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***Nymphalis xanthomelas* (Esper, 1781)**

Mass migration, temporary colonisation or sustainable expansion? (Lepidoptera: Nymphalidae)

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Abstract. The unprecedented migration of *Nymphalis xanthomelas* (Esper, 1781) into North-West Europe during the summer of 2014 has been preceded by the settlement of this species in Scandinavia in 2009-2013 (Finland and South-East Sweden). In July 2014, large numbers of *Nymphalis xanthomelas* were observed in many parts of Scandinavia (including Denmark and southern Norway), North Germany, the Netherlands, Northern Belgium (Flanders) and Southeastern England. The most compelling question that arises from this incursion: is this a long term settlement or an exceptional annual migration? Only the future will tell us.

Key words: *Nymphalis xanthomelas*, distribution, Northern Europe, migration.

***Nymphalis xanthomelas* (Esper, 1781)**

Nymphalis xanthomelas, a Eurasian species morphologically close to *Nymphalis polychloros* (Linnaeus, 1758), has in the last decade dramatically extended its range into northeastern and northwestern Europe. Only 5 years ago its distribution was considered predominantly Asiatic (Bozano & Fiorani 2012; Tolman & Lewington 2010) with only rare observations in Eastern Europe. The westernmost limit of its distribution was situated in Poland with historical records from North-East Germany, Slovakia, Hungary, Romania, the Balkan countries and northern Greece (Tolman & Lewington 2010). Prior to 2009 its occurrence in Eastern Europe appeared to be in decline, particularly in Slovakia and Greece. However, the European distribution of this discrete species is poorly known. The butterfly remains elusive and is rarely seen except in early spring after hibernation, similar to its close relatives, *Nymphalis antiopa* and *Nymphalis polychloros*. The westwards expansion started gradually in 2009 and 2010, increasing rapidly between 2011 and 2013 in Scandinavia with a real explosion over much of northwest Europe, including England, during July 2014. For the next paragraphs, the Internet site references are quoted at the end of the publication.

In Finland the species was known but rarely observed until 2009-2011 (circa 150 observations before 2011). During the summers of 2012 and 2013 a dramatic increase in sightings was first recorded in the southernmost part of the country in 2012 before incursion took place further north and west in 2013. There are fewer observations in 2014, all in the same areas.

In Sweden migration started during April-May 2009 in the south-easternmost part of the country (between Karlskrona and Kalmar). Confirmation from the same area was given in 2010 with additional sightings in 2011 from the island of Öland and from Hudiksvall, 200 km north of Stockholm. During the summer of 2012 the species was recorded from the isle of Gotland, the greater Stockholm area and over a substantial part of the southern third of the country, including the vicinity of Göteborg. 2013 brings confirmation of the expansion in the south of the country, predominantly along the eastern coast and its northward expansion was confirmed in 2014, especially along the western coast opposite Denmark, as far as Umeå.

The species was first recorded in Denmark in 1896 (Faxeladeplads) with subsequent sightings in 1901 (1 adult on 25.vii), 1954 (5 specimens in viii), 1979 (1 butterfly on 20.vii) and 2004 (1 adult on 17.iv). Most sightings were from the island of Bornholm, situated in Eastern Denmark. But it is in 2011-2013 that things are changing with one sighting at Ho on 26.vii.2011, another record from Karlstrup on 13.ix.2011 and a further observation on 17.ix.2013 at Højerup. However during 2014 an invasion took place with (initially) low number first appearing from March and April in Pinseskoven, Vaestamager (south of Copenhagen) then at Arresødal (to the north of the city) and in other localities of the island of Öland. After 10.vii.2014 and during the whole month of July, it is a massive invasion with hundreds of butterflies from 87 different localities.

Records from Norway are more scattered and the invasion seems to have occurred later on in the year (starting from 17.vii.2014) despite one early record of a hibernated specimen seen on 23.iv.2014. The map shows the status at the end of August 2014. Compared to Sweden, the invasion during 2014 took place later on in the summer, and all the observations were centred around the southeastern lowlands of the country. By 17.viii.2014 there had been 22 sightings in Norway.

In Germany the species has been observed sporadically during the last decade, especially from Sachsen: Oberlausitz, Bernbruch, 01.iv.2007 (lepidoforum.de) and Schönheide/Vogtland (July 2013: Reinhardt *et al.* 2013). In July 2014 two observations were made in Berlin (11th and 17th of July, Frank Rämisch, pers. comm.) but it is more than likely that many more specimens of *N. xanthomelas* migrated westwards along the German coastline from Denmark to the Netherlands (Schleswig-Holstein and Niedersachsen). Unfortunately we lack precise data.

