



On the taxonomy and ecology of *Nephrocerus* ZETTERSTEDT (Diptera, Pipunculidae) with a redescription of *N. lapponicus* and a key to the European species.

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Abstract

Nephrocerus lapponicus Zetterstedt, 1838 is redescribed. A key and diagnoses are given for the three European species. Phenology, distribution and host specificity are reviewed and discussed.

Introduction

Three species of the genus *Nephrocerus* are known from Europe : *N. flavicornis* Zetterstedt, 1844, *N. lapponicus* Zetterstedt, 1838 and *N. scutellatus* (Macquart, 1834). These rather large, syrphid-like flies are still an obscure group within the pipunculid family.

Although they are conspicuous in their appearance in comparison with the other small and dark coloured members of the Pipunculidae, they are only rarely captured. However, during the last years this impression of rare insects is somewhat altered. For example there is the extraordinary large amount of captures of *N. flavicornis* in a park in Amsterdam in 1984 : 66 specimens in a period of less than two months (van der Goot, pers. com.) Also in Belgium, the genus seemed to be very poorly represented and the two known species were only sporadically captured during the last 100 years (Maréchal, 1929, 1958 ; Maréchal & Petit, 1955 ; Goetghebuer, 1943 ; De Meyer, 1983). Since an intensive sampling project by means of Malaise traps has been started some five years ago, they seem to be much more abundant than previously was thought (De Meyer & De Bruyn, 1985) and in addition a third species was found (De Meyer, 1984) in relatively large quantities.

A detailed study of the three European species with a revision of the types, has led to the conclusion that the keys which are normally used and which are all based on the key of Becker, 1897 include some misleading diagnostic characters.

Systematic account

In 1897, Becker redescribed *N. lapponicus* and made a key for the three European species. The first step in his key was the presence or absence of long bristly hairs on the terminal tarsal segments of all legs. If no such conspicuous bristly hairs were present, the species should be *N. lapponicus*. Becker's key was copied and slightly adapted by several authors for almost 90 years (Verrall, 1901 ; Sack, 1935 ; Coe, 1966 ; Bankowska, 1973 ; Johnson, 1915 ; Aczèl, 1948). Coe (1966) based his key on the description of *N. lapponicus* by Sack (1935) and was probably inspired by the diagnosis given by Becker (1897). So he added in his key that the hind tibiae were absolutely simple in *N. lapponicus* while they are noticeably bent in the other species.

A study of material from several countries, including the types of *N. scutellatus* and *N. lapponicus*, as well as discussions with other specialists have led to the conclusion that all keys to *Nephrocerus* are misleading. *N. lapponicus* has also very prominent bristly hairs on the terminal tarsal segments of all legs and all tibiae are noticeably bent when viewed from above.

Key to the European species of the genus *Nephrocerus*

1. - Hind tibiae broadened at tip and with an apical fringe of stiff brown bristles (fig. 8) ; these are somewhat weaker in female than in male ; antennae entirely yellow ; arista yellow at base but black at apical part.

..... *N. flavicornis* Zetterstedt, 1844

- Hind tibiae only weakly thickened at tip and with a weakly developed fringe of bristly hairs (fig. 6, 7) ; third antennal segment brownish to black, arista completely black. 2

2. - Abdomen completely black or with inconspicuous light markings ; third antennal segment rather small

(a quarter of the height of the eyes ; male with distinct anteroventral bristles on hind femora (fig. 6) ; larger species.

..... *N. scutellatus* (Macquart, 1834)

- Abdomen with yellow maculations on tergites 1-3 (fig. 1) ; third antennal segment rather large (a third of the height of the eyes in male, about a quarter in female) ; only short bristles on the hind femora (fig. 7) ; smaller species.

..... *N. lapponicus* Zetterstedt, 1838

Nephrocerus lapponicus Zetterstedt, 1838 Figs 1-5, 7, 10.

Insecta lapponica, Dipt. : 578.

A relatively small species (7.3-7.8 mm) with a large black third antennal segment and yellow maculations on tergites 1-3. Hind femora with an inconspicuous anteroventral bristling. Tip of hind tibiae not swollen.

