

TEMPORAL CHANGES IN THE INCIDENCE OF HOUSEHOLD ARTHROPOD PESTS IN ZURICH, SWITZERLAND

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Abstract The Urban Pest Advisory Service (UPAS) is responsible for urban pests in the city of Zurich, Switzerland. We give approximately 2,000 consultations per year concerning pests and their control, survey the pest situation in the city and control rats in public areas. We present data on the temporal changes in the occurrence of some important pest species from 1994 to 2007 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 at the same low level. *Ectobius vittiventris*, an indigenous cockroach species that originated from south of the alps, is now very common and quite often enters into houses. The number of bed bug (*Cimex lectularius*) problems has dramatically increased since 1999. Since 2000 the number of inquiries regarding the outdoor pentatomid bug *Raphigaster nebulosa* has also increased significantly.

Key words *Blattella germanica*, *Supella longipalpa*, *Blatta orientalis*, *Cimex lectularius*, *Ectobius vittiventris*, *Raphigaster nebulosa*

INTRODUCTION

Zurich is the largest city in Switzerland and lies at the outlet of the lake Zurich. Today it has approximately 370,000 inhabitants (Statistik Stadt Zürich, 2008). 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. Our main duties are described in detail in Landau et al. (2008).

It is essential to collect longitudinal data over longer periods to monitor the distribution and dispersal of household pests. We collected such data over 14 years and present them for some key pest species here. The German cockroach, *Blattella germanica*, is probably the most important insect pest of homes, apartments and food processing facilities in many countries throughout the world (Cornwell, 1968; Cochran, 1982). The second and third most frequent cockroach pest species in Zurich are the brown-banded cockroach (*Supella longipalpa*) and the Oriental cockroach (*Blatta orientalis*). The bed bug (*Cimex lectularius*) was a common pest species in Europe and the USA until the 1940s (Ter Poorten and Prose, 2005). Afterwards, the invention and use of modern insecticides reduced bed bug numbers in the economically developed countries. Today we again see a worldwide increase in bed bug infestations (Pospischil, 2006). In Zurich in the 1920s fumigations of flats and buildings against bed bugs with hydrocyanic acid resulted in some deadly accidents. The city council established the UPAS in 1930 in order to supervise these fumigations. At that time there were around 200 bed bug cases per year. With the modern insecticides these were reduced to around 30 cases yearly and during the 1990s the number of inquiries stayed at a low level of around 10 per year.

Seasonally occurring outdoor insects like the cockroach species *Ectobius vittiventris* and the stink or shield bug *Raphigaster nebulosa* are not household pests. They cannot propagate indoors but annoy some people by their intrusion. *R. nebulosa* feeds on plants and insects. It is primarily a species of woodlands, but

it is also seen on walls of houses and sheds. It is a common species in most parts of Europe but not present in the northern countries, United Kingdom or Ireland (Wikipedia, 2008; The Garden Safari, 2008).

MATERIALS AND METHODS

The data were collected during our daily advisory work, inspections and control operations. They are registered in a SQL (Structured Query Language)-based database (www.pagewerkstatt.ch) which was especially designed for our purposes (Apel and Köhl, 2002). It includes a phylogenetic tree of the reported pests, which can be expanded anytime, based on scientific systematics with phylum, class, order, family, genus and species according to Sauter (1986), Stresemann et al. (1986) and Weidner and Sellenschlo (2003). There is a 3-digit code for each systematic group resulting in an 18-digit code for each species. Each data file contains the exact address, date of occurrence, animal species involved as far as determination is possible (sometimes only to the family or genus level), and specific notes on circumstances or the species. If necessary, control measures, accounts, documents and photos can be added.

Our database includes data since 1991 and contains over 30,500 data points (= inquiries). 23,511 inquiries come from the city of Zürich (77 %). 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 the team and are certain that the determination of pest species is reliable.

RESULTS

Between 1994 and 2007 the yearly number of inquiries fluctuated from 1,982 to 3,211 (Figure 1) and Figure 2 shows the average occurrence of the most often reported pests between 2005 and 2007.

