

***Musculium transversum* (Say, 1829): a species new to the fauna of France (Bivalvia, Sphaeriidae)**

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During a survey of various canals in northern France the bivalve *Musculium transversum* (Say, 1829) was collected, which species is new to the fauna of France. It inhabits a reach of the lateral canal of the Oise River near Apilly (between Noyon and Chauny). *M. transversum*, a native of North America, was first recorded from Britain in 1856 and next from the Netherlands in 1954. In the Mississippi River densities may exceed 100,000 per square metre, but in France so far numbers reach only about one hundred per square metre, which may be due to the production of ammonia during the summer. In the Oise R. lateral canal dominant species associated with *M. transversum* are characteristic of the potamon.

Key words: Bivalvia, Sphaeriidae, *Musculium*, alien species, freshwater ecology, France.

INTRODUCTION

In the course of the last two centuries a large number of plant and animal species, both vertebrates and invertebrates, have been introduced into France. Among the molluscs, *Dreissena polymorpha* (Pallas, 1771), *Potamopyrgus antipodarum* (Gray, 1843), and recently also *Corbicula fluminea* (Müller, 1774) (discovered only in 1980: Mouthon, 1981a), have occasionally caused problems to water management by their rapid dispersal and proliferation (Khalansky, 1997).

On the other hand, other species have extended their distribution almost unnoticed. This is particularly the case with *Lithoglyphus naticoides* (Pfeiffer, 1828), which species has migrated southward following the canalisation of the river Rhône south of Lyon, with *Menetus dilatatus* (Gould, 1841), a species of American origin, which via the British Isles has colonized all large river basins in France, and with *Emmericia patula* (Brumati, 1838). *E. patula* from the Dalmatian coastal area, discovered in a spring in southern Germany (Boeters & Heuss, 1985) and next in southern France (Mouthon, 1986), has recently been collected in a stream in the département Vaucluse.

In the course of a faunistic survey of various canals in northern France the bivalve *Musculium transversum* (Say, 1829), a species new to the fauna of France, was discovered. This species, from North America like *Menetus dilatatus*, has been recorded for the first time in Britain (England) in 1856 as *Sphaerium pallidum* Gray, 1856 (Kerney, 1976, 1999), and next in the Netherlands in 1954 in the IJsselmeer (IJssel Lake, the former Zuiderzee) not far from Amsterdam (Kuiper, 1981; Gittenberger & Janssen, 1998).

## SYSTEMATIC POSITION

*Musculium transversum* belongs to the bivalve family Sphaeriidae (suborder Sphaeriacea, order Cyrenodonta/Veneroida, subclass Heterodonta/Eulamellibranchia). Although frequently classified with the genus *Sphaerium* Scopoli, 1777 (Herrington, 1962; Ellis, 1978; Clarke, 1981), it has recently been included in *Musculium* Link, 1807 (Burch, 1975; Heard, 1977; Mackie et al., 1980; Glöer & Meier-Brook, 1994) of which the validity has been confirmed by electrophoretic studies of various enzymes (Hornbach et al., 1980).

## DIAGNOSIS

The following description of *M. transversum* (see figs 1-4) has been compiled from the accounts of Herrington (1962), Ellis (1978) and Clarke (1981).

