Proceedings of the Seventh International Conference on Urban Pests
William H Robinson and Ana Eugênia de Carvalho Campos (editors) 2011
Printed by Instituto Biológico, São Paulo, SP. Brazil.

NEW DATA ON THE INCIDENCE OF HOUSEHOLD ARTHROPOD PESTS AND NEW INVASIVE PESTS IN ZURICH (SWITZERLAND)

GABI MUELLER, ISABELLE LANDAU LUESCHER, AND MARCUS SCHMIDT

Dept. of Health and Environment, Urban Pest Advisory Service,
Walchestrasse 31, CH-8021 Zürich, Switzerland
gabi.mueller@zuerich.ch, *isabelle.landau@zuerich.ch*,
marcus.schmidt@zuerich.ch

Abstract The Urban Pest Advisory Service (UPAS) is responsible for urban pests in the city of Zurich, Switzerland. We advise approximately 2'000 people per year who have questions or problems regarding arthropods and their control, we survey the pest situation in the city and control rats in public areas. Since 2004 we work on projects regarding public health. We present data on the temporal changes in the occurrence of some important pest species from 1994 to 2010 in Zurich, based on the frequency of inquiries by the public. Inquiries concerning the German cockroach, *Blattella germanica,* and the brown-banded cockroach, *Supella longipalpa*, have decreased significantly, whereas inquiries regarding the Oriental cockroach, *Blatta orientalis,* have remained more or less on the same low level. In 2010 its number was unusually high due to a block of 23 houses with *B. orientalis* problems for several years. We coordinated the monitoring and control in these houses, the street and in the courtyard. The number of bed bug (*Cimex lectularius*) problems has increased exponentially since 1999. Complaints concerning the pentatomid bug *Halyomorpha halys* also increased exponentially. This new invasive species seeks houses to hibernate and is therefore annoying to people especially in autumn and spring. The Asian bush mosquito, *Aedes japonicus japonicus*, was first found in Switzerland in 2008. At that time it already colonized an area of 1400 km^2. In 2010 the colonized area was more than three times as large.

Key Words Cockroaches, *Blattella germanica, Supella longipalpa, Blatta orientalis, Ectobius vittiventris,* bed bugs*, Cimex lectularius, Halyomorpha halys, Aedes japonicus japonicus*

INTRODUCTION

Zurich is the largest city in Switzerland and lies at the outlet of the lake Zurich. Today it has approximately 382'000 inhabitants from more than 160 countries (Statistik Stadt Zürich, 2011). The Urban Pest Advisory Service (UPAS) is financed by the city of Zurich and belongs to the Department of Health and Environment. The UPAS is responsible for hygiene issues caused by urban pests in Zurich. It is the only non commercial and official pest advisory service in Switzerland. Our main duties are described in detail in Landau et al., 2008.

Collecting longitudinal data over long periods is essential to monitor the distribution and dispersal of household pests. We present data for 17 years. The German cockroach (*Blattella germanica,* Linnaeus, 1767), probably the most important insect pest of homes, apartments and food processing facilities in many countries (Cornwell, 1968; Cochran, 1982; Rust et. al., 1995), was also in Zurich the number one arthropod pest species until the end of the nineties. With the gel baiting technique however, its numbers are decreasing in many countries (Robinson 1999; Müller et al., 2008). The other two frequent cockroach pest species in Zurich are the brown-banded cockroach (*Supella longipalpa*, Fabricius, 1798) and the Oriental cockroach (*Blatta orientalis*, Linnaeus, 1758). The resurgence of the bed bug (*Cimex lectularius,* Linnaeus*,* 1758) was a main topic three years ago at the International Conference on Urban Pests in Budapest (Robinson and Bajomi, 2008). Our data show that infestations are still increasing in Switzerland.

