Monochroa ferrea (Lepidoptera: Gelechiidae): a new species in the Netherlands

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KEY WORDS
Air humidity, *Carex*, Finland, rare species, sandy places

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Monochroa ferrea **(Lepidoptera) was found in June 2013 as new species for the Dutch fauna. The species is rare in Europe, whilst its status outside Europe is unclear. To gain a better understanding of the distribution and the bionomics of the moth, observations from all over Europe are collated. These data are summarized and illustrated with photos, a table and a distribution map. There is a clear concentration of records around the Baltic Sea. The available records suggest that the immature stages require moisture in a sandy habitat, a habitat common in those countries. Very little is known about the early life stages, although the moth has been accidentally reared from *Carex ericetorum*, and it seems likely that other *Carex* species are utilized as well. It is not clear whether the species is single- or double-brooded. Although the moth comes sparingly at light, the best way to record the moth is by netting above *Carex* species by day or by sweeping it by day or night. As natural succession of vegetation in suitable habitats threatens the habitat, the species is considered endangered in some European countries.**

Introduction

On the 17th of June 2013, the National Park De Hoge Veluwe in the province Gelderland was visited to record moths by means of light trapping on a sheet. A 125 W MV bulb was used in combination with 4 TL-K 40W actinic tubes. The sky was partly cloudy, the wind was weakly easterly and the temperature falling from 19 ˚C to 17 ˚C. Among the 31 species of Microlepidoptera was an unfamiliar dark gelechiid male that could not be identified immediately, and thus was collected. In 2021 the genitalia were examined. After comparison with the images in Elsner *et al.* (1999), the moth was determined as a male *Monochroa ferrea* (Frey, 1870). This is the first record of this species in the Netherlands. As Dutch name 'zeggeboegsprietmot' is proposed. To gain a clear picture about its biology, information about the species was collected from observers, mainly from Europe and summarized in this article.

Diagnosis

Adult

The wing span is 12-13 mm (Kaila & Mutanen 2021). The ground colour of the forewing varies from brownish-grey to blackish-grey. There are three black spots on the forewing, in dark specimens these are sometimes indistinct. The outer one is the strongest, and is roundish to oval. The two inner ones are smaller and more elongated (figure 1-4). The three spots form points of a triangle with an obtuse angle of 150° (figure 5), and their relative positions are indicated based on eight wings of four specimens. The hindwing is lighter than the forewing.

The male genitalia are shown in figure 6. The shape of the valva-sacculus complex (figure 7), together with the relatively large aedeagus with two groups of spines in the distal part (figure 6) are characteristic and match the illustrations by Elsner *et al.* (1999) and Ivinskis & Piskunov (1979).

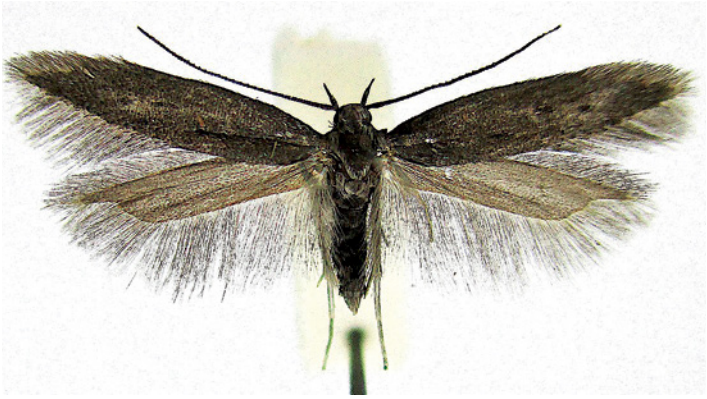
Larva

No description or illustration of the larva is known (Gregersen & Karsholt in press), most likely nobody has ever seen a larva.

Distribution

According to Elsner *et al.* (1999) *M. ferrea* ' is a very local and rare species. The species was described from the Swiss alps (Valais, Zermatt, 2800 m) and from North and West Europe: Sweden, Finland, Denmark, the Baltic states and Belarus, Italian Alps, France. Records from low-lying areas (Germany, Poland, South Moravia) are considered doubtful'. According to Gregersen & Karsholt (in press) *M. ferrea* 'is found mostly in N Europe, but also recorded from Italy and Switzerland; Belarus. Scattered and rare. Locally from C and N Europe to S Ural. Outside Europe reported from Transbaikalia (Budashkin & Kostjuk 1994) and Altai (Bidzilya *et al.* 2002: 207)'.