Male. Head globular. Eyes meeting on middle of frons, leaving a large black but silvery-grey dusted triangular space above antennae. Face broad, almost rectangular ; black in ground-colour, silvery-grey dusted including clypeus. Occiput concave velvet black in ground-colour with a grey dusting and densely set with whitish hairs. Palpi small, usually hidden ; tubiform, pale at base but tip brownish with two stout black bristles. Proboscis short, yellowish. Antennae large, black (fig. 4). First antennal segment darkened, with some black bristles dorsally and externally ; second antennal segment yellowish at inside, brownish to black at outside, dorsally and ventrally with long black bristles ; at the inside a large thumb-like projection ; third antennal segment reniform, dark to black, height 0.45-0.61 mm being about a third of the height of the eyes (1.69-2.09 mm). Thorax. Mesonotum subshining black on disc with a narrow shining median stripe and a stripe along the dorsocentrals ; humeri, notopleural depression, alar calli and scutellum yellow. All bristles and hairs black ; no humeral, 2 notopleurals, 1 supraalar, 2 postalars and 4-6 nearly equally strong marginal bristles on scutellum. No acrostichals. Dorsocentrals uniserial, short in front but some longer bristles behind. Prothorax with a row of 8 black bristles ; pleura brownish above, darker beneath, finely grey dusted.

Wings (fig. 1) almost hyaline with a faint brownish tinge. Veins at base of wings and half of the subcosta yellowish, veins further brownish. Squamulae small and pale ; halteres yellowish.

Legs yellow, long and slender (fig. 1) ; all coxae darkened at their base, yellowish at tips. Front coxae with some black bristles near tip. Legs covered with

short, black, inconspicuous pubescence. All femora long and slender. Anterior four tibiae slender and slightly arched dorso-ventrally ; hind tibiae (fig. 7) narrow on basal third, broader towards tip, laterally arched in apical half (in dorsal view). All terminal tarsal segments with long black bristles (fig. 10), longer than the unguis. Basal half of unguis yellow, apical half black.

Abdomen long cylindrical, shining black with yellow spots on first, second and third tergite ; first tergite with a yellow spot on sides, not reaching the hind margin ; second and third tergite posteriorly with a more or less triangular spot at sides sometimes touching dorsally ; following tergites completely black ; in one specimen there was an indistinct yellowish spot on hind margin of fourth and fifth tergite. Sides of first tergite densely set with long black bristles, following tergites with long fine black bristles along side and hind margins. First sternite not sclerotized, following sternites black with long bristles. Genitalia yellowish brown, aedeagus black (fig. 2-3).

Body length : 7.3-7.8 (7.5 mm) ; wing length : 7.0-8.6 mm (7.7 mm).

Female. In most characteristics identical to male. Antennae smaller than in male. Height of third antennal segment (0.43-0.57 mm) about a quarter of the height of the eyes (1.69-2.18 mm). Abdomen black with the same yellowish spots as in the male. Ovipositor (fig. 5) yellowish-brown.

Body length 7.0-9.5 mm (8.1 mm) ; wing length 6.9-9.0 mm (7.9 mm).

Material examined : Lectotype : Sweden : female Gransele Lapp. (in coll. Lund)

Paralectotype : female Gransele Lapp (in coll. Lund)

Other material : Sweden : Kvikkjokk, 8.VI.1948, 1 male ; Valbo, 27.VI.1935, 1 male ; Oland, Råppel. Grebyskogen, 6.VI.1956, 1 female (S. Johansson)

Netherlands : Hoog Soeren 29.V.1980, 1 female (B. van Aartsen).

Belgium : Ferrières (FR 88) 20.V-15.VII.1983, 2 males, 6 females (MT) ; Ethe-Buzenol (FR 80) 5.V-2.VI.1984, 1 male, 2 females (MT) ; Treignes (FR 25) 24.V-20.VI.1984, 1 male, 3 female (MT).

Nephrocerus lapponicus is recorded from Sweden, Finland (Hackmann, 1980), Czechoslovakia (Kozanek, 1981), Belgium (De Meyer, 1984) and the Netherlands.

