

Distribution of Chloropinae (Diptera, Chloropidae) in the Danish landscape

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Abstract

About 4,000 chloropine frit flies (Chloropinae) were collected in a variety of uncultivated grassy habitats in Denmark, mainly in Jutland, by means of sweep net, water traps and pitfalls, a few were reared from the vegetation as well. Eleven genera and 45 species were recorded. Three species, *Pseudopachychaeta ruficeps* (Zetterstedt), *Meromyza rufa* Fedoseeva and *Cryptonevra nigratarsis* (Duda), are new to the Danish fauna. The distribution of Chloropinae in various types of habitat is shown and the relative abundance distribution of all Chloropidae is discussed. The Danish landscape is dominated by continuous farmland, while uncultivated areas are often rather small and surrounded by cultivated fields. Species associated with cereals or grass crops are, therefore, also abundant in many natural habitats.

Sammendrag

Fordelingen af fritfluer (Diptera: Chloropidae) i det danske landskab. Fritfluer er blandt de hyppigste fluer på græsarealer i Danmark. Ca 4.000 individer af underfamilien Chloropinae, der rummer mange gule arter med sorte striber, er indsamlet med ketcher eller fanget i fangbakker og nedgravede fangglas, enkelte er klækket fra vegetationen. Materialet omfatter 11 slægter med 45 arter, hvoraf 3, *Pseudopachychaeta ruficeps* (Zetterstedt), *Meromyza rufa* (Fedoseeva) og *Cryptonevra nigratarsis* (Duda), er nye for den danske fauna. Arternes hyppighed i forskellige danske landskabstyper er vist, og den relative hyppighed af alle fritfluer (Chloropidae) diskuteres. Det danske landskab domineres af sammenhængende agerland, mens udyrkede arealer ofte er forholdsvis små og omgivet af dyrkede marker. De arter af fritfluer, der er knyttet til korn- og græsafgrøder, er derfor også hyppige i flere udyrkede landskabstyper.

Introduction

Chloropidae are abundant in a variety of grassy habitats. Studies of the diversity and distribution of the Danish chloropid fauna were the purpose of 5 years of collecting with sweep net in uncultivated grass. The subfamily Oscinellinae was treated in a previous paper (Nielsen 2014) and a total of 75 species belonging to 21 genera were so far recorded from Denmark. The present paper deals with subfamily Chloropinae. Only a few Chloropinae have hitherto been published from Denmark, but unpublished material is situated in private and public collections, primarily Natural History Museum of Den-

mark, Copenhagen, and Museum of Zoology, Lund, Sweden. These materials were recently mentioned by Nartshuk & Andersson (2013), counting 55 species of Chloropinae from Denmark. In the present paper 3 species are added.

Materials and methods

In 2008-2013, a total of 3,927 specimens of Chloropinae were collected by means of sweep net in a wide range of grassy habitats in Denmark primarily in Jutland. A total of 603 standardized sweep net samples were taken, each sample consisting of 50 strokes. At 75 localities, various habitats were visited (see Nielsen, 2014, fig. 1). From 182 galls of *Lipara* species 39 chloropine specimens were reared. Unpublished material from other investigations kindly placed at my disposal is also included: 151 specimens collected in water traps and wind traps in Store Vildmose (by B. Overgaard Nielsen), and 107 specimens from pitfall traps in sand dunes of National Park Thy (by S. Toft). In addition, 125 specimens collected during investigations in Mols Bjerge, Sepstrup Sande and Tønder marshland are included; they were briefly mentioned in final reports (Nielsen & Nielsen, 2006; Nielsen & Toft, 1989; Toft et al., 1993). The entire material is stored in alcohol, preparations of terminalia are imbedded in Euparal on individual slides. All specimens were identified by the author and are kept by the author. Also included are about 300 dry, pinned Chloropinae collected in 1894-1917 by Carl C. R. Larsen in North Zealand and deposited in Museum of Natural History, Aarhus. For further information, see Nielsen (2014).

Results

During the actual investigation 41 species of Chloropinae were collected, and an additional 3 species were found in the collection of Carl C. R. Larsen (Table 1). In the following all species are presented and their abundance in various habitat types is shown.



Fig. 1. *Meromyza* sp., possibly *M. bohémica*. Body length about 3 mm. Ruth Ahlburg phot.

Fig. 1. *Meromyza* sp., *muligvis* *M. bohémica*. Længde ca. 3 mm. Foto: Ruth Ahlburg.

Table 1. List of Chloropinæ recorded from Denmark. Numbers recorded during the actual investigation and in the collection of Carl C. R. Larsen (CRL).

– Not found during the actual investigation, but present in Denmark according to Nartshuk & Andersson (1913).

+ New to the Danish fauna.

Tabel 1. Liste over Chloropinæ registreret fra Danmark. Antal fundne i den aktuelle undersøgelse og i Carl C. R. Larsens samling (CRL).

– Ikke fundet i den aktuelle undersøgelse, men registreret for Danmark af Nartshuk & Andersson (2013), + ny for Danmark.

