

New and remarkable records of tyrphophilic caddisfly species (Insecta, Trichoptera) from Hamburg and Schleswig-Holstein (Northern Germany)

MARTIN KUBIAK & RALPH S. PETERS

(with 4 figures)

Abstract

We present new faunistic records of caddisfly species from raised bog sites located in the federal states of Hamburg and Schleswig-Holstein in Northern Germany. *Holocentropus insignis* Martynov, 1924 (Polycentropodidae) is recorded for the first time for the city state of Hamburg. *Hagenella clathrata* (Kolenati, 1848) (Phryganeidae), a presumably extinct species in Hamburg and Schleswig-Holstein, was rediscovered at three sites in the latter federal state. Furthermore, the heavily endangered bog species *Rhadicleptus alpestris* (Kolenati, 1848) and *Limnephilus elegans* Curtis, 1834 (Limnephilidae) were found both in Hamburg and Schleswig-Holstein.

Key words: Insecta, Trichoptera, caddisflies, faunistics, raised bogs, Northern Germany.

Introduction

Raised bogs are extreme habitats. They are characterized mainly by high acid degrees, extremely low nutrient and oxygen values and considerable temperature fluctuations on the surface (Harnisch 1929, Peus 1932, Krey 1938, Burmeister 1990, Thiele & Berlin 2002). Only highly adapted species can continuously exist under such conditions. These highly adapted species show only little tolerance for abiotic parameter fluctuations. This is the main reason why taxa specialized on raised bogs are often placed in high threat categories (Burmeister 1990, Thiele & Berlin 2002).

In the past raised bogs covered huge areas in the Northern Germany lowlands. Today fens and bogs belong to the most severely anthropogenic influenced habitats in Northern Germany, many of them have been irretrievably destroyed by extensive peat cutting and drainage for reclamation of pastureland within the last two centuries (Krey 1938, Burmeister 1990). Only a few raised bogs survived the peat cutting era. These are generally small and isolated biotopes.



Fig. 1. Peat cut in regeneration stage at the Madenpohl area in the nature reserve Duvenstedter Brook (Hamburg).



Fig. 2. The raised bog Herrenmoor near the village of Kleve (Schleswig-Holstein).

Our knowledge about the Trichoptera fauna of raised bogs in Northern Germany is strikingly sparse. Especially for bogs in Hamburg and Schleswig-Holstein data is lacking (Speth *et al.* 2006). The majority of records from Hamburg and Schleswig-Holstein trace back to early trichopterists working at the beginning of the 20th century (Struck 1900, 1904, Ulmer 1903, 1909, Krey 1938, Weiß 1948). More recent studies are almost completely lacking for both federal states, only Vermehren (1977) and Speth *et al.* (2006) reported about some Trichoptera species in raised bogs in Schleswig-Holstein. Speth *et al.* (2006) also provide a basic review of trichopteran faunistic research in Schleswig-Holstein, but also note that especially habitats like small ponds and bogs are insufficiently studied compared to running waters.

In contrast to the poorly known faunistics of many Trichoptera species, it is well known that the aquatic immature stages of Trichoptera are influenced by several abiotic factors of their habitats and generally react very sensitive to habitat modifications. Accordingly, caddisflies are well-known as excellent bioindicators in limnic habitats (Morse 2009).

In this study we check Trichoptera material from the Duvenstedter Brook (Hamburg: Fig. 1) and three raised bogs in Schleswig-Holstein (Vaaler Moor, Herrenmoor (Fig. 2) and Scharfenhörn) for new faunistic records. Examined material was either newly collected or represents museum material from the Collection Georg Ulmer in the Zoologisches Museum Hamburg. We focus our study on the presence of rare or tyrphophilic species.

With these new faunistic Trichoptera records we try to make some conclusions about the present status of the study sites, some of the few remaining raised bog sites in Hamburg and Schleswig-Holstein.

Material and methods

Sampling sites

Collection trips were performed at four sampling sites in the federal states of Hamburg and Schleswig-Holstein.

The raised bog Duvenstedter Brook (Hamburg, district Wohldorf-Ohlstedt) is a nature reserve in the northeastern part of the Hamburg territory, adjacent to the state of Schleswig-Holstein. Sampling was done in the northwestern part of the reserve area at the Madenpohl locality, approximately 500 m southeast of the village of Wiemerskamp (N 53.7289°; E 10.1558°). The Madenpohl area is a treeless, water saturated raised bog relict in a regeneration stage (Fig. 1).