Inquiries concerning *B. germanica* ($F_{1,12} = 201.908$; $p < 0.001$; $y = 35889.68 - 17.88x$; $r^2 = 0.944$) have decreased significantly over the past 14 years (Figure 3). The same can be said for inquiries concerning *S. longipalpa* (Figure 4: $F_{1,12} = 214.616$; $p < 0.001$; $y = 6923.28 - 3.444x$; $r^2 = 0.947$), whereas inquiries regarding *B. orientalis* have remained at the same low level (Figure 4). *C. lectularius* shows a significant exponential increase since 1994 (Figure 5: $F_{1,12} = 53.854$; $p < 0.001$; $y = (1.66^{-134})_x e^{0.155_x}$; $r^2 = 0.818$) similar to *R. nebulosa* (Figure 6; best fit quadratic relationship: $F_{1,12} = 38.957$; $p < 0.001$; $y = 23.421 - 5.644x + 0.348x^2$; $r^2 = 0.876$).

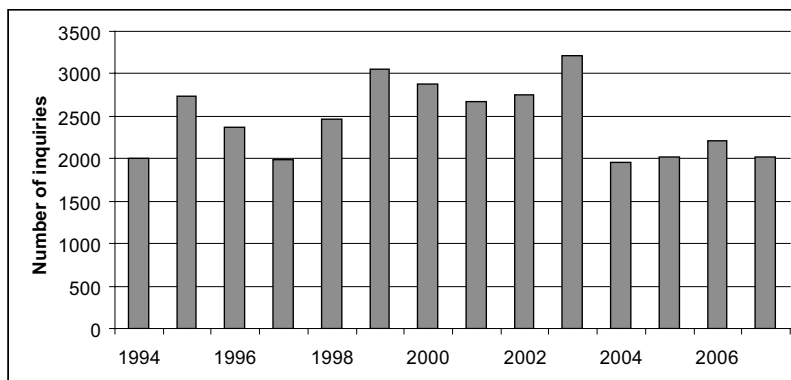


Figure 1. Total number of inquiries from 1994-2007.

The majority (99 %) of our inquiries regarding outdoor cockroaches of the family Ectobiidae concern *E. vittiventris* (see Baur et al., 2004 for a key of Swiss species) and not *E. lapponicus* (Linnaeus, 1758), which was wrongly determined by us in 1999 (Landau et al., 1999). This number increased in the nineties and reached a high level of 13 % of all inquiries (ca. 300) in 2003. In the following years their numbers dropped again to 4 % (ca. 100) of all inquiries (Figure 7). We presume that the species is spreading northwards. In 2006 *E. vittiventris* was frequently found in Freiburg im Breisgau, Germany (Claudia Gack, Universität Freiburg, pers. comm.). UPAS also received inquiries from Stuttgart and the surroundings. The two outdoor

species *E. vittiventris* and *R. nebulosa* have different peaks in their occurrence over the year (Figure 8): while *E. vittiventris* is most frequently found in and around houses in summer, inquiries regarding *R. nebulosa* come most often in spring and autumn.

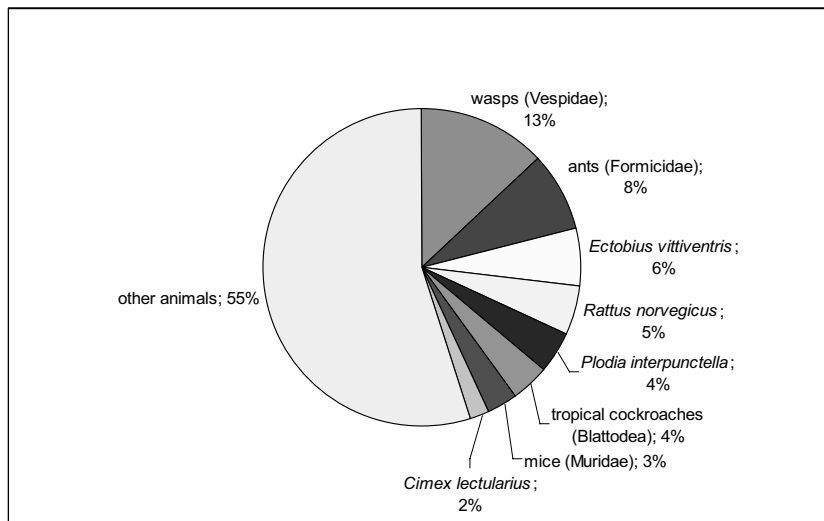


Figure 2. Average occurrence of the most often reported pests from 2005-2007.