		Nos	CRL
	<i>Meromyza bohemica</i> Fedoseeva, 1962	861	
	<i>Meromyza femorata</i> Macquart, 1835	150	8
	<i>Meromyza mosquensis</i> Fedoseeva, 1960	221	
	<i>Meromyza nigriseta</i> Fedoseeva, 1960	8	
	<i>Meromyza nigriventris</i> Macquart, 1835	112	4
	<i>Meromyza ornata</i> (Wiedemann, 1817)	49	9
	<i>Meromyza palposa</i> Fedoseeva, 1960	18	
	<i>Meromyza pluriseta</i> Péterfi, 1961	8	
	<i>Meromyza pratorum</i> Meigen, 1830	50	2
	<i>Meromyza rohdendorfi</i> Fedoseeva, 1974	9	
+	<i>Meromyza rufa</i> Fedoseeva, 1962	4	
	<i>Meromyza saltatrix</i> (Linnaeus, 1761)	88	10
	<i>Meromyza triangulina</i> Fedoseeva, 1960	157	
–	<i>Meromyza variegata</i> Meigen, 1830		
–	<i>Meromyza zimzerla</i> Nartshuk, 1992		
	<i>Platycephala planifrons</i> (Fabricius, 1798)	5	32
–	<i>Platycephala umbraculata</i> (Fabricius, 1794)		
–	<i>Eurina calva</i> Egger, 1862		
–	<i>Eurina lurida</i> Meigen, 1830		
–	<i>Chlorops anthracophagoides</i> Strobl, 1901		
	<i>Chlorops calceatus</i> Meigen, 1830	58	6
–	<i>Chlorops dasycerus</i> Loew, 1866		
–	<i>Chlorops frontosus</i> Meigen, 1830		
–	<i>Chlorops geminatus</i> Meigen, 1830		
	<i>Chlorops hypostigma</i> Meigen, 1830	798	1
	<i>Chlorops limbatus</i> Meigen, 1830	108	6
	<i>Chlorops meigenii</i> Loew, 1860	63	15
	<i>Chlorops obscurellus</i> (Zetterstedt, 1838)	40	3
	<i>Chlorops planifrons</i> Loew, 1866	4	15
	<i>Chlorops pumilionis</i> (Bjerkander, 1778)	45	10
	<i>Chlorops ringens</i> Loew, 1866		7
–	<i>Chlorops rossicus</i> Smirnov, 1955		
	<i>Chlorops scalaris</i> Meigen, 1830	13	8
	<i>Chlorops serenus</i> Loew, 1866	12	7
	<i>Chlorops speciosus</i> Meigen, 1830	92	24
	<i>Chlorops strigulus</i> (Fabricius, 1794)		3
	<i>Chlorops troglodytes</i> (Zetterstedt, 1848)	2	
	<i>Parectecephala longicornis</i> (Fallén, 1820)	7	
	<i>Epichlorops puncticollis</i> (Zetterstedt, 1848)	4	1
	<i>Melanum laterale</i> (Haliday, 1833)	24	5
	<i>Diplotoxa messoria</i> (Fallén, 1820)	6	7
–	<i>Diplotoxoides dalmatina</i> (Strobl, 1900)		
	<i>Cetema cereris</i> (Fallén, 1820)	82	11

	<i>Cetema elongatum</i> (Meigen, 1830)	360	3
–	<i>Cetema myopinum</i> (Loew, 1866)		
	<i>Cetema neglectum</i> Tonnoir, 1921	61	3
	<i>Thaumatomyia glabra</i> (Meigen, 1830)	128	13
	<i>Thaumatomyia hallandica</i> Andersson, 1966	157	2
	<i>Thaumatomyia notata</i> (Meigen, 1830)	60	
	<i>Thaumatomyia rufa</i> (Macquart, 1835)	11	
	<i>Thaumatomyia trifasciata</i> (Zetterstedt, 1848)	2	5
	<i>Cryptonevra diadema</i> (Meigen, 1830)	26	4
	<i>Cryptonevra flavitarsis</i> (Meigen, 1830)	82	20
+	<i>Cryptonevra nigratarsis</i> (Duda, 1933)	13	
–	<i>Neohaplegis tarsata</i> (Fallén, 1820)		
–	<i>Eutropha fulvifrons</i> (Haliday, 1833)		
	<i>Pseudopachychaeta approximatonervis</i> (Zetterstedt, 1848)		1
+	<i>Pseudopachychaeta ruficeps</i> (Zetterstedt, 1838)	16	
		4,014	245

Eighteen types of habitat are selected: arable land (fields and field borders), pastures, lawns, paths of short grass (mown or worn), dry grassland, road verges, grass heaths (dominated by *Deschampsia flexuosa*), inland dunes, meadows (wet grassland), fens, bogs, freshwater margins (of lakes and streams), glades (in woods and forests), woodland edges, coastal meadows, epilittoral grass, coastal dunes, and galls of *Lipara* species. For each type of habitat, the number of specimens collected is presented in parenthesis. For species few in number or present in only a single sample or locality, the locality is presented as well. The faunistic districts are also applied: EJ, NEJ, WJ etc. (according to Enghoff & Nielsen, 1977). Specimens from the collection of Carl C. R. Larsen are marked: *CRL*; here, the exact habitats are rarely known, but the names of the localities are presented and thus also the faunal districts.

Meromyza

Males are identified on the shape of postgonites and cerci (Fedoseeva, 1960; Ismay, 1980; Nartshuk & Fedoseeva, 2011; Nartshuk & Andersson, 2013). Identification of females is less reliable because it is based on rather variable characters such as colour and length of mesonotal stripes, colour of pleural marks, and thickness of hind femur (Fig. 1). Altogether 537 females were identified with some hesitation, while 463 could not be identified to species.

Meromyza (Meromyza) bohémica Fedoseeva, 1962

Material: 584 ♂♂ (277 ♀♀). Habitats (♂♂): arable land (3), pastures (27), lawns (36), grassy paths (13), dry grassland (155), road verges (75), grass heath (1), meadows (136), fens (20), freshwater margins (90), glades (17), coastal meadows (10), epilittoral grass (1). Region: EJ.

The most abundant and widespread species of *Meromyza* in eastern Jutland. Swept in almost all types of habitat and from many species of grasses. June to August.

Identification of females: palpi yellow, mesonotal stripes reddish with dark outer margin of lateral stripes. Central mesonotal stripe not reaching scutellum, katapisternal mark reddish, three dark stripes on abdomen.

Meromyza (Meromyza) femorata Macquart, 1835

Material: 96 ♂♂ (62 ♀♀). Habitats (♂♂): pastures (2), lawns (8), dry grassland (8), road verges (19), inland dunes (2), meadows (14), fens (8), freshwater margins (18), glades (9). CRL (8). Regions: EJ, NEJ, NWZ, NEZ.

Swept in various types of grassland, dry as well as wet. Late June to early August.

Identification of females: distal half of palpi dark, all mesonotal stripes almost reddish, central one extending over scutellum, all pleural marks red. Hind femur very robust, 3.5 to 4.0 times as broad as tibia.

Meromyza (Meromyza) mosquensis Fedoseeva, 1960

Material: 169 ♂♂ (52 ♀♀). Habitats (♂♂): arable land (1), lawns (2), grassy paths (5), dry grassland (111), road verges (32), inland dunes (3), grass heaths (9), freshwater margins (2), glades (2), epilittoral grass (2). Regions: EJ, WJ, NEJ.

Very abundant in warm, dry sites, and swept in high numbers from sandy patches with *Corynephorus canescens*.

Morphological remarks: postgonite similar to the drawing in the original description (Fedoseeva, 1960), but a little longer than that figured in Ismay (1980) and in Nartshuk & Andersson (2013). Surstylus, however, is identical with all drawings of *M. mosquensis*, and the long median stripe reaching scutellum supports the identification. Identification of females is doubtful: greenish-yellow in live, palpi pale, central part of mesonotal stripes reddish, lateral stripes mostly dark. Median stripe reaching scutellum. Pleural marks dark. Hind femur 2.5 times as broad as tibia.

