The harlequin ladybird (*Harmonia axyridis* Pallas) in Denmark: spread and phenology during the initial phase of invasion

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The harlequin ladybird, *Harmonia axyridis* (Pallas), is an invasive species new to the Danish insect fauna. A few adult specimens were recorded in 2006. By October 2007 huge numbers of larvae, pupae and adults were found in greater Copenhagen and aggregations of overwintering adults were reported from indoor locations. Through personal observations and records by the public we have mapped the spread and habitat colonization of *H. axyridis* since October 2007 and have made the first observations on the biology of the species in Denmark. Verified records exist from the southern and eastern part of the country with Hvide Sande as the northernmost location by April 2009, and the species is well established in Copenhagen, in Funen and in South-East Jutland. So far, most records have been made from urban habitats, such as parks and gardens. A number of records also exists from reed beds, ruderal vegetation, cereal fields, meadows and heathland and from wash-up on sea shores, particularly in the southern and eastern part of Denmark. Based on the observed phenology and on calculations of thermal sums for complete development, we suspect that *H. axyridis* is bivoltine in Denmark with a possible third generation in warm years. The harlequin ladybird emerges from overwintering sites from mid-April onwards. In 2008 eggs were observed from the beginning of May, and the new generation emerged after approximately 5 weeks. Generations are overlapping, and in mild autumns with ample food supply as in 2007, larvae and adults can be active until mid-December. Long-term studies of possible adverse effects of *H. axyridis* on the native fauna have been initiated.

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Dansk sammendrag

Harlekinmariehønen, *Harmonia axyridis* (Pallas), er en ny invasiv art i den danske insektfauna. Enkelte voksne individer blev fundet i 2006, og i oktober 2007 blev store mængder larver, pupper og voksne fundet i Københavnsområdet, samtidig med at der indløb rapporter om overvintrende hobe indendørs. Ved hjælp af egne observationer og indberetninger fra offentligheden har vi siden oktober 2007 kortlagt harlekinmariehønens spredning og habitatkolonisering i den første fase af invasionen og foretaget de første observationer af artens biologi i Danmark. Verificerede fund foreligger fra den sydlige og østlige del af landet med Hvide Sande som det hidtil nordligste fundsted. Arten er veletableret i København, på Fyn og i SØ-Jylland. De fleste fund stammer indtil videre fra levesteder domineret af vedplanter i byområder, såsom parker og haver. Et antal fund er desuden gjort i tagrør, ruderater, kornmarker, enge og hedeområder

samt i opskyl langs kyster, især i de sydlige og østlige egne. Ud fra fænologiske undersøgelser og beregninger af temperatursum for udvikling antager vi, at *H. axyridis* har to generationer i Danmark med mulighed for en tredie generation i varme år. Fremkomst fra overvintringsstederne finder sted fra midten af april. I 2008 blev æg observeret fra begyndelsen af maj, og den nye generation klækkede ca. 5 uger senere. Generationerne er overlappende, og i milde efterår med rigelig føde, som i 2007, kan både larver og voksne være aktive indtil midten af december. Langtidsstudier af *H. axyridis*' mulige negative indflydelse på hjemmehørende arter er indledt.

Introduction

The harlequin ladybird *Harmonia axyridis* (Pallas), an invasive species originating in East and Central Asia, is a new element in the Danish insect fauna (Brown et al., 2008a). It is a voracious predator of aphids and other homopteran insects and has been widely used as a biological control agent in glasshouses and in agricultural and horticultural field crops outside its native range since 1916, when it was first released in North America (Koch, 2003).

Despite repeated releases in the US, naturalized populations were not recorded until 1988 after which *H. axyridis* rapidly spread across the North American continent. Also in Europe, the ladybird has been deliberately introduced, and the first established populations were observed in the wild in 1991; particularly since 2002 large parts of Europe have been invaded (Brown et al., 2008a).

H. axyridis is a very successful invader. It has adapted to a wide range of climates and habitats and is considered one of the most undesirable invasive insect species: reports are accumulating that it has a negative impact on biodiversity and that intraguild predation may affect native coccinellids and other aphidophagous species. Further, from being a beneficial insect *H. axyridis* is now becoming a pest in soft fruit production, especially in vineyards, and its overwintering behaviour makes it a human nuisance, as it aggregates in high numbers in buildings, where it is fouling contents and may elicit allergic reactions. Koch (2003) provides a review of the ecology of the species and additional information on various aspects of the biology of the harlequin ladybird can be found in Roy and Wajnberg (2008).