DISCUSSION

The increase in the number of inquiries until 2003 shown in Figure 1 may be partly due to climatic factors, with over 3,200 inquiries in 2003, the warmest summer of the century. Another explanation might be that, due to our public relation work, the advisory service was becoming better known to the residents of Zurich and its surroundings. Information such as fact sheets for 45 pest species or occurrence of actual pest species can be found on our homepage (UPAS, 2008). With the reorganisation of our department in 2004 the number of inquiries decreased from around 2,900 per year to about 2,000. This is because we had to restrict our advisory work to the inhabitants of the city of Zurich and thus had to turn down all other inquiries.

The average occurrence of the most common pests during 2005-2007 (Figure 2) has changed compared to the numbers reported for 1996-1998 (Landau et al., 1999). The most drastic change is shown in the reduction of tropical cockroach species from 15% of all inquiries in 1996-98 to only 4% in 2005-07. This is mostly due to the decreased numbers of *B. germanica* and *S. longipalpa* shown in Figures 3 and 4. Inquiries regarding *E. vittiventris* also decreased from 10 % in 1996-98 to 6 % in 2005-07 (Figure 2). Apart from *C. lectularius*, inquiries of the other most often reported pests did not change. Therefore the percentage of other animals (e.g. outdoor insects, stored products pests) is higher than in 1996-98.

The decrease in *B. germanica* numbers since 1994 was significant already in 1999 (Landau et al., 1999). We ascribe this decrease mainly to the increased use of the new gel baiting technique for cockroaches. This is confirmed by Swiss pest control companies (Anton Hasenböhler, ISS Pest Control; Gérard Cuendet, Zoocontrol and Sybille Stettler, Kistler + Stettler AG, 2008, pers. comm.). Unpublished data on *B. germanica* of the Danish Pest Infestation Laboratory (DPIL) show the same trend for Denmark: from over 80 in 2000 the number of inquiries has decreased to less than 10 in 2007 (Anne-Marie Rasmussen, DPIL, 2008, pers. comm.). The same can be said of *S. longipalpa* in Switzerland, but at a lower level. *B. orientalis* is not very frequent in Zurich (Figure 4), but in some older parts of the city there were repeated re-infestations of buildings via the sewer system over several years.

Figure 3.
Number of *B. germanica*
With linear regression from
1994-2007.

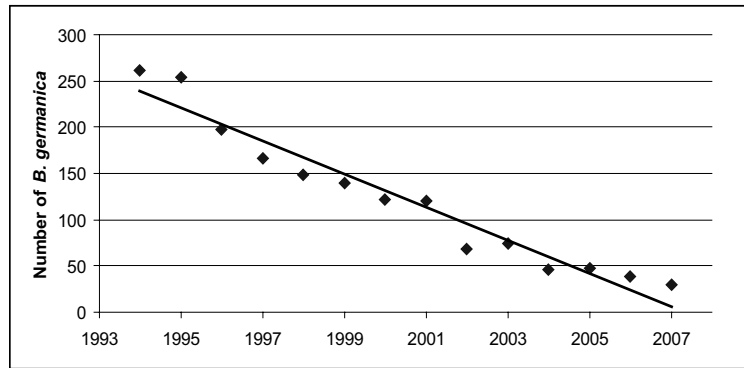
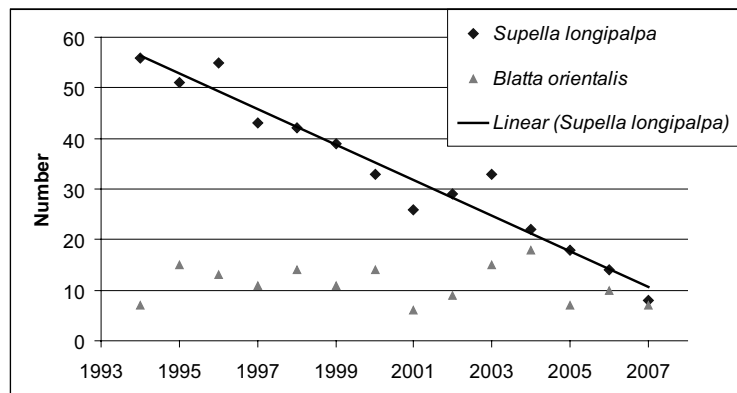


Figure 4.
Number of *S. longipalpa* and *B. orientalis* with
linear regression for
S. longipalpa from 1994-2007.



