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The family Chloropidae (Diptera) in Belgium ; a synopsis of the present knowledge

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Summary

The family Chloropidae, or shootflies, consists of usually small (< 4 mm) almost bristleless flies. The larvae of most species develop in the stems, in the leafsheets, on the inflorescences or in the spikelets of Poaceae. Some feed on cereals, and may cause extensive damage or substantial economic loss.
In the past, the family Chloropidae was a commonly overlooked insect group, in Belgium. Except some rather "accidental" faunistical observations, no other substantial data were available. A few years ago a more specific study on this phytophagous fly family was started. The aim of this study is to make a profound analysis of the Belgian shootfly fauna. Besides the collection of faunistical data (number of species, species distribution, ...), also ecological/behavioral (phenology, host specificity, lifecycle strategies, ...) and taxonomical/systematical investigations are performed.
The present contribution gives a synopsis of the knowledge concerning higher mentioned fields, brought together until now.
key-words : Diptera ; Chloropidae ; Faunistics ; Ecology ; Review

Introduction

The family Chloropidae represents a rather common but usually overlooked group of minute flies. It is one of the largest families of the order Diptera, and includes about 2000 described species (KANMIYA, 1983). The larvae of most species develop in the stems, leafsheets or panicles of Poaceae, while some also attack cereals. Other species develop in monocotyl families which are close allied to the Poaceae like Liliaceae, Juncaceae, Juncaginaceae or Cyperaceae. Furthermore, some species develop on organic detritus, or are predacious. The first record of a Belgian chloropid species was made by JACOBS (1884), who reported the invasion of several specimen of *Chlorops laeta* MEIGEN in a house. Later publications were usually limited to some faunistical observations (TONNOIR, 1921; COLLART, 1938). A few years ago a more profound study on the family Chloropidae was started in view of a general survey of the Belgian Diptera fauna (DE BRUYN, 1983, 1984, 1985a, 1985b; DE BRUYN & DE MEYER, 1985). The aim of this study was not only to compile some faunistical data, but also to examine the biology of the species involved (DE BRUYN, 1987a, 1987b; DE BRUYN & DE MEYER, 1984).

According to the most recent phylogenetic studies, the family Chloropidae belongs to the superfamily Tephritoidea. Together with the related families Acartophtalmidae, Carnidae and Milichiidae they are placed in the family-group Chloropidae (GRIFFITHS, 1972; STEYSKAL, 1974; ANDERSSON, 1977).
The species of the family Chloropidae are usually small (< 4 mm) flies, chiefly dark gray to black or yellow and greenish with black, brown or red stripes on the mesonotum. The typical plate-like frontal triangle is usually large and distinct. The costal vein reaches to r_{4+5} (subfamily Chloropinae) or to m_{1+2} (subfamily Oscinellinae) and possesses a costal break near r_1, while the subcostal vein is partly reduced. A peculiar flexure of vein M_{3+4} at the middle of the discal cell is usually present. The anal vein and anal cell are both absent. The legs are usually simple and relatively short. The hind femora may sometimes be thickened. The most important features for the specific determination, however, are the male genitalia.

Material & Methods

To gather the data, a first examination of the existing collections (Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels and some personal collections) was performed. To sample fresh material, flies were captured by means of three trap types, viz. Malaise traps, emergence traps and colored water traps (DE BRUYN, 1986; DE BRUYN & DE MEYER, 1984), which were operational during at least one entire season. These traps were emptied at regular intervals. In addition flies were reared from infested hostplants in the laboratory.

Results

The results will be split in three main topics, viz. faunistics (the species composition and distribution of the Belgian Chloropidae fauna), hostplant specificity, and phenology.