In Denmark, *H. axyridis* was first recorded in 2006 when a few adult specimens were found in Copenhagen and also in light traps on the island of Møn (Pedersen, 2007; Pedersen et al., 2008). In October 2007, the finding of overwintering aggregations in two apartments in central Copenhagen, the discovery of several hundred larvae, pupae and adults nearby and the finding of several additional locations in Copenhagen with similar numbers of specimens proved the establishment of the species in Denmark (Steenberg & Harding, 2007). Due to its status as a highly invasive species, the beetle received considerable media attention, and it was soon provided with the common name harlekinmariehøne (Martin, 2008).

The finding of large populations of *H. axyridis* in Copenhagen provided a unique opportunity to initiate studies of an invasive insect species establishing in a new environment.

Since the discovery of the first naturalised populations of *H. axyridis* in Denmark, we have followed the spread and habitat colonization by continuous mapping of the geographical distribution, and we have undertaken the first studies of the phenology and voltinism in Denmark. Further, studies of interspecific interactions have been initiated focusing on natural enemies and the possible adverse effects of *H. axyridis* on native coccinellid species. In this paper we present the results of our observations of the dispersal, phenology and voltinism of *H. axyridis* during the initial phase of the invasion in Denmark.

Methodology

Mapping of the spread

Mapping of the spread of *H. axyridis* has been done by personal observations by the authors and by collaboration with the public.

Personal records. From October 2007 to October 2008 and again in the winter 2008-2009 we made intensive surveys in greater Copenhagen, supplemented with occasional surveys in Funen and South-East Jutland. In the winter of 2007-2008, adults overwintering outdoors were searched for. Typical overwintering sites were identified as being tree trunks, especially of *Acer* and *Tilia*, and erect objects (statues, fences etc.) underneath or close to trees. After the dispersal from overwintering sites in spring and during early, mid and late summer, surveys were made in urban woodland habitats in the greater Copenhagen area and in a number of locations in Funen and Southern Jutland. Surveys were made by visual inspections, by beating of branches of woody plants and by sweep netting in herbaceous vegetation.

Records by public collaboration

In connection with the coverage of the discovery by newspapers, TV and radio, advertisements were issued in press releases and in the newspapers from November 2007. Further, we advertised for sightings of *H. axyridis* in magazines and journals addressing the green sector, such as park managers and ornamental tree growers, and entomologists and naturalists (e.g., Harding & Steenberg 2008a, b, c).

In May 2008 we launched a harlequin website including an electronic recording scheme (http://www.dpil.dk/dpil2005/harlekin/harlekinmariehone.htm.) and again issued a press release asking the public to contribute their sightings. The harlequin website received almost 2700 visits from the launch in May 2008 until February 2009. In addition, almost 3000 hits were recorded for an information leaflet on ladybirds found indoors, made available on the internet in November 2007. The verified records received are published on a map which is being continuously updated.

These data were combined with data kindly provided by collaborators who arranged for the public to engage in the survey. Data were provided by the naturalists' website www.fugleognatur.dk, where also a supplementary inquiry (NETOBS) specifically targeting *H. axyridis* was made.

An intense 6-week "ladybird hunt" was arranged by the website OBSNatur (www.obsnatur.dk) from mid-August. More than 300 school classes participated (J. Bønløkke, pers. comm.), which gave further attention to the species and a handful of new locations. Only verified records from these websites have been included in our distribution map.

Phenology and voltinism

The emergence of adults in spring was monitored by inspections of overwintering sites during the winter and spring. Following dispersal from overwintering sites, spring habitats in Copenhagen were located, and seven of these were inspected bi-weekly or weekly. From late June–early July and onwards, summer habitats were located and frequently inspected. At each inspection, observations were made of the presence of eggs, larvae, pupae and adults.

In the calculation of thermal sum (degree days) for complete development, a developmental threshold of 10.5°C was used (Poutsma et al., 2008). Meteorological data were accessed from a weather recording station in Copenhagen (DMI).