Several recorders across Europe were contacted to gain a better understanding of this species' distribution. These data are shown in table 1 and summarized in a map (figure 8). Outside Europe, there are five sites known, four in Russia and one in Canada (table 1). In Canada the specimen was identified by means of DNA-barcoding (Kate Perez) (Bold Systems 2021).

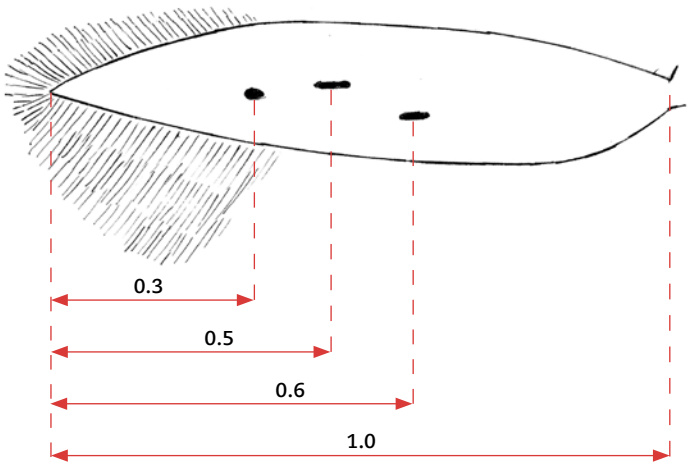


1. *Monochroa ferrea*. Sweden, Öland, Gårdby sandhed, 15.vi.2018, leg. & col. B.Å. Bengtsson. Photo: Bengt Å. Bengtsson
1. *Monochroa ferrea*. Zweden, Öland, zandheide bij Gårdby, 15.vi.2018.

2. *Monochroa ferrea* male, De Hoge Veluwe (province of Gelderland), 17.vi.2013. Photo: Joop Schaffers
2. *Monochroa ferrea* mannetje, De Hoge Veluwe (Gelderland), 17.vi.2013.

3. *Monochroa ferrea,* Switzerland, Zermatt, 18.vii.1937. Photo: Michel Kettner, Lepiforum e.V. (2008-2021)
3. *Monochroa ferrea,* Zwitserland, Zermatt, 18.vii.1937.

4. *Monochroa ferrea*, Russia, Altai Republic, Aktash, 21.vi.2015, leg. J. Šumpich. Photo: Jan Šumpich
4. *Monochroa ferrea*, Rusland, Republiek Altaj, Aktash, 21.vi.2015.



5. Relative positions of the black spots on forewing of *Monochroa ferrea*. Drawing: Joop Schaffers
5. Relatieve positionering van de zwarte vlekken op de bovenkant van de voorvleugel van *Monochroa ferrea*.

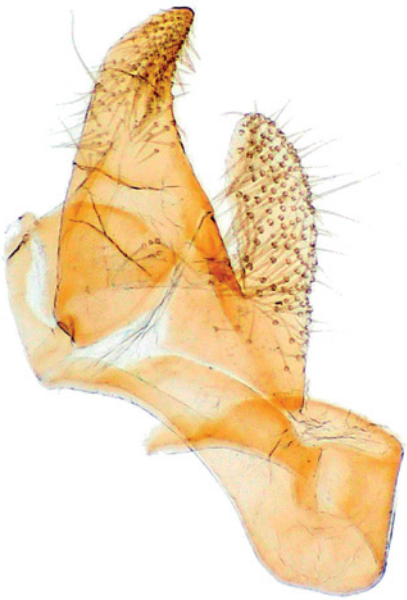
Bionomics

Larva & foodplant

The species has accidentally been reared on two occasions by collectors in Finland. Jorma Kyrki and Jaakko Karvonen mention: 'A few specimen were reared when whole plants of *Carex ericetorum* were dug out in June. The larvae obviously live in the roots or in the soil by the roots (Kaitila 1996)'. Marko Mutanen (personal communication) accidentally reared this species when he collected larvae of *Elachista juliensis* Frey, 1870 on *Carex ericetorum*.

At the locality where the Dutch specimen was observed, the only *Carex* species present is *Carex arenaria*, this in considerable quantity. Several other *Carex* species have been noted where this species has been found flying elsewhere, and could provide clues to further potential foodplants: *C. ericetorum* (Kerppola *et al.* 1984), *C. arenaria* and *C. colchica* (Bengt Å Bengtsson, Sweden, personal communication) and *C. nigra* (T. Mutanen, Finland, personal communication).