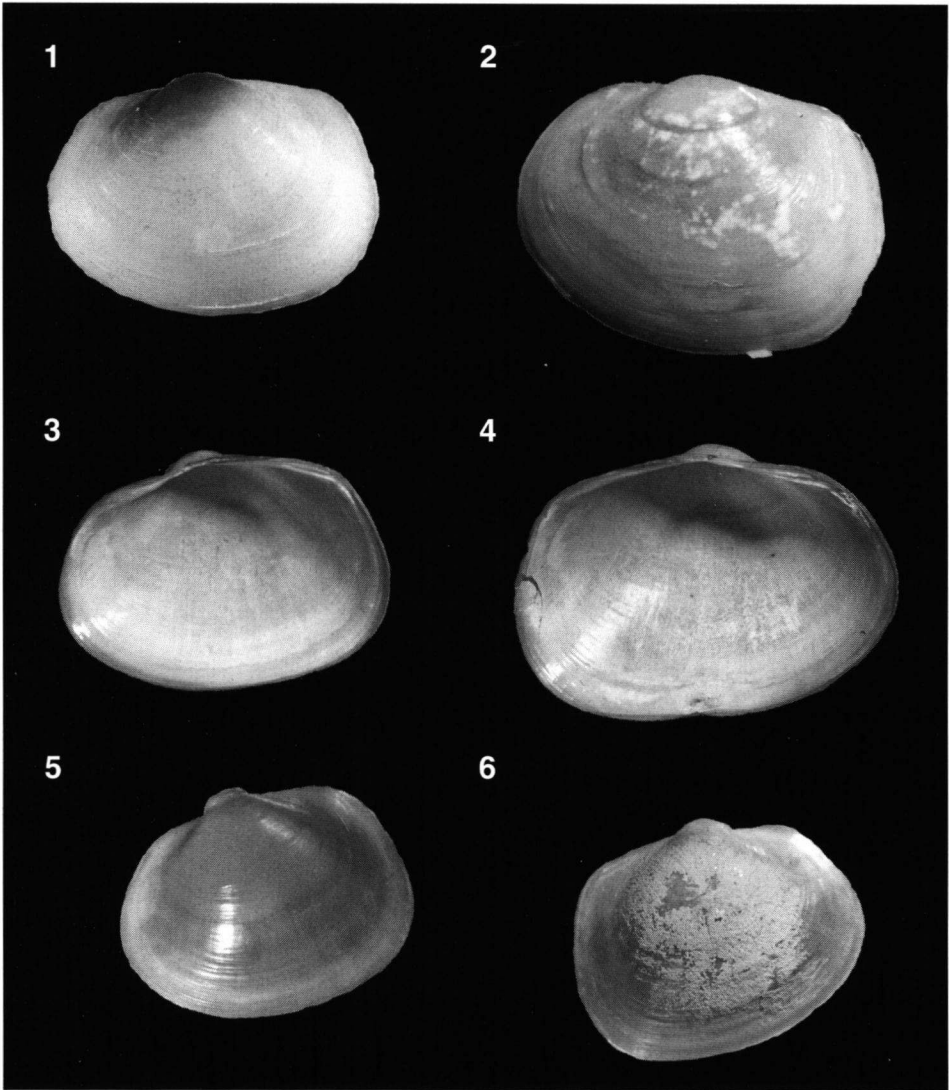
Shell elongate, with the anterior part higher than the posterior part. Shell thin, periostracum dull to somewhat shining. Apex markedly developed, closer to the anterior part of the shell, but less prominent than in *M. lacustre* (Müller, 1774) (figs 5-6). Embryonal shell sometimes separated from the adult shell by a depression as in *M. lacustre*. Since the number of specimens showing this depression varies with the season Gale (1972) and Herrington (1962) consider this character (calyculism) to be of little taxonomic value. The superior margin in front of the apex is straight and forms a marked angle with the posterior margin. The superior margin behind the apex smoothly joins the anterior margin without an angle. Ligament long and straight, exterior. Cardinal plate also long and straight, with poorly developed teeth, lateral teeth thin and almost straight (figs 3-4). Measurements recorded in the United States and Britain: 13 x 9 x 6 mm. In the Oise canal maximum dimensions are 12 x 8 x 6 mm.

## DISTRIBUTION

*Musculium transversum* was discovered in a reach of the Oise lateral canal between the towns of Noyon and Chauny in the municipality of Apilly, département Aisne (fig. 7). It was not found in various canals connected with the Oise lateral canal (St. Quentin canal, Oise-Aisne canal, Sambre-Oise canal, and Canal du Nord). This bivalve seems to have a very limited distribution. However, the Oise river, which is very difficult of access in this sector because of steep and soft banks, has not been sampled.

## BIOLOGICAL AND ECOLOGICAL DATA

The majority of the data discussed here are extracted from work done in the United States. *M. transversum* is found in a large array of habitats, i.e. lakes, rivers, canals, swamps and swampy areas. It colonizes various substrates, viz. stone, sand, sandy mud, and mud, but it prefers the last (Gale, 1971). In the Oise lateral canal this bivalve lives on bottoms consisting of a mixture of stones, sand, mud and clay at depths of between one and two metres. One does find it also on the sediment that has been deposited between the wooden supporting structures of the canal and the margin of the bordering road, where water depth does not go beyond 20 cm. Individuals of over 3 mm length



Figs 1-6. Shells of *Musculium* species. 1-4. *M. transversum* (Say), (1) non-calyculate form, length 10.5 mm; (2) calyculate form, length 7.5 mm; (3) right valve, internal view, length 12.0 mm; (4) left valve, interior view, length 12.0 mm. 5-6. *M. lacustre* (Müll.), (5) non-calyculate form, length 8.7 mm; (6) calyculate form, length 8.3 mm.

