

NEUROPTERIDA OF NORTHERN EUROPE

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The collections of Neuropterida (Megaloptera, Raphidioptera and Neuroptera) from Northern Europe in the museums in Denmark, Sweden and Finland were revised or identified. Many species are established for the first time in some provinces. *Chrysopa commata*, *Chrysopa formosa*, *Peyerimhoffina gracilis* and *Nineta pallida* are added to the species hitherto known in the area. So far, 82 species are known from Northern Europe. Of the individual national faunas that of Sweden has the most complete subset, 76 species, due to the presence of the tundra fauna in Lappmark (*Sialis sibirica*) and the thermophilous fauna in the southern provinces Skåne and Småland (*Osmylus fulvicephalus*) and the islands of Öland and Gotland (*Aleuropteryx loewii*). The territory of Denmark is not a part of the coniferous forest zone but belongs to the deciduous forest zone. Expectedly, some species, absent in Scandinavia, occur in Denmark (*Sialis nigripes*, *Helicoconis hirtinervis*, *Hypochrysa elegans*), while other species, typical for the taiga, do not occur here (*Sialis sordida*, *Raphidia ophiopsis*, *Hemerobius simulans*, *Wesmaelius mortoni*). Norway and Finland have a reduced Swedish fauna. *Chrysopa dasyptera* from Finland is the only species in the two countries which does not occur in Sweden.

Key words: Neuroptera, Megaloptera, Raphidioptera, Northern Europe, distribution, zoogeography

INTRODUCTION

The ice sheet retreated from Northern Europe at the end of the Würm Glacial Period about 10 000 years ago. The short period since that time has proved to be enough for the colonization of the territory with its whole recent fauna and flora. Humans occupied its southern parts at least 12 000 years ago.

Before discussing the composition and characteristics of the fauna of Neuropterida, it is necessary to consider the meaning of the term Northern Europe and of some other terms connected with this territory. The area under discussion covers the territories of Norway, Sweden, Finland, Denmark and of the faunistically poor Faeroe Islands, Iceland and Greenland, the last of which belongs zoogeographically to the Nearctic. The less explored northern part of European Russia, where the same species generally occur (see the last part of the zoogeographical analysis below), is not included. The terms used in the literature for these territories are as follows:

- the Scandinavian Peninsula for Norway and Sweden;

- Fennoscandia for the Scandinavian Peninsula, Finland and the adjacent parts of Russia;
- Scandinavia for Fennoscandia and Denmark;
- the Nordic countries for Scandinavia, Iceland and the Faeroes.

