Growth of Stonefly Nymphs in Swedish Lapland

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Abstract

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The author has studied the growth of twelve stonefly species in the stream Kaltisjokk near Messaure in Swedish Lapland. The growth pattern of two of these species, viz. *Nemoura flexuosa* Aub. and *Siphonoperla burmeisteri* Pict., was previously unknown. The factors determining the growth of the species studied are briefly discussed.

Introduction

On investigating the drift of benthic invertebrates of the stream Kaltisjokk near Messaure, a large material of stonefly larvae was collected. It has been used for a study of the growth of various species.

The growth and life history of Swedish Plecoptera were studied by Brinck (1949) in various parts of Sweden, by Svensson (1966) in the northeastern coastal part of the country and by Ulfstrand (1968) in central Swedish Lapland. For some species, however, is the growth pattern still unknown.

Kaltisjokk stream

A typical "Northern stream" according to the definition of Brinck (1949). It was described by Müller (1970 a and b), and Müller-Haeckel (1970) surveyed its chemical properties.

It is a woodland tributary to the Stora Lule Älv (Lule river) near Messaure, at 66° 42′ N. lat. and 20° 25′ E. long. The stream is usually ice-covered from the middle of October until the middle of May. Its temperature is from the middle of November until the end of April approximately constant close to 0° C without daily variations. The temperature rises in May, when daily variations also appear, reaching its annual peak between June and August. The high temperatures reach about 20° C and the daily amplitude is in summer 5°—6° C.

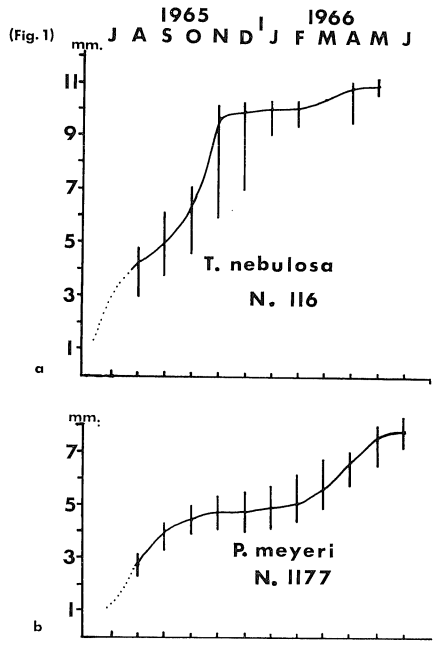
Material and methods

Drifting larvae were trapped during from July 1965 to June 1966 with an automatic stream drift sampler (Müller 1965) at the lower part of Kaltisjokk. The body length of the specimens was measured from the front of the head to the rear of the last abdominal segment under a binocular provided with micrometer ocular. It is given in mm as monthly averages.

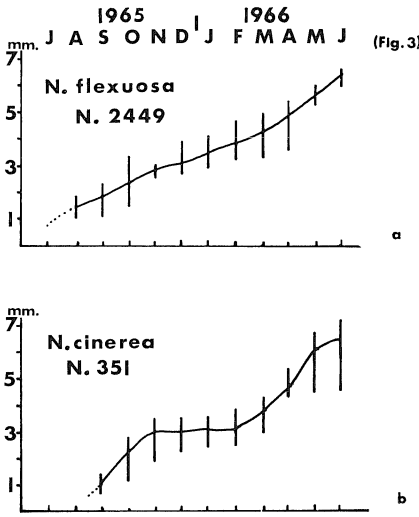
Results

The following 12 species of the 25 listed for Kaltisjokk (Thomas 1969, Benedetto 1970) were trapped during the sampling period in sufficient numbers to permit analysis.

