The Plecoptera of some small streams near Silkeborg, Jutland.

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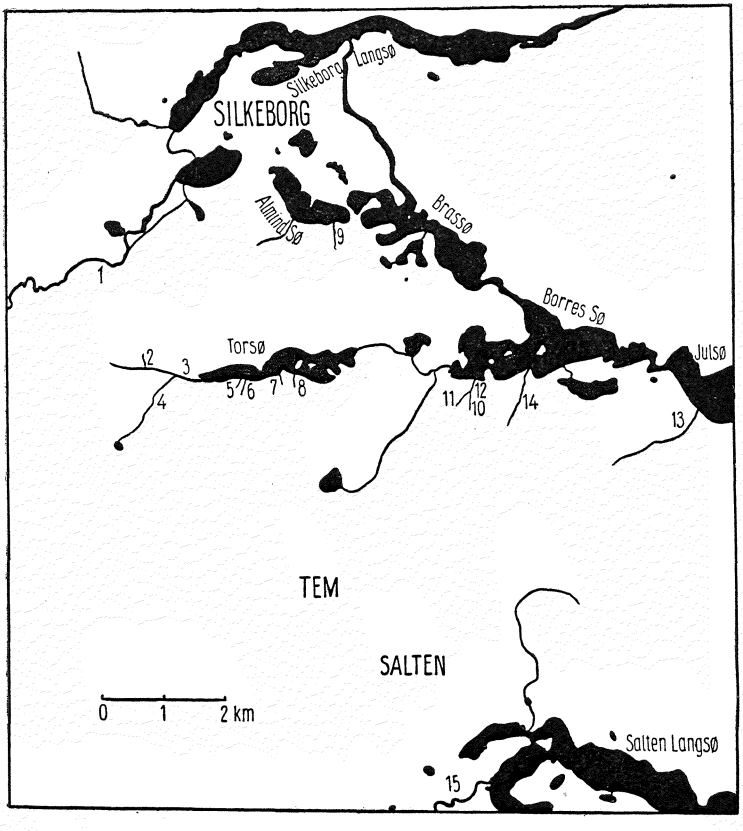
During August 1951, at the kind invitation of Professor Kaj Berg, and with the greatly appreciated financial assistance of Rask-Ørsted Fondet, I spent three weeks at the Silkeborg field laboratory of the University of Copenhagen in a joint study with Professor Berg of the Amphipoda of several small streams in the watershed of the Guden å. During this work I collected Plecoptera in the streams, and Professor Berg has also allowed me to study collections of animals made in the same localities at other times of year. As a result it has been possible to form some idea of the stonefly fauna of these streams. In view of the recent extensive study of Jensen (1951) on the stoneflies of the Skern å system, and the excellent paper of Brinck (1949) on Swedish stoneflies, it is felt that the present investigation, although very limited, may be of interest as an appendix to their work. The table gives details of the species found, and the map shows the localities. In the table the species are shown as A (abundant>30 specimens found), C (common>10 specimens), F (frequent>5 specimens) and P (present< 5 specimens). The physical and chemical data are based on measurements made in August 1951, and temperatures were recorded by Professor Berg in all months except mid-winter. In the text I have also referred to analyses of water samples made at Professor Berg's request by the Danish Geological Survey.

Most of the stoneflies collected were nymphs, but it proved easy to identify nearly all these to species with the keys in Brinck (1949). Specimens of five of the

Number of localities shown on map	Stream	*Taeniopteryx nebulosa* (L.)	*Protonemura meyeri* (Pict.)	*Amphinemura standfussi* (Ris)	*Nemoura cinerea* (Retz.)	*Nemurella picteti* (Klap.)	*Nemoura erratica* Claas.	*Leuctra nigra* (Oliv.)	*Leuctra digitata* Kemp.	*Leuctra fusca* (L.)	*Leuctra hippopus* Kemp.	*Perlodes sp.*	Size of stream	Amount of iron hydroxide deposits	Ferrous iron in water (mg/l.)	Total iron in water (mg/l.)	Maximum recorded temperature (° C)
1	Funder å	C	P	F	P					P			large	little	<0.1	0.9	12.8
2	Kilde til Jenskær							P					small	none	0.1	0.2	10.0
3	Jenskær bæk			A	P	F		C	P				medium	much	2.1	2.9	—
4	Gedsø bæk					A					P		small	none	<0.1	0.3	—
5	Kilde til Thorssø no. 4					A		A					small	none	<0.1	0.1	11.5
6	Kilde til Thorssø no. 3				P	A		A					small	little	<0.1	0.4	11.2
7	Kilde til Thorssø no. 2					C		F					small	none	<0.1	0.2	15.5
8	Kilde til Thorssø no. 1			P	P	P		P					small	much	0.4	1.4	10.5
9	Odderbæk				P	A		A					small	much	0.6	1.0	10.5
10	Østlig kilde til Rødkær				P	P	P	A					small	none	<0.1	<0.1	10.5
11	Vestlig kilde til Rødkær							A			P		small	none	<0.1	0.2	11.0
12	Rødkær bæk			A	C	F		P	F				medium	much	0.4	0.9	10.5
13	Svejbæk			C				P					medium	none	0.2	1.6	15.5
14	Rødebæk			P	A	P			A				medium	little	<0.1	0.4	12.5
15	Salten å	A	A	P	P					F	P	P	large	none	0	0.7	13.4

species (*A. standfussi, N. cinerea, N. picteti, L. digitata* and *L. fusca*) were bred out in August, and confirmed the identification of the nymphs. The *Perlodes*, of which only two very small nymphs were obtained, could not be identified to species.



Map of the Silkeborg Area.

