Parasitol Res (2011) 109:1161–1164
DOI 10.1007/s00436-011-2361-0

ORIGINAL PAPER

Phlebotomus (*Transphlebotomus*) *mascittii* Grassi, 1908, in Carinthia: first record of the occurrence of sandflies in Austria (Diptera: Psychodidae: Phlebotominae)

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Received: 15 March 2011 / Accepted: 16 March 2011 / Published online: 27 April 2011

Abstract During an entomology survey in July 2009 and July 2010, 4 males and 22 females of *Phlebotomus (Transphlebotomus) mascittii* were caught in southeastern Carinthia. These are the first documented records of the occurrence of Phlebotominae in Austria.

Introduction

Sandflies (Psychodidae: Phlebotominae)—vectors of *Leishmania* species as well as of phleboviruses—have been known in Mediterranean parts of Europe for long and have been recorded in the west of Europe sporadically also far more north, up to about 49° N latitude (Lewis 1982). The northernmost records of sandflies in Europe are represented by *Phlebotomus (Transphlebotomus) mascittii* Grassi 1908 (Rioux et al. 1969). In Germany, the first records of sandflies, namely *P. mascittii* were reported from the southwestern parts in 1999 (Naucke and Pesson 2000; Naucke 2002), and subsequently also in the south of Belgium (again *P. mascittii*) (Depaquit et al. 2005). These findings were of particular significance in connection with apparently autochthonous cases of leishmaniasis in humans and animals in Germany (Bogdan et al. 2001; Naucke 2002; Walochnik and Aspöck 2010).

In Austria (in its present boundaries), the occurrence of sandflies has, however, never been verified although the insect fauna in this part of Central Europe is largely composed by Mediterranean elements. There is only one observation around the 1950s by the late Prof. Max Beier, former director of the Department of Zoology of the Natural History Museum in Vienna and a leading authority in the Austrian entomology, who reported to one of the authors (H.A.) in the 1970s that he had been attacked by a sandfly somewhere in the Lavant valley in Carinthia in the 1950s; more information was, however, not available.

The detection of sandflies in Germany more than a decade ago and the emergence of possibly autochthonous cases of visceral leishmaniasis (Beyreder 1962; Kollaritsch et al. 1989; Dornbusch et al. 1999) gave rise to start a search for sandflies in Austria. These field studies were successful.

Material and methods

From 24 to 29 July 2009 and from 13 to 14 July 2010, field studies with the aim to detect sandflies were carried out in 33 capture sites with 63 trap nights in Carinthia (see map, Fig. 1). This area was chosen because the northernmost focus of

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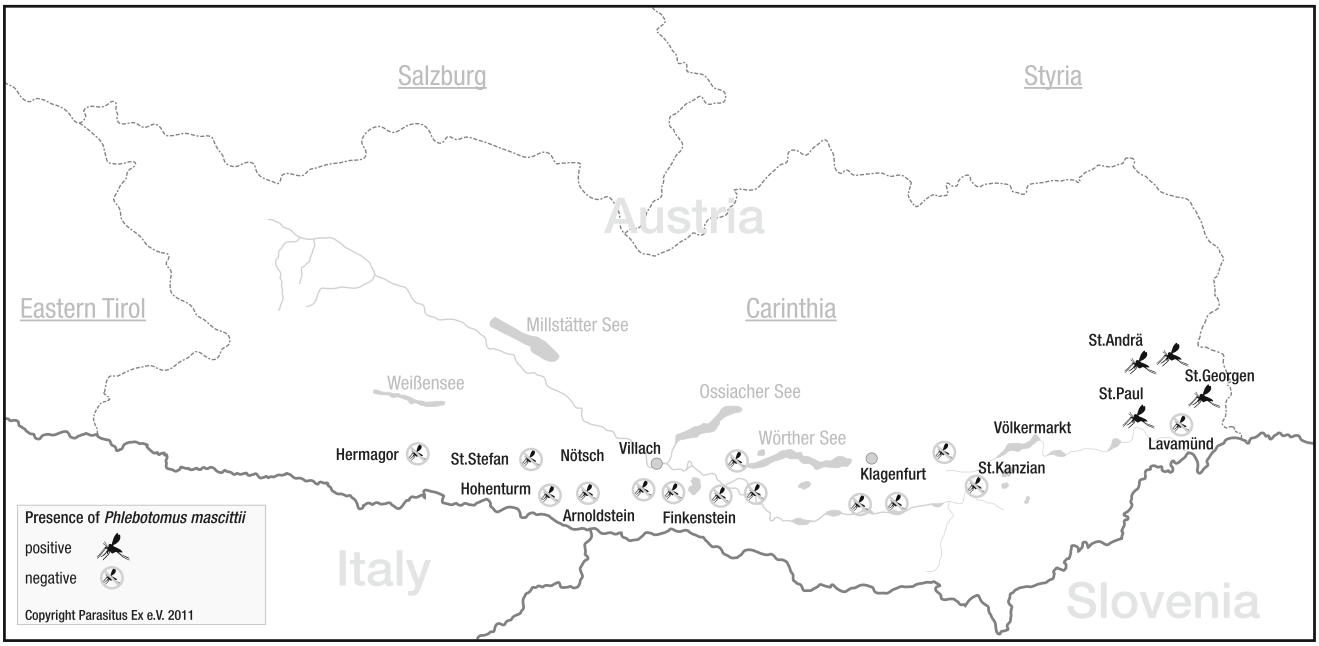