6. Male genitalia of *Monochroa ferrea*. Bar length = 1 mm. Photo: Joop Schaffers
6. Mannelijk genitaal van *Monochroa ferrea*.



7. The valva-sacculus structure of *Monochroa ferrea*. Photo: Joop Schaffers
7. De valve-sacculus-structuur van *Monochroa ferrea*.

Habitat

The Swedish name for *M. ferrea* would appear indicative of its preferred habitat: sandhedsdystermal (=sandheath sombre moth). A summary of the description of the habitats in which the various observers have seen the moth is given in table 2. The species has perhaps surprisingly been found at a wide range of altitudes: it is present from sea level up to alpine level (see table 1).

Adult activity

The moths are observed flying from late afternoon, especially in the sunshine, until the evening. The majority of the specimens are collected by sweeping and netting, particularly in Finland (Marko Mutanen and others, Finland, personal communication). Netting took place in the late afternoon in sunshine. Sweeping was done in daylight but also late after sunset, before the dew sets in (Bengt Å Bengtsson, Sweden, personal communication). Frey (1870) reports in his description of *M. ferrea*: 'Caught at the same time as *G. diffluella* on the Riffelberg near Zermatt'. In the section on *G. diffluella* (now *Scrobipalpula diffluella* (Frey, 1870)): 'I found the little animal in both sexes around mid-July 1869 on the Riffelberg near Zermatt. It swarmed in the sunshine early in the morning right next to the inn'. Hence, *M. ferrea* may also fly naturally in morning sunshine.

They are also active at night and come sparingly to light, although males seem to be more attracted to light compared to females. The collated data in Europe show that two females have been reported to be caught by light compared to nine males. Bengt Å Bengtsson mentions: 'I have never caught *M. ferrea* on light even when I have had light exactly on the spot where I have netted it'.

Frey (1870) indicates that he caught six males early in the morning in the sunshine and not a single female. Yet, Marko Mutanen netted males and females close to the ground in the late afternoon when the sun was shining. The species has also been trapped on one occasion in a flight interception trap in Canada (Bold Systems 2021). A flight interception trap consists of an upright placed see-through barrier under which one or more small basins with a preserving fluid are placed. *Monochroa ferrea* has also been observed far away from its preferred habitat as witnessed by one specimen at light in the garden of Ivars Šulcs. A male recorded in a garden in Gedesby (Denmark) and the specimen found in the light interception trap (Canada) belong to the same category.

It is not clear whether the species is single- or double-brooded. In Finland the flight period runs from 8 June to 26 August (Kaila & Mutanen 2021). Yet, elsewhere in Europe it has been recorded from 21 May (Siegenburg, Germany) until 21 August (Gedesby, Denmark). Such a long flight period may indicate that there is a second generation.

8. Distribution map of *Monochroa ferrea* in Europe. The area of ● ≙ 1 site.
8. Verspreidingskaart van *Monochroa ferrea* in Europa. De oppervlakte van ● ≙ 1 vindplaats.

Table1. Records of *Monochroa ferrea*.
Tabel 1. Vondsten van *Monochroa ferrea*.