Seasonally occurring outdoor insects, like the cockroach species *Ectobius vittiventris* (Costa, 1874) and the brown marmorated stink bug, *Halyomorpha halys* (Stål, 1855), are no household pests. They cannot propagate indoors but can annoy people when they find them in their homes. *H. halys*, a new invasive species in Switzerland,

can easily be mistaken for *Rhaphigaster nebulosa* (Poda, 1761), an indigenous Pentatomid bug. Until the publication of Wermelinger et al. (2008) in spring 2008 we thought that it was *Rh. nebulosa*. Its seasonal occurrence and pest status in Zurich is described in Müller et al. (2008) and its biology in Jacobs (2011). Wyniger and Kment (2010) present a key for the separation of *H. halys* from similar appearing Pentatomidae in Central Europe.

The Asian bush mosquito, *Aedes (Finlaya) japonicus japonicus* (Theobald, 1901) (=*Ochlerotatus japonicus*), was first detected in Switzerland in 2008 (Schaffner et al., 2009). It is breeding in natural and artificial containers and lives in rural and urbanized environments. It prefers to bite during daytime and is tolerant to cold conditions (Andreadis et al., 2001; CDC, 2011).It is listed as an invasive species (ISSG, 2011) and a competent laboratory vector of several arboviruses, e.g. West Nile virus.

MATERIALS AND METHODS

The data are collected during our daily advisory work, inspections and control operations. They are registered in a SQL(Structured Query Language)-based database which was especially designed for our purposes (Apel and Köhl, 2002). It is described in detail in Müller et al. (2008). It includes data since 1991 and contains over 35'400 data points (= inquiries), 76 % of these are from the city of Zurich. A large part of the others originate from the greater Zürich area and only about 7 % from other parts of Switzerland. We use only data since 1994 for the pest species statistics because since then we have continuity in our team and are certain that the determination of pest species is reliable.

RESULTS

Between 1994 and 2010 the yearly number of inquiries fluctuated from 1870 to 3211 (Figure 1). Figure 2 shows the average occurrence of the most often reported pests from 2008 to 2010.

Inquiries concerning *B. germanica* (Figure 3: $F_{1,15} = 514.196$; $p < 0.001$; $y = (6.897^{144}) * e^{-0.164} * x$; $r^2 = 0.972$) and *S. longipalpa* (Figure 4: $F_{1,15} = 218.755$; $p < 0.001$; $y = 6187.877 * -3.076x$; $r^2 = 0.936$) have decreased significantly over the past 17 years, whereas inquiries regarding *B. orientalis* have remained at the same low level except for 2010 (Figure 4). *C. lectularius* shows a significant exponential increase since 1994 (Figure 5: $F_{1,15} = 99.930$; $p < 0.001$; $y = (4.253^{-129}) * e^{0.149} * x$; $r^2 = 0.869$).

The number of inquiries regarding the indigenous cockroach species *E. vittiventris* increased in the nineties and reached a peak in 2003 with 13 % of all inquiries. In the following years their number dropped again to 4 % of all inquiries (Müller et al. 2008). The first European record of the brown marmorated stink bug, *H. halys,* was from Switzerland. Its number is increasing exponentially, this is significant in spite of the few data points (Figure 6: $F_{1,3} = 36.649$; $p < 0.01$; $y = (7.0001^{-315}) * e^{0.362} * x$; $r^2 = 0.924$). In 2009, *H. halys* was number three and in 2010 it was number two on our list of the most frequent species. The first specimen of the Asian bush mosquito, *Ae. japonicus japonicus,* was sent to us in September 2008 from somebody who suspected it to be an Asian tiger mosquito (*Aedes albopictus*). In October 2009 and August 2010 we received two other specimens. All of them were identified by Françis Schaffner at the Institute of Parasitology of the University of Zurich.

