

**Rapid range expansion of Ligurian leafhopper,  
*Eupteryx decemnotata* Rey, 1891 (Hemiptera: Cicadellidae),  
a potential pest of garden and greenhouse herbs, in Europe**

**Быстрое расширение ареала лигурийской цикадки, *Eupteryx decemnotata* Rey, 1891 (Hemiptera: Cicadellidae), потенциального вредителя садовых и оранжерейных растений в Европе**

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**ABSTRACT.** Data on range expansion of the typhlocybid leafhopper *Eupteryx decemnotata* Rey, 1891 in Europe are compiled. Until the mid 1980s the species was known only in Mediterranean regions of France and Italy, but during the last decade it has been found in Portugal, Switzerland, Austria, Slovenia, Greece, southern Britain and large parts of Germany. Invasion into most parts of central Europe and Britain only since the 1990s is well documented, whereas populations from Greece and Portugal may be indigenous. The species is oligophagous on sage (*Salvia officinalis*), catmint (*Nepeta x faassenii*), rosemary (*Rosmarinus officinalis*) and other aromatic species of Lamiaceae. Increased feeding can weaken host plants and damage has been reported on cultivated sage and rosemary. Dispersal occurs probably largely by commercial trade of infested plants.

**РЕЗЮМЕ.** Собраны данные по распространению *Eupteryx decemnotata* Rey, 1891 в Европе. До середины 1980-х вид был известен только из средиземноморских районов Франции и Италии, но уже в течение прошлого десятилетия вид был обнаружен в Португалии, Швейцарии, Австрии, Словении, Греции, Южной Великобритании и на большей части Германии. Проникновение вида в большинство стран Центральной Европы и Великобританию хорошо документировано только начиная с 1990-х, в то время как популяции в Греции и Португалии могут быть туземными. Вид является олигофагом шалфея (*Salvia officinalis*), кошачьей мяты (*Nepeta x faassenii*), розмарина (*Rosmarinus officinalis*) и дру-

гих ароматических видов семейства Lamiaceae. Интенсивное питание насекомого может ослабить кормовое растение, были отмечены повреждения культурного шалфея и розмарина. Вероятно, распространение вида происходит в значительной степени благодаря коммерческой торговле пораженными растениями.

### Introduction

In 1891 the French zoologist Claudius Rey described a number of planthoppers and leafhoppers, including a taxon, which he considered only as a variety of *Eupteryx putoni* Lethierry, 1876, which in turn is now treated as a younger synonym of *E. zelleri* (Kirschbaum, 1868) [see Ribaut, 1936; Nast, 1972]. The original name of the taxon was *Eupteryx putoni* var. *10-notata* Rey, 1891; its description comprised only a single phrase, stating that there are no differences from the typical form except the presence of altogether 10 (instead of 6) patches on vertex and face [Rey, 1891]. St. Raphael (Var) and Collioure (Pyrénées-Orientales) were stated as type localities. Later Ribaut [1936], after studying extensive material, concluded that the ten-spotted form clearly constituted a distinct species occurring sympatrically with *E. zelleri* (Kbm.) in large parts of southern France. Accordingly, the main differences were the shape of the aedeagus and the colouration of the head, notably the number and shape of the black patches on vertex and face.

In Italy the first records date from the end of the 1920s from the Ligurian Sea island of Capraia [Mancini,

1935], and later, the species was recorded in Emilia, Tuscany, and on the island of Sardinia [see Servadei, 1967]. After D'Urso [1995], it is now known to be widespread all over Italy. Günthart [1987] published the first record from Switzerland (Mittelland near Horriwil, 1983). The first record from Greece dates from 1988 [Drosopoulos et al., 1989], and very recently, material collected in coastal southern Portugal (Faro, Cacela Velha, 28.IV.2004) by the first author revealed another population, thus extending the species' known range considerably.

The first German record dates from 1989 [Remane, 1995], and more recently, it was published from Kromberk and Panovec, both Slovenia [Holzinger & Seljak, 2001], Basel, Switzerland [Mühlethaler, 2001], near Colmar, eastern France [della Giustina & Balasse, 1999] and Ascot and Wisley, both southern Britain [Maczey & Wilson, 2004].

