Alien Heteroptera in Belgium: a threat for our biodiversity or agroforestry?*

Michel Dethier & Frédéric Chérot

Abstract
During the two past decades, various nonindigenous species of Heteroptera (Insecta, Hemiptera) were collected for the first time in Belgium. We provide an annotated checklist of these exotic species and we briefly discuss the potential consequences of their presence in our country.

Keywords: Hemiptera, Heteroptera, Belgium, alien species.

Kurzfassung
Exotische Wanzen (Insecta: Heteroptera) in Belgien: Eine Bedrohung für unsere Artenvielfalt oder Land- und Forstwirtschaft?
Während der letzten beiden Jahrzehnte sind mehrere nichteinheimische Arten von Wanzen (Insecta: Heteroptera) neu in Belgien aufgetreten. Wir stellen diese Arten mit kurzen Kommentaren vor und besprechen kurz die möglichen Auswirkungen ihres Auftretens in Belgien.

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Introduction

Ten years ago, Baugnée et al. (2003) published a list including 624 species of Heteroptera (Insecta, Hemiptera) for Belgium. Today, the specific richness of our fauna is higher. The family Miridae alone accounts at least 15 additional species. Among these new species for the country, we observe numerous "exotic" species, most of them originating from the Mediterranean region, the remainder coming from other continents, including North America and Southeast Asia.
Several recent changes in the local Heteropterofauna – including arrival of alien species – were documented and analyzed in European e.g. Austria (Rabitsch 2008), Great Britain (Kirby et al. 2001), The Netherlands (Aukema 2003) and foreign countries e.g. Canada (Wheeler et al. 2006). The estimation of the magnitude of these changes, their causes, and their ecological consequences are not always easy to establish. Some authors proposed a methodological approach, dividing the set of all species of an area or country into different categories (Kirby et al. 2001, Dethier & Baugnée 2002):

– Species known for a long time, without significant alterations of occurrences and distribution.
– Species known for a long time (for example: XIXth century) but that appear to have recently expanded or reduced their range.
– Species recently discovered but known for many years in the surrounding areas and probably overlooked in the past (for taxonomical or biological reasons).
– Finally "exotic" species recently arrived. The exotic species could have been introduced by man, voluntary or accidentally, or could have altered their range themselves. They can be classified according to their origins or according to the stage of their colonization (first arrival, establishment of a viable population, expansion of the species etc.).

In the present work, we focus on this last category. We provide an annotated checklist of the exotic species collected in Belgium during the two past decades presented by chronological order of the first occurrence and we briefly discuss the potential consequences of their presence in our country.

Results

Nezara viridula (Linnaeus, 1758) (Pentatomidae). This big green bug was reported in Belgium for the first time by Schmitz (1986), who found a male collected in Auderghem in 1950! Later Gallant (1996) and Dethier & Gallant (1998) published six additional occurrences. Nowadays, specimens are frequently found in student collections preserved at AgroBioTech (Gembloux) or mentioned on several Internet Web sites.

* Dr. Christian Rieger, honouring his 70th birthday.

This bug is now present in all the tropical and subtropical regions (Indo-australian, Ethiopian, Nearctic and Palearctic). In Europe, the species is reported from the whole Mediterranean basin and the Balkan region. It is a pest on cultivated plants favored by tropical green-houses, probably introduced in numerous areas by importation of fruits and vegetables, but is also able to colonize remote places due to its flying abilities.

Deraeocoris flavilinea (Costa, 1860) (Miridae). Collected for the first time in Belgium in 1994, this bug was regarded as endemic in Italy until its recent extension in Western Europe (Chérot 1998).

Tuponia hippophaes (Fieber, 1861) (Miridae). Collected for the first time in Belgium on *Tamarix sp.* in great numbers at De Panne, West Flanders in August 2003 (Chérot & Baugnée 2004); also recently found in the province of Namur (Claerbout leg. and in litt.). Originating from the Mediterranean basin, Eastern and Central Europe and living on *Tamarix* spp. – a genus not indigenous in Belgium, sometimes planted in gardens.

Stephanitis takeyai Drake & Maa, 1955 (Tingidae). Observed first in Belgium in 2003 and 2004 in the provinces of East Flanders, Antwerp and Limburg (Aukema et al. 2005a); the species has been known in Europe since 1994 (Aukema 1996). This Japanese bug lives on *Pieris japonica*, an ornamental plant frequently imported for gardening. Presently *S. takeyai* is present in India, North America and, in Europe, in The Netherlands, Belgium, Italy, Germany and Great Britain. The sucking induces yellowing and leaf drop.