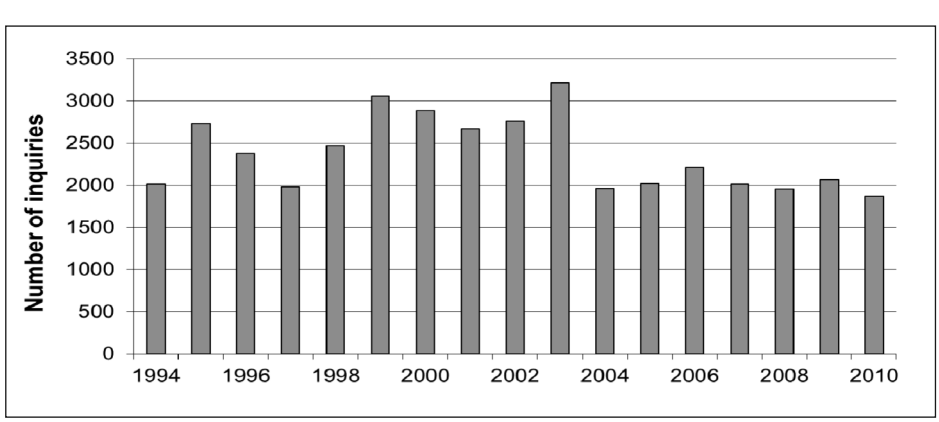

Figure 1.: Yearly number of inquiries from 1994-2010.

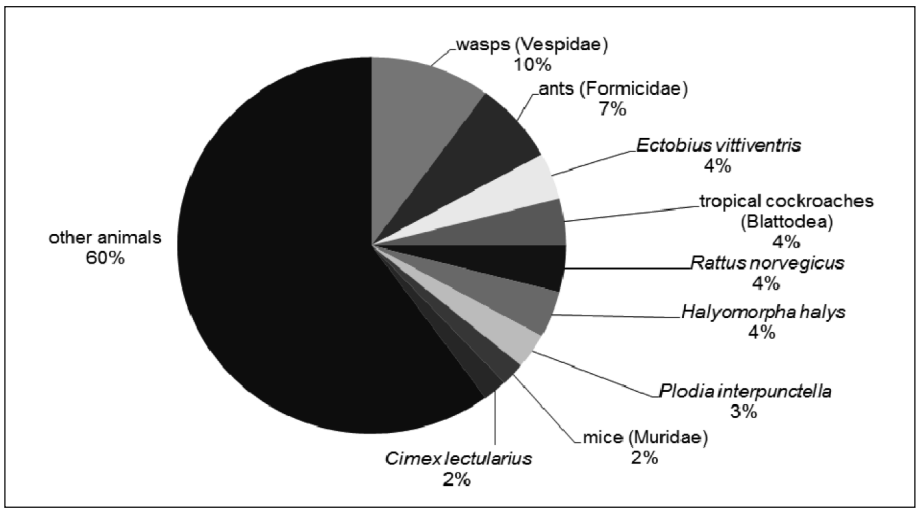

Figure 2. Average occurrence of the most often reported pests from 2008-2010.