Country (number of localities per country) / land (aantal vindplaatsen per land)	**City or locality** / stad of gebied	**Year** / jaar	**Altitude (m)** / hoogte (m)	**Observer(s)** / waarnemer(s)
Europe / Europa				
Switzerland (2)	Zermatt	1869, 1935, 1937	1850-2800	Frey, Amsel, Anderegg, Weber
Italy (1)	Salbertrand	1983	2200-2700	Bassi
France (1)	Fontanalba	2013	ca 2200	Nel
Denmark (2)	Rønne	1913	20	Sønderup
	Gedesby	1997	10	Szyska
Norway (2)	Elverum	1979, 1980, 1981	180	Aarvik, Svendsen, Karsholt
	Vågåmo	2006, 2007	665	Jørgensen
Sweden (5)	Öja	1933	10	Benander
	Simrishamn	1955, 1962	20	Svensson
	Vamlingbo	1961	20	Benander
	Baskemölla	1996	20	Svensson
	Gårdby	1976, 1987, 1996, 2004, 2005, 2018	10	Jonasson, Svensson, Bengtsson
Finnland (37)	≈ 37 sites	between 1925 and 1967 in 8 different years, between 1980 and 2019 regularly in 29 different years		33 observers
The Netherlands (1)	Hoenderloo	2013	50	Schaffers
Germany (2)	Berlin	1991, 1993	30	Gerstberger
	Siegenburg	1995, 2011	400	Kolbeck, Lichtmannecker
Latvia (9)	Riga	1961, 1967, 1995, 2006	10	Šulcs, Muskars
	Daugavpils	1987, 1991, 1997, 2001	90	Šulcs, Savenkov
	Garkalne	1988, 2000, 2001, 2002, 2005-2008	20	Šulcs, Savenkov
	Aizkraukle	1993	70	Savenkov
	Carnicava	2000	3	Junnilainen
	Piedruja	1997, 1999	110	Šulcs, Junnilainen
	Balvi	2000	90	Savenkov
	Saule	2009	60	Šulcs
	Lilaste	2012, 2013	10	Šulcs, Junnilainen
Estonia (3)	Kogula	1984, 1994	3	Nupponen, Junilainen
	Aegviidu	2001, 2002, 2012	70	Jürivete
	lake Peipsi	2003		Jürivete
Lithuania (2)	Lake Glebas	1974	130	?
	Kaunas	1974	30	?
Belarus (1)	?	between 1968-1996		
Europe in total (68)		**1869-2019**	**3-2800**	**59**
Outside Europe / buiten Europa				
Russia (4)	Transbaikalia	1994		Budashkin & Kostjuk (1994)
	Altai Republic	1995	2100-2400	Bidzilya
	Arkaim	1996	310	Junnilainen *et al.* (2020)
	Altai Republic	2015	1400	Šumpich
Canada (1)	Jasper Lake	2012	958	Perez
Outside Europe in total (5)		**1994-2015**	**310-2400**	**6**

Discussion

Striking is the concentration of the large numbers of sites around the Baltic Sea, especially in Finland, Estonia, Latvia and Sweden (figure 9). 54 of the 68 recorded sites in Europe are located in these countries (79%); in number of observed specimens, 708 out of 778 (91%). In the opinion of the author it has to do with the presence of water supplies in the vicinity of the sites.

Interestingly, when taking a closer look at the surroundings of all the specified sites in Europe on Google Earth (https://earth.google.com), in many cases (>80%) there was water in the environment such as a sea, a lake, a river, a fen or a pond at a distance of three to a few hundred meters. This may indicate that the larva and pupa require moisture. This is, perhaps, not to be unexpected given that most species of the genus *Monochroa* are restricted to wetland habitats (Huemer & Karsholt 2010).

Open water surfaces lead to an increased humidity of the air in the surrounding area. Sandy places cool down relatively quickly after sunset. During the cooling of the sand and the air above it, the temperature reaches the dew point relatively quickly and the water condenses on the soil and plants. If the temperature continues to drop, the condensation continues. In this way the roots of the *Carex* species can collect a certain amount of water. Assuming that the larva is active in the spring, the relatively cold nights at that time of year can provide the need of moisture. The same goes for the pupa. If this hypothesis is true, it might be not surprising that the species is relatively well represented in the countries such as Finland, Estonia and Latvia with their many lakes, rivers, swamps, marshes and peat bogs. The record in a wet meadow of a small stream in the French Alps and the one in a wetland northeast of Jasper Lake

Table 2. Habitats in Europe.
Tabel 2. Habitats in Europa.

Description habitat / beschrijving habitat	**Observer** / waarnemer	**Country** / land
'Dry and sandy places'	Bengtsson	Sweden
'A wet meadow next to a small stream in the French Alps'	Nel	France
'It lives very strictly only on open, hot and sandy places with little vegetation. Sometimes there is little else but food plant on plain sand'	Mutanen	Finland
'All habitats are sandy, with a scarce vegetation'	Mutanen	Finland
'It is an open area with inland sand dunes and much broom as vegetation'	Lichtmannecker	Germany
'Dry places that are *Calluna*-rich and where *Carex* species grow in between'	Šulcs	Latvia
'Heatherlands (where *Calluna vulgaris* grows), dry pine forests and clearings, where *Carex ericetorum* can be a typical plant'	Savenkov	Latvia
'We were netting *Carex ericetorum* on a dry sandy slope'	Karvonen	Finland
'Xerothermic open sandy slopes and also burned areas after forest fires, alvars, military training terrain with *Calluna*, *Thymus serpyllum*, *Antennaria dioica* and *Solidago virgaurea* and probably *Carex*'	Jürivete	Estonia
''Gravel and esker areas'	Kullberg	Finland
'A sandy river bank'	Aarvik	Norway
'Very dry sandy habitats'	Junnilainen	Finland
'A slightly sloping open former sand drift with a pioneer vegetation of *Corynephorus canescens*, *Festuca*, *Polytrichum piliferum*, *Campylopus introflexus*, and *Carex arenaria* (2021!). The situation in 2013 is unfortunately unknown'	Schaffers	The Netherlands

