, 9b, 10
Stempellinella brevis (Edwards, 1929)	P	Im, N, Pe, L	2, 3, 4, 5a, 8b, 9, 10
S. reissi Casas & Vilchez-Quero, 1991	P	Im, N, Pe, L	8a, 8b, 4b, 9a
Tanytarsus buchonius Reiss & Fittkau, 1971	P	Pe	8a, 8b
T. chinyensis Goetghebuer, 1934	P	Im, Pe	2, 9, 10
T. cretensis Reiss, 1987	P	Pe	9b
T. gibbosiceps Kieffer, 1922	P	Im, Pe	8, 9a
T. glabrescens Edwards, 1929	*	Im, Pe	4, 10
T. longitarsis Kieffer, 1911	*	N, Pe	1b, 2
T. multipunctatus Brundin, 1947	*	Im, N, Pe	1b, 2
T. occultus Brundin, 1949	P	Im, N, Pe	2, 9
T. signatus (van der Wulp, 1859)	P	Im, Pe	2, 9, 10
T. telmaticus Lindeberg, 1959	*	Pe	2
T. tika (Tourenq, 1975)	P	Pe	9b
Virgatanytarsus sp. 1	**	Pe	8b, 9a, 9b
Virgatanytarsus sp. 2	**	Pe	1b, 2
Zavrelia pentatoma Kieffer, 1913	P	Im, Pe	9a, 9b

4. Faunal and biogeographical outline

New records and some other localized species are recapitulated in Table II (pp. 12-15), which includes for each species the corresponding collecting sites throughout Continental France. Fau-

nal significance associated together with biogeographic potential of the listed species is believed to outline the parcelling out in ten major biogeographic regions and sub-regions of the French territory (Figure 1).

- In high and middle mountains areas (Alps, Pyrenees) distribution of characteristic elements is restricted to springs, streams, peat pools and lakes above 1500 m elevation. Communities occurring in high mountain include: *Procladius* sp. 1, *Diamesa aberrata, D. bertrami, D. bohemani, D. thomasi, D. veletensis, Syndiamesa edwardsi, Chaetocladius suecicus, Georthocladius* sp. 1, *Parachaetocladius* sp. 1, *Paraphaenocladius intercedens, Pseudosmittia forcipata, Smittia paranudipennis, Krenopsectra nohedensis, Micropsectra auvergnensis, Micropsectra* sp. 1, *Parapsectra uliginosa*.

- Populations occurring in Northern regions (1, 2) include in general widely distributed species in North Europe and England. Southern border for some North European elements is limited to areas located in the half Northern part of France: *Procladius crassinervis, P. rufovittatus, Eurycnemus crassipes, Dicrotendipes pallidicornis, Polypedilum tetracrenatum, Tanytarsus longitarsis, T. multipunctatus, T. telmaticus*.

- Chironomid communities with Mediterranean faunal affinities are encountered in southern regions (8, 9, 10), which especially include Mediterranean elements and some well known Afrotropicals from the Mediterranean region: *Chaetocladius algericus, Cricotopus beckeri, C. caducus, Cricotopus* sp. 1, *Eukiefferiella bedmari, Krenosmittia hispanica, Parametriocnemus valescurensis, Parakiefferiella pyrenaica, Paratrichocladius lanzavecchiae, P. veronicae, Pseudorthocladius berthelemyi, Thienemannia libanica, Dicrotendipes fusconotatus, D. peringueyanus, Polypedilum nubifer, Zavreliella marmorata, Micropsectra schrankelae, M. sofiae, Tanytarsus cretensis, T. tika*.

- Chironomid fauna of some regions or sub-regions (1, 2, 3, 4, 5a, 10) is still little known and needs to be more explored. Their biogeographical significance is still underestimated and deserves greater consideration in the years to come. Nevertheless, likewise for *Brillia pudorosa* and *Eukiefferiella bedmari*, it can be assumed that these two species, as well as some other ones, have reached respectively sub-regions 3a and 1a by a migration path from streams and rivers located in North East of Spain through the Atlantic coastal streams.