### Identification

The species can be easily distinguished from all other congeners by the head colouration (Figs 5, 7, 10), notably by the constant presence of 5 pairs of black spots visible from anteriorly. The extent of these spots may vary, however, and in strongly pigmented specimens, neighbouring spots on the vertex may be fused. On this basis, Ribaut [1936] has described a number of varieties, which are probably the result of mere intraspecific variation, without any taxonomic significance. Even in the closely related *Eupteryx zelleri* (Kbm.) the number of spots does not exceed 6 (Figs 6, 8, 9, 11), and these spots do never show any tendency of merging. Further, in our specimens, the aedeagus is similar to that of *E. zelleri* (Kbm.), but the dorsal side is more evenly curved, without any step-like concavity, with a shorter subapical process directed towards the basis (see Figs 1, 3). The apical part of the shaft shows serrated (not smooth) lateral ridges and is barely wider than the appendages, which are moderately curved (Fig. 2). In *E. zelleri* (Kbm.), however, the apical part of the shaft is smooth laterally and broader, about 3 times as wide as the appendages, which are more strongly curved (Fig. 4). Fig. 12 shows an adult specimen, Fig. 13 shows a nymph.

### Habitat, host plants and phenology

Many species of the genus *Eupteryx* show a general preference of aromatic plants such as members of the Lamiaceae and, to a lesser extent, Asteraceae and Malvaceae [Stewart, 1988; Nickel & Remane, 2002]. Compared to leafhopper guilds on other plant families, oligophagy prevails in the Lamiaceae guild, i.e. most leafhopper species utilise a rather broad range of host species *within* the plant family [Nickel, 2003].

For *Eupteryx decemnotata* Rey, Vidano [1964] mentions aromatic species of Lamiaceae on Sardinia, and

Vidano & Arzone [1978] specify *Rosmarinus officinalis* and *Salvia officinalis* from Piedmont. The latter is also quoted from Sicily, the Swiss Mittelland and southern Britain [Guglielmino, 1993; Günthart, 1987; Maczey & Wilson, 2004]. Two garden populations in Mediterranean parts of Slovenia lived on *Melissa officinalis* and *Origanum vulgare* [G. Seljak, pers. comm.]. Drosopoulos et al. [1989] found it on *Rosmarinus officinalis* and *Majorana hortensis* in Greece. Mittaz et al. [2001] reported large populations also on *Rosmarinus officinalis* in the Valais (Switzerland).

In central Europe the main host plants are clearly *Salvia officinalis* and *Nepeta x faassenii* (Table); in further occasions, populations were found on cultivated thyme (*Thymus vulgaris*), balm (*Melissa officinalis*) and pepper mint (*Mentha x piperita*). Thus *Eupteryx decemnotata* Rey must be regarded as oligophagous on various aromatic species of Lamiaceae, with a regional preference of *Salvia officinalis* and *Nepeta x faassenii*.

According to the present data (see Table), the species overwinters in the egg stage. In central Europe adult specimens were found from the beginning of June to the end of October, indicating at least two generations. Records of freshly emerged individuals of the second generation date from mid July, and thus, a third generation seems possible. In southern Europe, including southern Switzerland and Austria, the first adult individuals were recorded from mid April onwards [Mittaz et al., 2001], but may probably be found earlier, and later than October, indicating three or more generations in these regions. On potted rosemary brought indoor in Graz (Austria), insects were also found in winter [B. Komposch, pers. comm.], and there are several greenhouse December records on potted sage from the vicinity of Göttingen (Germany).