Photographs by B. Vollat.

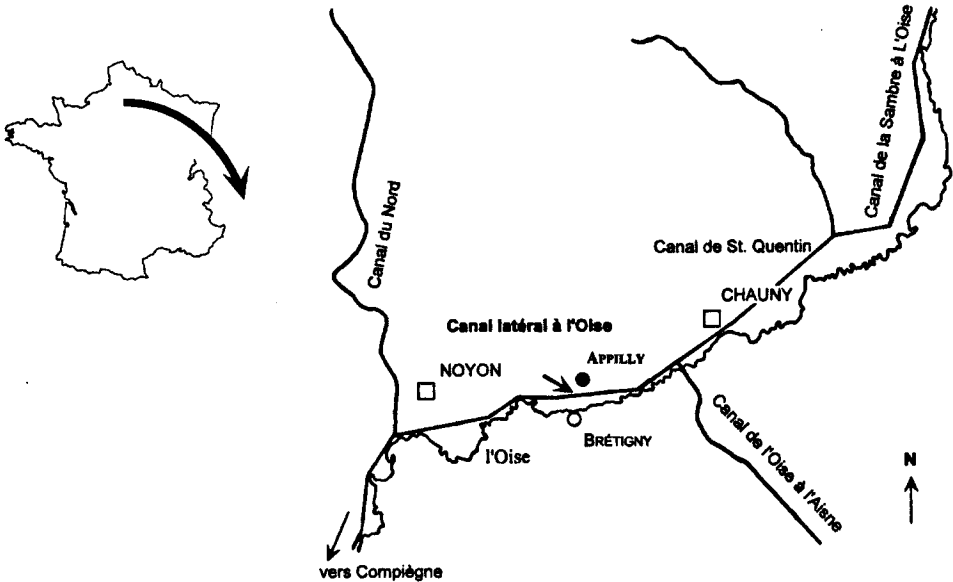


Fig. 7. The locality of *Musculium transversum* (Say) in the Oise River lateral canal (arrow).

live essentially in the top layer of the sediment between 0 and 2.6 cm. On the other hand, specimens with lengths of under 3 mm may burrow to a depth of 16 cm (Gale, 1976). Juveniles embedded deep in the sediment may stay in diapause for a number of weeks. This strategy enables the species to regulate its populations and to survive prolonged periods of less favourable conditions.

*M. transversum* may at times reach considerable densities; in the Mississippi River Gale (1969) has counted more than 100,000 individuals per square metre. In the Oise lateral canal density has been estimated at only about one hundred per square metre.

It feeds by filtering phytoplankton, particularly green algae and diatoms but does not seem to exhibit any particular preference (Gale & Lowe, 1971).

*M. transversum* is hermaphrodite and ovoviviparous and is also able to reproduce by means of self-fertilization (Gale, 1969). According to that author, it may complete its life cycle in approximately one month. Juveniles may become sexually mature early in life as soon as they reach a length of 5 mm. The juveniles of Mississippi River populations are released from the gills of the adults in spring or summer as soon as they reach an average size of 2.2 mm, and die at the end of the summer or in the autumn. Nevertheless, a few individuals born in the course of these seasons survive the winter and die in the next year. Lifespan is generally under one year and frequently only about six months.

CHAUNY	T° °C	pH	Cond µS/m	DO mg/l	COD mg/l	BOD <sub>5</sub> mg/l	KJN mg/l	NH <sub>4</sub> <sup>+</sup> mg/l	NO <sub>2</sub> <sup>-</sup> mg/l	NO <sub>3</sub> <sup>-</sup> mg/l	PO <sub>4</sub> <sup>3-</sup> mg/l	Ptot mg/l	Chl a µg/l	Phae µg/l
16/06/1998	16.5	8	415	9.6	30	6	0.5	0.5	0.15	13	0.21	0.3	9	17
21/07/1998	20.5	7.8	433	9.5	30	5	1.9	2.1	0.14	11.4	0.15	0.2	22	14
18/08/1998	19.8	7.9	451	8.9										
15/09/1998	14.5	8	406	9.4	30	5	1.5	0.9	0.28	14.3	0.21	0.1	10	5
20/10/1998	10.4	7.6	347	11.6	30	3	1.3	0.3	0.15	15	0.15	0.19	9	8
17/11/1998	6.2	7.2	284	10	69	6	1.4	0.5	0.21	11.2	0.31	0.2	5	5
<b>NOYON</b>														
16/06/1998	17.9	8	460	9.3	30	6		0.5	0.05	12.8	0.15	0.05	12	24
21/07/1998	20.5	8.2	474	11.4	30	6		3.2	0.06	11.3	0.4	0.4	24	28
18/08/1998	22.4	7.8	442	15.1										
15/09/1998	15.5	8.3	433	10.9	30	6		0.7	0.15	14.5	0.15	0.05	18	26
20/10/1998	10.9	7.6	379	10	30	3		0.2	0.15	13.4	0.15	0.07	13	17
17/11/1998	6.3	7.3	311	10.8	30	7		1.4	0.05	11.2	0.21	0.13	6	8