5. Distribution of some species and remarks

• *Procladius* sp. 1

Pupal material of *Procladius* sp. 1 was collected in a high altitude lake in the Eastern Pyrenees. It fits the description of *Procladius* sp., reported from Norway by FITTKAU & MURRAY (1985: 96, fig. 5.31, C). This undescribed species can be easily recognized on the basis of the following thoracic horn characters: elliptic plastron; rim weakly represented, almost absent; respiratory atrium oval, elongated and larger at apex.

• *Procladius crassinervis* (Zetterstedt, 1838)

P. crassinervis was first reported by SERRA-TOSIO & LAVILLE (1991) as a probable species from South Eastern France. The present record is based upon mature male adults, pharates adults and pupal exuviae collected in lakes, ponds and large reservoirs located in Northern areas at low altitude (1b, 2).

• ***Boreoheptagyia* sp. 1**

One male adult was collected in a spring located in South Eastern France (region 10). The species is morphologically similar to *Boreoheptagyia rotunda* Serra-Tosio but can be distinguished from this species by the following combination of characters: - antenna, 715 µm long; AR = 0,67; last flagellomere 185 µm long, elongated, longer than preceding 4 segments combined; - hypopygium : presence of anal point on tergite IX; absence of notch on gonostylus.

• ***Diamesa thomasi* Serra-Tosio, 1970**

In France, *D. thomasi* has been recorded from only the two type localities, in the Central Pyrenees (7a, 4 adults) by SERRA-TOSIO (1970). I have found it in the Eastern Pyrenees (subregion 8a) where very large populations (adults, pharates adults, pupae and larvae collected) inhabit high altitude peat pits located at 2250 m; examples of some associated species are *D. aberrata*, *D. bohemani*, *D. bertrami*, *D. veletensis*, *D. zernyi*, *Pseudodiamesa nivosa*, *P. branickii*, *Syndiamesa edwardsi*, *Chaetocladius suecicus*, *Krenopsectra nohedensis*, *Micropsectra auvergnensis*, *Neozavrelia cuneipennis*.

• ***Cricotopus* sp. 1**

This species is morphologically similar to *C. levantinus* Moubayed and Hirvenoja known from the lotic part of the Orontes river in the Lebanon. Recently this species has been recorded from South-West Europe including Continental France, Spain, Corsica (LAVILLE & LANGTON 2002; Fauna Europaea, SÆTHER & SPIES 2004). Associated material including male adults, pharates adults, pupae and pupal exuviae of *Cricotopus* sp.1 was recently reported also from Algeria by MOUBAYED-BREIL et al. (2007) and shows that it belongs to a new species or new subspecies different from *C. levantinus* : the male imago lacks a notch on the gonocoxite lobe, the distribution of anterior armament on tergites III-VI of the pupal exuviae are not crescent-like and the size of spines on the pupal abdominal tergites are stronger in *levantinus*. Comparison of material from both Algeria and France, with type material from the Lebanon, allow us to conclude that *Cricotopus* sp.1 from France belongs to the same new species or subspecies as reported from Algeria. In addition, despite several lists of species reported from intense investigations in Syrian and Turkish territories along the extended basin of the Orontes river (REISS 1985, 1986; CASPERS & REISS 1989) populations of *C. levantinus* are not recorded from these two neighbouring countries.

• ***Eukiefferiella bedmari* Vilchez-Quero & Laville, 1987**

Reported as a circum-mediterranean element well known from both Atlanto-Mediterranean (Spain, Morocco, Corsica) and Ponto-Mediterranean (Greece, Lebanon, Turkey) regions (VILCHEZ-QUERO & LAVILLE 1987; LAVILLE & REISS 1992; LAVILLE & LANGTON 2002). However, *E. bedmari* shows an unexpectedly large geographical distribution in France northward along both South-West and Central-West Atlantic coastal streams (3a, 3b) to the North-Western areas reaching the Channel coastal streams (1a), but have not been encountered in Southern France including Mediterranean coastal streams and rivers. This is the first record for this species for France. The material examined consists of a few pupal exuviae collected in some small Atlantic coastal rivers located in subregions 1a, 3a and 3b.

• ***Limnophyes gelasinus* Sæther, 1990**

Described from a single male adult from Korea. Here, *L. gelasinus* is recorded for the first time from the European continent (France), but it has also recently been recorded from the North African region (Algeria) by MOUBAYED-BREIL & LOUNACI (2007). The material consists of a

few male pharate adults and pupal exuviae, and the species seems to be well represented in both South Eastern France (region 10) and the Aïssi oued basin in Algeria.