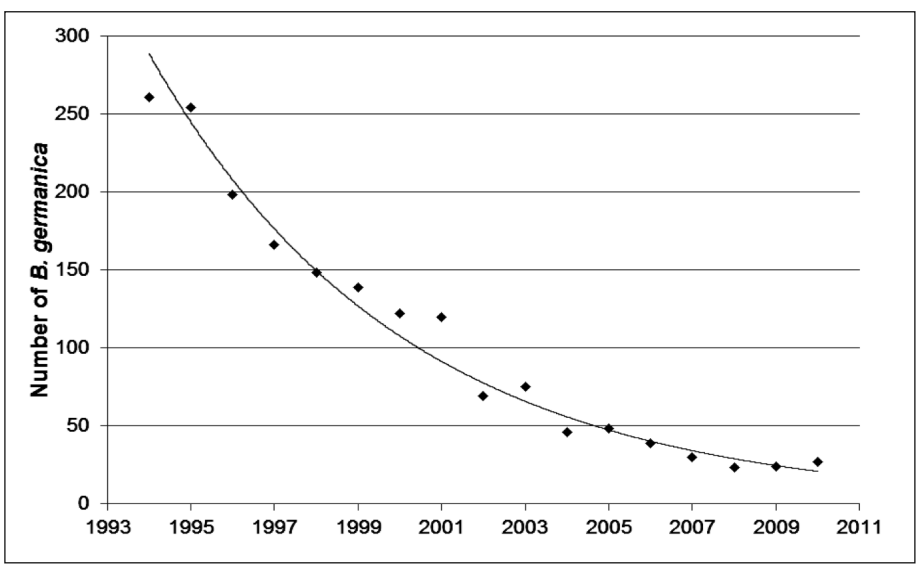

Figure 3. Number of *B. germanica* with exponential regression from 1994-2010.

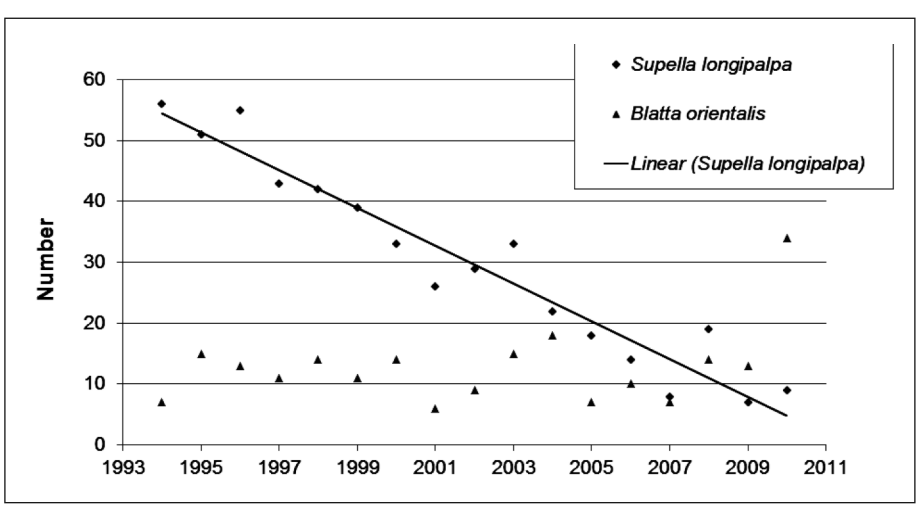

Figure 4. Number of *S. longipalpa* and *B. orientalis* with linear regression for *S. longipalpa* from 1994-2010.

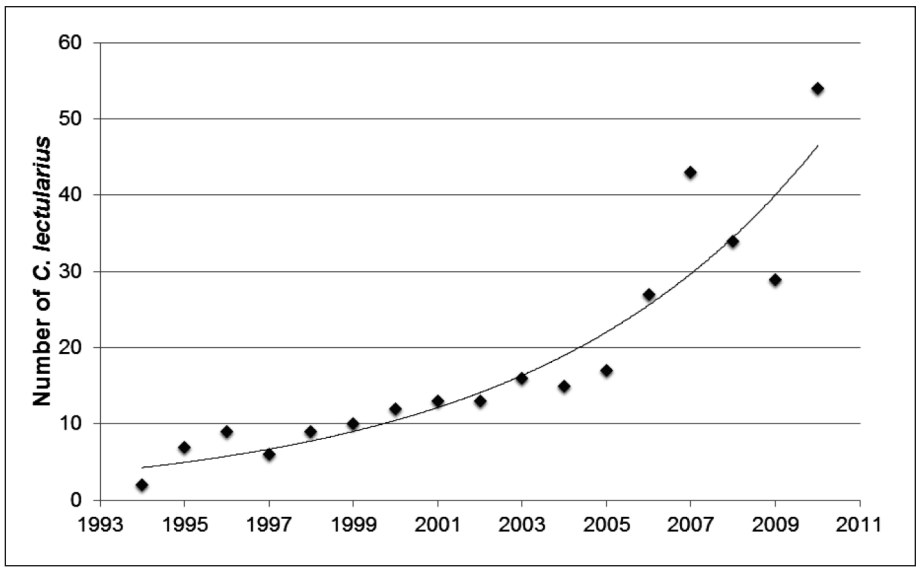

Figure 5. Number of *C. lectularius* with exponential regression from 1994-2010.