### Range expansion

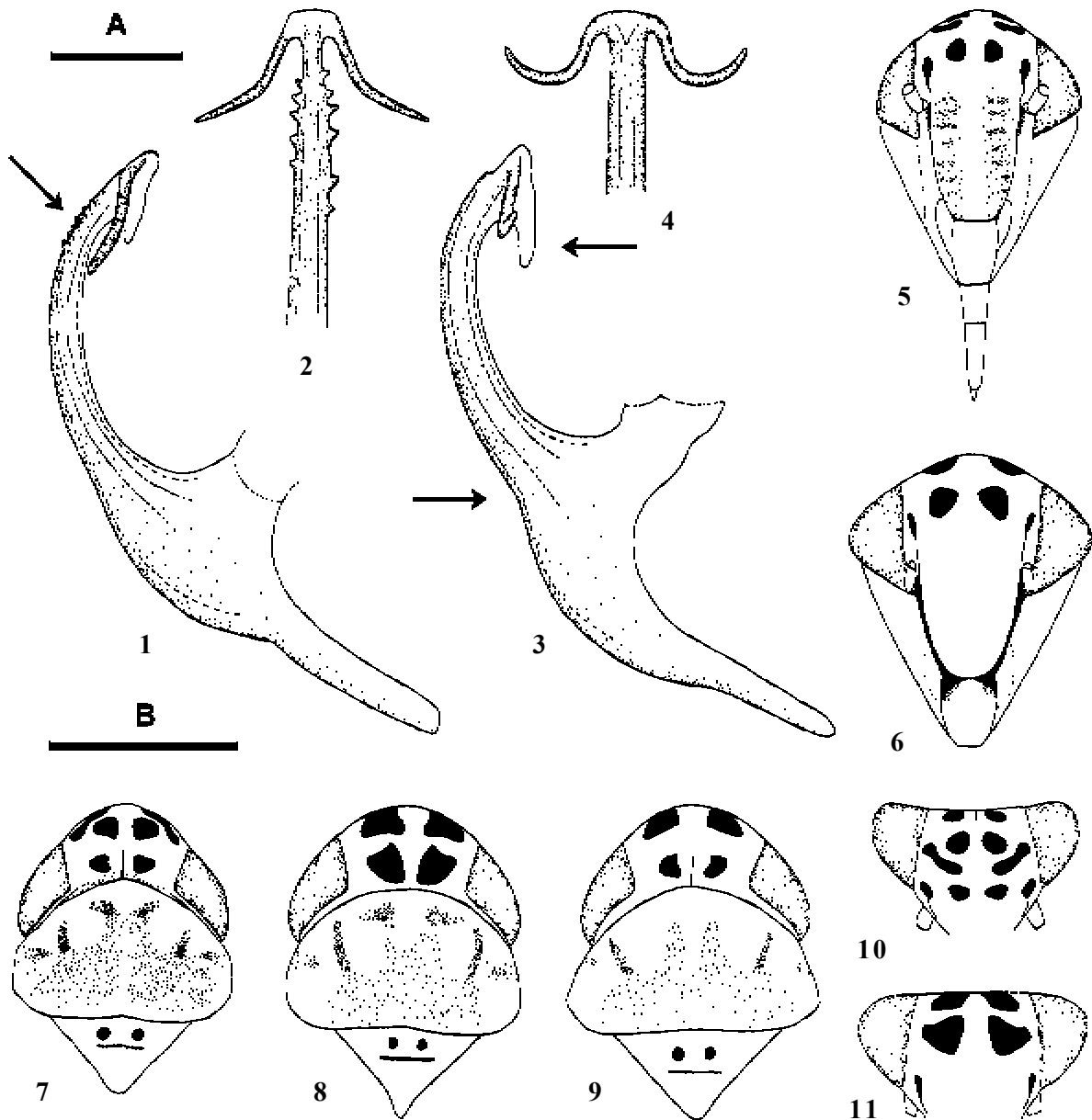
According to our data the species has colonised entire central Europe within less than 20 years (Fig. 14). The earliest German record was gathered in the southwestern parts (upper Rhine plain near Speyer) in 1989. From then on, the species has been found in numerous localities (see Table) and is apparently expanding its range rapidly. Currently known localities at the north-eastern border include Cologne, Münster, Wilhelmshaven, Oldenburg, Lübeck, the Baltic Sea island of Fehmarn, Berlin and Erfurt, but it is likely that almost all larger lowland cities have been colonised. In Austria its distribution is less well known, but there are records from Graz and Vienna dating from 1994, and the species has probably become much more widespread since then.

Although the leafhopper fauna is generally little known in central and northern parts of Europe, evidence of a recent range expansion of *Eupteryx decemnotata* Rey is convincing. Garden herbs have been frequently sampled by Kuntze [1937], Ossiannilsson [1981], Nowacka & Adamska-Wilczek [1972] and Stewart [1988]. Further, W. Wagner, H.-J. Müller and R.

Remane had an eye on these plants over many years and made remarks about their leafhopper fauna in several publications, without any note on this species [e.g. Wagner, 1939; Müller, 1956; Remane & Fröhlich, 1994].

Moreover, three of the sites listed below were apparently not infested some years earlier (see Table).