Meromyza (Meromyza) nigriseta Fedoseeva, 1960

Material: 7 ♂♂ (1 ♀). Habitats (♂♂): meadow (3), freshwater margin (2), epilittoral grass (2). Region: EJ.

Swept in and near a meadow. Also swept from *Leymus arenarius* at the coast. Mid July to early August.

Meromyza (Meromyza) nigriventris Macquart, 1835

Material: 94 ♂♂ (22 ♀♀). Habitats (♂♂): arable land (9), pasture (1), lawns (10), road verges (7), meadows (14), fen (1), freshwater margins (5), glades (4), coastal meadows (29), epilittoral grass (10). CRL (4). Regions: EJ, NEJ, NEZ.

Swept in arable land and at small habitats close to cultivated fields, also swept from *Phragmites* on the coast, but near arable land. May to September. Trapped in emergence traps in winter barley.

Females: only the dark form (Nartshuk & Andersson, 2013) was identified: dark palpi, ocellar spot almost squarish, abdominal tergites broadly darkened, mesonotal stripes mostly black, katapimeron with black mark. Hind femur less wide (2 times width of tibia).

Meromyza (Meromyza) ornata (Wiedemann, 1817)

Material: 21 ♂♂ (37 ♀♀). Habitats (♂♂ + ♀♀): pasture (2), lawns (2), grassy path (1), dry grassland (1), road verges (4), meadows (26), fens (8), freshwater margins (5). CRL (9). Regions: EJ, WJ, NEJ, LFM, NEZ.

In wetland localities, often with *Phalaris arundinacea* and *Glyceria maxima*.

Identification of females seems reliable: lateral abdominal stripes absent, katapimeral mark black. Palpi pale, frons protruding in front of eyes almost as long as width of first flagellomere. Most females are collected together with males.

Meromyza (Meromyza) palposa (Fedoseeva, 1960)

Material: 14 ♂♂ (4 ♀♀). Habitats (♂♂ + ♀♀): inland dunes (14, Sødring Skov, Kirkemiløen at Skagen), coastal sand dunes (4, several localities in National Park Thy). Regions: EJ, NWJ, NEJ.

Swept from *Corynephorus canescens* in June. Trapped in pitfalls in grey sand dunes, July to August.

Identification of females is difficult, but 4 females swept together with males of *M. palposa* are included.

Meromyza (Meromyza) pluriseta Peterfi, 1961

Material: 4 ♂♂ (4 ♀♀). Habitats (♂♂ + ♀♀): pasture (1), meadow (1), coastal meadow (1), epilittoral grass (5). Regions: EJ, NWJ.

Swept in a few humid, cattle-grazed localities, late June to early August.

Female identification: palpi black, frontal triangle with apical dark spot. Stripes of scutum black and broad, the central one extending over scutellum.

Meromyza (Meromyza) pratorum Meigen, 1830

Material: 19 ♂♂ (33 ♀♀). Habitats (♂♂ + ♀♀): epilittoral grass (11), coastal sand dunes (39). *CRL* (2). Regions: EJ, NWJ, LFM, NEZ.

Swept in July in a dry epilittoral site with *Leymus arenarius* and *Corynephorus canescens*. Trapped in pitfalls in white and grey sand dunes, July to September.

Female identification seems reliable: lateral abdominal stripes absent, katapimeral mark reddish-yellow. Palpi yellow, frons protruding in front of eyes well longer than width of first flagellomere.

Meromyza (Meromyza) rohdendorfi Fedoseeva, 1974

Material: 9 ♂♂. Habitats: road verges (2), meadows (3), freshwater margins (3), epilittoral grass (1). Regions: EJ, NEJ.

Males swept in or close to humid sites, July to early August. Females are not identified.

Meromyza (Meromyza) rufa Fedoseeva, 1962

Material: 4 ♂♂. Habitat: grassy path (4, Klosterhede plantage). Region: WJ.

Males swept late June from a dry grassy path. Females are not identified. First record from Denmark. Not recorded from Fennoscandia. The morphology of the terminalia is close to the drawings in Ismay (1980) and deviates clearly from that of the rather similar *M. bohémica*.

Meromyza (Meromyza) saltatrix (Linnaeus, 1761)

Material: 75 ♂♂ (13 ♀♀ identified with hesitation). Habitats (♂♂): arable land (16), pastures (6), lawns (4), grassy paths (2), dry grassland (2), road verges (26), meadows (5), fens (3), woodland edges (2), glades (4), epilittoral grass (5). *CRL* (10). Regions: EJ, WJ, NEJ, NWZ, NEZ.

Very abundant in Denmark. Swept in a variety of warm habitats with short grass, e.g. road verges, mown grass and pastures. Active from early June to early August.

Female identification is rather difficult, but the green colour of living individuals in combination with dark scutal stripes and dark-tipped palpi may be valid characters.

Meromyza (Meromyza) triangulina Fedoseeva, 1960

Material: 117 ♂♂ 40 ♀♀. Habitats (♂♂): pastures (9), lawns (10), grassy path (1), dry grassland (9), road verges (36), meadows (3), fens (17), freshwater margins (14), glades (3), coastal meadows (10), epilittoral grass (4), coastal sand dune (1). Regions: EJ, WJ, NWJ, NEJ.

Abundant in Denmark. Swept from almost all types of grass habitat late June to early August.

Female identification is uncertain: apical half of palpi black, ocellar triangle with large black mark and dark margins, femora rather slender (2 times tibial width).

Platycephala planifrons (Fabricius, 1798)

Material: 37 ♂♀. Habitats: coastal meadows (5). *CRL* (32). Regions: EJ, NWZ, NEZ.

Swept from *Phragmites australis* in July. Larvae develop in small inconspicuous galls on reed. The distribution of its inquiline *Calamoncosis aprica* indicates a wider distribution of the species (Nielsen, 2014).

Chlorops

Species of *Chlorops* are mostly identified on external characters in accordance with Nartshuk (1998) and Nartshuk & Andersson (2013), i.e. width of gena and first flagellomere, size of palpus, and colour and dusting of mesonotum and katepisternum together with colour pattern of the abdomen. Females are, therefore, also identified. To confirm the identifications, the terminalia are compared with drawings in Beschowski (1980, 1985), Nartshuk (1998) and Nartshuk & Andersson (2013). In some species the differences are, however, rather small and indistinct (Fig. 2).