• ***Paralimnophyes longiseta* Thienemann, 1919**

In Continental France, this species has been exclusively encountered in the Central and Northern regions (SERRA-TOSIO & LAVILLE 1991, DELETTRE 2001). Male adults of *P. longiseta*, are quite common in wetland areas near marshes and ponds located eastward and westward of Central-France.

• ***Pseudosmittia angusta* Edwards, 1929, *Smittia foliacea* (Kieffer, 1921) and *S. contingens* (Walker, 1856)**

These three species were previously reported from France for the first time by DELETTRE (2001), but were overlooked in the new version of Fauna Europaea. Only male imagines of *P. angusta* and *S. foliacea* were collected in wetland and river basins located in both the Western and the Eastern parts of France: Atlantic and Channel coastal streams in the West (1a, 3a); inland rivers in the East (5). In addition, a few populations of *S. foliacea* are recorded from wetland areas located in the Mediterranean region (9a, 9b, 10).

• ***Micropsectra schrankelae* Stur & Ekrem, 2006 and *M. sofiae* Stur & Ekrem, 2006**

These two species were recently described from Europe. Their identification in the male adult or pupal stage must be considered with care as they are morphologically very similar to *M. atrofasciata* (Kieffer). I have recorded these two species from many regions throughout France, and will expect to see more records throughout the Holarctic region as the species' descriptions become better known. Undoubtedly, many specimens previously believed to be *M. atrofasciata* are probably different species in the *atrofasciata* group, and *M. atrofasciata* might be less widespread than it has been regarded in previous literature.

• ***Stempellinella reissi* Casas & Vilchez-Quero, 1991**

S. reissi was until recently only known from its type locality in the Sierra Nevada, Andalucia, Spain. The material I collected in the French Eastern Pyrenees was included in a recently published revision on *Stempellinella* (EKREM 2007). Large populations of *S. reissi* have been captured from middle and high altitude springs and streams located in the Eastern Pyrenees (8a) and Central France (region 4b). Larvae of *S. reissi* inhabit sandy and gravely habitats of cold waters near springs, peat pits and streams located at various altitudes. Dense populations are more common in streams located in high altitude areas.

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Table II. Sampling sites: geographical location of the new records for French fauna, and localized species.

Tableau II. Localisation géographique des sites correspondant aux citations nouvelles pour la France et aux espèces localisées.