DISCUSSION

The number of inquiries shown in Figure 1 is influenced mainly by the weather. If it is warm and sunny we get more inquiries because of the higher insect activity. Other reasons for the fluctuation are given in Müller et al. (2008).

The average occurrence of the most common pests from 2008-2010 (Figure 2) has changed compared to the numbers reported for 2005-2007 (Müller et al., 2008) and 1996-1998 (Landau et al., 1999). We explain the decreased number of wasp and ant inquiries by the weather conditions at that time. These animals are outdoor species and more active and successful when the weather is favourable for them. The number of inquiries regarding the indigenous cockroach *E. vittiventris* dropped again from 6 % to 4 % of all inquiries. We ascribe this to the fact that people know this species now and can distinguish it from the German cockroach and perhaps to climatic factors. The number of tropical cockroaches stayed low at 4 %. Bed bug numbers stayed at 2 % which is probably too low for its real numbers as explained below. The brown marmorated stink bug, *H. halys*, is a new and very successful invasive species in Switzerland. It reached 4% of all inquiries in the last three years (Figure 2).

The decrease in *B. germanica* numbers since 1994 was already significant in 1999 (Landau et al., 1999) and 2008 (Müller et al., 2008). We ascribe this decrease mainly to the increased use of the gel baiting technique for cockroaches. The same can be said for *S. longipalpa* in Switzerland, but at a lower level. *S. longipalpa* was only found in Switzerland for the first time in 1965 (Ineichen, 1997). *B. orientalis* is not very frequent in Zurich (Figure 4), but in some older parts of the city there have been repeated re-infestations of buildings via the sewer system over several years. The high number of *B. orientalis* in 2010 is due to a control campaign and to the structure of our database, because one data point corresponds to one single building. In 2010 we looked at 23 apartment buildings built in a ring, and we supervised a coordinated pest control. This included inspections in flats, basements, staircases and sewers. Five pest control companies treated all infested houses, the common courtyard and the streets. 20 out of these 23 buildings were infested with *B. orientalis*. If these cases are subtracted from the total number of *B. orientalis* in 2010, the number lies in the usual range (Figure 4).

The dramatic increase in *C. lectularius* numbers reached a new peak in 2010 after two years with less inquiries (Figure 5). We think, that this decrease reflects the high publicity that followed the rising numbers in 2007. People heard about bed bugs in the media and recognised them without consulting us. The new peak in 2010 could result on one hand from the still increasing number of bed bug infestations in Zurich and Switzerland and on the other hand from our asking pest control operators more often about their cases and adding these to our database.

The first record of *H. halys* in Switzerland was in 2007 from the area around the city of Zurich (Wermelinger et al., 2008). We found several specimens in our collection from 2006. One earlier record was provided by Arnold (2009) from a light-trap in Liechtenstein in 2004. Since 2006 the number of inquiries regarding *H. halys* increases significantly (Figure 6). *H. halys* is thought to have been imported with plants from the east. It is a major agricultural pest in Asia where it causes damage mostly on fruit and vegetable crops (Funayama 2004; Hoebeke