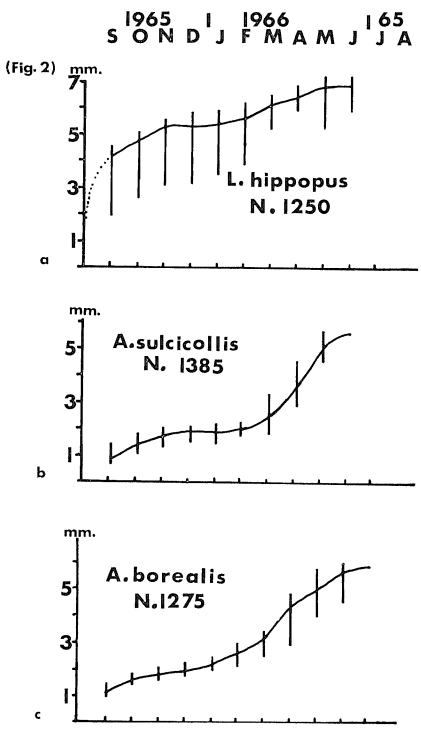
(Fig. 1)



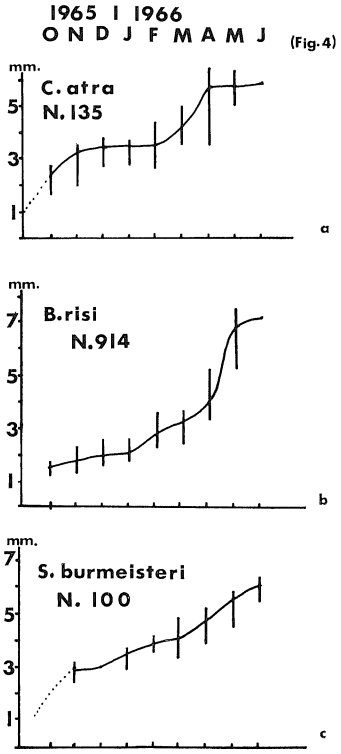
(Fig. 3)

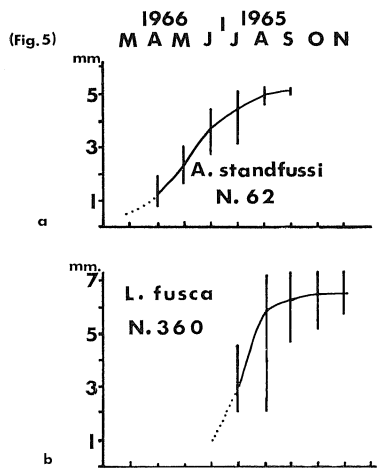


(Fig. 2)



(Fig. 4)





Figs. 1—5. Annual growth of stonefly nymphs in the stream Kaltisjokk. — N=number of nymphs.

1. *Brachyptera risi* Mort. (Fig. 4 b)

Small numbers of nymphs were found in October, whereas they were trapped in abundance in November—April. In May and June some large nymphs were obtained. The larvae of *B. risi* grew very slowly in autumn. Their development was retarded in December and January, while growth again started in February under the ice-cover. The growth rate accelerated in May after ice-melting, when the nymphs increased approximately 40 % of the total length. Emergence began on the first days of June (cf. Thomas op. cit.).

2. *Taeniopteryx nebulosa* L. (Fig. 1 a)

In August nymphs appeared for the first time. Most were over 4 mm long indicating that they grow rapidly after hatching. Large nymphs were almost full-grown in November and entered quiescence which lasted until April, whereas the small ones grew continuosly until emergence. Data supplied by Svensson, Brinck, and Ulfstrand (op. cit.) generally agree with the present finding.

3. *Protonemura meyeri* Pict. (Fig. 1 b)

Nymphs of this species were first found in August. They grew moderately until November when they were about halfgrown, and entered quiescence which lasted until February. In March growth started. It finished in May with the emergence. A few nymphs were still found in June. The flight period was in May and June.

4. *Amphinemura sulcicollis* Steph. (Fig. 2 b)

Brinck (op. cit.) included *A. sulcicollis* among the hiemal species with a late flight period, and Ulfstrand (op. cit.) recorded its main growth period to be June and July in Ammarnäs. In Kaltisjokk the catches of *A. sulcicollis* began in September with very small specimens, evidently newly hatched. The specimens grew slowly until November and the development was interrupted from December until February. Growth began in March and accelerated in April and the first half of May. Emergence took place in the middle of May. The species flies from May to August.