New records and localized species	**Geographical location of collecting sites**
Tanypodinae:	
Arctopelopia barbitarsis	Springs in lowland : Crau, Coucou
Arctopelopia sp. 1	Swamps, emergent water : Crau, Salat
Larsia atrocincta	Steams : Massane, Nohèdes
L. curticalcar	Streams : Mantet, Malière, Verne, Saint-Daumas, Rascas
Procladius crassinervis	Rivers : Essonne basin, Seine basin
P. lugens	Lakes, reservoirs : Rophemel, Charpal, Raviège, Castillon, Chaudane
P. rufovittatus	Lakes, ponds : Valière, Ferté-Alais, Dombes, Charpal
Procladius sp. 1	Mountain lakes : Nohèdes basin, Gorg Estelat (2020 m)
Thienemannimyia carnea	Rivers : Tech, Têt, Mantet, Nohèdes
T. pseudocarnea	Streams : Argens basin (Endre), Roya
Zavrelimyia signatipennis	Rivers, streams : Argens, Valescure
Diamesinae	
Boreoheptagyia rugosa	Streams : Massane, Malière
Boreoheptagyia sp. 1	Streams : Verne
Diamesa aberrata	Mountain streams : Neste d'Oô, Aston, Ressec, Ferrado, Caret, Tech
D. bertrami	Mountain streams : Ressec, Mantet, Alemany, Caret, Tech
D. bohemani	High mountain springs : Tech, Mantet, Ferrado, Ressec, Nohèdes
D. thomasi	High mountain springs : Aston, Louron, Ressec, Ferrado
D. veletensis	Upper course of streams : Tech, Mantet, Rotja, Ferrado
Potthastia sp. 1	Springs and upper course of stream : Allier
Syndiamesa edwardsi	High mountain streams : Mantet, Ressec, Soques, Ferrado, Tech
Orthocladiinae:	
Brillia pudorosa	Streams : Nivelle, Escource
Bryophaenocladius aestivus	Upper and middle course of streams : Caret, Massane
B. muscicola	Helocrenes : Massif des Maures, Valescure, Argens
B. nidorum	Helocrenes : Roque-Haute, Buèges
B. scanicus	Peat pits, wet moss : Dombes, Pinet
Bryophaenocladius sp. 1	Helocrenes, seepages : Roque-Haute
Chaetocladius algericus	Springs, seepages : Valescure, Argens basin, Soronne
C. gracilis	Streams, wet moss : Mantet, Alemany, Caret, Massane
C. suecicus	Streams : Holadoco, Aston, Mantet, Nohèdes, Ferrado, Rotja, Caret, Tech
Corynoneura arctica	Lakes, Pools : Nohèdes, Têt
C. fittkaui	Springs : Mantet, Tech
C. gratias	Streams : Durdent, Avre, Varenne, Dronne, Isle, Nive, Nohèdes, Caret
C. lacustris	Rivers, streams : Essonne, Isle, Adour, Nohèdes, Tech, Buèges, Verne
Cricotopus algarum	Lakes, ponds, pools : Arques, Risle, Lacanau, Adour
C. beckeri	Streams : Massane, Libron, Argens, Collobrier
C. caducus	Marshes, ponds : Risle, Lacanau, Adour basin, Clamadour, Lairan, Bagnas
Cricotopus sp. 1	Streams : Collobrier, Argens, Valescure, Malière
Epoicocladius ephemerae	Middle course of streams : Avre, Béthune, Guiel, Essonne, Massane, Lot
Eukiefferiella bedmari	Streams : Mesnil-Andelle, Nivelle
E. brehmi	Streams : Tech, Cady, Lentille, La Roque, Argens
Eurycnemus crassipes	Streams : Charentonne, Guiel
Euryhapsis fusciropes	Middle and lower course of streams : Saison, Têt