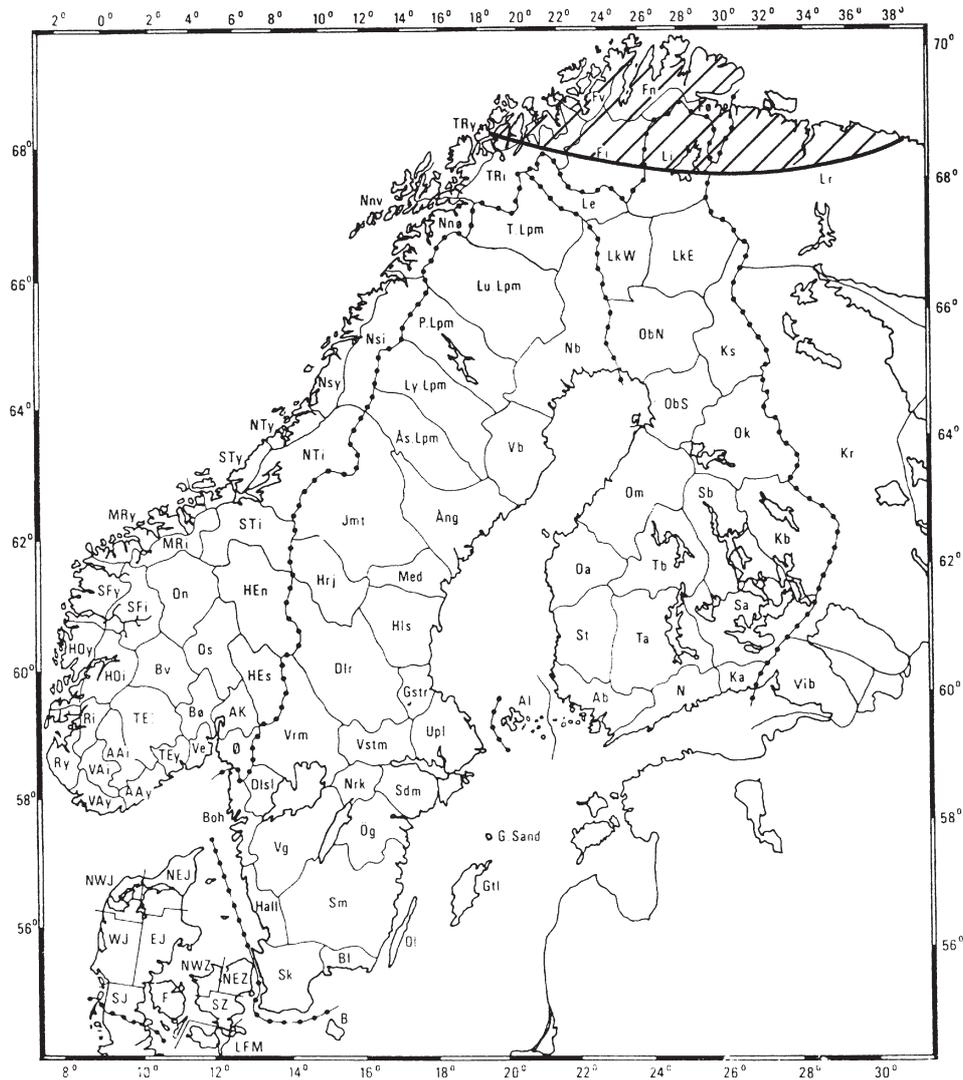


Fig. 1. Biogeographical provinces of Scandinavia (Denmark, Norway, Sweden and Finland). The hatched area is North Lapland, inhabited by 28 species. Figure and abbreviations after *Fauna Entomologica Scandinavica*

The most suitable term to use is Fennoscandia. It is divided in Western Fennoscandia or the Scandinavian Peninsula, consisting of Norway and Sweden, and Eastern Fennoscandia, consisting of Finland and Russian Karelia and Lapponia. The terms Scandinavia and Nordic countries have been used with different meanings and are quite confusing.

FAUNISTIC RESULTS

In the course of six years (1991–1997) I visited the main zoological and natural history museums in Denmark, Sweden and Finland several times and revised or identified the collections of Neuropterida from Northern Europe in: Zoologisk Museum, København; Naturhistorisk Museum, Århus; Zoologiska Institutionen, Lund; Naturhistoriska Riksmuseet, Stockholm; Eläinmuseo (Zoologiska Museet), Helsinki (Helsingfors).

The investigated specimens number over 5 600 in Danish museums, over 6700 in Swedish museums and over 12 000 in the Zoological Museum in Helsinki. On the basis of this rich material of ca. 24 000 examined specimens, some more detailed data on the species distribution in the three countries have been obtained. Many species have been established for the first time in some provinces. The biogeographical division of the investigated countries into 98 provinces (Fig. 1) has been used. A complete list of species distribution according to provinces in the three countries is in preparation.

Being a cradle of systematic entomology, Northern Europe is well-explored in respect to many insect groups. Neuropterida is not an exception to this rule. A series of species, widespread in the Palearctic or in Europe, were described from this region by LINNAEUS, FABRICIUS, WALLENGREN, REUTER. In the last hundred years there were published some generalizing papers (on the orders Megaloptera, Raphidioptera, Neuroptera and Mecoptera according to the current classification) for each country: Denmark – a monograph from Danmarks Fauna (ESBEN-PETERSEN 1929); Norway – a check list with distribution according to provinces (TJEDER 1945); Sweden – an outdated monograph (MJÖBERG 1909), a check list with distribution according to provinces (TJEDER 1940), a supplement to it (TJEDER 1953) and a check list according to the new nomenclature (TJEDER 1972); Finland, Russian Karelia and Kola Peninsula – a monograph from Fauna Fennica (MEINANDER 1962) and two additions to it (MEINANDER 1963, LAMMES 1977).

Notwithstanding the good exploration of Northern Europe, four species of chrysopids are added to the species hitherto known in the area. They are *Chrysopa commata* KIS et ÚJHELYI, *Chrysopa formosa* BRAUER, *Peyrimhoffina gracilis*