Nysius huttoni F. B. White 1878 (Lygaeidae). First records in Belgium in West and East Flanders and in Brabant in 2003-2004. In The Netherlands since 2002 (Aukema et al. 2005b, 2007). Imported from New Zealand, where *N. huttoni* is an economically important species. In New Zealand, several cultivated plants including *Brassica sp.*, lucerne, clover and wheat are attacked. Control is difficult because usually the bug feeds on weedy plants of waste lots and roadsides in the vicinity of fields and only migrates to crops in dry years.

Dyroderes umbraculatus (Fabricius, 1775) (Pentatomidae). Observed for the first time in Belgium in 2004 and subsequently in 2005, in a nature reserve near Brussels (the "Moeraske", i.e. the little marsh) (Bracke et al. 2006). *D. umbraculatus* is a Mediterranean and an East European species living on different *Galium* species. Its northbound expansion is perhaps natural (Bracke et al. 2006).

Xylocoris afer (Reuter, 1884) (Anthocoridae). In the harbour of Antwerp, on tropical woods imported from Gabon, in 2006 and 2009 (Chérot et al. 2011).

Corytucha ciliata (Say, 1832) (Tingidae). Since 2006 and 2007 in Antwerp (several places); also in Brussels (2007) and East Flanders (2008) (Aukema et al. 2007, 2009). Since, found in numerous other places. This Nearctic species (the genus is restricted to the New World) was cited for the first time in Europe (Italy) in 1964 (Servadei 1966). Today, *C. ciliata* is present everywhere in South, Central and East Europe. The species is a pest on different species of planetrees, especially in the U.S.A. The sucking on the underside of the leaves induce the appearance of mould.

Amphiareus obscuriceps (Poppius, 1909) (Anthocoridae). In the provinces of East Flanders, Antwerp and Liège since 2007 (Aukema et al. 2007). From Japan, Korea, South Siberia, Nepal… First record in Europe in 1987 (Péricart & Stehlik 1998) and today all over the continent. The bug preys upon tiny insects (such as Psocoptera) in dead organic matter.

Arocatus longiceps Stål, 1872 (Lygaeidae). In Belgium since at least 2007, found also in 2008 and 2009 in the provinces of West and East Flanders, Antwerp and Liège (Aukema et al. 2009). From Southeastern Europe (remarkable expansion since 1995), Caucasus, Near and Middle East. On planetrees, where nymphs and adults feed mainly on seeds. Very close to *A. roeselii* (Schilling, 1829), much rarer in Belgium (Aukema et al. 2007).

Tupiocoris rhododendri (Dolling, 1972) (Miridae). In East-Flanders, Antwerp and Brabant, in 2007 (Aukema et al. 2007). Prey upon other small insects in the terminal buds of rhododendrons. Originated from the eastern U.S.A. but described from London (Dolling 1972).

Leptoglossus occidentalis Heidemann, 1910 (Coreidae). In Belgium since 2007 (Ostend, West and East Flanders). Since 2008 in the provinces of Antwerp and Namur and now all over the country (Aukema & Liebeer 2007, Aukema, Bruers & Viskens 2009, Chérot et al. 2013, Claerebout 2011). Chérot et al. mention 392 observations in our country and note that during 2010-2011 the expansion of the species was exponential. *L. occidentalis* originated from the western U.S.A. but since the fifties, the species expanded eastward. It was discovered for the first time in Europe in 1999 near the harbour of Venice (Italy). Today the species is present everywhere in South and

Central Europe. *L. occidentalis* is considered as a pest in North America because it feeds on sprouts and seeds of different conifers (mainly *Pinus*) but also in California on *Pistacia vera*. Up to now, no damages have been observed in Europe. The bug flies well and overwinters in houses, sometimes in very high numbers, an additional nuisance (Mitchell 2000).

Fulvius anthocoroides (Reuter, 1875) (Miridae). In the harbour of Antwerp, on tropical woods, in 2008, 2009 and 2011 (Chérot et al. 2011 and 2013). This bug, described from the harbour of Rouen (France), comes from Africa but now is cited from Seychelles, India, Sri Lanka, Taiwan, Central and South America, Antilles, U.S.A. and some Pacific Islands. The bug feeds on larvae of xylophagous beetles and moths.