The dramatic increase in *C. lectularius* numbers is also reported across Europe, USA and Australia (Boase, 2000; Brumback, 2006; Pospischil, 2006). The main reason is thought to be the increasing world travel. If bed bug incidences are higher, the possibility of spreading them is also greater. The trade with second-hand furniture, increased immigration and travel from poor countries where bed bug infestations have always occurred at a higher level, and the change in pest management practices from surface treatments to toxic baits that are not attractive to bed bugs are possible other reasons for the rise. Insecticide resistance could be a factor, too, although we have no reports of control failures in Switzerland. Doggett (2004) further notes the lack of awareness about bed bugs among PCO (pest control operators) and health professionals. He writes that this pest species was not in the curriculum of many pest control courses in Australia, so that the knowledge was often lacking among pest managers. We cannot confirm this for Switzerland.

We do not know why the number of inquiries regarding *R. nebulosa* has increased. There exists almost no literature and we do not know anyone who collects data about this species.

The distinctive drop of *E. vittiventris* numbers after 2003 (Figure 7) can be ascribed to the same reasons as the decrease of the total number of inquiries: climatic factors, increased publicity of *E. vittiventris* and our restriction of advisory work to the inhabitants of Zurich. This decrease does not match our observation in nature. We find *E. vittiventris* more frequently every year in gardens, parks and urban areas with some open vegetation. This is confirmed by many (hobby) entomologists in Switzerland. We presume that people are by now used to the fact that these insects come into the flats during the warm season. As they never propagate inside nor live for a long time in the house, people by now know that control measures are not necessary. The Swiss Pest Control Association (FSD-VSS) strictly objects to control measures when *E. vittiventris* occurs in buildings. Fly screens for windows are recommended. Due to global warming, *E. vittiventris* probably will spread further north, especially in urban areas.

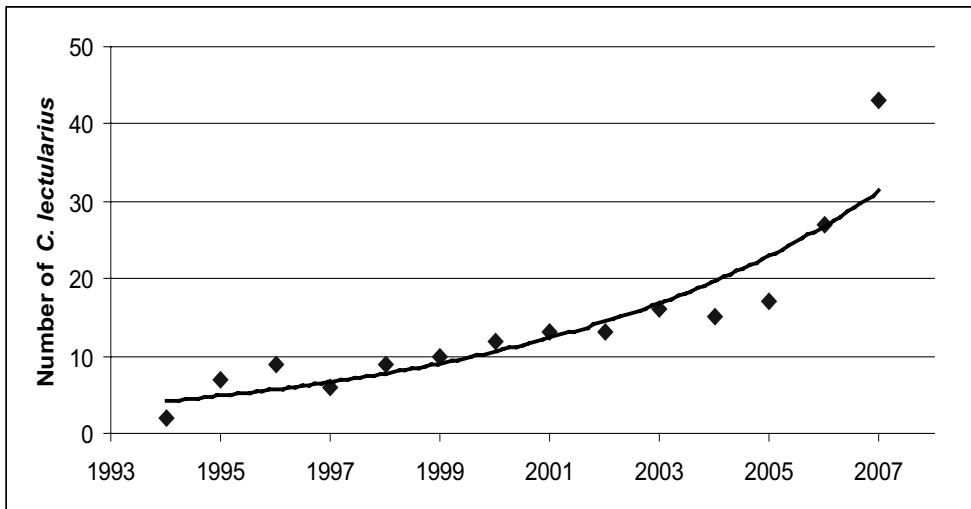


Figure 5. Number of *C. lectularius* with exponential regression from 1994-2007.