5. *Amphinemura borealis* Mort. (Fig. 2 c)

Numerous larvae were found from October until the first week of August. They grew very slowly until February. In March development accelerated so that the nymphs were full-grown in June and July. Emergence started in the second half of June. The imagines fly until the end of August.

6. *Amphinemura standfussi* Ris (Fig. 5 a)

No nymphs were found before April when a rapid growth started. The nymphs grew regularly through May, June and July. Some nymphs reached their full size in the first half of July, while smaller specimens were growing until the first half of August. *A. standfussi* is a hiemal species in southern Sweden (Brinck op. cit.) but becomes estival in the north. The flight period of *A. standfussi* lasts from July to October.

7. *Nemoura cinerea* Retj. (Fig. 3 b)

Although no nymphs appeared before September the pattern is basically similar to that

of *P. meyeri* with two moderate growth periods separated by a quiescence period between November and February. Emergence took place in June and the imagines flew until August.

8. *Nemoura flexuosa* Aub. (Fig. 3 a)

A considerable amount of nymphs were trapped from August to June. They grew slowly during late summer, winter and spring. Winter quiescence is just indicated and the nymphs grew under the ice-cover. In spite of the long growth period *N. flexuosa* belongs to the hiemal species with late flight period at Kaltisjokk. Imagines flew from May to July.

9. *Capnia atra* Mort. (Fig. 4 a)

No nymphs were caught before October, but evidently the species grows in autumn until November at what time it is about half-grown (cf. Ulfstrand op. cit.). After quiescence in December to February, the nymphs grew rapidly, reaching full size and emergence in April. The species flies until July.

10. *Leuctra hippopus* Kemp. (Fig. 2 a)

Numerous nymphs were caught from September to June. Most of the growth occurs in autumn, followed by quiescence from December to February. Growth recommenced in March under the ice-cover and continued until emergence in May. *L. hippopus* flies until July.

11. *Leuctra fusca* L. (Fig. 5 b)

An estival species with rapid growth after the appearance of the nymphs in July. Emergence began in the last days of July and continued to November, which was also the flight period of the species.

12. *Siphonoperla burmeisteri* Pict. (Fig. 4 c)

Half-grown nymphs were first found in November. A few larvae were obtained in winter. Evidently the nymphs grew rapidly in autumn. Growth slowed down from December until March and increased in April, May and part of June. Emergence took place in the middle of June. The flight period lasted until the first week of August.

Discussion

Because of the influence of the water temperature the growth pattern of North Scandinavian Plecoptera may vary slightly from one place to another (cf. Brinck 1949). In the Kaltisjokk material the growth pattern of the following species agrees fairly well with what is illustrated by Brinck (1949), Svensson (1966) and Ulfstrand (1968): *T. nebulosa, A. borealis, C. atra, P. meyeri, N. cinerea, L. hippopus, L. fusca, A. sulcicollis* and *A. standfussi.*

The growth pattern of *B. risi,* previously not described for North Sweden, agrees in principal with that described by Brinck (1949) on specimens from southern Sweden. The growth pattern of two species was previously unknown, viz. *N. flexuosa* and *S. burmeisteri.* They belong to the species with hiemal growth (Brinck 1949), with a late flight period. *N. avicularis* Mort. which has a late flight period in southern Sweden (Brinck 1949) has early flight in Kaltisjokk.

In most species the time between the end of November and the beginning of March was a period of quiescence (Brinck 1949). Schwarz (1970) demonstrated that temperature is a main factor determining growth of stoneflies, followed in importance in habitats with physico-chemically favourable conditions by food availability, changes of water level, current velocity etc. (cf. Svensson 1966 and Ulfstrand 1968). In Kaltisjokk environmental conditions including temperature are comparatively uniform for a long time in winter and during this time changes in growth may happen (cf. illustrations above). As shown by Schwarz (1973) for *Diura bicaudata* L. the end of the period of quiescence is not temperature dependent what is in agreement with my findings.

Acknowledgements

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