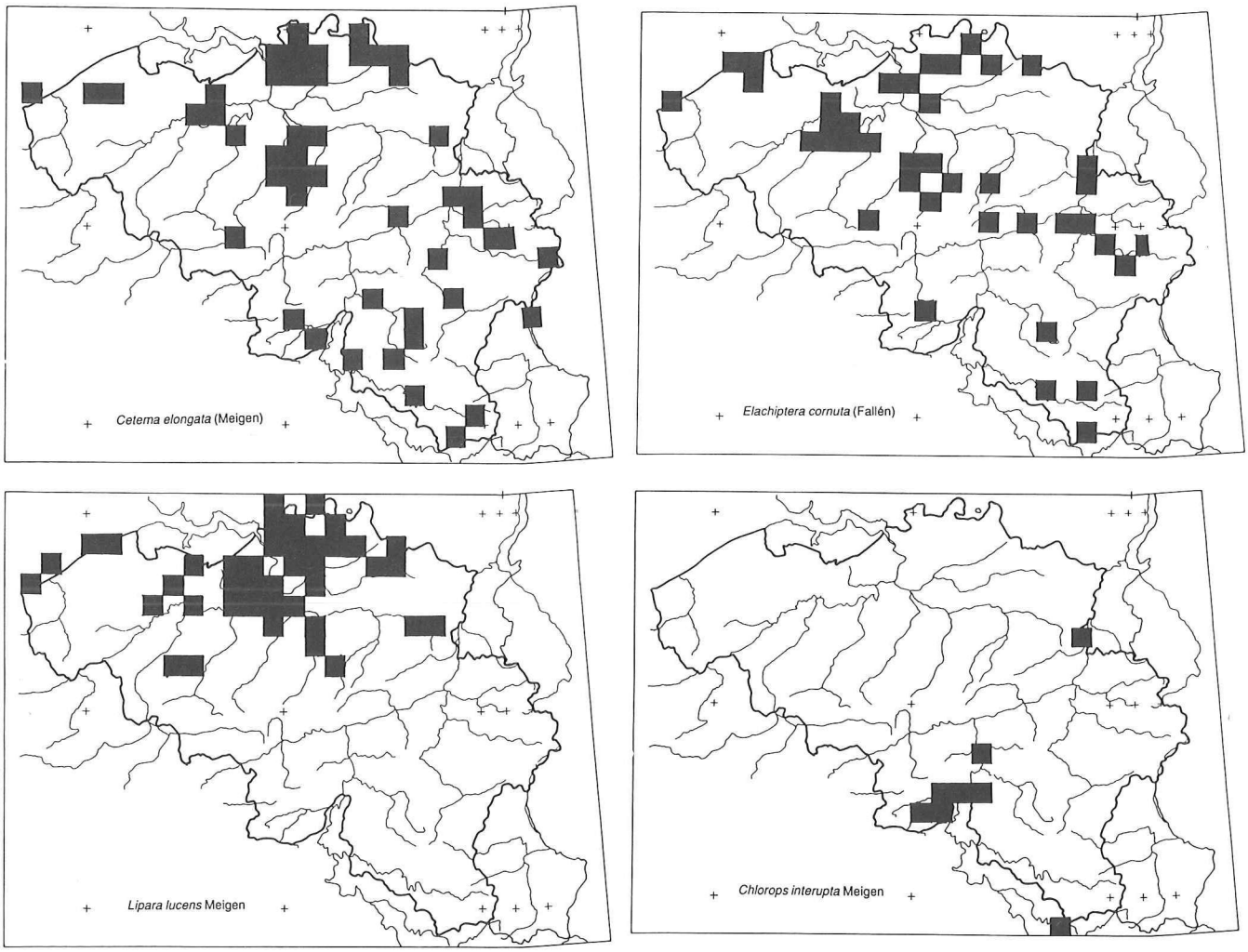

Fig. 1. - Distribution maps (U.T.M.-squares) of some Chloropidae in Belgium.