Fig. 1 Map showing 18 from 33 capture sites in Carinthia where CDC traps were run for searching for sandflies. Overlapping capture sites are not shown. *Crosses* indicate localities where no sandflies were found, the sandflies symbolize localities where *P. mascittii* could be detected

leishmaniasis in Italy is located only in a distance of 80 km to the Austrian (Carinthian) border (Otranto et al. 2009). CDC miniature light traps were used; they were run from 7:00 p.m. to 9:00 a.m. when the gaze bags were collected. The bags were exposed to CO_2 for about 1 h or put into a deep freezer for 1 h. Afterwards the contents were carefully inspected on a sheet of white paper. Sandflies were immediately transferred into 70% ethanol for later identification. Each individual was cleared in potassium hydroxide solution and slide-mounted in Hoyer's fluid for microscopic examination (Naucke 1998). The identification was based on the examination of morphological characters of the male genitalia and of the female spermathecae, respectively.

Results

Altogether, 26 specimens were clearly identified as *P. (Transphlebotomus) mascittii* (Fig. 2). In detail, the specimens originated from the following four localities (see map):

1. Mühldorf (46°44′10.5″ N/14°51′37.9″ E at 415 m.a.SL): two males (1, 2) and nine females (3–11) in 2009, and two males (23, 24) and two females (25, 26) in 2010. The traps were set on a farm close to animal sheds (cattle, goats, chicken) from 28 to 30 July 2009 for two nights and from 13 to 14 July 2010 for one night.
2. Ragglach (46°44′29.8″ N/14°54′16.0″ E at 530 m.a.SL): seven females (12–18). The trap was set on a small farm close to an animal shed with cows from 28 to 30 July 2009 for two nights.
3. Matschenbloch (46°42′06.8″ N/14°55′24.7″ E at 460 m.a. SL): two females (19, 20). The trap was set near a household with two dogs in a barn from 28 July to 30 July 2009 for two nights.
4. Schwabegg (46°39′0.3″ N/14°50′51.9″ E at 378 m.a. SL): two females (21, 22). The trap was set in a barn from 28 July to 30 July 2009 for two nights.

These are the first documented findings of sandflies in Carinthia and in Austria.