Two of the three bog habitats in Schleswig-Holstein (Herrenmoor and Vaaler Moor) represent a habitat cluster of small raised bog sites and are located quite close to each other. They are relicts from a former raised bog called Großes Moor. The nature reserve Herrenmoor (Fig. 2) is situated west of the village of Kleve near Itzehoe (N 53.9728°; E 9.3819°). The Vaaler Moor complex (N 53.9997°; E 9.3253°) is situated very close to the Kiel Canal. The collection site Scharfenhörn is a raised bog habitat west of the nature park Aukrug and southeast of the village of Christinenthal (N 54.0500°; E 9.5333°). All localities belong to the district of Steinburg in southwestern Schleswig-Holstein.

Additionally to the new samples we checked the material of the Collection Ulmer at the Zoologisches Museum Hamburg (ZMH) for relevant species records.

collection date	leg.	species	number of individuals	det.	RL SH & HH
21.06.2010	M. Kubiak & H. Riefenstahl	<i>Tinodes waeneri</i> (Linnaeus, 1758)	1 ♀	M. Kubiak	*
		<i>Holocentropus insignis</i> Martynov, 1924	1 ♂		0
		<i>Trichostegia minor</i> (Curtis, 1834)	1 ♀, 1 ♂		*
		<i>Limnephilus elegans</i> Curtis, 1834	1 ♀		2
		<i>Rhadicleptus alpestris</i> (Kolenati, 1848)	1 ♀		1
		<i>Oecetis ochracea</i> (Curtis, 1825)	3 ♂		*
30.06.2010	M. Kubiak & C. Bramer	<i>Limnephilus elegans</i> Curtis, 1834	1 ♂	M. Kubiak	2
		<i>Leptocerus tineiformis</i> Curtis, 1834	1 ♀		3
		<i>Mystacides niger</i> (Linnaeus, 1758)	1 ♀		*

Table 1. Species list of Trichoptera at the nature reserve Duvenstedter Brook, Madenpohl area (Hamburg). [Red List status for Schleswig-Holstein (SH) and Hamburg (HH) after Brinkmann & Speth (2000), threat categories: 0- extinct, 1- in danger of extinction, 2- endangered, 3- vulnerable, *- not endangered; typhophilic species in bold print (after Botosaneanu & Malicky 1978)].

Sampling methods

Collection of caddisflies in the Duvenstedter Brook was made by light trapping. Two different trap systems were used (automated 12V light trap type „Weber“ and light tower type „bioform“) at two dates (21.06. and 30.06.2010). Specimens at Scharfenhörn (27.05.2006 and 13.05.2010), Herrenmoor (26.05.2010, 02.06.2010 and 09.06.2010) and Vaaler Moor (09.06.2010) were obtained via sweep net sampling. All collected specimens are adults.

Laboratory procedures

The examination procedure of the genitalic apparatus follows Aspöck (1971) and Malicky (1983, 2004). After maceration in heated caustic potash the abdomen was transferred to distilled water for cleaning. Then genitalic structures were examined with a Leica M 165C stereo microscope or with a Zeiss Standard 14 light microscope in a glycerin drop. After identification the specimens and abdomen fragments were preserved in 70% ethanol.

For species identification we used Malicky (1983, 2004) and Tobias & Tobias (1981). Nomenclature and systematics follow Robert (2001, 2004, 2007). Voucher specimens are deposited at the ZMH.

Results

A total of eleven caddisfly species was found in the four sampling sites (Table 1, 2). Eight species were recorded in the nature reserve Duvenstedter Brook at two different dates in June 2010. On the first date more species were recorded (Table 1).

Holocentropus insignis Martynov, 1924 is new to Hamburg, *Limnephilus elegans* Curtis, 1834 and *Rhadicleptus alpestris* (Kolenati, 1848) are rediscovered for Hamburg. From the eight recorded species two are classified tyrphophilic (Table 1).

A total of five species was found in the three raised bogs in Schleswig-Holstein (Table 2). In the Herrenmoor all five species were recorded. In the Vaaler Moor and Scharfenhörn two and three species were found respectively (Table 2). *Hagenella clathrata* (Kolenati, 1848) is rediscovered for Schleswig-Holstein. The species was present in all raised bogs. From the five collected caddisfly species three are tyrphophilic (Table 2). The heavily endangered species *R. alpestris* was recorded in two bog complexes (Herrenmoor and Scharfenhörn), the endangered *L. elegans* was found at the Herrenmoor (Table 2).