In the Netherlands the invasion started on 10.vii.2014 with more than 100 specimens observed in at least 72 localities during July with a few sightings during August. The whole country was concerned including the south-eastern part (Limburg) and south-western area (Zeeland) that only have late (August), isolated records.

Observations in Belgium, focused around Flanders in the northern part of the country, are less numerous but significant. From July 15-24th 2014 there were confirmed records from Turnhout and Ekeren (Province Antwerpen), at Gent-Muide (Province Oost-Vlaanderen), at Meeuwen-Gruitrode (Province Limburg) and probably (but without proof) from Mol (Province Antwerpen) and Hoepertingen (Province Limburg).

There are, at present, no observations from the province of West-Vlaanderen, the area of Brussels and Wallonia (one single specimen observed south of Maastricht, the Netherlands, Limburg province) nearby Eben-Emael (province of Liège) and the Grand Duchy of Luxemburg.

There is only one (unconfirmed) record for France, a controversial observation from 16.vii.2014 at Englancourt, département Aisne (not far from the Belgian border) made by Dirk Maes (see red point in département Aisne (F-02) in the Belgian map). However it is impossible to positively identify the species from the two photographs provided, and the observer, along with several authoritative figures, believe the specimen depicted in these photos may be that of *N. polychloros*. The ALF requested data, from its members at the end of July 2014, but no information, regarding sightings in France, was forthcoming.

In the United Kingdom the only confirmed specimen, prior to sightings made after July 2014 was collected at Shipbourne, near Sevenoaks in the occidental part of the county of Kent county on 2.vii.1953. After a gap of 60 years a specimen was observed on the Shetland islands, Scotland during November 2013. The following year, from mid July onwards, the species was recorded at several different locations in England; at Layer (Essex) from July 14th, in the nature reserve at Minsmere (Suffolk) on July 15th by Ian Barthorpe and then in several different localities in southeastern England including Kent (at Sandwich), Lincolnshire and Norfolk (ukbutterflies.co.uk). Mark Shardlow, a conservational butterfly specialist at Minsmere nature reserve, assured: «*They have never arrived in these numbers before. This is the first time they have migrated and they have come all the way from Hungary across Europe on Britain's shores.*» NB: The migration probably came from Scandinavia and the Netherlands and not from Hungary!

In Hungary a mass migration was noted in 2006 (De Jong, 2007, 10-11). We have no information on the summer of 2014. In the Republic of Slovakia there were several observations at Rosnava and Brzotin during April 2014 made by Andrei Makara (lepidoforum.de).

In Poland the species is less rare, especially in the north-eastern quarter of the country, and previously from the southern sector (www.lepidoptera.eu/=PL). For the moment, no information regarding 2014 is available.

Discussion

Nymphalis xanthomelas has long been recognized as an established species in Europe and its presence is well documented in Eastern Europe with a boundary line extending from northern Greece to mid Poland (Buszko 1997). Populations can fluctuate, and records of solitary vagrants migrating west to the Czech Republic, western Poland, Germany, Austria and the Baltic States are not uncommon. Since the year 2000, observations tended to decrease but this downturn was reversed after 2009-2010!

Southern Finland and Sweden were the first NW European countries to be invaded by *N. xanthomelas* (during 2010-2011, with isolated cases in 2009) and a steady westerly and north-westerly progression, probably initiated from the Baltic States and Belarus, was also recorded in 2011,. The invasion extended into central Finland and the western part of central Sweden during 2012-2013, followed by Denmark (over the whole country, but especially in the eastern part, notably Sjaelland) and southeastern Norway (April 2014). Further to the south the first records from North Germany occurred during the middle of July 2014 (few data and only available from the North-East of the country but with a migration route presumably following the northwestern coastline) and then the Netherlands, with more limited records from Flanders (Belgium) and the East of England (from southern counties bordering the North Sea) during July-August 2014. A single observation (an undetermined identification made from photographs), during mid-July 2014 is attributed to France in the département Aisne, not far from the Belgian border.

Many identifications are based on photographic evidence without physical examination of the specimen, but even if some of these observations are erroneous (potential confusion with *N. polychloros*) the fact remains that this massive migration cannot be in doubt. Only some borderline cases will remain doubtful.

Before trying to explain the phenomenon of this mass migration a fundamental question needs to be asked: Is this mass migration temporary or an expansion of the species into NW Europe? To help answer this question we have to make a distinction between the two main regions: Scandinavia and rest of northwestern Europe.