Georthocladius luteicornis	Upper and middle course of streams : Ariège, Salat
Georthocladius sp. 1	Upper course of stream : Tech
Heterotrissocladius grimshawi	Upper and middle course of streams : Aire, Aube, Doubs,
H. subpilosus	Swamps in middle course of streams : Aude basin
Heterotrissocladius sp. 1	Temporary helocrenes : Roque-Haute
Hydrobaenus conformis	Temporary helocrenes and pools : Roque-Haute
H. distylus	Wet moss, wet litter : Roque-Haute
H. pilipes	Lower course of streams : Têt, Vauxonne
Krenosmittia hispanica	Middle course of streams : Tech, Caret, Carança
Limnophyes bidumus	Springs, streams : upper Verdon, Mantet, Buèges, Ardèche, Argens
L. difficilis	Wet litter : Roque-Haute, Verne, Rascas, Saint-Daumas
L. edwardsi	Wet moss, hygropetric : Massane, Agout, Espinouse
L. gelasinus	Wet moss, temporary streams : La Roque, Péguière, Soronne
L. inanispatina	Madicolous, helocrenes : Roque-Haute
L. ninae	Hygropetric : Massane, Roque-Haute, Santa-Fé, Valescure, Esterel
L. punctipennis	Wet litter : Roque-Haute, Bagnas, Buèges, Agout, Santa-Fé
L. roquehautensis	Madicolous, helocrenes : Roque-Haute
L. spinigus	Hygropetric, streams : Aston, upper Ariège, upper Têt
Mesosmittia flexuella	Wet moss, wet litter : Roque-Haute
Metriocnemus atriclavus	Wet moss, wet litter : Roque-Haute, Haut-Languedoc, Buèges, Lamalou
M. corticalis	Wet moss, hygropetric : Nohèdes
Orthocladius calvus	Lower course of streams : Vauxonne, Libron, Ardèche, Vidourle
O. holsatus	Middle course of streams, inflow of lakes : Lys, Pique, Castillon
O. lignicola	Streams : Béthune, Velvette, Sioule, Alagnon, Massane, Caret, Thoré
Parachaetocladius sp. 1	High mountain streams : upper Tech
Parakiefferiella pyrenaica	Streams : Saison, Holadoco, Pique, Aston, Mantet, Tech, Dourbie, Argens
Parakiefferiella sp. 1	Middle course of streams : Guiel, Arn
Paralimnophyes longiseta	Wetland areas, ponds : Essonne basin, Charente basin, Dombes
Paraphaenocladius intercedens	Upper course of streams : Tech, Mantet
Paratrichocladius lanzavecchiae	Springs, streams : Massane, Roque-Haute, Lamalou, Crès, Vis, Verne, Argens
P. veronicae	Springs, streams : Riberette, Roque-Haute, Santa-Fé, Vissec, Lamalou
Psectrocladius platypus	Lowland swamps and springs : Crau, Coucou, Crés, Buèges
Pseudorthocladius berthelemyi	Hygropetric habitats : Lys, Aston, Mantet, Tech, Clamoux, Argens, Malière
Pseudorthocladius sp. 1	Hygropetric habitats : Mantet river, Carança
Pseudosmittia baueri	Lowland springs and streams : Roque-Haute, Valescure
P. forcipata	Wetland areas, pools : upper Têt, Grave, Formiguères, upper Aude
P. holsata	Wet moss : Massane, Orb, Ardèche, Argens, Soronne
P. nanseni	Lower course of streams : Gave de Pau, Pierrefitte, Adour basin
Rheocricotopus tirolus	Middle course of streams : Massane
Smittia aquatilis	Wetland areas : Essonne basin, Seine basin
S. betuletorum	Wetland areas : Essonne basin
S. paranudipennis	High mountain wetlands : Tech basin, Mantet basin
S. reissi	Wet litter and wet moss in helocrenes : Roque-Haute, Bagnas
S. rupicola	Wet litter and wet moss near temporary pools : Roque-Haute
S. superata	Wet litter and wet moss near temporary pools : Roque-Haute
S. vesparum	Wet litter and wet moss near temporary pools : Roque-Haute
Smittia sp. 1	Wetland areas : Guiel basin, Velvette basin
Thienemannia fulvofasciata	Middle course of streams : Massane, Eyne, Caret
T. libanica	Streams : Buech, Verdon, Valescure
Thienemanniella flavescens	Rivers, streams : Avre, Essonne, Maisse, Erdre, Dronne, Isle
Tvetenia discoloripes	Rivers, streams : Risle, Esonne, Misery, Erdre, Nivelle