Revision of historical Trichoptera material of Georg Ulmer at the ZMH yielded more information on tyrphophilic species in Hamburg: *H. clathrata* was found at at least three sites in Hamburg until the middle of the 20th century. Specimens are labelled (1) 1 ♀ “Duvenstedter Brook, leg. Dr. Gimbel, 16.VI.1915“; (2) 1 ♂ “Umgebung von Hamburg, Duvenstedter Brook“ (= vicinity of Hamburg; no information on collector and collection date); (3) 2 ♀ “Duvenstedter Brook, leg. Zool. Exkursion, 09.VI.1951“; (4) 2 ♂ “Wohldorfer Wald, leg. Zool. Exkursion, 26.V.1951“; (5) 1 ♀ “Steinwerder, 27.VI.1895“; (6) 1 ♂, 1 ♀ “Tarpfenbek, 24.VI.1906“. However, in 2010 *H. clathrata* was not recovered from the Duvenstedter Brook.

collection date	location	species	number of individuals	det.	RL SH & HH
26.05.2010	Herrenmoor	<i>Oligotricha striata</i> (Linnaeus, 1758)	1 ♂	M. Kubiak	3
09.06.2010		<i>Hagenella clathrata</i> (Kolenati, 1848)	5 ♂	J. Lietz, H. Reusch	0
		<i>Limnephilus elegans</i> Curtis, 1834	5 ♂		2
26.05.2010	Herrenmoor	<i>Rhadicleptus alpestris</i> (Kolenati, 1848)	3 ♂, 5 ♀	H. Reusch	1
		<i>Rhadicleptus alpestris</i> (Kolenati, 1848)	1 ♂	M. Kubiak	1
02.06.2010		<i>Beraea pullata</i> (Curtis, 1834)	1 ♂	J. Lietz, H. Reusch	3
09.06.2010	Vaaler Moor	<i>Hagenella clathrata</i> (Kolenati, 1848)	1 ♂	J. Lietz, H. Reusch	0
		<i>Beraea pullata</i> (Curtis, 1834)	1 ♀	H. Reusch	3
27.05.2006	Scharfenhörn	<i>Oligotricha striata</i> (Linnaeus, 1758)	1 ♂	M. Kubiak	3
		<i>Hagenella clathrata</i> (Kolenati, 1848)	1 ♂	M. Kubiak	0
13.05.2010		<i>Rhadicleptus alpestris</i> (Kolenati, 1848)	2 ♂, 2 ♀	M. Kubiak	1

Table 2. Species list of Trichoptera from three raised bog sites in Schleswig-Holstein (all species leg. L. Lange). [Red List classification for Schleswig-Holstein (SH) and Hamburg (HH) after Brinkmann & Speth (2000), threat categories: 0- extinct, 1- in danger of extinction, 2- endangered, 3- vulnerable, *- not endangered; tyrophilic species in bold print (after Botosaneanu & Malicky 1978)].

Furthermore, *R. alpestris* and *L. elegans* are of special interest. Museum material includes three records of *L. elegans*: (1) 1 ♀ “Eppendorfer Moor, 22.V.1907“; (2) 2 ♂ “Eppendorfer Moor, 25.V.1906“; (3) 1 ♀ “Tarpenbek, 24.V.1907“, and one record of *R. alpestris*, 1 ♂, 1 ♀ “Tarpenbek, 24.V.1907“. These are the first and only records of *L. elegans* from Hamburg until our rediscovery in 2010 and one of the very few records of *R. alpestris* from Hamburg.

Discussion

It is clearly beyond the scope of this study to give complete inventories or ecological assessment of the investigated biotopes. We want to present some remarkable faunistic records of rare Trichoptera species in Hamburg and Schleswig-Holstein from our ongoing faunistic data collection.

The starting idea of this work was to assess the present status of *H. clathrata* (Fig. 3) in the nature reserve Duvenstedter Brook in Hamburg. In 2009 the Zoologisches Museum Hamburg received caddisfly material collected by L. Lange from sites in Schleswig-Holstein, not too far away from Hamburg. This material contained specimens of *H. clathrata*. Until then, this conspicuous species was thought to be extinct in Hamburg and Schleswig-Holstein (Brinkmann & Speth 2000, Speth *et al.* 2006). This led us to a revision of *H. clathrata* material in the entomological collections of the ZMH, revealing several specimens of the species in the Collection Ulmer. They were collected in the first half of the 20th century in the wetland areas of the Duvenstedter Brook and Wohldorfer Wald raised bog complex. With these records in mind, the perspective to find *H. clathrata* at the Duvenstedter Brook looked promising. However, our efforts to rediscover that phryganeid species in 2010 remained unsuccessful.