Fig. 2. *Chlorops* sp., possibly *C. speciosus*. Body length about 4 mm. Gunnar Knudsen phot.

Fig. 2. *Chlorops* sp., muligvis *C. speciosus*. Længde ca 4 mm. Foto: Gunnar Knudsen.

Chlorops (Chlorops) calceatus Meigen, 1830

Material: 64 ♂♀. Habitats: lawn (1), dry grassland (6), meadows (3), freshwater margins (27), glades (5), coastal meadows (14), epilittoral grass (2). *CRL* (6). Regions: EJ, WJ, NEZ, NWZ.

Generally found in humid places, inland as well as coastal, but also in a few dry sites near the coast. Late June to mid July.

Chlorops (Chlorops) hypostigma Meigen, 1830

Material: 799 ♂♀. Habitats: arable land (7), pasture (1), lawns (120), grassy paths (10), dry grassland (2), road verges (71), meadows (99), fens (74), bog (1), freshwater margins (23), woods (14), glades (367), coastal meadows (8), epilittoral grass (1). *CRL* (1). Regions: EJ, NEJ, NEZ.

The most abundant *Chlorops* species in Denmark. Swept from June to early September in meadows, fens, freshwater margins, road verges near fresh water, and humid glades and lawns. Very numerous in a garden lawn. In June males were numerous in flowers of *Aegopodium podagraria* in a couple of glades; they were probably feeding on nectar.

Chlorops (Chlorops) meigeni Loew, 1866

Material: 78 ♂♀. Habitats: lawn (1), fens (15), bog (2), freshwater margins (12), glades (33). *CRL* (15). Regions: EJ, NEJ, NEZ, NWZ.

In several wetland sites and humid glades in June.

Chlorops (Chlorops) obscurellus (Zetterstedt, 1838)

Material: 43 ♂♀. Habitats: arable land (18), pasture (1), road verge (1), meadows (7), fen (1), freshwater margin (1), coastal meadows (11). *CRL* (3). Regions: SJ, EJ, WJ, NEZ.

Swept in a humid grass field and in fresh and salt meadows. Early June to mid August.

Chlorops (Chlorops) planifrons (Loew, 1866)

Material: 19 ♂♀. Habitats: fens (4). *CRL* (15). Regions: EJ, NEZ.

Swept only in fens with *Carex* in July. Larvae are recorded from stems of *Carex* (Nartshuk & Andersson, 2013).

Chlorops (Chlorops) pumilionis (Bjerkander, 1778)

Material: 55 ♂♀. Habitats: arable land (2), pastures (19), lawn (1), dry grassland (1), road verges (4), meadows (4), fens (3), glades (3), coastal meadows (8). *CRL* (10). Regions: SJ, EJ, WJ, NEJ, NEZ.

Swept in grazed or mown habitats near arable land. Early June to late August. Also captured in wind traps in the extensive pastures of Store Vildmose.

Chlorops (Chlorops) ringens Loew, 1866

Material: 7 ♂♀. Not found by the author. *CRL* (7, Ermelunden, Dyrehaven, Frederiksdal, Tegstrup Hegn). Region: NEZ.

Chlorops (Chlorops) scalaris Meigen, 1830

Material: 21 ♂♀. Habitats: pastures (5), lawn (1), dry grassland (1), road verge (2), freshwater margin (1), glade (1), epilittoral grass (2). *CRL* (8). Regions: EJ, NEJ, NEZ.

Swept in short grass, late June to mid July. Collected in emergence traps in pastures.

Chlorops (Chlorops) serenus Loew, 1866

Material: 19 ♂♀. Habitats: pasture (1), lawns (3), grassy paths (4), road verge (1), meadow (1), freshwater margin (2). *CRL* (7). Regions: EJ, NEZ.

Swept in short grass, July to August.

Chlorops (Chlorops) speciosus Meigen, 1830

Material: 116 ♂♀. Habitats: arable land (1), pasture (1), grassy path (1), dry grassland (1), road verges (2), meadows (64), fens (7), freshwater margins (9), glade (1), coastal meadow (1), epilittoral grass (4). *CRL* (24). Regions: EJ, WJ, NEJ, NEZ.

In humid meadows, fens and other wet sites, late June to mid August. Larvae are recorded from *Deschampsia caespitosa* (Nartshuk & Andersson, 2013).

Chlorops (Chlorops) strigulus (Fabricius, 1794)

Material: 3 ♂♀. Not found by the author. *CRL* (3, Boserup, Dyrehaven). Region: NEZ.

Chlorops (Chlorops) troglodytes (Zetterstedt, 1848)

Material: 1♂ 1♀. Habitats: meadow (1, Skjern Enge), fen (1, Kasted Mose). Regions: EJ, WJ.

Swept in humid sites, mid August.

Chlorops (Sclerophallus) limbatus Meigen, 1830

Material: 114 ♂♀. Habitats: road verges (6), meadows (70), fens (23), freshwater margins (4), coastal meadows (5). *CRL* (6). Regions: EJ, WJ, NWJ, NEZ.

Found exclusively in or close to meadows and fens, and swept from *Phalaris arundinacea* and *Glyceria fluitans*. Late May to mid August.

Parectecephala longicornis (Fallén, 1820)

Material: 7 ♂♀. Habitats: arable land (1), dry grassland (5), epilittoral grass (1). Region: EJ.

Swept in dry habitats with *Deschampsia* near the coast, July-August.

Epichlorops puncticollis (Zetterstedt, 1848)

Material: 5 ♂♀. Habitat: road verge (4, Klosterhede). *CRL* (1, Jyderup). Regions: WJ, NWZ.

Swept in June in a dry locality with *Calluna* and *Deschampsia flexuosa*.

Melanum laterale (Haliday, 1833)

Material: 29 ♂♀. Habitat: coastal meadow (24, Kalø). *CRL* (5, Frederiksholms lergrav, Valby Fælled). Regions: EJ, NEZ.

Swept in a coastal meadow with *Juncus gerardii*. Late June and early August. Larva in *Juncus gerardii* (Tschirnhaus, 1981). According to Wendt (1993) a halophilic species.

Diplotoxa messoria (Fallén, 1820)

Material: 13 ♂♀. Habitat: coastal meadow (6, Skagens Gren). *CRL* (7, Damhussø og -mose, Frederikssund). Regions: NEJ, NEZ.

Swept from *Eleocharis* late June. Regarded as halophilic by Wendt (1993).