(SCHNEIDER) and *Nineta pallida* (SCHNEIDER). The last three species are locally distributed in the area and have definitely not been spread by man. The fact that *Peyerimhoffina gracilis* and *Nineta pallida* are established in two or three localities and *Chrysopa formosa* was known from Komi (ZAKHARENKO & SEDYKH 1981) and near Saint Petersburg (DOROKHOVA 1973) is a strong argument in favour of that opinion. *Chrysopa commata* has been confused with *Chrysopa phyllochroma* WESMAEL. The main distinguishing feature of the populations of both species in Central and Southern Europe is the presence of a black spot on the scapus of *Chr. commata* and the absence of such a spot in *Chr. phyllochroma* (KIS & ÚJHELYI 1965, KLEINSTEUBER & RÖHRICHT 2000 etc.). The verification by examination of male genitalia has shown that in Northern Europe *Chr. commata* rarely has a spot on its scapus. Most specimens of the two species do not differ in this characteristic. Besides by male genitalia, it is possible to distinguish the two species in both sexes by the lateral sutures of the thorax which are always black in *Chr. commata* and always green in *Chr. phyllochroma*. The same combination of characteristics (black sutures, absence of a spot on the scapus) is typical for almost all specimens of *Chr. commata* from England (PLANT 1997). The hitherto neglected *Chr. commata* is the more common of the two species in Northern Europe.

So far, 82 species altogether are known from this area. The number of the established species of Neuropterida (and separately of Neuroptera) in each country is given on Table 1.

ZOOGEOGRAPHICAL ANALYSIS

Most Neuroptera in the area are widespread in Europe or the Palearctic. The Raphidioptera, known for their high degree of endemism in the South (ASPÖCK *et al.* 1991), are very poorly represented in the northern parts of the range of this or-

Table 1. Number of species of Neuroptera and all Neuropterida recorded in Northern Europe

Country	Neuropterida	Neuroptera
Norway	63	55
Sweden	76	67
Finland	63	55
Denmark	64	58
Faeroes	2	2
Iceland	2	2
Greenland	3	3
Northern Europe	82	71

Table 2. Zoogeographical categories of North European species of Neuropterida according to their origin

Categories	Species	%
Oreotundral	1	1
Siberian	31	38
Siberian–Mediterranean	11	13
Siberian–Nearctic	9	11
Central European	8	10
Central European–Mediterranean	8	10
Mediterranean	14	17
Total	82	100

der. These are the reasons for the absence of any endemic species among Neuropterida in Northern Europe. The situation is the same in many other insect groups.

Despite the relatively low diversity of the habitats, the zoogeographical analysis of the species according to their origin classifies them into 9 categories (Table 2). The zoogeographical categories of DE LATTIN (1967) were mainly used. A hemerobiid (1% of all the species) is the unique non-arboreal species in the area. The Siberian faunal elements are most numerous. The Holarctic (Siberian–Nearctic) and the Siberian–Mediterranean species are represented approximately equally. The three last categories are united in a group originating from the Manchurian Subregion which consists of altogether 62% of the species. The Central European faunal elements and the Central European–Mediterranean species form a group originating from the western part of the Eurosiberian Subregion and comprising 20% of the species altogether. Some very expansive Holomediterranean faunal elements have also reached Northern Europe. Together with a few species from the secondary Mediterranean centres they form the group of the Mediterranean species comprising 17% of the species altogether.

The following species have typical ranges for the respective categories (all the Mediterranean species *sensu lato* in Northern Europe are of course expansive and therefore with extreme ranges):

- Oreotundral: the only representative is *Wesmaelius malladai* (NAVÁS);
- Siberian: *Xanthostigma xanthostigma* (SCHUMMEL), *Sisyra jutlandica* ESBEN-PETERSEN (with a range eastward to Baikal Lake and Yakutsk according to ZAKHARENKO, 1988), *Psectra diptera* (BURMEISTER) (presumably introduced in North America according to KEVAN & KLIMASZEWSKI 1986), *Nineta vittata* (WESMAEL), *Myrmeleon bore* (TJEDER);

- Siberian–Mediterranean: *Coniopteryx pygmaea* ENDERLEIN, *Hemerobius nitidulus* FABRICIUS, *Dichochrysa prasina* (BURMEISTER);
- Siberian–Nearctic: *Helicoconis lutea* (WALLENGREN), *Sisyra fuscata* (FABRICIUS), *Wesmaelius nervosus* (FABRICIUS)*;
- Central European: *Phaeostigma notata* (FABRICIUS), *Sisyra dalii* MAC-LACHLAN, *Nineta pallida* (SCHNEIDER);
- Central European–Mediterranean: *Sialis nigripes* PICTET, *Helicoconis hirtinervis* TJEDER, *Euroleon nostras* (FOURCROY);
- Mediterranean: *Subilla confinis* (STEPHENS) (Adriatomediterranean element), *Aleuropteryx loewii* KLAPÁLEK (least expansive northwards Holo-mediterranean element), *Coniopteryx borealis* TJEDER (most expansive northwards among the Mediterranean species).