Results and discussion

Mapping the spread

Geographical distribution

Prior to our mapping, adult *H. axyridis* had been found in two locations in 2006 (Pedersen et al., 2008). From May 2007, records, particularly from Copenhagen, started to appear on www.fugleognatur.dk and by the end of October 2007, adult specimens had been found in two additional locations on Funen and also in Brøndby west of Copenhagen.

The media coverage of our discovery of dense populations in Copenhagen in October 2007 resulted in 26 verified records of *H. axyridis* found indoors in the period November 2007 to April 2008 (Table 1). Among these was the first record of the species in Jutland. Our search for overwintering sites yielded further locations in Copenhagen, and by the end of 2007 ten outdoor locations were verified.

By April 2009, the presence of *H. axyridis* had been confirmed from 53 locations covering Southern and Eastern Denmark (Fig. 1). No verified records exist north of Hvide Sande at the west coast of Jutland. Observations of *H. axyridis* in more northerly parts of Jutland (occurring on www.obsnatur.dk or reported to us) were either misidentifications or undocumented. At present, *H. axyridis* is very abundant in Copenhagen and there are indications of emerging strongholds in Funen and in South-East Jutland. A description of the course of the spread in Denmark is presented in Steenberg et al. (2009).

Most records outside Copenhagen were of single specimens of adult *H. axyridis*. However, the findings of larvae in South-East Jutland, in Funen and in two locations in Zealand indicate that the species is now becoming established outside the capital.

A comparison of indoor and outdoor records demonstrates a correlation between aggregations of overwintering *H. axyridis* reported from private households and records of large numbers of adults and/or of larvae and pupae, i.e. established populations, in the vegetation. So far, no records of *H. axyridis* overwintering indoors have been reported from areas outside Copenhagen, Funen and South-East Jutland.

Habitat colonization

The vast majority of records were from urban locations dominated by deciduous trees. In Copenhagen, *H. axyridis* was recorded from parks, gardens and tree-lined streets, and in late summer it was also observed in reed beds and ruderal vegetation. Most of the 33 locations outside greater Copenhagen where *H. axyridis* has been recorded also belong to these types of habitats.

Only few records of *H. axyridis* were made in other habitat types – a cereal field, heathland and meadows. These records were made in late July and onwards. In late June – early July we observed that aphid populations on deciduous trees had collapsed, and

Number of *H. axyridis* per record	Number of records winter 2007–2008	Number of records from Copenhagen
0 specimens*	11	4
1 specimen	21	14
<10 specimens	2	1
≥10 specimens	6	6
In total	26	21

Table 1. Indoor overwintering of *Harmonia axyridis*. Records of aggregations November 2007 to April 2008. *Other species of coccinellids (*Adalia bipunctata, A. decempunctata, Coccinella septempunctata, C. undecimpunctata, Anatis ocellata, Myzia oblongoguttata*).

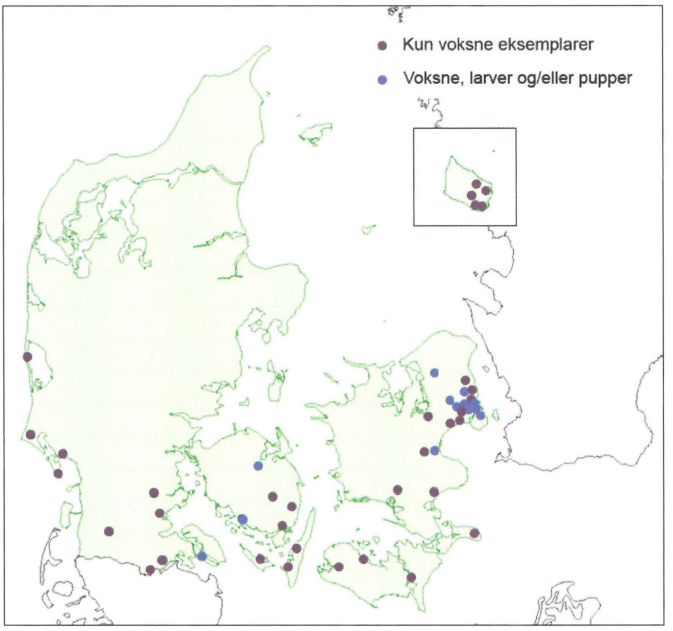

Fig. 1. Geographic distribution of *Harmonia axyridis* in Denmark (April 2009). Only verified records are shown. ● (larvae and adults), ● (only adults). For each location 1-10 records were made.