Fig. 3. *Cetema* sp. Four species of *Cetema* are recorded from Denmark. Ruth Ahlburg phot.

Fig. 3. *Cetema* sp. Fire arter af *Cetema* er hidtil fundet i Danmark. Foto: Ruth Ahlburg.

Cetema (*Cetema*) *cereris* (Fallén, 1820)

Material: 93 ♂♀. Habitats: arable land (3), pastures (55), dry grassland (1), fen (2) coastal meadow (1), coastal sand dunes (20). *CRL* (11). Regions: EJ, NEJ, LFM, NEZ.

Captured in emergence traps in pastures late June to early July. Swept in arable land July to September. Also trapped in pitfalls in white coastal sand dunes in August.

Cetema (*Cetema*) *elongatum* (Meigen, 1830)

Material: 363 ♂♀. Habitats: arable land (4), pastures (137), lawns (28), grassy paths (9), dry grassland (24), road verges (22), heath (1), meadows (33), fens (31), freshwater margins (26), woodland edges (3), glades (36), coastal meadows (2), epilittoral grass (2). *CRL* (3). Regions: EJ, WJ, NWJ, NEJ, NEZ.

A very abundant species. Captured in emergence traps in pastures, late June to late July. Swept in humid as well as very dry habitats late June to late August. Females were identified on the dark setae covering the abdomen.

Cetema (*Cetema*) *neglectum* Tonnoir, 1921

Material: 64 ♂♀. Habitats: grassy paths (4), meadows (28), fens (17), freshwater margins (5), glades (5), coastal meadows (2). *CRL* (3). Regions: EJ, NEZ.

Swept only in humid sites. Late June to early August. Females were separated from the abundant *C. elongatum* by the pale setae on the abdomen.

Thaumatomyia glabra (Meigen, 1830)

Material: 141 ♂♀. Habitats: arable land (32), pastures (7), lawns (4), grassy paths (7), dry grassland (16), road verges (29), meadows (21), glades (7), coastal meadows (4), coastal sand dune (1). *CRL* (13). Regions: EJ, WJ, NEJ, NEZ.

Common in arable land, dry grassland and meadows, and collected in emergence traps and water traps in cereal fields. Larvae browse on root aphids (Ismay, 1999; Nartshuk & Andersson, 2013). Photo on front page.

Thaumatomyia hallandica Andersson, 1966

Material: 159 ♂♀. Habitats: arable land (1), lawns (3), grassy paths (2), dry grassland (48), road verges (6), inland dunes (2), grass heaths (27), meadows (2), fen (1), freshwater margin (1), glade (1), coastal meadows (4), epilittoral grass (2), coastal sand dunes (57). *CRL* (2). Regions: EJ, NWJ, NEJ, NEZ.

In dry, sandy habitats. Swept from *Corynephorus canescens* and trapped in pitfalls in grey sand dunes. May to mid September. Also collected in sand dunes in England (Ismay, 1999). According to Wendt (1993) a halophilic species collected in many inland saline localities. Larvae are predators on root aphids (Nartshuk & Andersson, 2013).

Thaumatomyia notata (Meigen, 1830)

Material: 60 ♂♀. Habitats: arable land (1), lawns (9), grassy paths (2), dry grassland (6), road verges (8), meadows (19), fens (5), bog (1), freshwater margins (6), woodland edge (1), glade (1), epilittoral grass (1). Regions: EJ, WJ.

Swept in a variety of habitats, especially in humid or shaded places. Collected from late April to late October. Larvae browse on root aphids, preferably *Pemphigus bursarius* (Wendt, 1989).

Thaumatomyia rufa (Macquart, 1835)

Material: 11 ♂♀. Habitats: lawn (1), grassy path (1), dry grassland (3), grass heaths (3), fens (2), glade (1). Region: EJ.

Rare in Denmark, swept in vegetation near humid sites. Early May to early August. Found in halophytic biotopes by Tschirnhaus (1981). Larvae are eating root aphids (Nartshuk & Andersson, 2013).

Thaumatomyia trifasciata (Zetterstedt, 1848)

Material: 7 ♂♀. Habitats: freshwater margin (2, Ramten Sø). *CRL* (5, Damhussø og -mose). Regions: EJ, NEZ.

Rare, swept at the margin of a lake.

Cryptonevra diadema (Meigen, 1830)

Material: 30 ♂♀. Habitats: fens (5), freshwater margin (1), coastal meadows (17), *Lipara* galls (3). *CRL* (4). Regions: EJ, NWJ, NEJ, NEZ.

Hatched from galls of *Lipara lucens*. Swept from *Phragmites australis* near the coast, late May to mid June.

Cryptonevra flavitarsis (Meigen, 1830)

Material: 102 ♂♀. Habitats: meadow (1), fens (28), freshwater margins (4), coastal meadows (13), *Lipara* galls (36). *CRL* (20). Regions: EJ, NEJ, NEZ.

Hatched from galls of *Lipara lucens* and *L. pullitarsis* on *Phragmites australis*; often many from the same gall. Swept from *Phragmites australis* late May to late June.

Cryptonevra nigratarsis (Duda, 1933)

Material: 13 ♂♀. Habitats: fens (8), coastal meadows (5). Regions: EJ.

Swept from *Phragmites australis* and *Bolboschoenus maritimus*, late May to mid June. According to Ismay (1994) inquiline with Lepidoptera larvae damaging stems of *Phragmites*. Larvae belonging to Noctuidae were actually found in *Lipara* stems at one of the localities. New to Denmark, not recorded from Fennoscandia.

C. nigratarsis is distinguished from *C. diadema* and *C. flavatarsis* by the following characters: Scutum totally dusted, wing very whitish, tarsi yellow with tarsomere 5 dark or darkened. On fore tarsus also tarsomere 4 is darkened. For further descriptions see Ismay (1994).

Pseudopachychaeta approximatonevis (Zetterstedt, 1848)

Material: 1 ♀. Not found by the author. *CRL* (1, Valby Fælled). Region NEZ.

Pseudopachychaeta ruficeps (Zetterstedt, 1838)

Material: 16 ♂♀. Habitats: bogs (15), freshwater margin (1). Regions: NEJ, NWJ.

Swept from the inflorescences of *Eriophorum* spp, mid June to mid July. New to Denmark. Also present in Sweden, Norway and Finland.

Discussion

Species diversity.