Previous authors stated that this species has a boreoalpine distribution. According to Aczél (1948),

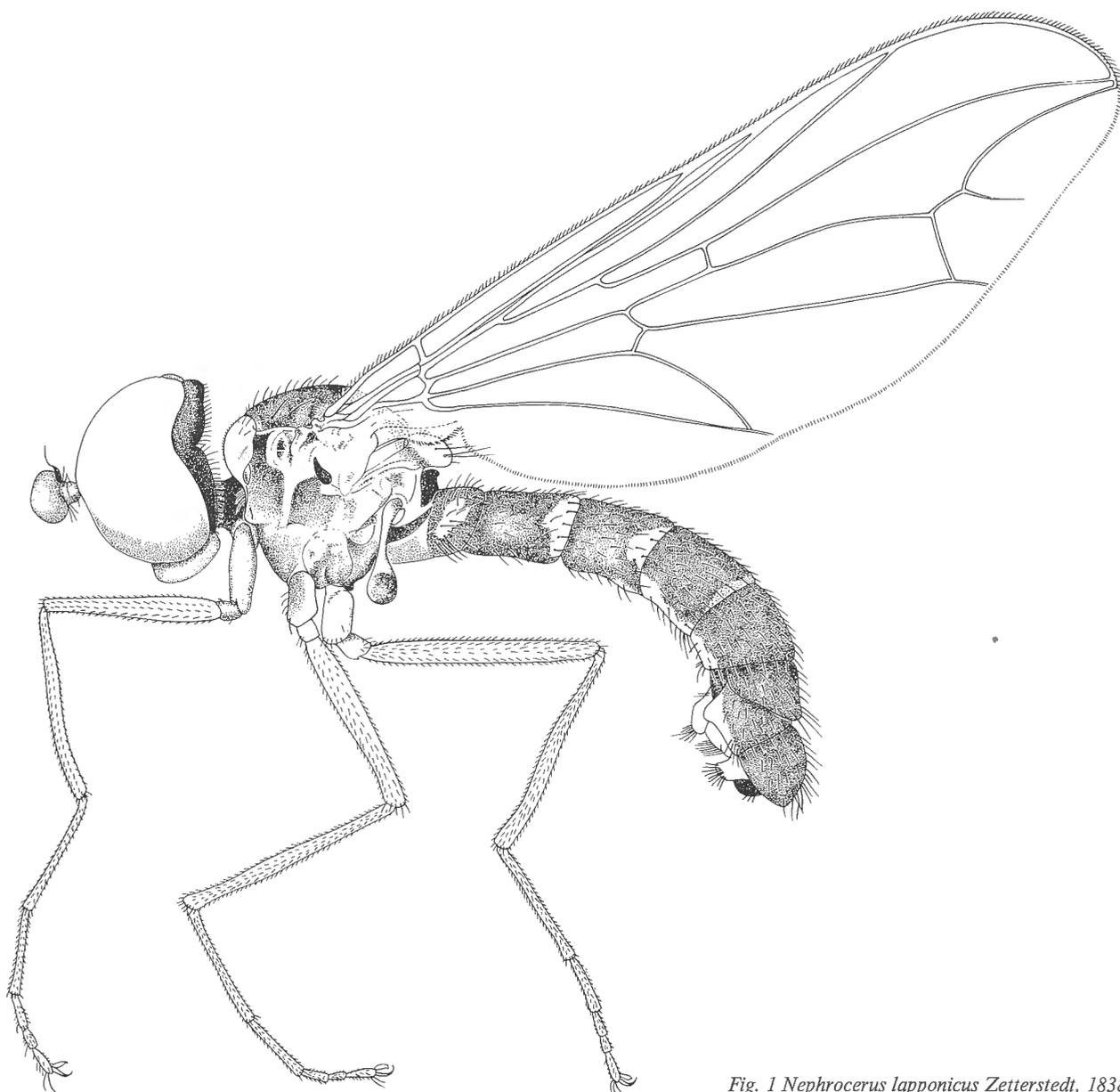


Fig. 1 *Nephrocerus lapponicus* Zetterstedt, 1838.

the alpine distribution was based on a misidentification and thus the species had only a boreal distribution.

However the records from Czechoslovakia and especially from Belgium and the Netherlands show that *N. lapponicus* is not limited to boreal or boreoalpine sites.

N. flavicornis Zetterstedt, 1844 Figs 7-8.

Dipt. scand. 3 : 945.