9. Locallity of *Monochroa ferrea* in National Park De Hoge Veluwe (province of Gelderland) in 2021. Photo: Joop Schaffers
9. Vindplaats van het Nederlandse exemplaar van *Monochroa ferrea* in het Nationaal Park De Hoge Veluwe (Gelderland) in 2021.

in Canada, also fit this possible preference. The requirement of the larva and pupa for moisture does not conflict with the preferred habitat of a dry, sandy area of the moth.

The number of observers in a country has an effect on the number of observations. Finland has for example 103 records from 33 observers in 37 different years, whereas Estonia only five records from two observers in five different years. A reason for this low number might be the low number of microlepidopterists in Estonia (Urmas Juriviete personal communication). Moreover, the number of observations is also influenced by the accessibility of the suitable habitat, especially in sparsely populated areas and mountains.

The prime habitat for *M. ferrea* seems to be an open dry sandy area with little more vegetation than the food plant. In the next stage of succession the species is able to survive for some time in heathlands, clearings in pine forests, etc. Secondary habitats are also used, such as clearings after forest fires, road slopes, airports, military shooting and training camps.

In Finland, where there are many records, the species is considered endangered (Kaila & Mutanen 2021). It appears rare and possibly threatened in several others countries. Bengt Å Bengtsson mentions 'that the primary habitat is unfortunately slowly disappearing. I know of only two rather recent localities in Sweden, of which one seems to have been overgrown and is now unfavorable for the moth. However, there is a program for restoring some of the potentially most promising sandy areas, so perhaps *M. ferrea* may spread to new locations'.

On the Dutch site, the vegetation is in its pioneer stage (figure 9) or slightly further in the succession. Young trees of Scots pine *Pinus sylvestris* are present. It is not clear what the effect is of the invasive heath star moss *Campylopus introflexus* carpets in cooling of the soil. However, the dense carpets of the moss are likely to limit the colonization by other plants such as *Carex* species. If *M. ferrea* is still present at this location, care must be taken to ensure that the sand is kept open by removing the mats of heath star moss and removing any invading shrubs and trees, such as Scots pine.

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Samenvatting

***Monochroa ferrea* (Lepidoptera: Gelechiidae): een nieuwe soort voor Nederland**

In juni 2013 werd op de Hoge Veluwe een nieuwe boegsprietmot voor Nederland gevangen: de zeggeboegsprietmot *Monochroa ferrea*. De soort staat in Europa als zeldzaam bekend en buiten Europa zijn er slechts vijf vindplaatsen. De zeldzaamheid is mogelijk een waarnemerseffect en kan samenhangen met de ontoegankelijkheid van gebieden. Om een meer gedetailleerd beeld te krijgen van de verspreiding is er zo veel mogelijk data verzameld bij waarnemers in Europa. Opmerkelijk is de verticale verspreiding van de soort: hij is op bijna alle hoogtes tussen zeeniveau en de alpine zone aangetroffen. Uit de verspreidingskaart is een opmerkelijke waarnemingenconcentratie te zien in de landen rondom de Oostzee. Dit zou te maken kunnen hebben met de voorkeur voor vochtige grond rondom de wortels van de voedselplant, hetgeen belangrijk is voor de ontwikkeling van de rups. In landen rondom de Oostzee zijn er veel watervoorraden aanwezig, bijvoorbeeld meren, rivieren, vennen, moerassen en de zeekust. De belangrijkste habitat blijkt een droge, zandige open vlakte met daarop soms alleen de voedselplant. Verschillende zeggesoorten *Carex* komen naar voren als mogelijke voedselplant. Uit de data van de waarnemingen in één jaar in één gebied valt niet eenduidig te concluderen of er één of dat er meer dan één generatie per jaar is. De beste vangstmethode is door óf overdag met het net bóven de voedselplant te vangen óf door overdag en 's nachts met een net dóór de voedselplant te slepen. Binnen Europa staat de soort in Finland als bedreigd aangeduid, hetgeen mogelijk ook in enkele andere landen het geval is. Voor het behoud van de soort zijn beheermaatregelen nodig om open zandige plaatsen te behouden of te creëren.

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