Faunistics

At present the known Belgian Chloropid fauna consists of 112 species belonging to 34 genera. Although a profound knowledge concerning the Chloropidae fauna is confined to a few countries (NARTSHUK et al., 1970; KLOET & HINCKS, 1975; DELY-DRASKOVITS & PAPP, 1978; VON TSCHIRNHAUS, 1981), most species seem to occur all over Europe (DUDA, 1932-33; NARTSHUK, 1984). Some species, however, reveal a rather remarkable distribution. *Chlorops adjuncta* BECKER, 1910, *Chlorops obscurellus* ZETTERSTEDT, 1848 and *Chlorops puncticornis* LOEW, 1866 were formerly reported from Central-Europe. The latter species was also reported from South-Europe (DELY-DRASKOVITS, 1978). The distributional area of *L. similis* SCHINER, 1854 is mainly situated in Central-Europe (BESCHOVSKI, 1984). Recently this species was also reared from *Phragmites* galls in Belgium (DE BRUYN, 1988). Seemingly, *L. similis* reaches the border of its areal in Belgium.

Due to the lack of available records, no comprehensive survey of the species distribution maps can be given yet. For some species however, the small amount of data is sufficient to notice already a general tendency. Both *Cetema elongata* (MEIGEN, 1830) (fig. 1.a.) and *Elachiptera cornuta* (FALLEN, 1820) (fig. 1.b) are frequent to very common, occurring all over the country. Probably they will be found in every U.T.M.-square when searched long enough. *C. elongata* is a polyphagous species, and was formerly reared from the grass genera *Poa, Hordeum, Agropyron, Lolium, Phleum, Agrostis* and the cereals: *Avena sativa, Zea mais* (NYE, 1958; WENDT, 1968; NAPIORKOWSKA-KOWALIK & ZIARKIEWICZ, 1980; VON TSCHIRNHAUS, 1981). The other species *E. cornuta* is a saprophagous species feeding on organic detritus (BALACHOWSKY & MESNIL, 1935).

The two following species are more restricted in their distribution. *Lipara lucens* MEIGEN, 1830 (fig. 1.c) is well spread in the nothern part of the country. More to the south, this species disappears. *L. lucens* is a strict monophagous parasite of the Common Reed, *Phragmites australis* (CHVÁLA et al., 1974). When the distribution of its hostplant is analysed, an analogous pattern is found. Hence, the presence of *L. lucens* in a particular locality is strongly influenced by its hostplant.

The second species *Chlorops interupta* MEIGEN, 1830 (fig. 1.d) is even more restricted. This species was only found in four regions, always in a calcareous habitat, viz. St-Pietersberg, Fond de Leffe, the natural park of Viroin-Hermeton and the natural reserve "R. Mayné" at Torgny.

Hostplant specificity

The larvae of most Belgian Chloropidae are phytophagous herbivores of the grass family Poaceae. Among the various species a wide range of possible hostplants can be found. While some species are strictly monophagous herbivores: *Lipara* spp. on *Phragmites australis* (CHVÁLA et al., 1974), *Dicraeus vagans* (MEIGEN, 1838) on *Arrhenatherum elathius* (NARTSHUK, 1960), other chloropids are polyphagous: *Chlorops hypostigma* MEIGEN, 1830 on *Dactylis, Poa, Festuca* (VON TSCHIRNHAUS, 1981). Sometimes the number of possible hostplants may even be very high: *Oscinella frit* (LINNAEUS, 1758): ± 60 grass species (WENDT, 1968). Usually however, these species exhibit a distinct preference for one or a few host species (VICKERMAN, 1978).
The localisation of the larvae in the foodplant and the resulting deformation of the host tissues can vary considerably. The most conspicuous transformation is induced by the flies of the genus *Lipara* on their hostplant *Phragmites australis*. Due to feeding activities and/or metabolic products of the larvae, the newly formed internodes of the reedshoot are strongly shortened and a typical cigar- or spike-like gall is formed (DE BRUYN, 1985). An equivalent gal is formed by *Chlorops novaki* STROBL, 1902 on *Elymus repens*. Another form of deformation was observed on *Arrhenatherum elatius* caused by the larvae of *Oscinella frit*. Here, the leaves above the feeding site of the larva were brown and dry. The same phenomenon was observed on the hostplants infested by *Oscinella trochanterata* COLLIN, 1946 and *Chlorops brevimana* LOEW, 1866. According to WETZEL (1967) this form of deformation is also commonly found in other species. Some species such as *Chlorops obscurellus* ZETTERSTEDT, 1848 on its hostplant *Carex riparia*, cause no external changes at all.
The species of the genus *Dicraeus* feed on the seeds of gramineous plants (NARTSHUK, 1960, 1967). Due to the feeding activity of the larvae a small furrow is produced in the seed.
Some Chloropidae develop in other monocotyl families that are closily allied to the Poaceae like Liliaceae, Juncaceae, Juncaginaceae or Cyperaceae. An example is *Oscinella cariciphila* COLLIN, 1946 which develops in *Carex* spp. (COLLIN, 1946).
The larvae of the species *Tricimba cincta* (MEIGEN, 1830) possess an exceptional broad dietary spectrum. Besides some grass species they were also reared from a number of mushrooms and berries of *Sambucus racemosa* (DELY-DRASKOVITS, 1972; RYGG, 1966; SCHATZMAN, 1977).
A few chloropid species are saprophagous and feed on organic detritus, like *Elachiptera* spp., *Oscinisoma cognata* (MEIGEN, 1830) (ISMAY, 1976).
A rather aberrant form of larval feeding in the family is found for *Conioscinella halophila* DUDA, 1933, and the flies of the genus *Thaumatomyia*, which are zoophagous. The larvae of the first species can be reared from egg cocoons of spiders (COLLIN, 1946), while the larvae of the latter are predacious on root aphids of the family Pemphigiidae (Homoptera) (YARKULOV, 1971).