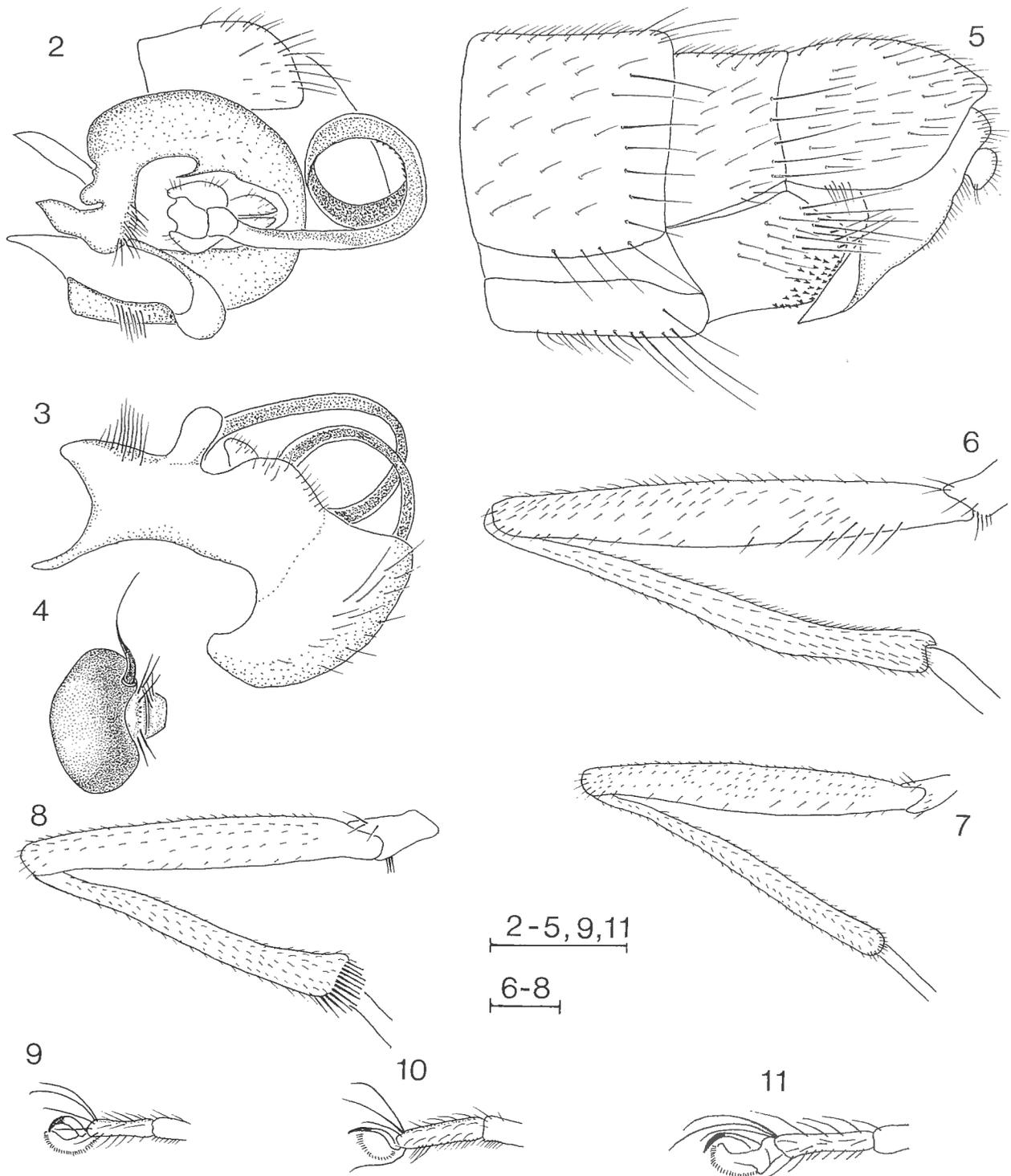
Diagnosis : A stout species (7-9 mm) with a relatively large, yellow third antennal segment and yellow maculations on at least tergites 2 and 3. Tip of hind tibiae swollen and with a fringe of stiff bristles.