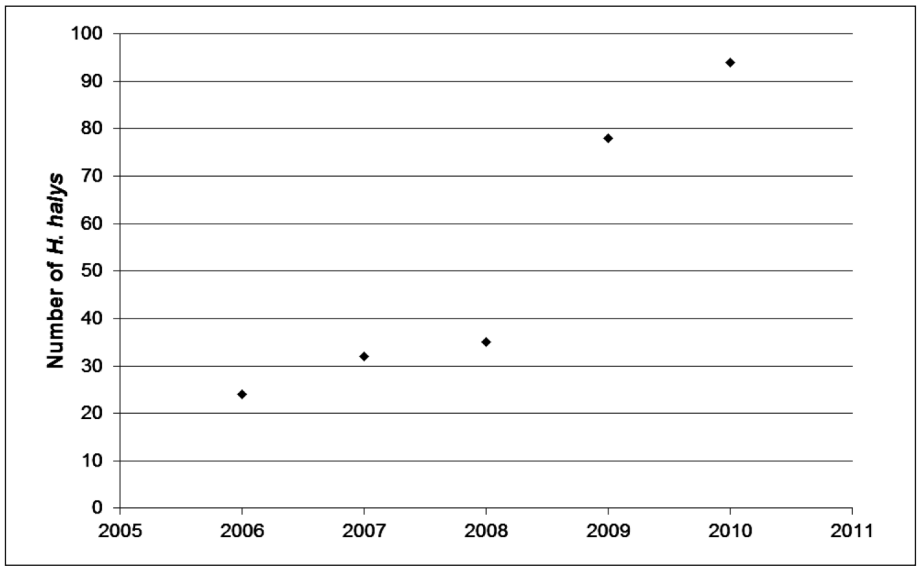

Figure 6. Number of *H. halys* from 2006-2010.

and Carter, 2003; Nielsen and Hamilton, 2009a; Nielsen and Hamilton, 2009b). Until today it is not yet an agricultural pest in Switzerland but the development in Pennsylvania shows that this can happen from one year to the other (McPheron 2010).

Aedes japonicus japonicus was first collected in Switzerland in 2008. Schaffner et al. (2009) discovered that it must have been established in Switzerland for several years because it has already colonized an area of approximately 1400 km^2. In 2009 the colonized area increased to 2500 km^2 and in 2010 it has doubled to 5000 km^2 (Schaffner et al. pers. communication). This was the first finding of proliferation and spread of an invasive mosquito species in Central Europe. Its public health significance is great because it is a competent laboratory vector of several arboviruses. Therefore further studies on the possible vector potential and the stop of progress of *Ae. japonicus japonicus* and other invasive mosquito species in Europe are very important.

ACKNOWLEDGEMENTS

We thank Prof. Wolf Blanckenhorn for his help with statistics and Stefan Apel for his data base assistance.

REFERENCES CITED

Andreadis, T.G., Anderson, J.F., Munstermann, L.E., Wolfe, R.J. and Florin, D.A. 2001. Discovery, Distribution, and Abundance of the Newly Introduced Mosquito *Ochlerotatus japonicus* (Dipera: Culicidae) in Connecticut, USA. J. Med. Entomol. 38(6): 774-779.

Apel, S. and Köhl, M. 2002. Integrated web application with knowledge base. http://www.leanux.ch/cms/index.php?sql-ledger-beschreibung (April 26, 2011).

Arnold, K. 2009. *Halyomorpha halys* (Stål, 1855), eine für die europäische Fauna neu nachgewiesene Wanzenart (Insecta: Heteroptera, Pentatomidae, Pentatominae, Cappaeini). Mitt. des Thüringer Entomologenverbandes e.V. 16: 10.

CDC (Centers for Disease Control and Prevention) 2011. Information on *Aedes japonicus*. http://www.cdc.gov/ncidod/dvbid/arbor/japonicus.htm (April 28, 2011).

Cochran, D.G. 1982. Cockroaches – Biology and Control. World Health Organization Technical Report. Vol. 82.856: 1-53.

Cornwell, P.B. 1968. The cockroach A laboratory insect and an industrial pest. Vol. 1. London: Hutchinson & Co.

Funayama, K. 2004. Importance of apple fruits as food for the brown-marmorated stink bug, *Halyomorpha halys* (Stål)(Heteroptera: Pentatomidae). Applied Entomology and Zoology 39: 617-623.