The figures indicate the Plecoptera localities. No. 1 — Funder å. No. 2 — Kilde til Jenskær. No. 3 — Jenskær bæk. No. 4 — Gedsø bæk. No. 5 — Kilde til Thorssø no. 4. No. 6 — Kilde til Thorssø no. 3. No. 7 — Kilde til Thorssø no. 2. No. 8 — Kilde til Thorssø no. 1. No. 9 — Odderbæk. No. 10 — Østlig kilde til Rødkær. No. 11 — Vestlig kilde til Rødkær. No. 12 — Rødkær bæk. No. 13 — Svejbæk. No. 14 — Rødebæk. No. 15 — Salten å.

A few points in the table require explanation. The streams are arbitrarily classified as large, medium and small. The two large streams were between 3 and 5 m. across and more than 1 m. deep, and both contained rooted aquatic plants and flowed through open agricultural land. The medium sized streams were 1—1½ m. wide and less than 50 cm. deep, and the small streams were less than 1 m. wide and only a few cms. deep; all, except Rødkær bæk, which crossed an open marsh, flowed through forest, and were without rooted aquatic vegetation. Four of the streams contained a great deal of iron, and the beds of the streams and everything in them, including the stoneflies, were coated with ferric hydroxide. The iron content of the water was determined by the α-α-dipyridyl method using an electric colorimeter.

The conductivity of the water varied from 135—290 μ-mhos, and the calcium content from 12—53 mg/l. No correlation was found between these factors and the occurrence of stonefly species. The oxygen content of all the streams except Gedsø bæk, including even the iron-depositing streams, was high. Gedsø bæk is reputed to be polluted, but while no pollution was obvious the relatively low oxygen content, and the fact that its water contained more than twice as much chloride and nearly twice as much nitrate as any other stream, tend to confirm this. The pH, measured on fresh samples with a glass electrode, of all streams was found to be between 6.4 and 8.0, and most waters were nearly neutral. The lowest pH values were found in the iron-depositing waters.

When the results of this investigation are compared with those of Jensen (1951) on the Skern å, and of Brinck (1949) in Sweden, the following facts emerge.

(1) The stonefly fauna of the two large streams, which appear to fall into Brinck's category of Southern Streams, is in fairly close agreement with the findings of the other

two authors, except that Jensen found only two specimens of *A. standfussi* in the whole Skern å system.

(2) Considerable numbers of stoneflies were found in the four iron-depositing streams, which is in complete contrast with Brinck's statement that no stoneflies have been found in springs, trickles and streams with a high iron content.

(3) The small streams would appear to fit into Brinck's category of Cold Trickles, and to contain a stonefly fauna similar to that found in similar localities in Sweden.

(4) The medium sized streams do not fit clearly into any of Brinck's categories as, although they are as large as his Eutrophic Forest Streams, they are no more eutrophic than the Cold Trickles, and had a similar temperature régime and stonefly fauna to the latter. Three of them, however, contained *L. digitata* which Brinck found characteristic of streams in northern Sweden, and did not find in trickles nor in streams in southern Sweden.

(5) Two species which Jensen did not find in the Skern å system, *L. digitata* and *L. nigra*, were found in considerable numbers, the latter being present in nearly all the small and medium sized streams.

(6) Two species which Jensen found only rarely, *A. standfussi* and *N. picteti*, were found in large numbers. Jensen found the latter species only in the region of Rørbæk sø, where I also found it in Svinebæk. This apparently very limited distribution in the Skern å system is very strange, especially as it was found in so many of the streams in the neighbouring watershed, and is known from a wide range of habitats in Sweden (Brinck, 1949) and England (Hynes, 1941).

(7) It is interesting to note that the reputed pollution in Gedsø bæk was reflected in the stonefly fauna, which was limited almost entirely to *N. picteti*. This is a species which often occurs in still water (Hynes, 1941), and so is presumably tolerant of relatively low oxygen concen-

trations. Brinck also has noticed that it is one of the first species to reappear downstream of pollution.

Literature.

Brinck, P. 1949. Studies on Swedish Stoneflies. Opusc. Entomol. Suppl. XI, Lund.

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Jensen, C. F. 1951. Plecoptera (Slørvinger). En faunistisk biologisk undersøgelse af Skern å. 1. Flora og Fauna 1951: 17—40.

Anmeldelse.

H. von Lengerken: **Das Tierreich IV/3, Insekten.** Sammlung Göschen Bd. 594. 128 S., 58 Fig. Berlin (Walter de Gruyter & Co.) 1953. Pris DM 2.40.

For den Amatør-Entomolog, som gerne vil vide lidt om Insekterne uden for hans specielle Gruppe, for Insekter i Almindelighed, og som er i Stand til at skaffe sig denne Viden paa egen Haand, er denne Bog den helt rigtige. Det er en hasarderet Opgave at skrive en Entomologi, ovenikøbet med baade en almindelig og en systematisk Del, paa godt 100 meget smaa Sider (Sammlung Göschens bekendte Lommeformat); men det er lykkedes von Lengerken at faa utroligt meget med. Han har grupperet Stoffet saaledes, som det gøres i entomologiske Haandbøger: en morfologisk, en anatomisk, en biologisk og en systematisk Del; under Anatomien hører Udviklingen fra Æg til Imago. Den biologiske Del kunde man have ventet righoldig; den er særdeles knap, for spartansk naar den overhovedet skulde med; den systematiske er ifølge Sagens Natur kun en hastig Opremsning; bedst er den beskrivende Del lykkedes. 58 Figurer — uden Kildeangivelse — oplyser Texten. Som en Oversigt, man selv kan arbejde videre udfra, er Bogen meget at anbefale; den er jo ogsaa meget billig.

S. L. Tuxen.