Material examined : Belgium : Ottignies (FS 01) 3-10.VII. 1982, 1 male (MT), Tervuren (FS 02) 8.VII.1933, 1 female ; Treignes (FR 25) 27.VI-11.VII.1984, 2 females (MT) ; Logne, 27.VI.1986, 1 female ; 2.VII.1986, 2 males, 2 females ; Ethe-Buzenol (FR 80) 16-30.VI.1981, 1 male (MT) ; Melle (ES 55) 5.VII.1942, 2 females (J. Verbeke).

the Netherlands : Amsterdam, Amstelpark 1.VI-22.VII. 1984, (van der Goot).

France : Hte Pyrénées, Lourdes, 20-26.VI.1986, 1 male, 1 female (by G. Haghebaert).

Nephrocerus flavicornis is reported from Austria (Schiner, 1862), Belgium (Goetghebuer, 1943), Cze



Figs 2-10; *N. lapponicus* : 2-3, male genitalia ; 4, antenna ; 5, ovipositor ; 6, *N. scutellatus* hind leg in anterior view ; 7, *N. lapponicus* hind leg ; 8, *N. flavicornis* hind leg ; 9, terminal tarsal segment of *N. flavicornis* ; 10, terminal tarsal segment of *N. lapponicus* ; 11, terminal tarsal segment of *N. scutellatus*. Scale 0.5 mm.

choslovakia (Kozanek, 1981), Denmark (Lyneborg, 1975), 'Germany' (Becker, 1897), Finland (Hackmann, 1980), Great Britain (Coe, 1966), the Netherlands (van der Goot, 1961), Poland (Bankowska,

1972) and Scandinavia (Collin, 1956).

Thus the species is distributed in West-, North- and the northern part of Central Europe ; data from South Europe are lacking.

N. scutellatus (Macquart, 1834)

Pipunculus scutellatus Macquart, 1834 Recueil. Soc. agricult. Lille : 356, 9.

Diagnosis : A stout species (9-11.5 mm) with a relatively small black third antennal segment and a completely black abdomen. Hind femora in male with prominent black anteroventral bristles. Tip of hind tibiae not swollen.

Material examined: France : Holotype male (without data in Mus. Hist. nat. Paris).

Belgium : Turnhout (FS 38) 13-20.VI.1982, 1 female (MT); Ohain (FS 01) 16.V.1948, 1 male (J. Verbeke); Virelles (ER 94) 23.VI.1982, 1 male; Embourg (FS 80) 25.V.1985, 1 female (E. Candeze); Ferrières (FR 88) 30.V-3.VI.1983, 1 male (MT); Logne, 27.VI.1986, 1 female; Maredsous (FR 27) 3.VI.1943, 1 male; 23.V.1947, 1 female; Treignes (FR 25) 11-19.VII-1984, 1 female (MT).

Sweden : Gotland, Visby 19.VI.1920, 1 male, 1 female (Ringdahl coll.).

Nephrocerus scutellatus is reported from Austria (Schiner, 1862; Aczél, 1948), Belgium (Maréchal, 1929, 1958), Corsica (specimens in coll ITZ), Czechoslovakia (Kozanek, 1981), France (Macquart, 1834; Stubbs, 1980), Greece (Stubbs, 1980), Great Britain (Stubbs, 1980), Hungary (Aczél, 1948), Italy (Aczél, 1948), the Netherlands (specimens in coll. ITZ de Meijere), Roumania (Aczél, 1948), Sweden (spec. in coll. Lund), U.S.S.R. (Kola peninsula) (Lindberg, 1946), Yugoslavia (Aczél, 1948), Switzerland (Stubbs, 1980).

Nephrocerus scutellatus is found in several countries of West-, South- and South-eastern Europe. The northernmost records seem to coincide with the southernmost limit of *N. flavicornis*. However, the records from South Sweden and especially from the Kola peninsula disturb this picture. The material from South Sweden was checked but not that from the Kola peninsula.

PHENOLOGY

All *Nephrocerus* are restricted to late spring, early summer.

N. lapponicus

All data from the literature (Kozanek, 1981; Lauterer, 1981) as well as the records from Belgium are situated between the beginning of May till the end of June, with sporadic records from the second half of July. No distinct peakperiod could be distinguished

but it seems earlier than in *N. flavicornis*; probably somewhere at the end of May or the beginning of June.