In contrast to Hamburg, *H. clathrata* was recorded from three different localities in the federal state of Schleswig-Holstein. However, the collection sites Vaaler Moor and Herrenmoor somewhat belong together as they form a cluster of raised bog relicts originating from a former huge raised bog complex west of the city of Itzehoe called Großes Moor. The latter was mostly destroyed through peat cutting activity. These biotopes are part of the physical region Holsteinische Elbmarschen (Witt 1965). The Großes Moor was formed through elevation processes when the European ice sheet dissolved after the last glacial. The raised bog Scharfenhörn is part of a different physical region, the Heide-Itzehoer Geest (Witt 1965). This area is characterized by a remarkably higher elevation than the Holsteinische Elbmarschen. Accordingly, geological conditions and development of Scharfenhörn are considerably different compared to Herrenmoor and Vaaler Moor.

Our results indicate a wide distribution of *H. clathrata* in Schleswig-Holstein. We can conclude that some vital characteristics of raised bogs are still present in the area of the former Großes Moor and enable continuous existence of *H. clathrata* populations. Our records support the classification of *H. clathrata* as tyrophilic by Botosaneanu & Malicky (1978). These records, however, are not surprising when comparing our data with faunistic research in bordering federal states. *H. clathrata* has



Fig. 3. Male specimen of *Hagenella clathrata* (Kolenati) collected at the Duvenstedter Brook, Hamburg (09.VI.1951).



Fig. 4. Male specimen of *Limnephilus elegans* Curtis from the Collection Ulmer (ZMH), found at the Eppendorfer Moor, Hamburg (1906).

been recorded from raised bogs in Lower Saxony and Mecklenburg-Western Pomerania over the last years (Robert 2001, Thiele & Berlin 2002).

We failed to detect a cryptic population of *H. clathrata* in the Duvenstedter Brook, but we found some other remarkable species (Table 1). The records of *R. alpestris*, *L. elegans* and especially *H. insignis* indicate the presence of a tyrphophilic caddisfly biocoenosis in the Duvenstedter Brook. Until now, *R. alpestris* was listed for only two sites in Schleswig-Holstein, the raised bog Dosenmoor near Neumünster (Speth *et al.* 2006) and the raised bog Salemer Moor near Ratzeburg (Vermeeren 1977). For Hamburg, only Weiß (1948) recorded this species in the Duvenstedter Brook. Also, *R. alpestris* was found at all three bog sites in Schleswig-Holstein (Table 1, 2). *R. alpestris* is not strictly dependent on raised bog structures (Botosaneanu & Malicky 1978, Tobias & Tobias 1981, Burmeister 1990) but was repeatedly found in raised bog habitats (Weiß 1938, Speth *et al.* 2006). Peus (1932) classified it as a tyrphophilic species, Burmeister (1990) classified the taxon as ubiquitous. Our findings might corroborate the classification of Peus (1932), at least for Northern Germany.

According to Ulmer (1909), Botosaneanu & Malicky (1978) and Speth *et al.* (2006) *L. elegans* (Fig. 4) is closely related to raised bog habitats and can be classified as tyrphophilic. Our results show high concordance with that (records in Herrenmoor and Duvenstedter Brook: Table 1, 2). Records of *L. elegans* on the Hamburg territory date back to Ulmer (1909) more than 100 years ago, who reported the species from the Eppendorfer Moor and the Tarpenbek basin. At this time these sites were situated outside the city of Hamburg and anthropogenic influence was low. Today they are located within the city. Especially the Tarpenbek basin is negatively affected by the anthropogenic influence and cultivation. We found a population of *L. elegans* in the Duvenstedter Brook (Table 1), thus the species is still present in Hamburg. However, *L. elegans* most likely disappeared from its former distribution areas along the Tarpenbek basin. A study on the caddisfly fauna of the Eppendorfer Moor very close to the Tarpenbek basin is in progress and it might bring more certainty to this matter. In Schleswig-Holstein *L. elegans* is a rare species (Speth *et al.* 2006). Our record from the raised bog Herrenmoor is the first record of *L. elegans* for the region Holsteinische Elbmarschen.