probably food depletion forced *H. axyridis* to disperse into new habitats. In this period *H. axyridis* was also found washed up on sea shores along with *Coccinella septempunctata*, *Propylea quatuordecimpunctata*, *Anatis ocellata* and other coccinellids. Sporadic searches in orchards and Christmas tree plantations were unsuccessful. However, *H. axyridis* was found feeding on aphids on *Malus*, *Prunus* and *Abies* in Copenhagen (Table 2), indicating the likelihood of colonization of habitats with these plants during a later phase of the invasion. Based on experiences from other countries invaded by *H. axyridis*, the preferred habitats observed during this study are expected to change with increasing population size (Adriaens et al., 2008).

On a local scale, population densities were highly variable. Not uncommonly, several thousand larvae, pupae and newly emerged adults were found within a very restricted area, sometimes even on a single tree.

Verification of records submitted by the public

Involving the public in the survey and launch of public electronic recording schemes has been a successful tool in the mapping of *H. axyridis* in other countries (Brown et al., 2008 a,b). However, due to difficulties with the identification of *H. axyridis* by inexperienced observers, it is imperative for a reliable mapping that each record is verified. *H. axyridis* is a large (5.5–8 mm) ladybird which appears less oblong and more convex than the larger native coccinellids. Most specimens have a transverse ridge at the posterior end of the elytra (95% in our material, N=105), but this ridge is not always distinct. The existence of melanic forms adds to the identification difficulties (Fig. 2).

Approximately 30% of the records submitted to us were misidentifications. From our experience, the main difficulty in the identification of records made by the public is to distinguish the *H. axyridis* red colour morph (f. *succinea*, with 0-19 black spots) from the

Plant genus	April–May	June–August	September–November
Abies		+	
Acer	+	+	+
Aesculus		+	
Angelica		+	
Barbarea		+	
Betula	+		+
Circium		+	
Cornus		+	+
Fagus	+	+	
Humulus		+	+
Malus	+		
Pastinaca		+	
Phragmites		+	
Populus		+	
Prunus		+	+
Quercus	+	+	+
Rosa	+	+	+
Salix		+	
Sambucus		+	
Tilia		+	+

Table 2. Plant genera observed to support actively feeding larvae or adults of *Harmonia axyridis* 2007-2008.

abundantly occurring red colour form of the 10-spotted ladybird (*Adalia decempunctata*, f. *decempunctata*, Fig. 3). Despite *H. axyridis* being larger than *A. decempunctata*, many photos submitted during the survey were *A. decempunctata* and not *H. axyridis*.

The eyed ladybird (*Anatis ocellata*) was the second species often mistaken to be *H. axyridis*, but they are easily distinguished by their markings on the pronotum and the colour of the legs and ventral surface. The melanic variants of *H. axyridis* have not caused similar identification problems. They can be distinguished from black native coccinellids and melanic types of e.g. *Adalia decempunctata* and *A. bipunctata* by the size. The larvae of *H. axyridis* are very conspicuous in the late larval instars (L3–L4) and are easily identifiable (Fig. 4).

The invasion history in Denmark

When did it arrive? The first official report of the finding of *H. axyridis* in Denmark dates from July 2006 (Pedersen, 2007). However, when overwintering specimens were first recorded in apartments in Copenhagen in late autumn 2007 (Steenberg & Harding, 2007) the occupants revealed that groups of harlequin ladybirds (up to approximately 100 individuals) had also been overwintering in two of these apartments in 2006. This indicates that *H. axyridis* has been present in relatively large numbers at these sites in the summer of 2006, and we cannot exclude that the species arrived here prior to 2006. On the other hand, larvae and pupae were not observed in Denmark before the summer of 2007 and have only been sighted in a few locations outside Copenhagen, despite their conspicuous appearance and the massive attention given to the species in the past year.