Nartshuk & Andersson (2013) recorded 55 species of Chloropinae from Denmark. During the present investigation 13 of these were not found, but 3 species are added as new to the Danish fauna: *Pseudopachychaeta ruficeps*, *Meromyza rufa* and *Cryptonevra nigratarsis*. The last two are not yet recorded from Fennoscandia. So up to now 58 species of Chloropinae, representing 15 genera, are listed from Denmark (Table 1). Three genera viz. *Lasiosina*, *Chloropsina* and *Tricheurina* are not yet found in Denmark, but are recorded from Fennoscandia. The first two are present in southern Sweden (SK, BL, HA, SM) and may thus be expected to be present in Denmark as well, whereas the last one, which has an eastern European distribution, is only recorded from Finland.

Distribution

The species distribution of Chloropinae is of course related to the distribution of larval habitats. In most chloropines the larval development is completed within grass shoots, the larvae feeding on the plant tissue. In a few species the larvae develop inside galls of *Lipara* (Oscinellinae) on *Phragmites australis*, eating the fresh or disintegrated tissue of the gall. Within the genus *Thaumatomyia*, the larvae are predators browsing on root aphids. As compared with the subfamily Oscinellinae, the spectra of host plants are much better investigated within the subfamily Chloropinae, especially regarding species of *Chlorops*, *Meromyza* and *Cetema*. Updated information on host plants are given by Nartshuk & Andersson (2013).

In the present investigation, the bulk of the material was collected by means of standardized sweep net sampling, while a minor part came from pitfalls and emergence traps. Since the number of sweep net samples varies from one site to another, and since the efficiency is clearly influenced by height and structure of the vegetation, the results are not suitable for proper statistical analyses. However, differences in species composition between habitats may indicate different preferences of the species in question.

In order to simplify the results, the habitats are grouped into six general habitat types based on some apparent resemblances regarding vegetation and living conditions. 1) Mown grass including lawns, mown or worn grassy paths and small densely grazed patches. 2) Dry grass comprising dry grassland, road verges, dry sandy spots and inland dunes. 3) Wetland comprising meadows, fens, bogs and freshwater margins. 4) Woodland including woods, glades and woodland edges. 5) Coastal grass, which includes coastal

Table 2. Chloropinae in uncultivated habitats – numbers per 50 sweep net samples:
+ 1-10, ++ 11-30, +++ 31-100, ++++ >100. Numbers collected in water traps, emergence traps or
pitfalls: ! 1-20, !! >20.

Tabel 2. Chloropinae fra udyrkede arealer - antal pr. 50 ketcherprøver: + 1-10, ++ 11-30, +++ 31-100,
++++ >100. Antal indsamlet i fangbakker, klækfælder eller fangglas: ! 1-20, !! >20.

	Mown grass	Dry grassland	Wetland	Woodland	Coast
<i>Meromyza bohemica</i>	+++	++++	+++	++	+
<i>Meromyza femorata</i>	++	++	++		
<i>Meromyza mosquensis</i>	+	+++		+	+
<i>Meromyza nigriseta</i>			+		+
<i>Meromyza nigriventris</i>	++	+	+	+	+++
<i>Meromyza omata</i>	+	+	+		
<i>Meromyza palposa</i>		+			!
<i>Meromyza pluriseta</i>	!				+
<i>Meromyza pratorum</i>					+ !!
<i>Meromyza rohdendorfi</i>		+	+		+
<i>Meromyza rufa</i>	+				
<i>Meromyza saltatrix</i>	++	++	+	+	+
<i>Meromyza triangulina</i>	++	++	++	+	+!
<i>Platycephala planifrons</i>					+
<i>Chlorops calceatus</i>	+	+	+		++
<i>Chlorops hypostigma</i>	++++	++	+++	++++	+
<i>Chlorops limbatus</i>		+	++		+
<i>Chlorops meigenii</i>	+		+	++	
<i>Chlorops obscurellus</i>	+		+		+
<i>Chlorops planifrons</i>			+		
<i>Chlorops pumilionis</i>	+	+	+	+	+
<i>Chlorops scalaris</i>	+	+		+	+
<i>Chlorops serenus</i>	+		+		
<i>Chlorops speciosus</i>	+	+	++	+	+
<i>Chlorops troglodytes</i>			+		
<i>Parectecephala longicornis</i>		+			+
<i>Epichlorops puncticollis</i>		+			
<i>Melanum laterale</i>					++
<i>Diplotoxa messoria</i>					+
<i>Cetema cereris</i>					+!
<i>Cetema elongatum</i>	+++	++	++	+!	+
<i>Cetema neglectum</i>	+		+	+	+
<i>Thaumatomyia glabra</i>	++	++	+	+	+
<i>Thaumatomyia hallandica</i>	+	+++!	+	+	+!!
<i>Thaumatomyia notata</i>	+	+	+	+	+
<i>Thaumatomyia rufa</i>	+	+		+	
<i>Thaumatomyia trifasciata</i>			+		
<i>Cryptonevra diadema</i>			+		++
<i>Cryptonevra flavitarsis</i>			+		+
<i>Cryptonevra nigratarsis</i>			+		+
<i>Pseudopachychaeta ruficeps</i>			+		

meadows and epilittoral grass. 6) Coastal sand dunes, white as well as grey, are regarded as a special type of habitat.

The distribution of the Danish chloropine species in relation to the five main types of habitat appears from Table 2. To eliminate differences due to different sampling intensity, the numbers of individuals are adjusted to number per 50 sweep net samples. When a species is also trapped in emergence traps or pitfalls it is marked with an exclamation sign because it is an underlining of the association with the habitat in question.

It is obvious that two species, *Meromyza bohemica* and *Chlorops hypostigma*, are ubiquitous being frequent in all habitats except coastal grass. The first one was present in 33% of the localities visited. It is associated with *Lolium perenne* (Nartshuk & Andersson, 2013) and is found almost everywhere. The latter, which has a wide spectrum of host grasses, was present in 47% of all localities. *Cetema elongatum* is also remarkably widespread being swept in 50% of the localities. Its host spectrum is extremely wide and includes many cultivated grasses. In addition, *C. elongatum* was trapped abundantly in emergence traps in the wide pastures of Store Vildmose. Two more species have a wide distribution: *Meromyza femorata* and *M. triangulina*, which are frequent in several types of habitat obviously not preferring one type to another. Both are associated with *Dactylis glomerata*, which is present in many different habitats and common at road verges and field borders. Widespread are also *Thaumatomyia glabra* and *T. notata*. Like other species of this genus their larvae browse on root aphids on various grasses. The first one was also trapped in emergence traps in cereals and cultivated grasses. No observations indicate preferences regarding species of grass or root aphid. *T. hallandica*, however, seems to prefer sand dunes and other dry, sandy habitats with *Corynephorus canescens*. It was swept from single tussocks of this grass and was trapped in large numbers in pitfalls in grey sand dunes. Due to a narrow host choice a number of species are preferring a single habitat type, e.g. *Cryptonevra* spp., *Platycephala planifrons*, *Melanum laterale* and *Diplotoxa messoria*.