We are confronted with another interesting case when discussing the record of a male specimen identified as *H. insignis* from the Duvenstedter Brook (Table 1). Speth *et al.* (2006) listed two localities for this species in Northwestern Germany (Dätgen and Meimersdorf) which trace back to their personal communication with H. Malicky, cited in Brinkmann & Speth (2000). To us, Malicky confirmed the presence of one *Holocentropus* specimen in his collection, collected at Dätgen (labelled "15 km Neumünster, 27.V.1973, leg. Willmann") but noted that this specimen belongs to *Holocentropus picicornis* (Stephens, 1836) (pers. comm. to M.K., 06. August 2010). Undoubtedly, this is the individual listed as *H. insignis* in Brinkmann & Speth (2000). This record is revised herein as *H. picicornis*. The status of the other record from Meimersdorf is unclear because there is no voucher material available. Our first record of *H. insignis* from

Hamburg is also the first reliable record from Northwestern Germany (Lower Saxony/Schleswig-Holstein/Hamburg). According to Tobias & Tobias (1981) *H. insignis* shows boreal distribution. Records for Germany only include the federal states of Mecklenburg-Western Pomerania (Borchert & Wolf 2005) and Saxony (Robert 2001). This indicates a distribution border status for the population of this species from Hamburg. Tobias & Tobias (1981), Brinkmann & Speth (2000) and Speth *et al.* (2006) classified *H. insignis* as a bog species. In contrast to this, Botosaneanu & Malicky (1978) did not classify it as tyrophilic. Our record from a raised bog and also the record of Borchert & Wolf (2005) from a raised bog in Mecklenburg-Western Pomerania suggest tyrophilicity of *H. insignis*.

Burmeister (1990) stated that only two Trichoptera species of the European fauna are strictly dependent on raised bog habitats (termed typhobiotic species). One of them, *Oxyethira boreella* Svensson & Tjeder, 1975, was declared a synonym of *O. falcata* Morton, 1893 by Malicky (2007). *O. falcata* is not restricted to bogs. Hence, the remaining *Lenarchus bicornis* (McLachlan, 1880) is the only recognized obligate raised bog caddisfly species. Thirteen species are considered as facultative bog inhabitants, termed tyrophilic (Burmeister 1990). Burmeister (1990) claims that appearance of such tyrophilics indicates disturbances of the natural raised bog morphology and termed them malfunction detectors. Accordingly, our results indicate structural deficits for the investigated raised bogs which have all been strongly influenced by intensive peat cutting.

In summary, we can state that there are several tyrophilic, highly endangered Trichoptera species of the Hamburg/Schleswig-Holstein fauna present in the studied bog habitats. Our study shows that knowledge about species like these is extremely low because research on bog and fen biotopes in Hamburg and Schleswig-Holstein has been widely neglected. If we examine such habitats more consequently, more records will follow. This will lead to a better understanding of distributional patterns and biology of Trichoptera species which can be implemented in nature conservation programs of any kind. Currently, restoration programs are running in the Duvenstedter Brook and partly in the Herrenmoor and Vaaler Moor. If natural conditions return in these habitats, the colonization and abundance of Trichoptera species will shift. More intensive future studies on Trichoptera species might help to assess the effect and possible success of the ongoing bog restoration programs.

Zusammenfassung

In der vorliegenden Arbeit werden für Hamburg und Schleswig-Holstein neue Köcherfliegenachweise aus vier Hochmoorlebensräumen aufgelistet. Bei *Holocentropus insignis* Martynov, 1924 handelt es sich um den Erstnachweis der Art für das Hamburger Stadtgebiet. Für die in Hamburg und Schleswig-Holstein als verschollen geltende Art *Hagenella clathrata* (Kolenati, 1848) werden mehrere neue Nachweise aus Schleswig-Holstein aufgeführt. Des Weiteren wurden die vom Aussterben bedrohten Arten *Limnephilus elegans* Curtis, 1834 und *Rhadicoleptus alpestris* (Kolenati, 1848) an verschiedenen Lokalitäten sowohl in Hamburg als auch in Schleswig-Holstein aufgefunden.

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Authors' addresses:

MARTIN KUBIAK, Biozentrum Grindel und Zoologisches Museum, Universität Hamburg, Abteilung Entomologie, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany (e-mail: martin.kubiak@hotmail.de);

DR. RALPH S. PETERS, Biozentrum Grindel und Zoologisches Museum, Universität Hamburg, Abteilung Entomologie, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany (e-mail: ralph.peters@uni-hamburg.de).