Even if the expansion into Finland and other Scandinavian and Baltic countries could potentially be sustained (although there was a decline in numbers in Finland during the summer of 2014) this is far less likely to occur in northern Germany, the Netherlands, Belgium and the United Kingdom. The migration into western Europe during the 2014 summer is more likely transient and was probably the direct result of an unseasonably hot month during July 2014 all over Northern Europe. By contrast, countries further south suffered from lack of sunshine with low temperatures and record rainfall for the entire summer of 2014 after a very mild, wet winter. This may explain why France remained on the cusp of this phenomenon! Favorable climatic conditions (resulting in a sustained settlement in Scandinavia) and beneficial weather (inciting a westwards migration during the summer of 2014 during an unusually hot year in Scandinavia) are assuredly major factors. This continental Eurosiberian species withstands very cold winters but also enjoys hot summers if they are as wet as in eastern Europe and these conditions prevailed during July 2014 in the regions where mass migration occurred.

A second explanation for the 2014 migration could relate to the massive expansion into Scandinavia: this incursion may have been facilitated by the population explosion of *N. xanthomelas* in southern Scandinavia, stimulating a westerly migration needed for the balance of the populations to expand its territory aided by optimal summer conditions that prevailed in the region.

Some observations are probably erroneous, e.g. data from Belgium, France (vide supra) and England but this in no way diminishes the validity and magnitude of the phenomenon. As previously mentioned, many of the records appearing on websites are based on the testimony of naturalists, not always specialists, with or without photographic evidence and are rarely based on the examination of captured specimens. It must be pointed out that captured specimens offer a much more compelling evidence than a simple photographic image, which can lack detail or sharpness, a favorable viewing angle allowing only partial examination of the specific characters, unfavorable lighting and the inability to take measurements, compare the sizes and other small properties of the specimens ...

Even if it is not always necessary to keep all captured specimens, being able to check them from nearby in a net should a priori not be considered as an offence or a crime, even in regulated areas. This is unfortunately not always the case and many of us have been questioned in the field for the mere fact of having a net in the hand. This remains an indispensable tool to avoid disseminating unverified data by lack of evidence and digital photography, which obviously remains an interesting contribution, will never replace the examination of the specimens, including genetic analysis that can separate similar species as it may be the case between *N. polychloros* and *xanthomelas*. The photographic data or the testimonials on observations of *xanthomelas* probably lead us to overestimate the number of actual observations in some regions while other countries that do not yet have a permanent observatory have been under sampled.

The fact remains that, if we were able to publish numerous and accurate, although certainly incomplete, informations as close to the event in September 2014 it is due to the existence of Internet, social networks and fauna monitoring programs that exist in different countries. This would have been impossible 20 years or even 10 years ago!

Entomology is a whole, based primarily on the actions of naturalists and field entomologists that are almost always volunteers, with or without net, with or without digital camera but with two constants: the need for a continuous presence of observers in the field, particularly in the context of associations and observatories of biodiversity and the existence of Internet and the progress that it facilitates in terms of communication and information exchange.

We wanted to publish this inventory very quickly, knowing that the future will confirm and perhaps partially invalidate some of our assumptions! We knowingly take this risk but we believe that publishing and analyzing in real time such an information will bring progression to the entomological world.

See you in a few years!

Tentative distribution map of *Nymphalis xanthomelas*, early September 2014, in northern Europe p. 73

Depicted in red are incursions made into territories between 2011-2014, with mass migration starting from 2010 to 2012 in Sweden and Finland, in Denmark in 2013, in Norway in the spring of 2014 and in Germany, the Netherlands, Belgium and England during July 2014. The occurrence of the species in areas indicated with a brighter red colour is more uncertain. The southern boundary of the entire migration zone, especially in the North of Germany, is unclear due to the lack of information. Indicated in pink are areas of Europe where the species has periodic incursions (more uncertain in light pink) compared to those refuges situated more to the South-Eastern Europe (eastern Poland, Slovakia, eastern Hungary, Ukraine, Belarus and Russia) depicted in purple.

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- Netherlands: <http://waarneming.nl/soort/info/80857>
- Belgium: <http://observations.be/soort/view/80857>
- United Kingdom: <http://www.ukbutterflies.co.uk/species.php?species=xanthomelas>
- Poland: <http://www.lepidoptera.eu/show.php?ID=93&country=PL>
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Figures

All figures can be consulted in the original pdf: [hyperlink](#).