Dispersal is probably strongly enhanced by trade and transport of catmint, which has become a wide-



Figs 1–11. *Eupteryx* spp. 1, 2, 5, 7, 10 — *Eupteryx decemnotata* Rey, 1891. 3, 4, 6, 8, 9, 11 — *Eupteryx zelleri* (Kirschbaum, 1868). 1 — aedeagus, lateral view (Germany: Würzburg, 1994, leg. Nickel); 2 — apex of aedeagus, dorsoventral view (same specimen as Fig. 1); 3 — aedeagus, lateral view (France: Cogolin, 1994, leg. della Giustina); 4 — apex of aedeagus, dorsoventral view (same specimen as Fig. 3); 5 — face of female (Germany: Würzburg, 1994, leg. Nickel); 6 — face of male (Slovenia: Lijak, 2002, leg. Seljak); 7 — head and fore body, dorsal view (same specimen as Fig. 5); 8 — head and fore body of female, dorsal view (Italy: San Vigilio, 1914, coll. NHM Vienna); 9 — head and fore body of male, dorsal view (same specimen as Fig. 6); 10 — apex of head (same specimen as Fig. 1); 11 — apex of head (same specimen as Fig. 8). Scale bar: A — 0.005 mm for Figs 1–4; B — 0.5 mm for Figs 5–11.