Fig. 2. Colour forms of *Harmonia axyridis*.
a. Forma *succinea* (Photo: J. Martin), b. Forma *spectabilis* (Photo: T. Steenberg), c. Forma *conspicua* (Photo: J. Martin), d. Forma *axyridis* (Photo: S. Harding).
Forma *succinea*, *conspicua* and *spectabilis* have been described from other European populations (Brown et al., 2008a). The nominate form, f. *axyridis*, was found in Copenhagen in late 2007 in two locations (Steenberg & Harding, 2008) in very small proportions and was also found during 2008 (Steenberg & Harding, unpublished data).

How did it arrive here? In conflict with the information given in Brown et al. (2008a) on deliberate introduction of *H. axyridis* in Denmark, the species was indeed marketed for biocontrol of pests by several Danish companies and, although the sale was limited due to the price of the product, the last company only stopped sales in 2005. Thus, it cannot be excluded that the Danish populations originate from released biocontrol agents. However, based on pathways of entry into other European countries, we consider it more likely that *H. axyridis* arrived here either by wind from areas south and east of Denmark or in vehicles or imported commodities. Already in 2002 the harlequin ladybird was recorded in very high numbers in Hamburg, less than 150 km south of the Danish border (Tolasch, 2002), and it was found near the Baltic Sea in Eastern Germany already in 2004 (H. Ringel, pers.comm.). From the present distribution of *H. axyridis* in South and East Denmark, observations of washed-up specimens on sea shores in the same regions and light trap catches in different southern locations, it is likely that the Danish *H. axyridis* originate from Germany and/or Poland. Yet, an independent introduction to Denmark from outside Europe cannot be excluded at present as the relative frequency of colour forms in Denmark differs from that found in other parts of Europe (Steenberg & Harding, 2008, Nedved et al., 2008).

Fig. 3. *Adalia decempunctata* f. *decempunctata* (Photo: N. V. Meyling). This abundantly occurring colour form of the 10-spotted ladybird is the main cause of misidentification of *H. axyridis*. *A. decempunctata* is markedly smaller than *H. axyridis* (3.5–5mm).

Fig. 4. Larvae of *Harmonia axyridis* on thistle, July 2008 (Photo: T. Steenberg).

Dispersal rate. Compared to the UK, the dispersal within Denmark appears to have been rather slow. In the UK, the species has on average spread northwards 58 km per year and westwards 144.5 km per year (Brown et al. 2008b). The hotspot discovered in Copenhagen in late autumn 2007 was restricted to the central parts of the city and to adjacent neighbourhoods, with single specimens being reported from outer suburbs. From the center of Copenhagen, where large populations developed in spring 2008, the species has now spread to locations at a distance of up to only 30 km.

The major spread of the population occurs as migratory flight in spring and autumn when the adults leave and seek to overwintering sites, respectively (Koch, 2003). Additional dispersal takes place in summer as a result of food depletion in spring habitats. *H. axyridis* was sighted frequently in central Copenhagen in May and June 2008 until aphid populations collapsed. After this, numbers decreased significantly in the locations surveyed and most likely the adults, like other generalist coccinellid species, dispersed into the rural landscape in search of food. In addition, transport at distances of up to 25 km of *H. axyridis* larvae, dropped from trees onto parked vehicles, has been observed after driving at speeds up to 95 km/h (P. Esbjerg, pers.comm.).

***Phenology and voltinism: a year with* H. axyridis**

The winter 2007-2008 provided ample opportunity to initiate studies of the phenology of *H. axyridis*, because the temperatures and dense aphid populations on *Acer* and other

Fig. 5. *Harmonia axyridis* f. *succinea*, dark autumn colouration (Photo: S. Harding).

woody plants benefited the activity and development. Hundreds of adults and larvae were observed to be active until 19 December. As long as aphids were present *H. axyridis* fed on available food. Small larvae were encountered in November. Also, pupation took place in late autumn and adults emerging from pupae were observed throughout November. Compared to adults emerging in summer, these individuals were very dark. The dark spots on the elytra of f. *succinea* were enlarged, frequently merging into large dark areas (Fig. 5), and in the case of the melanic colour forms, the red spots were sometimes hardly discernible. All live pupae observed at the end of November (several thousand specimens) died during winter.