Phenology

The results of the phenological analyses demonstrate that the family Chloropidae includes univoltine (*Dicraeus vagans* (MEIGEN, 1838), *Incertella kertezi* (BECKER, 1910)), bivoltine (*Oscinella nigerimma* (MACQUART, 1835), *Oscinella pusilla* (MEIGEN, 1830)) as well as trivoltine (*Oscinella frit* LINNAEUS, 1758) representatives. Some species can be caught during the whole season, but don't exhibit clearly separated generations (*Tricimba cincta, Aphanotrigonum trilineatum*) (DE BRUYN & DE MEYER, 1984). A closer examination reveals that species with a broad host spectrum (*Oscinella frit:* > 60; *Oscinella nigerimma*: 12) are multivoltine.
Oscinella frit was trapped during a long period from end May until early October (fig. 2.a). During this period, three strongly overlapping generations were found, with peaks at the end of June, half July and half August. Each time the numbers caught were higher than in the previous generation.
The number of generations seems to depend on the surrounding temperature, and can vary from two generations in northern Europe (VON TSCHIRNHAUS, 1981) to three in southern England (JEPSON & SOUTHWOOD, 1958; VICKERMAN, 1980). When the weather is exceptional warm, a partial fourth generation may occur (VAN EMDEN et al., 1961).
Elachiptera cornuta was trapped from early spring to late autumn (fig. 2.b.). Except for a small peak in April, no definite generations occur. *E. cornuta* usually overwinters as an adult fly (NYE, 1958). Under influence of a few warm days, diapause will be terminated, and these adults will give rise to the first peak in spring.
The species of the genus *Dicraeus* feed on the seeds of gramineous plants. Both *D. fennicus* DUDA, 1932, a parasite of *Agropyron repens* and *A. pungens*, and *D. tibialis* (MACQUART, 1835), a parasite of *Helicotrichon pubescens*, display one, very short adult generation (fig. 2.c). An analogous result is obtained for *Lipara lucens* (fig. 2.d). This species, just as the other representatives of this genus, is a strict monophagous herbivore on *Phragmites australis*. The foodplants of the three species are only susceptible of infestation during a very short