The most complete picture of Scandinavian fauna of Neuropterida is given by the fauna of Sweden with 93% of the North European species. This is due to the



Fig. 2. The ranges of *Sialis sibirica* (1) and *Coniopteryx haematica* (2) in Fennoscandia. The former is a representative of the tundra fauna, the latter – of the thermophilous fauna

* *Wesmaelius nervosus* is conspecific with *W. disjunctus* (BANKS), *W. frostinus* (NAVÁS), *W. alexanderi* (NAKAHARA) and *W. melaleuca* (NAKAHARA), all the four synonymized by KLIMASZEWSKI & KEVAN (1987).

presence of two extreme faunas. On the one hand, the tundra fauna of Lappmark; and on the other hand, is the thermophilous fauna of the southern provinces of Skåne and Småland and the islands of Öland and Gotland (Fig. 2).

The extreme north of the Scandinavian Peninsula or the northern half of Lapland above 68–69° northern latitude (Fig. 1) is inhabited by 28 species or 34% of all the 82 species. Two thirds of the Holarctic species, half of the Siberian and less than half of the Siberian-Mediterranean and the Central European – Mediterranean species occur there.

The territory of Denmark is not part of the coniferous forest zone but belongs to the deciduous forest zone. This explains the absence of some species, typical for the taiga, e.g. *Sialis sordida* KLINGSTEDT, *Raphidia ophiopsis* LINNAEUS, *Hemerobius perelegans* STEPHENS, *Hemerobius simulans* WALKER, *Wesmaelius mortoni* (MACLACHLAN), *Megalomus hirtus* (LINNAEUS), *Nineta inpunctata* (REUTER). The same fact contributed to the appearance of the reverse situation. That is, other species, which are not distributed in Fennoscandia, occur in the discussed area only in Denmark, such as the Central European–Mediterranean *Sialis nigripes* PICTET, *Helicoconis hirtinervis* TJEDER and *Hypochrysa elegans* (BURMEISTER). The Central European *Nineta pallida* (SCHNEIDER), an inhabitant of the spruce forests which are not autochthonous in Denmark, also falls into this category. The most southern parts of the investigated area with mild climate are inhabited by some Central European *sensu lato* and Mediterranean *s. l.* elements. In their expansion northwards, the above mentioned Central European and Central European – Mediterranean species and the Atlantomediterranean element *Subilla confinis* (STEPHENS) in Northern Europe have only reached Denmark. Other species, such as *Osmylus fulvicephalus* (SCOPOLI), *Nothochrysa fulviceps* (STEPHENS), *Nothochrysa capitata* (FABRICIUS) and *Euroleon nostras* (FOURCROY) have reached Denmark and South Sweden, *Aleuropteryx loewii* KLAPÁLEK has only reached the islands of Öland and Gotland, and *Coniopteryx haemastica* MACLACHLAN has only reached South Sweden.

Norway and Finland have a depauperate Swedish fauna which is devoid of most of the thermophilous southern species. Some Siberian species have also colonized Fennoscandia from the east with different intensity. Five species not occurring in the countries investigated have been established in North Russia. They are *Drepanopteryx algida* (ERICHSON), *Chrysopa walkeri* MACLACHLAN and three species with doubtful distributional data (*Coniopteryx hoelzeli* ASPÖCK*, *Chrysopa hummeli* TJEDER and *Chrysopa reichardti* BIANCHI *sensu* ZAKHARENKO =

* *Coniopteryx hoelzeli* was confused with *Coniopteryx pygmaea* ENDERLEIN *sensu* GÜNTHER – see the synonymic list in MEINANDER 1990 sub *C. pygmaea*. Both species under other names were not correctly separated by ZAKHARENKO & KRIVOKHATSKY (1993).

altaica HÖLZEL). If the spread of the species from east to west is examined, it is evident that some species have reached different longitudes (Fig. 3). Thus *Drepanepteryx algida* has reached westward Uhta in Central Komi (ZAKHARENKO & SEDYKH 1981), *Chrysopa walkeri* (perhaps the spread has passed rather from southeast than from east) has reached Ladoga Lake in Russian Karelia, i.e. Eastern Fennoscandia (HULDÉN *et al.* 1977), *Chrysopa dasyptera* MACLACHLAN – South-eastern Finland (MEINANDER 1962), *Sialis sibirica* MACLACHLAN – Lapland (ASPÖCK *et al.* 1980), *Psectra diptera* (BURMEISTER) – Sweden (TJEDER 1940). *Inocellia crassicornis* (SCHUMMEL) occurs only in restricted territories in Central Sweden (Dalarna – TJEDER 1940 and Hälsingland – HEDSTRÖM 1985)* and Russian Karelia (Kuusamo – HULDÉN *et al.* 1977). However the distribution of most species covers the whole Fennoscandia from its western to its eastern boundaries.