Aggregations of *H. axyridis* overwintering outdoors were located (in cracks and crevices of tree trunks, on iron fence posts and statues (Fig. 6), in dead leaves at the base of trees) and were observed at intervals throughout the winter. These clusters allowed easy observation of the exact time the ladybirds resumed activity in spring 2008.The first active

Fig. 6. Aggregation of *Harmonia axyridis* overwintering on statue, January 2008 (Photo: T. Steenberg).

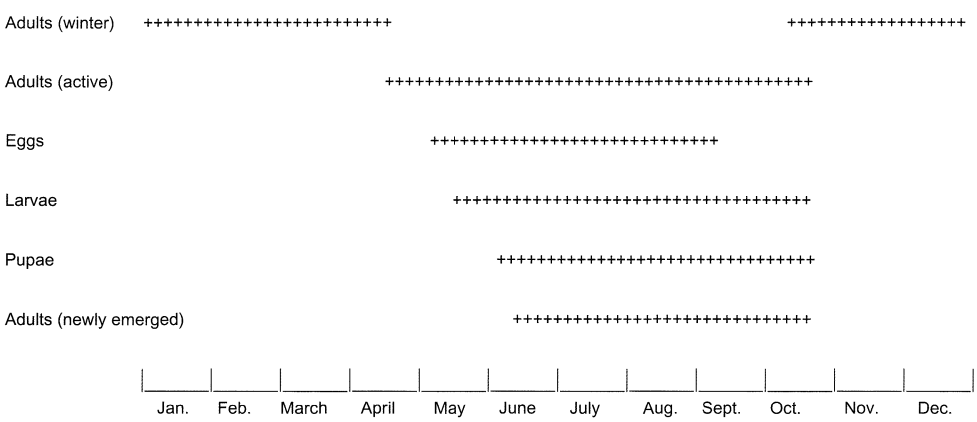

Fig. 7. The phenology of *Harmonia axyridis* observed in Copenhagen in 2008. 'Adults (active)' denotes the finding of actively moving adults in outdoor locations, while 'Adults (winter)' are adults found indoors or found in an inactive state outdoors.

H. axyridis was observed on 19 April 2008. Eggs were found 4 May, and the first large larvae (L3 and L4) were sighted 28 May. Pupae were frequent from 2 June onwards, and emergence of adults of the new generation was recorded from 12 June onwards, i.e. 39 days after the first observation of eggs (Fig. 7).

Throughout late June to July all life stages were observed on herbaceous plants, among others *Circium*, *Humulus* and Cruciferae (Table 2). From mid-August larvae, pupae and newly emerged adults were recorded in reed beds and on oak trees. Eggs were last being observed in early September and last-instar larvae, pupae and emerging adults until 25 October. Adults were reported from inside buildings from mid-October onwards.

The population overwintering in 2008-2009 appeared to be markedly lower than the previous year. Only few outdoor locations in Copenhagen with outdoor overwintering adults were located. This is also reflected in fewer reports of *H. axyridis* overwintering indoors and in lower numbers of individuals reported from the private households that harboured *H. axyridis* the previous winter.

From our observations we suspect that *H. axyridis* develops two generations per year with a possibility of a third generation in warm years. The first generation is initiated in early May and emerges from mid-June onwards. Newly emerged adults observed in mid-August most probably represent a second generation originating from eggs laid by the first generation adults in late June–early July. In 2008, the last adults emerged in late October. The occurrence of small and large larvae in November 2007 demonstrates that reproduction may take place late in the season, if temperature levels and food supply allows. Unfortunately, no phenological observations are available from spring or summer 2007. Therefore, at present it remains an open question whether a third generation was produced in 2007 or 2008.