Hoebeke, E.R. and Carter, M.E. 2003. *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): a polyphagous plant pest from Asia newly detected in North America. Proc. Ent. Soc. of Washington 105: 225-237.

Ineichen, S. 1997. Die wilden Tiere in der Stadt. Frauenfeld: Verlag Im Waldgut

ISSG (Invasive Species Specialist Group) 2011. http://www.issg.org/database/species/search.asp?sts=sss&st=sss&fr=1&sn=aedes +japonicus&rn=&hci=-1&ei=-1&lang=EN (April 20, 2011).

Jacobs, S. 2011. Fact Sheet: Brown Marmorated Stink Bug. http://ento.psu.edu/extension/factsheets/brown-marmorated-stink-bug (April 21, 2011).

Landau, I., Müller, G. and Schmidt, M. 1999. The Urban Pest Advisory Service of Zurich (Switzerland) and the situation of some selected pests. In: Robinson, W.H., Rettich, F. and Rambo, G.W., eds. Proceedings of the 3rd International Conference on Urban Pests. Czech Republic: Grafické závody Hronov

Landau Lüscher, I., Schmidt, M. and Müller, G. 2008. Official measures by the city of Zürich (Switzerland) to eradicate pharaoh ants *Monomorium pharaonis* and to instruct people on the reasonable use of insecticide sprays in households. *In*: Robinson, W.H. and Bajomi, D., eds. Proceedings of the 6th International Conference on Urban Pests. Hungary: OOK-Press

McPheron, B. 2010. On the Trail for the Stink Bug. http://agsci.psu.edu/dean/blog/2010/on-the-trail-of-the-stink-bug (April 21, 2011).

Müller, G., Landau Lüscher, I. and Schmidt, M. 2008. Temporal Changes in the Incidence of Household Arthropod Pests in Zurich, Switzerland. *In*: Robinson, W.H. and Bajomi, D., eds. Proceedings of the 6th International Conference on Urban Pests. Hungary: OOK-Press

Nielsen, A.L. and Hamilton, G.C. 2009a. Life history of the invasive species *Halyomorpha halys* (Hemiptera: Pentatomidae) in Northeastern United States. Ann. Ent. Soc. Am. 102: 608-616.

Nielsen, A.L. and Hamilton, G.C. 2009b. Seasonal occurrence and impact of *Halyomorpha halys* (Hemiptera: Pentatomidae) in tree fruit. Hort. Ent. 102: 1133- 1140.

Robinson, W.H. 1999. The Changing Status of the German Cockroach in the Urban Environment. Proc. 52nd N.Z. Plant Protection Conf. 16-21.

Robinson, W.H. and Bajomi, D. 2008. Proceedings of the 6th International Conference on Urban Pests, Hungary: OOK-Press

Rust, M.K., Owens, J.M. and Rierson, D.A. 1995. Understanding and Controlling the German Cockroach. New York: Oxford University Press

Schaffner, F., Kaufmann, C., Hegglin, D. and Mathis, A. 2009. The invasive mosquito *Aedes japonicus* in Central Europe. Short communication. Medical and Veterinary Entomology 23: 448-451.

Statistik Stadt Zürich 2011. http://www.stadt-zuerich.ch/prd/de/index/statistik/bevoelkerung/bevoelkerungsstand.html (April 11, 2011).

Wermelinger, B., Wyniger, D. and Forster, B. 2008. First records of an invasive bug in Europe: *Halyomorpha halys* Stål (Heteroptera: Pentatomidae), a new pest on woody ornamentals and fruit trees? Mitt. Schweiz. Ent. Ges. 81: 1-8.

Wyniger, D. and Kment, P. 2010. Key for the separation of *Halyomorpha halys* (Stål) from similar-appearing pentatomids (Insecta: Heteroptera: Pentatomidae) occurring in Central Europe, with new Swiss records. Mitt. Schweiz. Ent. Ges. 83: 261-270.