



Article

Chironomids on brook banks above the water level*

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Key words

- terrestrial Chironomidae
- banks of brooks
- dynamic habitat
- West Europe

Parole chiave

- Chironomidi terrestri
- rive di torrenti
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- Europa occidentale

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Summary

The chironomids living just above the water level in brooks were investigated in more than 50 brooks in the lowlands and hilly country in and around The Netherlands. Terrestrial and semiterrestrial species appeared to be often very numerous, aquatic species were obtained rarely. One of the most important factors at the banks of brooks seems to be the dynamic character of the habitat. Especially the water's edge of brooks is a very dynamic world, with much erosion and transport of organic material. The microhabitat is therefore only occasionally the appropriate environment for the larvae. Many species do not have their optimum here and often it concerns more temporary guests on the banks of brooks. Banks of lowland brooks are usually less stable than those of fast flowing brooks. This is one of the reasons that along brooks in the hilly country more characteristic species are found; along lowland brooks usually species dominate which have their optimum in other habitats of the environment. Nevertheless the banks of brooks can be important for some species as a refugium in dry periods. *Limnophyes minimus* (Meigen) was one of the most abundant species in all sites, followed by *Paraphaenocladus impensus* (Walker). Most species have been found along the lowland brooks as well along the faster flowing brooks in the hilly country. Only few species seemed to be characteristic for lowland brooks e.g., *Allocladius* species.

Riassunto

I chironomidi che vivono sopra il livello dell'acqua nelle rive sono stati esaminati in più di 50 ruscelli di pianura e in collina nei Paesi Bassi e dintorni. Generalmente le specie terrestri e semiterrestre erano più numerose delle specie acquatiche, come previsto a causa dell'elevato dinamismo che caratterizza questo habitat a causa dell'erosione e del trasporto di materiale organico. Questo habitat è quindi solo occasionalmente favorevole alle larve acquatiche. Quindi, molte specie acquatiche sono solo "ospiti" temporanei sulle rive del fiume. Laddove il disturbo era più alto, come nel litorale dei ruscelli di pianura, è stata raccolta una comunità più eterogenea, con specie tipiche di diversi tipi di habitat. Viceversa, le rive dei ruscelli che scorrevano velocemente in collina erano più stabili e quindi colonizzate da specie tipiche di quell'habitat specifico. *Limnophyes minimus* (Meigen) è risultata la specie più abbondante in tutti i siti seguita da *Paraphaenocladus impensus* (Walker). La maggior parte delle specie sono state trovate sia nel fondovalle che nelle regioni collinari. Solo poche specie sono risultate caratteristiche del fondovalle, quali le specie del genere *Allocladius*.

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Introduction

Semiaquatic and terrestrial chironomids (Diptera, Chironomidae) have been studied by several authors, e.g., Strenzke (1950), Frouz (1994), Delettre (1984, 1986), and Przhiboro & Paasivirta (2012). However, the zone above the water level of flowing water is still poorly known. To implement this knowledge, a preliminary investigation was carried out along brooks in lowland and hilly landscape in The Netherlands and neighbouring regions in France and Germany.

Banks of brooks are inhabited by many semiaquatic and terrestrial invertebrates, among which chironomids. Larvae of chironomids can be numerous because during the year there is a zone, above the water level, always wet or moist. They are almost absent only on eroded banks (mainly because there is no organic silt). Stretches with fresh sediment are inhabited by other species of chironomids than stretches with dense vegetation. The banks of the brooks in hilly country are usually more stable and often more overgrown with mosses.

Almost everywhere the water level changes throughout the year, even up to one meter, depending on rainfall. Especially this factor makes the zone above the water level to a very dynamic one. Terrestrial and semiterrestrial chironomids display various reactions upon inundation, varying from remaining on the spot to moving in order to seek the preferred microhabitat (Moller Pillot, 2005).

Methods

The lowland brooks were located mainly in the Dutch provinces of North Brabant and Gelderland; brooks in hilly country were located in South Limburg, in the French Ardennes and in Germany near Aachen and in Bavaria. Only brooks less than 10 m wide were chosen.

Except for the small brooks in the Veluwe, in all the other lowland brooks the water level fluctuates a lot during the year depending on rainfall, up to + 50 cm in one day. Very low and rather high water levels can last some weeks or even months. The brooks on the Veluwe are small tributaries of the Renkumse beek which have a rather stable water regime because of the many springs.