In laboratory experiments, the number of degree days (DD) required to complete development from egg to adult has been found to range between 231 (above a developmental threshold of 10.5°C) and 267 (developmental threshold 11.3°C). Including an arbitrary thermal sum for the preoviposition period, a thermal sum of 330 DD (above 10.5°C) has been used in calculations of completion of a total life cycle (Poutsmaa et al., 2008). According to calculations based on this temperature sum and using daily mean temperatures from recordings from Copenhagen, only two generations could develop in 2007 and 2008 (2007: 857,1 DD; 2008: 897,3 DD). However, the observed phenology

in 2008 is not in accordance with the predictions: based on DD calculations, adults of the new generation would emerge on 5 July, but were observed 23 days earlier (after 205 DD above 10.5°C). Several factors may explain this discrepancy: the arbitrary thermal sum of the preoviposition period may be too high yielding an overestimation of the total thermal sum of 330 DD, temperature requirements of the Danish population may differ from previous findings, or the actual temperature experienced by *H. axyridis* at the breeding sites may differ from the temperature recordings used in the calculations of temperature sums. Further, due to the high developmental temperature threshold a bias may arise from DD calculations based on daily mean temperatures: warm days in spring with cold nights may add significantly to the accumulation of the thermal sum, although the daily average temperature may not exceed 10.5°C. Hence, the emergence of the new generation may occur earlier than predicted. In 2007, day temperatures in spring were very high, and the activity and subsequent development of *H. axyridis* may have started earlier than anticipated from DD calculations. The occurrence of high numbers of larvae and pupae in late autumn 2007 therefore may indicate the occurrence of a third generation. Further data collection over the next years will hopefully provide an answer to this question.

Bivoltinism is consistent with reports from most of the distribution area, including Europe (Roy and Wajnberg, 2008). The occurrence of larvae and pupae in November and December has also been observed in the UK (Brown & Roy, 2007). Development of a partial third generation is mentioned from other continents (Iablokoff-Khnzourian, 1982; LaMana & Miller, 1996), and from Southern Europe, four generations were obtained in a cage experiments (Bazzocchi et al., 2004; Katsoyannos et al., 1997). Irrespective of the number, generations are overlapping as is also demonstrated by our observations.

Natural enemies

Few natural enemies have been reported from populations of *H. axyridis* outside its native range and enemy escape could be a factor contributing to the high invasiveness of the species (Roy & Cottrell, 2008). We have recorded two groups of natural enemies which are shared with native coccinellid species. Two adult *H. axyridis* have been found parasitized and carrying a cocoon ventrally between the legs (D.V. Dimitrova, pers. comm.). The parasitoid never emerged, but is assumed to be *Dinocampus coccinellae*, the only hymenopteran parasitoid documented from *H. axyridis* (Hodek & Honěk, 1996; Roy & Cottrell, 2008). In addition, five species of mitosporic fungi known to be entomopathogens have been isolated from dead larvae, pupae and adults of *H. axyridis* (Steenberg & Harding, 2009).

Will* H. axyridis *become the dominant coccinellid species?

Reports from North America indicate that *H. axyridis* threatens native biodiversity and that it may have a negative impact on other coccinellids, especially through intraguild predation (see reviews in Roy & Wajnberg, 2008). The harlequin ladybird can become the dominant coccinellid within a few years after having established in an area (Colunga-Garcia & Gage, 1997). However, dominance within the coccinellid guild does not necessarily imply that other species of ladybirds, other aphidophagous insects or native arthropods in general are being affected adversely, and correlations found in observational studies of coccinellid assemblages do not demonstrate causality (Harmon et al., 2007).

We have collected data from a number of indoor locations 2007/2008 and 2008/2009 harbouring *H. axyridis* and other coccinellids, mainly *A. bipunctata*, for comparison of relative numbers. Further, sampling of coccinellids in spring and summer in a number of survey locations has been initiated. In August 2008 *H. axyridis* constituted almost 84% of the coccinellids sampled in reeds (N = 323) and 47% in oak (N = 147). This

dominance in late summer likely reflects the bivoltinism of the species, as more individuals are produced compared to indigenous, univoltine species. However, population densities of coccinellid species fluctuate and long time series are needed to evaluate the ecological consequences of the introduction of *H. axyridis* into the Danish fauna. Our data represent a starting point and data collected in the coming years will show whether *H. axyridis* becomes the dominant coccinellid in Denmark.

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Vi efterlyser fortsat fund af voksne *H. axyridis*, men fokuserer i 2009 særligt på fund af larver og pupper. Der sættes også fokus på fund af den sjældne farveform forma *axyridis*. Elektronisk indberetningsskema og yderligere oplysninger om arten kan findes på www.dpil.dk.