N. flavicornis

The most detailed information is from the Amstelpark in Amsterdam. In 1984, 66 specimens were caught during a period from the first of June till the 22th of July with a peakperiod at the end of June, beginning of July. This agrees well with captures of *N. flavicornis* in Belgium with malaise traps (De Meyer & De Bruyn, 1985). Here the peak periods are also situated around the end of June, beginning of July. Other records in the literature (Coe, 1966) are similar except for some sparse captures in August.

N. scutellatus

Aczél (1948) has made some preliminary notes on the phenology of this species, based on the 75 specimens which are deposited in the collections of the National Museum of Hungary. The peak period lies somewhere between the 14th of May and the 19th of June, and one deviated record from Italy : 19th August. Data from the literature (Kozanek, 1981) as well as from material from malaise traps in Belgium and from the collections of the Koninklijk Belgisch Instituut voor Natuurwetenschappen (Brussel, Belgium) and the Instituut voor Taxonomische Zoologie (Amsterdam, the Netherlands) agree well with this period. There are only a few records dated July. So *N. scutellatus* seems to appear at the same time as *N. lapponicus*. In Pipunculidae, the usual period between two generations in one year is about ten weeks (Hardy, 1943; Waloff, 1975; De Meyer & De Bruyn, 1984). If this is also the case with *Nephrocerus* (which we do not know) and if we see that only one peakperiod can be distinguished in all three the cases, we may assume that all *Nephrocerus* are univoltine.

N. lapponicus and *N. scutellatus* seem to appear in the same period (end of May, beginning of June) whereas *N. flavicornis* occurs somewhat later (end of June, beginning of July). To get a decisive answer regarding eventual temporal spatio-temporal variation all the species should be studied at one site at the same moment. At Treignes (prov. Namur, Belgium) the three species were captured by means of malaise trap at the same site (De Meyer, 1984). The data however were too limited to draw any conclusions.

DISTRIBUTION

All species are uncommon in Belgium and it is difficult to see any distinct pattern in the distribution. We can only remark that the three species are very rare in the northern and western part of the country.

HOST SPECIFICITY

The hosts of the flies are still unknown. However, some assumptions have been made. Verrall (1901) assumed that *Cicadetta montana* was the host of the only English species at that time (*N. flavicornis*). The potential host ought to be of a great size considering the length of *N. flavicornis*. Further the known distribution of both species in Great Britain was similar (Coe, 1966). However the special life history of *Cicadetta montana*, especially during the larval stage, seems to make it improbable as a host because the larvae live for several years in the soil. Coe (1966) stated that the distribution of *N. flavicornis* (as it is known today) is far outside the range of *C. montana*. This is the case in Belgium. Here, *C. montana* is restricted to a few localities in the south-eastern part of the country while the records of *N. flavicornis* in particular and all *Nephrocerus* species in general are scattered all over Belgium. According to Ossiannilsson (1983) the northernmost records of *C. montana* are the South of Sweden and Karelia, while *Nephrocerus* occurs still further northwards.

Coe (1966) suggested that *Ledra aurita* may be the host of *N. flavicornis* because they have a similar distribution and type of habitat. This may be true in Great Britain but in Europe *Ledra aurita* seems to be even more restricted than *Cicadetta montana*. It does not occur in Finland or the north-eastern part of the U.S.S.R. (Ossiannilsson, 1983). Also the larval deve-

lopment of *Ledra aurita* takes more than one year (Ossiannilsson, 1981).

Lauterer (1981) collected *N. lapponicus* in thermophilous Quercetum where leafhoppers such as *Iassus lanius* and *I. mirabilis* were abundant. These leafhoppers were parasitized by an unknown species of Pipunculidae. They are also a potential host although the size of these leafhoppers is much smaller than that of the former two Homoptera (Ossiannilsson, 1981).

The only incontestable fact we can observe is that *Nephrocerus* seems to have a preference for Quercus woods (Lauterer, 1981 ; Coe, 1966 ; Stubbs, 1980). Presumably the host of *Nephrocerus* is also confined to this biotope and *Ledra aurita* and the *Iassus* species correspond to this requirement. Of course it is still a question whether *Nephrocerus* species have a similar way of development as the other Pipunculidae. If we only look at the diversity of the larval life histories within the related family of Syrphidae, it is not so self-evident.

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