Bottom samples were taken from March to August (from 1988 up to 2015). The investigated habitat was the moist to wet zone directly above the water level of the brooks (mainly 0 – 40 cm above the water's edge, rarely higher). Samples were taken with a small spade, usually about 4 (3-6) cm deep in the substrate. A complete sample consisted of five to seven subsamples with a total of 2.5 dm².

A mini-emergence-trap (as developed by Henk Vallenduuk) was used to catch adults: a small bucket (bottom area of 2.5 dm²) with a dark cap and a tube with chloral hydrate 5% (Figure 1). The bottom samples were put in the bucket on the field, closed with a water-proof cover. In the laboratory the emerged insects were collected every week in the tube (the insects fly to the light in the top of the cap).

In few cases the Tullgren method was adopted, i.e., drying the sample under a hot lamp to get the larvae of chironomids.

In total 75 samples were collected.

Results

In all, 37 taxa of terrestrial and semiaquatic chironomids were recorded in the 75 samples (Table 1). True aquatic species were very rare and are not listed in the table. Almost all species belong to the Orthoclaadiinae. Tanypodinae and Tanytarsini (subfamily Chironominae) were found with only one species, respectively *Krenopelo-*

bia binotata (Tanypodinae) and *Parapsectra uliginosa* (Tanytarsini). *Limnophyes* near *ninae*, *Limnophyes* "mechtildae", *Allocladius* near *nanseni* and *Pseudosmittia* n.d. are still undescribed.

Almost everywhere *Limnophyes minimus* (Meigen) was one of the most abundant species (Table 1), followed, with the exception of the Veluwe region, by *Paraphaenocladus impensus* (Walker).

Most species have been found along the lowland brooks as well along the faster flowing brooks in the hilly country. Only few species seemed to be characteristic for lowland brooks e.g. *Allocladius* species. An undescribed species, *Allocladius* near *nanseni*, emerged in very large quantities from freshly deposited silt along the Leij. Species rare or absent in lowland were *Limnophyes* near *ninae*, *Limnophyes pentaplastus* (Kieffer), *Paraphaenocladus penerasus* (Edwards) and *Pseudosmittia danconai* (Marcuzzi).

Sphagnum and other mosses are dominant on most banks of the brooks on the Veluwe. *Pseudorthocladus filliformis* (Kieffer) and *Pseudosmittia albipennis* (Goetghebuer) were more common here than elsewhere, whereas *P. impensus* (that avoids acid environment; Moller Pillot 2013) was almost absent.

Some species have been underestimated e.g., *Chaetocladus piger* (Goetghebuer) which emerges mainly from November to April.

Discussion

The banks of brooks are dynamic systems. In such systems most species are not specially adapted to particular biotic or abiotic factors. Their adaptation for survival is based mainly on mobility strategies. Irregular presence of the species is typical and biodiversity is mainly dependent on the spatial diversity of the landscape.

In other dynamic systems usually less than 20% of the species appeared to have their optimum in this habitat, where survive by a diapause or other adaptations (Moller Pillot 2003). The other species migrate to this habitat when find favourable conditions. For example, *L. minimus*, cannot survive as larvae in dry bottoms: after rainfall many places are quickly recolonized by adults from surrounding ecosystems (Delettre 1986).

Almost none of the 37 species is a specific inhabitant of banks of brooks; exceptions are *C. piger* and *L. pentaplastus* (Moller Pillot 2013). Some species are pioneer, e.g. *Allocladius* species, *Hydrosmittia oxoniana* (Edwards), *Pseudosmittia gracilis* (Goetghebuer). Other species prefer grassland, e.g. *Metricnemus picipes* (Meigen),



Fig. 1 - Mini-emergence trap / Mini trappola di emergenza per la cattura degli adulti

Tab. 1 - Presence of terrestrial chironomid species (in alphabetic order) in the seven study sites; + to +++++ : from very few to numerous specimens; ?: doubtful identification / Presenza di chironomidi terrestri nei sette siti di indagine(specie in ordine alfabetico); + to +++++ : da pochi a numerosi individui