Chironominae Chironomini:	
Chironomus lacunarius	Ponds : Hirondelles, Echarcon, Clot, Formiguères
Chironomus sp. 1	Rivers, potamal : Seine basin, Essonne basin
Cryptotendipes nigronitens	Rivers : Essonne, Adour, Lot
C. usmaensis	Rivers : Valmont, Seine, Essonne, Allier, Ardèche
Demicryptochironomus neglectus	Rivers, potamal : Saison, Ariège, Têt
Dicrotendipes fusconotatus	Potamal, rice fields : Petit Rhône, Mas d'Yvan, Sylveréal, Vidourle
D. lobiger	Ponds, lakes : Hirondelles, Echarcon, Clot, Bouillouses
D. pallidicornis	Brackish pools : Risle basin, Arques basin
D. peringueyanus	Potamal, rice fields : Vidourle, Petit Rhône, Mas d'Yvan
Kloosia pusilla	Rivers, potamal, rice fields : Petit Rhône, Vidourle, Mas d'Yvan
Microchironomus deribae	Rivers, potamal : Seine, Essonne, Dronne, Dordogne, Hérault, Vidourle
Parachironomus digitalis	Rivers, potamal : Lot, Ardèche, Vidourle
Parachironomus parilis	Rivers, potamal, pools : Vidourle, Petit Rhône, Roque-Haute
Parachironomus sp. 1	Potamal, ponds : Seine basin, Hirondelles, Vert le Petit, Echarcon
Paralauterborniella nigrohalteralis	Rivers, streams : Corbie, Essonne, Ardèche, Argens
Polypedilum acutum	Streams : Mantet, Soques, Estables, Tech, Buèges
P. arundineti	Rivers, streams : Essonne basin, Nohèdes, Massane, Arn, Ardèche
P. bicrenatum	Lakes, reservoirs : Isle, Dordogne, Adour basin, Aven, Valescure
P. nubens	Upper and middle course of streams : Tech, Mantet, Têt, Orb, Lergue
P. nubifer	Marshes, pools, rice fields : Crau (Coucou), Mas d'Yvan, Roque-Haute
P. tetracrenatum	Rivers, potamal : Essonne basin, Seine basin
P. (Cerobregma) lotensis	Rivers, hyporhithral : Lot
P. (C.) saetheri	Rivers, hyporhithral : Sioule, Allier basin, Lot
Sergentia coracina	Ponds : Seine basin, Essonne basin, Dombes, Allier basin, Charpal
Zavreliella marmorata	Permanent pools, submerged vegetation : Crau (Coucou), Quercy (Nave)
Chironominae Tanytarsini:	
Cladotanytarsus conversus	Rivers, potamal : Seine basin, Essonne, Erdre, Hyrôme, Aubance
Constempellina brevicosta	Northern and mountain lakes : Chèze, Castillon, Charpal
Constempellina sp. 1	Northern lakes : Chèze, Valière
Krenopsectra nohedensis	Upper course of streams : Nohèdes, Mantet, Tech
Micropsectra aristata	Streams : Guiel, Avre, Planche de Mozé, Isle, Dronne, Nivelle, Riberette
M. auvergnensis	Mountain streams : Dore, Enfer, Nohèdes, Mantet
M. bavarica	Streams : Allier, Dore, Ognon, Bléone, Buech, Mantet, Orb, Agout, Verne
M. schrankelae	Rivers, streams : widespread species
M. sofiae	Streams : Béthune, Cerny, Allier, Doubs, Têt, Tech, Lot, Buèges, Argens
Micropsectra sp. 1	High mountain springs and peat pits : Ressec, Mantet, Soques
Neozavrelia cuneipennis	Peat pools, wet litter : Durdent, Valmont, Velvette, Ressec, Espinouse
N. luteola	Southern calcareous streams : Lergue, Buèges, Lez
Parapsectra uliginosa	Mountain pools : Têt, Grave (Carlit), Mantet, Nohèdes
Paratanytarsus grimmii	Shallow pools : Nohèdes, Riberette, upper Orb, Roque basin
P. laccophilus	Mountain lakes and ponds : Gorg Estélat, Clot, Charpal, Aven
Rheotanytarsus sp. 1	Mountain streams : Nohèdes, Tech, Mantet
Stempellina almi	Lakes, ponds : Essone basin, Rophemel, Castillon, Charpal, Chaudane
S. subglabripennis	Emergent water, small streams : Buèges, Crau, Valescure,
Stempellinella reissi	Springs,streams : Mantet,Tech, Rotja, Alemany, Allier, Haut-Languedoc
Tanytarsus buchonius	Mountain peat pools and boggy seepages : Preste, Nohèdes, Tech, Têt
T. chinyensis	Lakes, reservoirs : Rophemel, Raviège, Salagou, Valescure
T. cretensis	Lower course of streams : Petit Rhône, Ardèche
T. gibbosiceps	Boggy swamps and pools : Nohèdes, upper Orb, Haut-Languedoc
T. glabrescens	Lakes, reservoirs : Charpal, Valescure

T. longitarsis	Potamal, ponds : Seine basin, Echarcon, Vert le Petit, Maisse
T. multipunctatus	Lakes, reservoirs, ponds : Valière, Rophemel, Locquet, Ballancourt
T. occultus	Lakes, ponds, reservoirs : Vinça, Raviège, Airette, Salagou, Valescure
T. signatus	Lakes, reservoirs : Rophemel, Airette, Raviège, Chaudane, Valescure
T. telmaticus	Lakes, reservoirs : Rophemel, Chèze
T. tika	Coastal wetland areas : near Aigue-Morte, near Sylveréal, Camargue
Virgatanytarsus sp. 1	Lower course of streams, pools : Massane basin, Causses du Quercy
Virgatanytarsus sp. 2	Rivers, potamal : Seine basin, Essonne basin
Zavrelia pentatoma	Peat bogs and boggy seepages : Pinet, Haut-Languedoc (Roque basin)