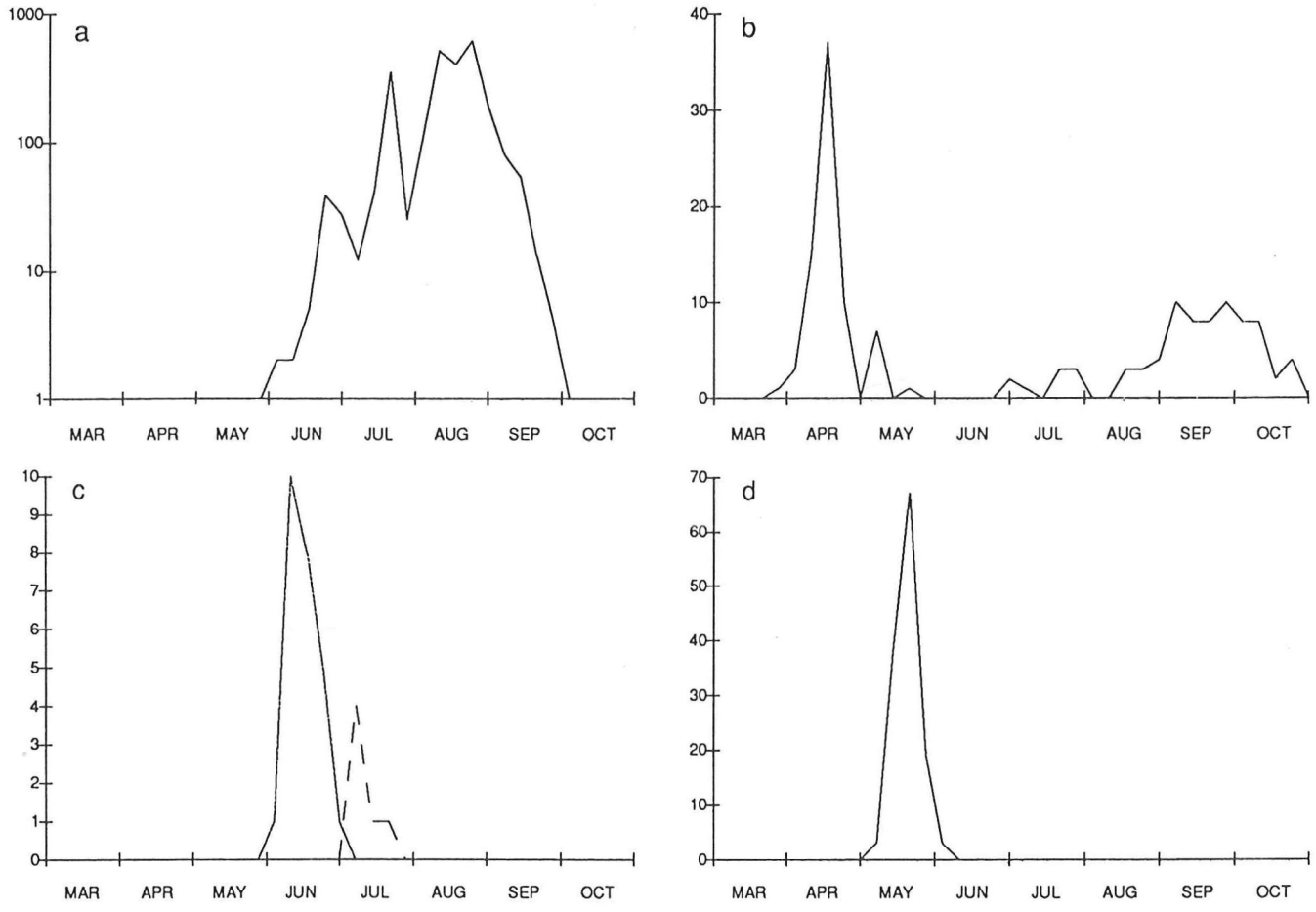

Fig. 2. - Annual adult generations of some Chloropidae : a. - Oscinella frit *; b.* - Elachiptera cornuta *; c.* - Dicraeus tibialis, ---- Dicraeus fennicus *; d.* - Lipara lucens.

time. Because the breeding succes of these highly specialised herbivores depends on the synchronisation between reproduction and the availability of the food, timing of adult emergence is critical.

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