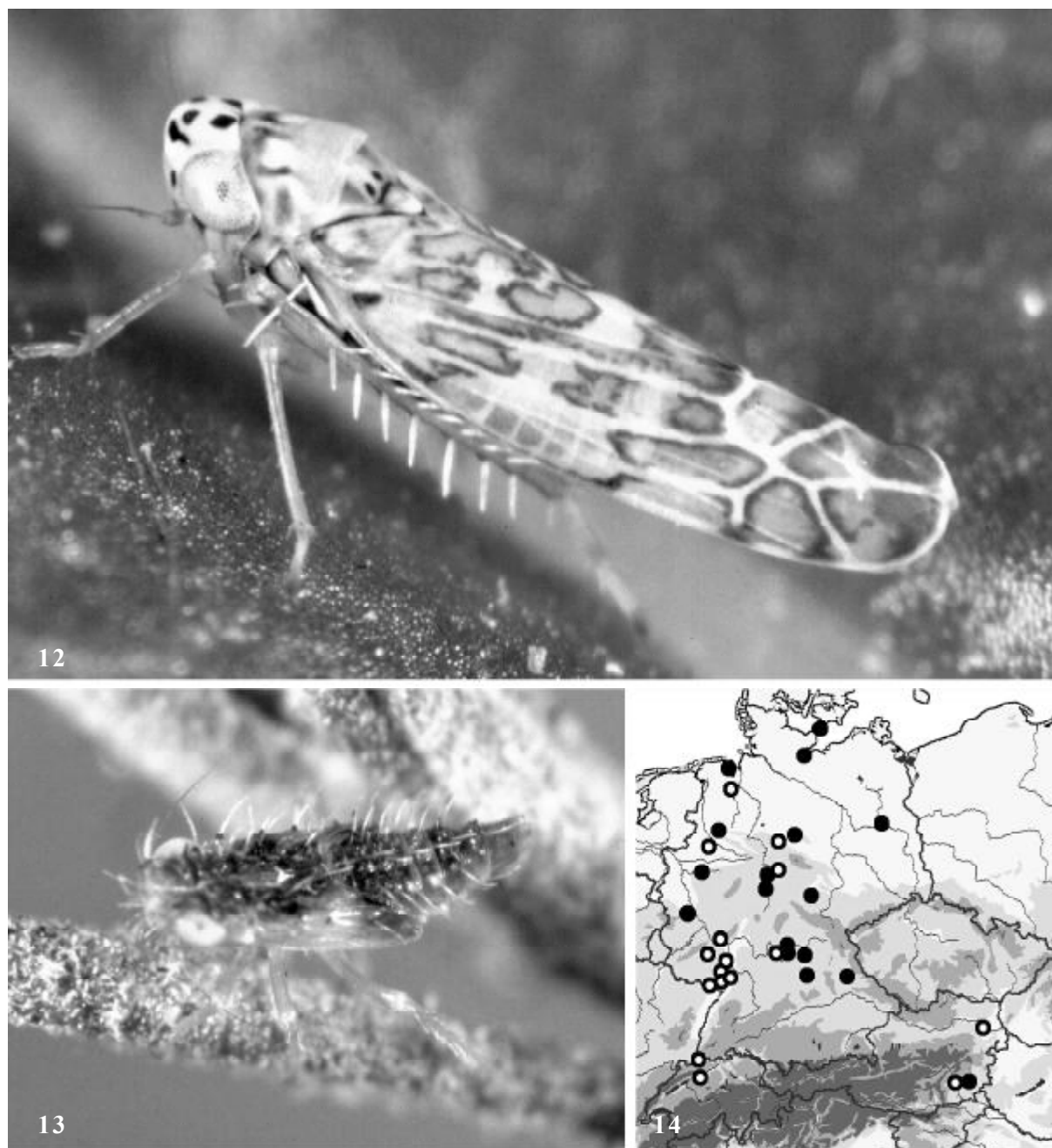
Рис. 1–11. *Eupteryx* spp. 1, 2, 5, 7, 10 — *Eupteryx decemnotata* Rey, 1891. 3, 4, 6, 8, 9, 11 — *Eupteryx zelleri* (Kirschbaum, 1868). 1 — эдеагус, сбоку (Германия: Вьрцбург, 1994, лег. Nickel); 2 — вершина эдеагуса, снизу (тот же экземпляр как и на Рис. 1); 3 — эдеагус, сбоку (Франция: Соголін, 1994, лег. della Giustina); 4 — вершина эдеагуса, сверху (тот же экземпляр как и на Рис. 3); 5 — лицо самки (Германия: Вьрцбург, 1994, лег. Nickel); 6 — лицо самца (Словения: Лижак, 2002, лег. Seljak); 7 — голова и передняя часть тела, сверху (тот же экземпляр как и на Рис. 5); 8 — голова и передняя часть тела самки, сверху (Италия: Сан Вигилио, 1914, coll. NHM Vienna); 9 — голова и передняя часть тела самца, сверху (тот же экземпляр как и на Рис. 6); 10 — вершина головы (тот же экземпляр как и на Рис. 1); 11 — вершина головы (тот же экземпляр как и на Рис. 8). Масштаб: А — 0.005 мм для Рис. 1–4; В — 0.5 мм для Рис. 5–11.