Chrysopa dasyptera is the only species among those of Finland and Norway which does not occur in Sweden. The range of this remarkable species (Fig. 4) ex-

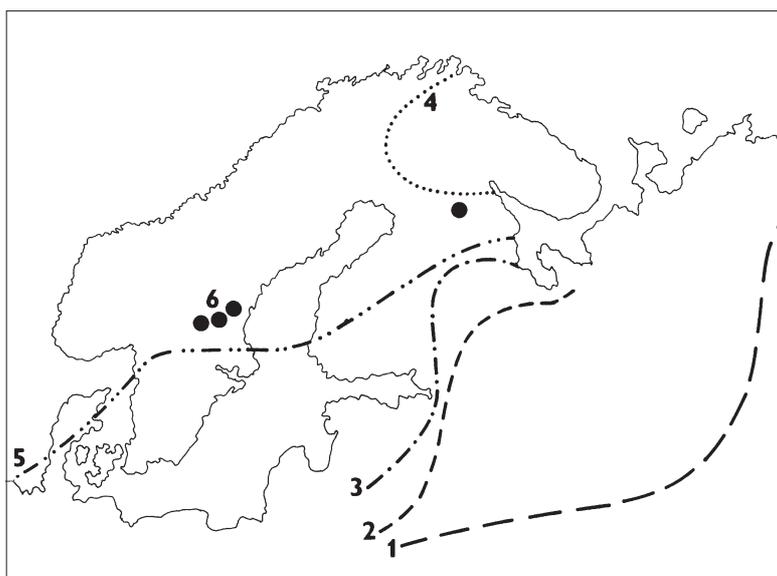


Fig. 3. Western and northwestern range borders of some species in Northern Europe: 1 = *Drepanepteryx algida*, 2 = *Chrysopa walkeri*, 3 = *Chrysopa dasyptera*, 4 = *Sialis sibirica*, 5 = *Psectra diptera*, 6 = the disjunct range of *Inocellia crassicornis* in Fennoscandia (for other localities of *In. crassicornis* in North Sweden see a footnote in the text)

* It seems *In. crassicornis* is wider spread in Sweden. During the print of this paper, the species was established on the basis of larvae and one female from traps on trees in four other provinces in North Sweden: Västerbotten, Norrbotten, Lycksele Lappmark and Pite Lappmark (BERGSTEN & PETTERSSON 2000). The new localities are not shown on Fig. 3.



Fig. 4. Distribution of *Chrysopa dasyptera*

tends from Southeastern Finland (MEINANDER 1962)*, East Poland (DOBOSZ 1996), Hungary (SZABÓ & SZENTKIRÁLYI 1981)** and Romania (PAULIAN 1996) through European Russia (Saint Petersburg District – DOROKHOVA 1973, Komi – ZAKHARENKO & SEDYKH 1981, Middle Volga – KOVRIGINA 1978) to North and Central Kazakstan (DOROKHOVA 1977), West Siberia (Krasnoyarsk District – ZAKHARENKO & KRIVOKHATSKY 1993) and North Mongolia (Chövsgöl District – STEINMANN 1971 and Central District – DOROKHOVA 1977).

There are some other interesting species in chorological respect which give a specific character to the North European fauna of Neuropterida: *Sialis sordida* KLINGSTEDT, *Sialis sibirica* MACLACHLAN, *Helicoconis hirtinervis* TJEDER, *Sisyra dali* MACLACHLAN, *Sisyra jutlandica* ESBEN-PETERSEN, *Wesmaelius balticus* (TJEDER), *Nineta inpunctata* (REUTER).

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* DOBOSZ (1996: fig. 2) incorrectly includes Southwestern Finland and Aland Islands in the range of *Chrysopa dasyptera*. This is due to an unintentional mistake in MEINANDER (1962: map 32) where the symbols of *Chrysopa dasyptera* and *Chrysopa dorsalis* BURMEISTER were reversed.

** According to F. SZENTKIRÁLYI (pers. comm.) the occurrence of *C. dasyptera* in Hungary needs confirmation.

seum, Helsinki), Dr ROY DANIELSSON (Zoological Department, University of Lund), Dr BERT VIKLUND (Swedish Museum of Natural History, Stockholm) and Dr PETER GJELSTRUP (Museum of Natural History, Århus). The study was supported by grants from the European Commission and the Carlsberg Foundation and by the Academy of Finland and the Royal Swedish Academy of Sciences.

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