Neuroctenus lestoni Kormilev, 1966 (Aradidae). In the harbour of Antwerp, under the bark of trunks of tropical woods, in 2009 (Chérot et al. 2011). This species comes from Ghana and Cameroun and, like the other Aradidae, is probably mycetophagous.

Tropidosteptes pacificus (Van Duzee, 1921) (Miridae). In Deurne (near Antwerp harbour) in 2009 (Aukema 2010); also in The Netherlands (Aukema, Schwartz & Den Bieman 2009). Imported (as eggs?) from British Columbia (Canada) and north-east U.S.A. with plant material of North American ash tree (*Fraxinus pennsylvanica*). Also on poplar and maple. The bug is a pest on ornamental ashes and induces foliar chlorosis and wilting of branches.

Fulvius subnitens (Poppius, 1909) (Miridae). In harbour of Antwerp, on tropical woods, in 2009 and 2011 (Chérot et al. 2011). This species, described from Papua, is now largely distributed around the world. It is cited from some places in U.S.A, Africa, Indonesia and Pacific Islands. Feed on beetle larvae.

Fulvius carayoni Pluot-Sigwalt & Chérot, 2013 (Miridae). A species found in 2011, also in the harbour of Antwerp, on tropical woods. Distributed in West and Central Africa.

Discussion

Aukema (2003) emphasizes that if turnover of species of local fauna may be considered a natural process, habitat changes, international trade and global warming have largely contributed to the recent changes observed in Dutch Heteropterofauna. The same is probably true in Belgium. Although the arrival in Belgium of some Mediterranean species may be explained by climatic changes (*D. umbraculatus*, *N. viridula*, *R. nebulosa*), most of the exotic species observed in our country during the two past decades were introduced accidentally by man as a consequence of ornamental plants (for example *D. flavilinea*, *T. hippophaes*, *S. takeyai* etc.), exotic fruits and vegetables (for example *N. huttoni*, maybe some *N. viridula*) or tropical woods (*F. anthocoroides*, *N. lestoni*,…) importations. Consequently, the main doorways seem to be harbours like Antwerp but airports could be also involved, as they are for other groups of insects, like mosquitos.

Rabitsch (2008) considers that 42 exotic species of Heteroptera are now introduced in Europe, 12 of them coming from other continents, a figure already not up to date. It is difficult to predict the development of such introductions: Establishment (i.e. installation of permanent populations) or extinction? The factors influencing the fate of the colonizers are very numerous (Rabitsch 2008) and the “rule of ten” – one of 10 imported species would settle in the wild, one of 10 of such introduced species would become established and one of 10 such established species would become “invasive” (Williamson & Fitter 1996) – knows numerous exceptions. Belonging to the exotic Heteroptera recently found in Belgium, some species such *F. anthocoroides*, *F. carayoni*, *F. subnitens*, *N. lestoni* and *X. afer* will probably be not able to start permanent populations. Some other, such as *A. longiceps*, *C. ciliata*, *D. flavilinea*, *N. huttoni*, *L. occidentalis* and *N. viridula* are obviously established, the status of remaining species being unclear.

Are these invading bugs threats for our agriculture, horticulture or forestry? Most of them are relatively minor pests in their country of origin and don’t seem to be really injurious in Belgium. However, the cases of *L. occidentalis* and *N. huttoni* could become problematic and should be monitored.

Are these invading bugs threats for our environment? A protocol of impact estimation of alien invading species on Belgian natural ecosystems has been established (http://ias.biodiversity.be), based on various criteria sometimes difficult to appreciate, particularly for relatively poorly known Heteroptera (for example: dispersion potential). It seems nevertheless, the impact on the ecosystems of a majority of alien Heteroptera recently introduced in Belgium should be restricted. This would be the case even for a large and invasive species such *L. occidentalis* (Chérot et al. 2013).

Do these exotic species represent a threat for the Belgian biodiversity? The ecological biodiversity is function of the specific richness and the evenness, the relative abundance of species in the community. Initially, the installation of exotic species in a community will increase the local specific richness and then the biodiversity. Later, the effect of the exotic one will depend on its impact on the native species and on their relationships in the community: If different native species disappear or if the evenness is strongly reduced, the biodiversity will be also modified. However, this will not necessarily be the case. A replacement of a native species by an exotic one does not modify ecological biodiversity as defined by Shannon index even if it is a loss in the biological heritage. Because the effects of exotic Heteroptera establishment in Belgium – a step not passed yet for some species – remain largely hypothetical, it is difficult to predict an eventual impact on biodiversity.

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