Table. New records of *E. decemnotata* Rey in Europe north of the Alps, in chronological order, only first records per site listed\*  
 Таблица. Новые указания *E. decemnotata* Rey из Европы к северу от Альп в хронологическом порядке, перечислены только первые указания\*

Locality	Country	Date	Host plant	Habitat	Remarks
Horriwil	CH	VII.1983	<i>Salvia officinalis</i>	Garden	Günthart 1987
Speyer	D	1989/1990			Remane [1995]
E.t.ville	D	05.VI.1993	<i>Melissa officinalis</i>	Private garden	Remane & Fröhlich [1994]
Langenzersdorf (near Vienna)	A	07.VII.1994	<i>S. officinalis</i> , <i>Ocimum basilicum</i>	Market garden	leg. A. Kahrer
Würzburg	D	15.VIII.1994	<i>Nepeta x faassenii</i> , <i>S. officinalis</i> , <i>Thymus</i>	Botanical Garden	
Graz	A	1994		Roof garden	leg. A. Kahrer
Lorsch	D	10.VI.1995		Monastery garden	Remane [1995]
Neustadt/Weinstrasse	D	16.VII.1995	<i>S. officinalis</i>	Private garden	
Wachenheim/Weinstrasse	D	16.VII.1995	<i>S. officinalis</i>	Museum garden	
Neustadt/Weinstrasse	D	18.VII.1995		Abandoned vineyard	
Wachenheim/Weinstrasse	D	VII.–X.1995		Abandoned vineyard	in Malaise traps
Schloßböckelheim	D	IX.–X.1995		Abandoned vineyard	in Malaise traps
Göttingen	D	03.X.1997	<i>S. officinalis</i>	Botanical Garden	not infested in 1994
Oldenburg	D	16.VII.1998		Greenhouse	leg. M. Hommes
Albersweiler	D	12.VIII.1999	<i>S. officinalis</i>	Private garden	
Göttingen	D	22.IX.1998	<i>N. x faassenii</i>	Roadside flowerbed	
Münster	D	25.X.1999		Medical garden	leg. M. Hommes
Basel	CH	2000		Inner city	Mühlethaler [2001]
Hildesheim	D	2000		Private garden	leg. T. Fechtler
Erfurt	D	04.VII.2001	<i>N. x faassenii</i>	Private garden	
Forchheim	D	23.VII.2001	<i>S. officinalis</i>	Private garden	
Bamberg	D	27.VII.2001	<i>N. x faassenii</i>	Flower box	
Berlin, Hackesche Höfe	D	17.IX.2001	<i>N. x faassenii</i>	Courtyard	
Schweinfurt	D	06.X.2001	<i>S. officinalis</i>	Private garden	not infested in 1993 and 1994
Gernach	D	09.X.2001	<i>S. officinalis</i>	Private garden	not infested in 1994
Neustadt/Waldnaab	D	2001	<i>S. officinalis</i>	Supermarket	
Ascot, Berkshire	UK	VIII.2002	<i>S. officinalis</i>	Potted plant	Maczye & Wilson [2004]
Wisley Gardens, Surrey	UK	X.2002	<i>S. officinalis</i>		Maczye & Wilson [2004]
Harste	D	04.X.2002		Greenhouse	
Langenzersdorf (near Vienna)	A	2002	<i>Rosmarinus officinalis</i>	Greenhouse	leg. A. Kahrer
Graz	A	2003, 2004	<i>R. officinalis</i>	Private garden	leg. B. & C. Komposch
Göttingen	D	06.VIII.2004	<i>Mentha x piperita</i>	Private garden	
Wilhelmshaven	D	2004	<i>S. officinalis</i>	Ornamental flowerbed	
Hübenthal	D	24.VII.2005	<i>S. officinalis</i>	Private garden	
Erfurt	D	30.VIII.2005	<i>M. officinalis</i>		leg. M. Hommes
Gleisdorf, Nitscha	A	VIII.2005	<i>S. officinalis</i>	Private garden	leg. K. & S. Dvorak
Hildesheim	D	IX.2005	<i>M. officinalis</i> , <i>M. x piperita</i>		leg. M. Hommes
Braunschweig	D	IX.2005	<i>M. officinalis</i> , <i>M. x piperita</i>	Nursery	leg. M. Hommes
Burg, Isle of Fehmarn	D	12.X.2005	<i>N. x faassenii</i>	Roadside flowerbed	
Lilbeck, Niendorfer Strand	D	15.X.2005	<i>N. x faassenii</i>	Roadside flowerbed	
Breckerfeld	D	26.X.2005	<i>S. officinalis</i>	Potted plant on garden terrace	photo A. Steiner
Bad Neuenahr, Esch	D	2005	<i>M. officinalis</i>	Medical garden	leg. A. Schneider
Bersenbrück	D	2005	<i>S. officinalis</i> , <i>R. officinalis</i> , <i>Thymus vulgaris</i>	Public garden	leg. E. Melzer

\* leg., det. et in coll. Nickel, if no other source given; A — Austria, CH — Switzerland, UK — United Kingdom.

\* материал собран и определен Никелем и хранится в его коллекции если нет других указаний; A — Австрия, CH — Швейцария, UK — Великобритания.



Figs 12–13. *Eupteryx decemnotata* Rey: 12 — adult specimen; 13 — nymph (photo: K. Schrameyer).

Рис. 12–13. *Eupteryx decemnotata* Rey: 12 — имаго; 13 — личинка (фото: К. Шрамейер).

Fig. 14. Records of *Eupteryx decemnotata* Rey in central Europe. Open circles show records until 2000, closed circles those afterwards. Shaded areas of the map are higher than 200 m.

Рис. 14. Указания *Eupteryx decemnotata* Рей из Центральной Европы. Незакрашенные внутри кружки показывают указания вида до 2000 г, закрашенные кружки — последующие указания. Затемненные участки карты соответствуют высотам более 200 м.

spread ornamental plant in urban areas of large parts of Germany during the recent decade. Additionally, alive individuals have been repeatedly found on sage plants sold on markets and even in shops.