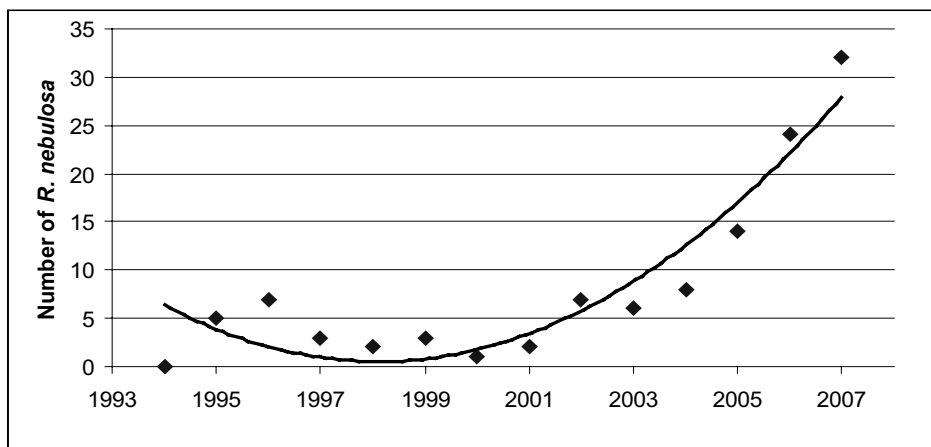


Figure 6. Number of *R. nebulosa* with quadratic regression from 1994-2007.

The seasonal occurrence of *E. vittiventris* and *R. nebulosa* is closely related to weather conditions but even so not the same (Figure 8). We get most complaints about *E. vittiventris* in summer because the warmer the weather the more active it is and the better its flight performance. As people also tend to be more outdoors with warmer weather, the possibility of encountering *E. vittiventris* is greater in summer. *R. nebulosa* on the other hand stays on the vegetation in summer and only comes near houses to seek hiding places to overwinter when temperatures drop. These can be cracks and crevices in unheated attics, in between the insulation of the roof or outer wall, or in the roller shutter cases (which are very common in Swiss apartment houses). We thus get most complaints about *R. nebulosa* in autumn, especially in October when leaves fall and temperatures drop and in spring time when the species becomes active again with warmer weather. Most of the complaints concerning *R. nebulosa* come from people with apartments under the roof: the species enters open windows when searching and leaving its hiding place. Some people are disgusted when they find *R. nebulosa* in their apartment. The size of 14-16 mm, the brown colour (in contrast to white curtains or walls) and the smell they excrete when touched does not help them to be popular. In one case from 2007 someone made her landlord call a PCO after applying numerous insecticide sprays. The PCO drilled holes in the wooden ceiling and inserted DDVP and a mixture of permethrin / pyrethrum two times within two

weeks at the end of February and beginning of March. The tenant had fly screens installed on the windows to stop *R. nebulosa* from coming in. The treatment was not effective and did not kill all bugs, as we still had more complaints by the same person afterwards. We inform the affected people that there is no harm and just temporary nuisance and advise them to catch the bug with a jar and throw it out of the window. Most people put up with them once they know the name and circumstance of their appearance.

Figure 7. Number of *E. vittiventris* from 1994-2007.

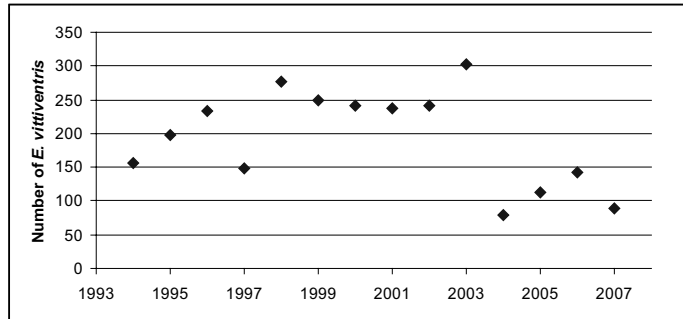
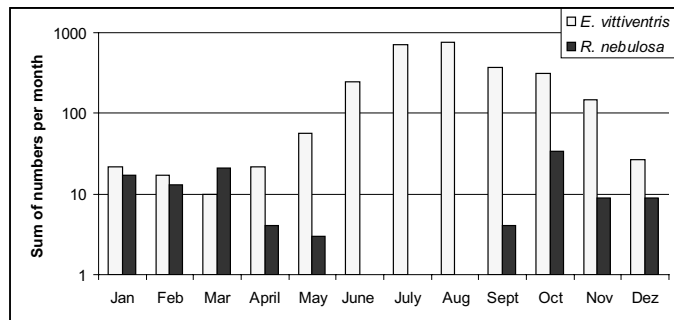


Figure 8. *E. vittiventris* and *R. nebulosa* Numbers per month from 1994-2007 at a logarithmic scale.



UPAS is the only non commercial and official pest advisory service in Switzerland. By registering all inquiries in our database we can follow up pest and outdoor species incidences over years. So we can consider and discuss the pest and other animal situation of the city of Zurich with specialists of other urban areas comparing data and discussing necessary measures on a professional level.

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