Cond = conductivity, DO = dissolved oxygen, COD and BOD<sub>5</sub> = chemical and biological requirement for oxygen, KJN = Kjeldahl nitrogen, Ptot = total phosphate, Chl a = chlorophyll a, Phae = phaeopigments.

Table 1. Water chemistry and chlorophyll data of the waters of the Oise River lateral canal (at Noyon) and the St. Quentin canal (at Chauny).

As is the case for most freshwater molluscs, *M. transversum* has numerous predators, i.e. various species of leaches like *Erpobdella* spec., *Glossiphonia complanata* (L., 1758) and *Helobdella stagnalis* (L., 1758), fish like carp and catfish and also birds such as duck. This bivalve is also host to trematode parasites of the genus *Crepidostomium* and the oligochaete worm genus *Chaetogaster* (Gale, 1973).

Research into the causes of the dramatic decline of the populations of *M. transversum* in the Mississippi River has revealed that the species is sensitive to various toxic substances, particularly the non-ionized form of ammonia (NH<sub>3</sub>) (Arthur et al., 1967; Sandusky & Sparks, 1979; Sparks, 1984; Eckblad & Lehtinen, 1991; Wilson et al., 1995). Therefore this organism has been widely used in the U.S.A. as a test organism for detecting the toxicity of the water and contaminated sediments (Paparo & Sparks, 1977; Zischke & Arthur, 1987). Water samples taken in July in the Oise lateral canal have revealed elevated concentrations of ammonia nitrogen resulting in high pH values which foster the forming of non-ionized NH<sub>3</sub>; this may explain the modest population levels of *M. transversum* in this habitat. As associates of this bivalve one usually observes species typical of the potamon such as *Ferrissia wautieri* (Mirolli, 1960), *Dreissena polymorpha* (Pallas, 1771), *Pisidium supinum* Schmidt, 1851, *Sphaerium rivicola* (Lamarck, 1818), and the heavier forms (i.e. those with thick shells and teeth) of *P. nitidum* f. *crassa* Stelfox, 1918, and *P. subtruncatum* f. *incrassata* Stelfox, 1918, and also species more typical of the rhithron such as *Bithynia tentaculata* (L., 1758), *S. corneum* (L., 1758), *P. amnicum* (Müller, 1774), *P. henslowanum* (Sheppard, 1823), and in addition *Corbicula fluminea*.

## CONCLUSION

As has been observed for *Dreissena polymorpha* and *Lithoglyphus naticoides* and also more recently, for *Corbicula fluminea*, canals are eminently suitable for invasion and colonisation. These types of habitat are rarely subjects of faunistic and floristic surveys and merit more attention from the biologist.

Strayer (1999) attributes a European origin to nine species of freshwater molluscs now living in North America. On the other hand, as regards western Europe, only the two species *Menetus dilatatus* and *Musculium transversum* have their origin in North America. If this discrepancy is also found in other groups of animals and plants, research into the causes of this phenomenon would possibly be of interest.

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## RÉSUMÉ

Au cours d'inventaires faunistiques réalisés sur plusieurs canaux du Nord de la France, une espèce nouvelle pour la faune malacologique de ce pays a été découverte dans un bief du canal latéral à l'Oise; il s'agit de *Musculium transversum* (Say, 1829). Ce bivalve signalé en Angleterre dès 1856, puis au Pays-Bas en 1954, est originaire du continent Nord Américain. Une description de cette espèce appartenant à la famille des Sphaeriidae, ainsi que différentes données concernant sa biologie et son écologie sont proposées.