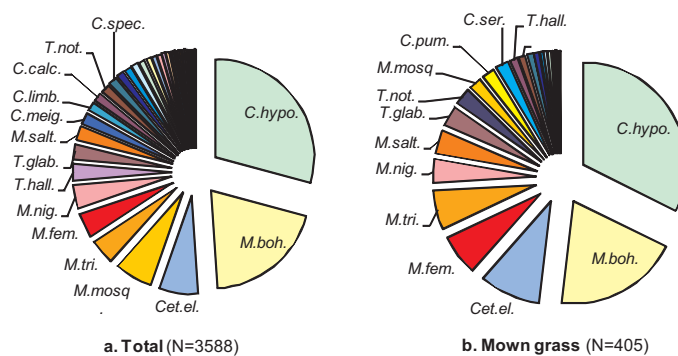


Fig. 4. Species composition of Chloropinae in sweep net samples from: a. all habitats together (numbers per 50 samples) and b. mown grass. For abbreviations see table 3.

Fig. 4 Artssammensætning af Chloropinae i ketcherprøver fra a. alle habitater tilsammen (antal pr. 50 prøver) og b. plæner og andre klippede græsarealer. Forkortelser: se tabel 3.

The species composition in sweep net samples from all habitats is shown in Fig. 4a. The two most widespread species, *Chlorops hypostigma* and *Meromyza bohemica* are also the most numerous ones, amounting to 29% and 20% of the total. Five species, *Cetema elongata*, *Meromyza mosquensis*, *M. triangulina*, *M. femorata* and *M. nigriventris*, amount to 25% while 32 species make up the last 26%. In mown grass (Fig.4b) the sequence of species is fairly similar to that of the total.

In dry grassland the species composition is, however, different (Fig. 5a). The share of *Meromyza bohemica* has increased to 39%, whereas that of *Chlorops hypostigma* has decreased to only 7%. *Meromyza mosquensis* is placed in between with 19%; it is swept in high numbers from extremely dry sites such as the top of wind-exposed cliffs, inland dunes and sandy patches with *Corynephorus canescens*. The same habitats are also preferred by *Thaumatomyia hallandica*.

In the sweep net samples from woodland, especially glades (Fig. 5b), *Chlorops hypostigma* is strongly predominant (73%, or 280 individuals per 50 samples) and the ♂:♀ ratio is re-

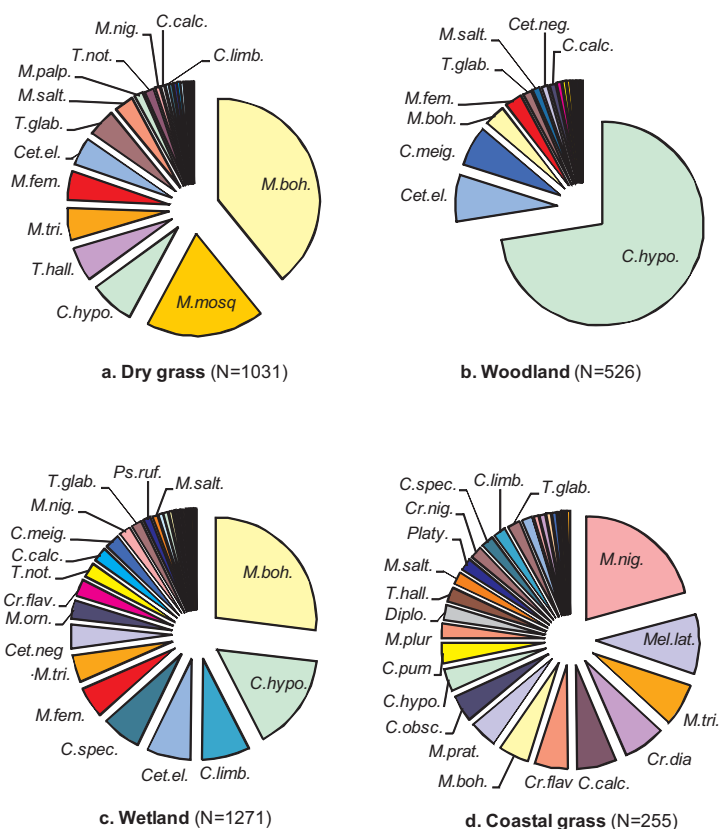


Fig. 5. Species composition of Chloropinae in sweep net samples from: a. dry grass, b. woodland, c. wetland and d. coastal grass. For abbreviations see table 3.

Fig. 5. Artssammensætning af Chloropinae i ketcherprøver fra a. tørre græsarealer, b. skovlysninger og -veje, c. vådt græsland og d. strandenge og andet kystnært græs. Forkortelser: Se tabel 3.

Table 3. Abbreviations in Figs. 4-5.
 Tabel 3. Forkortelser anvendt i fig. 4-5

C.calc.	<i>Chlorops calceatus</i>	M.fem.	<i>Meromyza femorata</i>
C.hypo.	<i>Chlorops hypostigma</i>	M.mosc.	<i>Meromyza mosquensis</i>
C.limb.	<i>Chlorops limbatus</i>	M.nig.	<i>Meromyza nigriventris</i>
C.meig.	<i>Chlorops meigenii</i>	M.om.	<i>Meromyza ornata</i>
C.obsc.	<i>Chlorops obscurellus</i>	M.palp.	<i>Meromyza palposa</i>
C.plan.	<i>Chlorops planifrons</i>	M.plur.	<i>Meromyza pluriseta</i>
C.pum.	<i>Chlorops pumilionis</i>	M.prat.	<i>Meromyza pratorum</i>
C.scal.	<i>Chlorops scalaris</i>	M.rufa	<i>Meromyza rufa</i>
C.ser.	<i>Chlorops serenus</i>	M.salt.	<i>Meromyza saltatrix</i>
C.spec.	<i>Chlorops speciosus</i>	M.tri.	<i>Meromyza triangulina</i>
Cet.el.	<i>Cetema elongatum</i>	Mel.lat.	<i>Melanum laterale</i>
Cet.neg.	<i>Cetema neglectum</i>	Platy.	<i>Platycephala planifrons</i>
Cr.dia.	<i>Cryptonevra diadema</i>	Ps.ruf.	<i>Pseudopachychaeta ruficeps</i>
Cr.flav.	<i>Cryptonevra flavitarsis</i>	T.glab.	<i>Thaumatomyia glabra</i>
Cr.nig.	<i>Cryptonevra nigratarsis</i>	T.hall.	<i>Thaumatomyia hallandica</i>
Diplo.	<i>Diplotoxa messoria</i>	T.not.	<i>Thaumatomyia notata</i>
M.boh.	<i>Meromyza bohemica</i>		