Discussion

P. mascittii was originally described from Rome (Italy) and subsequently found in several Mediterranean regions from Spain in the west to Turkey in the east (Seccombe et al. 1993). Moreover, it has been found in north of the Alps in

Fig. 2 A female of *P. (Transphlebotomus) mascittii* almost completely engorged with human blood

Switzerland, France, Belgium, and in recent years in Germany. In Switzerland, *P. mascittii* was captured in the western canton Vaud (Galli-Valerio 1912; Gaschen 1956a) and in the southern canton Ticino (Gaschen 1956b; Knechtli and Jenni 1989). In France, where *P. mascittii* has been reported from 25 departments, the most northern location was Savignies (department Oise) near Beauvais (Larrousse 1923; Langeron and Nitzulescu 1931), and one female was caught in the border province Alsace (Callot 1950). In southern Belgium (Depaquit et al. 2005) and in Germany, its wide distribution is known along the Rhine valley and at one location at the river Moselle near Cochem (Naucke et al. 2008a). Considering this distribution, the presence of *P. mascittii* in southwestern Austria is not surprising and confirms the expectations of Rioux's et al. (1969).

In a climatological study on the possible occurrence of sandflies in Austria, in which various parameters of the localities in other parts of Central Europe (including Hungary) where sandflies have been found, were compared with the climatic conditions in various parts of Austria. It was found that a slight increase of temperature would lead to conditions suitable for the occurrence of sandflies (Aspöck et al. 2007, 2008). Not surprisingly, apparently these conditions have already existed in isolated areas, as could have been expected with respect to at least three possibly autochthonous cases of visceral leishmaniosis. Thus, M. Beier's old—but not documented—observation could be confirmed impressively.

It may be a little bit surprising that *P. mascittii* has been found in Carinthia and not *Phlebotomus neglectus*, which is to be expected to be in the south and southeast of Austria (Aspöck et al. 2008).

As *P. mascittii* is always found at low densities, little is known about its biology. However, previous field surveys gave evidence of its anthropophilic nature (Pesson et al. 1985; Grimm et al. 1993). *P. mascittii* is the only European sandfly species, which can be found in special ecological niches, such as tunnels, even during winter time (Naucke et al. 2008a). During this study in the south of Austria, *P. mascittii* was caught in places situated close to human dwellings.

P. mascittii has never been proven to be a vector of leishmaniasis, but it is noteworthy that when it occurs in *Leishmania infantum*-endemic regions, it is often captured in small numbers in association with highly dense populations of the main local vector. Presently, data are not available on the natural and/or experimental infection of females. Nevertheless, the affinity of *P. mascittii* to the subgenera Adlerius and Larroussius (Rispail 1990), which includes all the potential vectors of Mediterranean kala-azar, suggests that the role of this species should no longer be overlooked, especially in areas such as Austria, where *Leishmania* infections have become the most frequently imported arthropod-borne disease in dogs, particularly in connection with the steadily increasing tourism and import of dogs from Mediterranean countries (Glaser and Gothe 1998a; b; Aspöck and Walochnik 2009; 2010; Naucke et al. 2008b; Walochnik and Aspöck 2010).

It has repeatedly been discussed whether the recent records of sandflies in Central Europe are recent immigrations due to global warming. This is certainly not the case! Although all sandfly species found in extra-Mediterranean parts of Europe are Mediterranean faunal elements (which means that they survived the last glacial period in refugial areas in Mediterranean parts), they have post-glacially expanded their distribution areas to the north even more widely than today. The most significant input of Mediterranean elements occurred during the Holocenian Optimum about 6,500 years ago, when the temperatures increased up to values around today or even higher than the present. Another warm period followed about 4,500 years ago and induced certainly further waves of immigrations of Mediterranean faunal elements to Central Europe. Many species—animals as well as plants—remained widely distributed in Central Europe also during the following colder periods, others disappeared entirely, but others survived in small areas with favourable climatic conditions, scattered in various parts of Central Europe. There are numerous examples also and particularly among the insects (Aspöck 2008, 2010), the sandflies represent such remnants of warmer periods in Central Europe. So far, they have simply been overlooked, as nobody had specifically searched for Phlebotominae. Nevertheless, global warming is of great importance as it leads to a new expansion of these much localized spots of the occurrence of sandflies.

It is no doubt that sandflies will gradually become insects much more widely distributed in extra-Mediterranean parts of Europe in the course of this century. With respect to their capacity as vectors of *Leishmania* species as well as of phleboviruses, this phenomenon merits greatest attention and surveillance (Walochnik and Aspöck 2010; Dobler and Aspöck 2010).

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