	Lowland			Hill country			
	Leij	Veluwe	NL other	South Limburg	Bavaria (Germany)	Ardennes (France)	Aachen (Germany)
Number of samples	20	5	8	20	6	8	8
<i>Allocladius arenarius</i> agg.	+++						
<i>Allocladius</i> near <i>nanseni</i> (Kieffer)	++++						
<i>Bryophaenocladus</i> Thienemann	+		+++				
<i>Chaetocladus piger</i> (Goetghebuer)	+		++				++
<i>Chaetocladus perennis</i> (Meigen)				+			
<i>Hydrosmittia oxoniana</i> (Edwards)	++						
<i>Krenopelopia binotata</i> (Wiedemann)			+			+++	
<i>Limnophyes asquamatus</i> Andersen			++				
<i>Limnophyes "mechtildae"</i> Dettinger Klemm				+++			
<i>Limnophyes minimus</i> (Meigen)	+++++	+++++	+++	+++++	+++	++++	++++
<i>Limnophyes natalensis</i> (Kieffer)		+++		+++++	+++	++++	+
<i>Limnophyes</i> near <i>ninae</i>				+++++		+++++	++++
<i>Limnophyes pentaplastus</i> (Kieffer)			+++	+++++	+++++	+++++	++++
<i>Limnophyes punctipennis</i> (Goetghebuer)	+++			++			
<i>Limnophyes spinigus</i> Saether				++			
<i>Metriocnemus</i> n.d.	+++		+				
<i>Metriocnemus</i> cf. <i>albolineatus</i> (Meigen)					+		+
<i>Metriocnemus</i> cf. <i>atriclava</i> (Kieffer)							+
<i>Metriocnemus beringensis</i> (Cranston & Oliver)						++	
<i>Metriocnemus fuscipes</i> (Meigen)		+++	+	+++++			+
<i>Metriocnemus hygropetricus</i> Kieffer	+			(++)			
<i>Metriocnemus inopinatus</i> Strenzke	++						
<i>Metriocnemus picipes</i> (Meigen)	++		?+	+		+	
<i>Mollerella calcarella</i> Saether & Ekrem						++	
<i>Paraphaenocladus exagitans</i> Johannsen					+		
<i>Paraphaenocladus impensus</i> (Walker)	++++	+	+++++	+++++	+++++	+++++	+++++
<i>Paraphaenocladus penerasus</i> (Edwards)					++++	++++	+
<i>Paraphaenocladus pseudirritus</i> Strenzke			++				
<i>Parapspectra uliginosa</i> Reiss		+++					
<i>Pseudorthocladus curtistylus</i> (Goetghebuer)	+++	?+	++	+++	+++	+	+++
<i>Pseudorthocladus filiformis</i> (Kieffer)		+++++	+++	+++		+	
<i>Pseudosmittia</i> n.d.					+	+	
<i>Pseudosmittia albipennis</i> (Goetghebuer)		+++++		+++		++	
<i>Pseudosmittia conjuncta</i> (Edwards)	+						
<i>Pseudosmittia danconai</i> (Marcuzzi)				+++	+		+
<i>Pseudosmittia gracilis</i> (Goetghebuer)	+++			+++++		+	+++
<i>Pseudosmittia trilobata</i> (Edwards)					?+	?++	
<i>Smittia</i> Holmgren (spp.)	+++		++	++++		+	++

Smittia pratorum (Goetghebuer) or marshes, e.g. *P. impensus*, *Pseudorthocladus curtistylus* (Goetghebuer).

Faster flowing brooks have more specialised species than the lowland brooks being more stable.. Van den Elsen (1988) found that *P. penerasus* lived only in a narrow zone of moist bottom less than

20 cm above the (very stable) water level of the Wilhelminakanaal (a stagnant water in the lowland of North Brabant). This species is a normal inhabitant of the banks of brooks in hilly country, but seems to be absent from lowland brooks. Most probably the key factor for this species is not the current velocity of the brook but the stability

of the moist zone (as we have seen in the introduction the banks of the lowland brooks have much more sedimentation and erosion). A similar distribution was found for *P. danconai* (Table 1).

Banks with a permanent wet or moist zone represent a refugium for inhabitants of surrounding habitats which dry in summer (Frouz & Kindlmann 2001; Moller Pillot 2003).

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