In the Mediterranean region, however, the question of range expansion must remain open. At least rosemary and sage as two of the main hosts are widespread native

plants. One of the Greek localities is situated at 1200 m [Drosopoulos pers. comm.]. Ribaut [1936] mentions the highest record from 1.600 m in southern France, suggesting an indigenous occurrence, whereas the Portuguese and at least some of the Italian records were gained in planted public or private green. According to relatively early records, before major development of herbal trade

in the 20th century, the species is probably native at least in most parts of Italy and southern France, although cultivation and trade of host plants may have contributed to an expansion also within this area.

### Economic importance

Like most typhlocybid leafhoppers, this species feeds on mesophyll tissue. Feeding mechanisms, notably stylet function, have been described in detail for the closely related *Eupteryx melissae* Curt. on sage [Polard, 1968, 1969]. Accordingly, the stylet penetrates intracellularly into the leaf body, and cell contents of the palisade and spongy parenchyma are ingested. Afterwards, damaged space becomes filled with air, resulting in the characteristic whitish feeding marks visible on the leaf surface, commonly known as typhlocybid stippling.

Densities of *Eupteryx decemnotata* Rey can be very high, and thus, the species has the potential to damage and even kill host plants. In the course of the summer, the areas of stippling marks increase and fuse, resulting in partial leaf necrosis and weakening of plants. Considerable infestations and strong stippling of leaves has been found in many of the German localities, notably on sage and catmint. Severe damages on rosemary have been reported from southern Europe. In southern Greece, single plants in a garden were killed by this insect [Drosopoulos, pers. comm.]; in Valais, southern Switzerland, the species has been causing substantial yield losses in greenhouse tunnels since the end of the 1990s [Mittaz et al., 2001]. Another population on potted rosemary in Graz caused severe leaf necrosis in summer, but plants were killed only in winter indoor [B. Komposch, per. comm.].

However, there is a number of congeneric species, which are also frequently found on cultivated catmint and sage, notably *Eupteryx melissae* Curt., *E. florida* Rib., and less frequently — *E. atropunctata* (Goeze), *E. aurata* (L.), *E. zelleri* (Kbm.) and the yellowish *Emelyanoviana mollicula* (Boh.). Further cultivated members of the Lamiaceae attacked by at least some of these leafhoppers include balm (*Melissa officinalis*), oregano (*Origanum vulgare*), garden thyme (*Thymus vulgaris*), motherwort (*Leonurus cardiaca*) and peppermint (*Mentha x piperita*) — for more details see Nickel [2003]. Thus, in many cases damages are probably caused by a mixture of *Eupteryx* species and other typhlocybine leafhoppers.

### Conclusions and perspectives

The species is also highly likely to occur in other parts of Europe such as Belgium, the Netherlands, Denmark, Poland, the Czech Republic, Hungary, Croatia, Albania, Spain and perhaps even Sweden and other northern countries. On market sales, potted plants of *Salvia* and *Nepeta* frequently show stippling marks of typhlocybid leafhoppers. Thus, range expansion is cer-

tainly favoured by increased trade and transportation of ornamental and medicinal plants through Europe, which has dramatically increased during recent years. Interestingly, almost all populations to the north of the Alps seem to live synanthropically (see Table), although in southwestern Germany a few were found in abandoned vineyards away from human settlements. This might lead to the prediction that natural or near-natural habitats will not be colonised. In addition, some large *Nepeta* stands were checked in the German foothills of the Alps at 800 m, without any positive record. However, *Eupteryx decemnotata* Rey feeds on numerous labiate host species and may have the potential to expand its host and habitat range in future, and colonisation of higher altitudes may merely be a matter of time.

At least in central Europe a less dramatic and less rapid range expansion is also likely to have occurred in *Eupteryx melissae* Curt. [see Nickel, 2003]. In contrast to *E. decemnotata* Rey, however, this species is known from Germany at least since 1910 [Schiemenz, 1990, vid. Nickel]. Most — if not all — resident populations apparently live in human settlements. Population densities on sage and catmint are often high, but the species is also found on motherwort (*Leonurus cardiaca*) and, in the second generation, on marsh mallow (*Althaea officinalis*), the latter belonging to the Malvaceae, but sharing ethereal oils with the Lamiaceae. Furthermore, literature host records include *Mentha*, *Marrubium* [Schiemenz, 1990], *Melissa officinalis*, *Lavatera arborea* and *Althaea rosea* [Stewart, 1988].

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