markably skewed at 79:21. The high abundance and skewed sex ratio are possibly due to attraction of foraging males to flowers present in many glades, especially *Aegopodium podagraria*. After elimination of 215 individuals swept specifically from flowers, *C. hypostigmus* is, however, still predominant (58%), but the sex ratio becomes almost equal (55:45). *Meromyza bohemica* is rather few in number (3%). It possibly prefers open land. The frequency of the other species depends seemingly on the humidity of the site.

In wetlands (Fig. 5c), 26 chloropine species are found. Many of them are associated with graminoids growing in wet habitats, e.g. *Chlorops limbatus* in *Phalaris arundinacea*, *C. speciosus* and *Meromyza ornata* in *Deschampsia caespitosa*, *Cryptonevra flavipes* in *Phragmites australis*, *Chlorops meigenii* in *Calamagrostis* spp., *C. planifrons* in *Carex* spp. and *Pseudopachychaeta ruficeps* in *Eriophorum* spp.. The ubiquitous *Meromyza bohemica* and *Chlorops hypostigma* are, however, still the most abundant, together amounting to 42% of the total in wetland habitats.

In coastal habitats (Fig. 5d), 29 species are swept, most of them in low numbers. *Meromyza nigriventris* is most frequent, amounting to 21%. In addition, it is more numerous in coastal habitats than in any other type of habitat (37 individuals per 50 samples vs 15, 13, 3, 4, 4 in mown grass, glades, dry grassland, wetland and woodland, respectively). The list of host grasses is long, but none of them are typical for coastal habitats. However, also Nartshuk & Andersson (2013) record a coastal distribution of *M. nigriventris*, i.e. along the Baltic coast of Sweden. Three species are associated with coastal graminoids: *Melanum laterale* with *Juncus gerardii*, *Meromyza pratorum* with *Ammophila arenaria* and *Diplotoxa messoria* with *Eleocharis* spp. (Nartshuk & Andersson, 2013). In wet coastal meadows, chloropine species common in wetland are also regularly found, while dry epilittoral sites have many species in common with dry grassland. *Meromyza bohemica* as well as *Chlorops hypostigma* were remarkably infrequent in the coastal habitats visited (5% and 4%, respectively). A specific coastal habitat is coastal sand dunes; in National Park Thy in NW Jutland, two species, *Meromyza pratorum* and *Thaumatomyia hallandica*, were often trapped in pitfalls in the grey sand dunes, the first one also in the white ones.

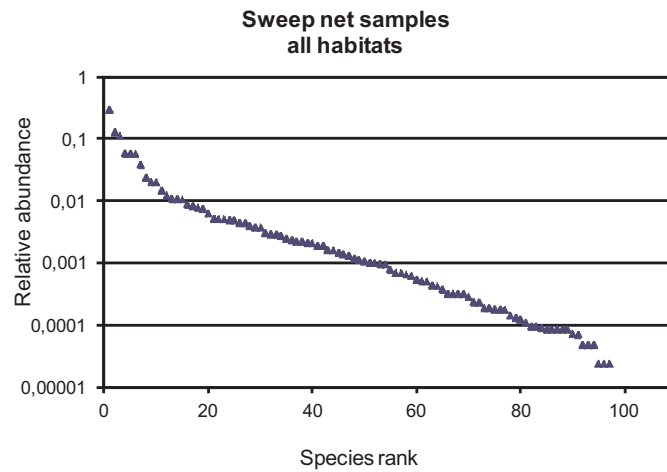


Fig. 6. Relative abundance of all Chloropidae (Oscinellinae + Chloropinae) swept in uncultivated habitats. Numbers per 50 samples.

Fig. 6. Den relative hyppighed af alle chloropider (Oscinellinae + Chloropinae) ketchet på udyrkede habitater. Antal pr. 50 prøver.

Final remarks

The distribution of frit flies (Chloropidae) in the Danish landscape is discussed in two papers, subfamily Oscinellinae in Nielsen (2014) and subfamily Chloropinae in the present paper. The third subfamily Rhodesiellinae with only one genus in the nordic countries is not treated. The entire material of Chloropidae consists of nearly 36,000 individuals swept or trapped in various uncultivated habitats. The major part (87%) belongs to Oscinellinae while only 13% are chloropines. A total of 108 species were recorded, 63 oscinellines and 45 chloropines. Additionally, 25 species are recorded from Denmark by Nartshuk & Andersson (2013) but not found during the present investigation. So, up to now 133 species of Chloropidae are known from Denmark.

The species abundance distribution of all chloropid species swept in uncultivated areas of Denmark is shown in Fig. 6. It appears that 7 species are dominating in the material. From rank 1 to 7 *Oscinella frit*, *O. vastator*, *O. hortensis*, *O. pusilla*, *O. nitidissima*, *Chlorops hypostigma* and *Meromyza bohemica* were captured in 2407, 1068, 921, 480, 474, 470 and 316 individuals per 50 samples, respectively. Together they amount to 74% of the total. They share that their larvae may develop in cereals or ryegrasses (*Lolium multiflorum* and *L. perenne*). Moreover, the first one is highly expansive. In the Danish landscape, agricultural and urban areas dominate, whereas uncultivated habitats only come to a fourth of the total area (Levin & Normander, 2008). Further, most uncultivated habitats are small or medium sized island within the farmland. The dominance of species associated with cereal or grass crops seems to reflect the proximity to farmland, where the high density of host grasses may result in increasing populations of the species in question and emigration also to uncultivated habitats with suitable grass species.

Acknowledgements.

I am grateful to dr. P. Gjelstrup, dr. B. O. Nielsen and dr. S. Toft for placing valuable material at my disposal. Also thanks to Naturhistorisk Museum, Aarhus for access to the chloropids of Carl Larsen's collection.

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