Mosquito Sampling for Arbovirus Surveillance
Central and Eastern Switzerland
Report 2013

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Abstract

Over the course of two months in late summer and early fall 2013, mosquitoes were collected in central and north-eastern Switzerland. Sixteen locations were selected to cover this area, each consisting of a suburban and a natural site. Additional sampling by using gravid traps which were run over night was done at sites in and around Zürich. Sampling at 8 of the 16 locations and at the additional sites yielded 311 mosquitoes only, and the sampling at the other 8 sites was cancelled (postponed to 2014). Probably, it was too late in the season to get high numbers of mosquitoes at these locations.

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Introduction

In order to expand the geographical range of an arbovirus surveillance conducted by the Laboratory Spiez, mosquito collections were done in central and north-eastern Switzerland. The focus was laid on collecting Culex and Aedes mosquitoes by using gravid traps which were filled with hay water infusion and which were run over night. Sixteen locations with a suburban and a natural site were chosen in this geographical area, and additional sites in and around Zürich were sampled.

Material and Methods

Locations and planned routes for sampling

Sixteen locations were chosen to representatively cover Central and Eastern Switzerland, including locations in the cantons of Zürich, Aargau, Luzern, Zug, Schwyz, Glarus, Schaffhausen, Thurgau and St. Gallen (Fig. 1). Four routes with four different locations each were planned for the field work (Table 1). At each location, a suburban and a natural habitat were identified. Additionally, mosquitoes were sampled with gravid traps at several time points around the Institute of Parasitology (suburban site) and at the Zoo of Zürich. Also, on single occasions, traps were run at the shores of Greifensee and Pfäffikersee (Canton of Zürich).

Table 1. The 16 chosen locations in Central and Eastern Switzerland, and their assignment to four (1-4) routes.

Route	Location			
1	Schaffhausen	Bodensee (Untersee)	Romanshorn	Frauenfeld
2	St. Gallen	Altstätten	Sargans	Weesen
3	Sihlwald	Zug	Schwyz	Einsiedeln
4	Zürich	Bözen	Hallwil	Luzern

Figure 1: Map showing the 16 chosen locations in Central and Eastern Switzerland, and their assignment to four (1-4) routes. The red colour indicates locations that were sampled in late summer 2013 and blue indicates locations that were selected but not sampled.

Sampling sites

Route 1

Location: Schaffhausen

Figure 2: The trapping locations in the vicinity of Schaffhausen. On the left is the suburban site (coordinates: N47.673277 E8.595790) and the natural site on the right (coordinates: N47.689211 E8.535022).

Location: Bodensee (Untersee)

Figure 3: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.664036 E9.080768) and the natural site on the right (coordinates: N47.652346 E8.977283).

Location: Romanshorn

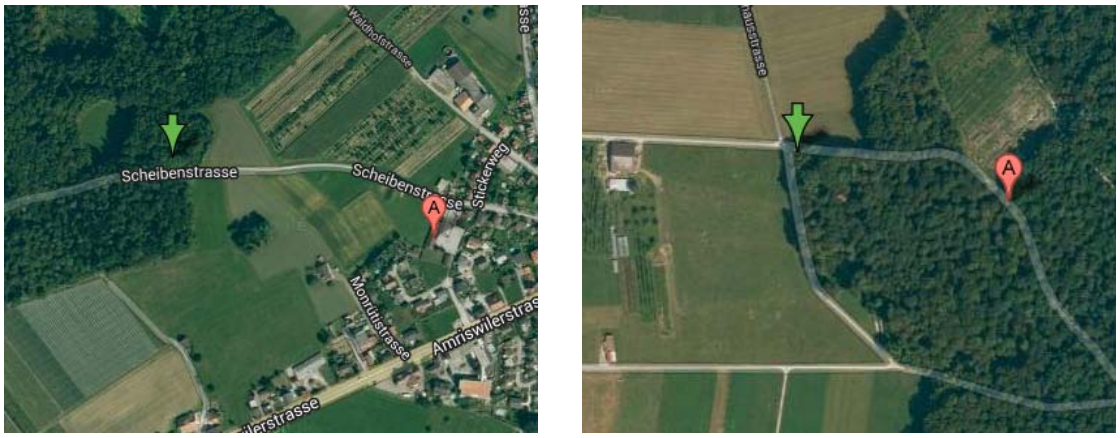

Figure 4: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.565505 E9.353790) and the natural site on the right (coordinates: N47.571111 E9.322778)

Location: Frauenfeld

Figure 5: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.550664 E8.913020) and the natural site on the right (coordinates: N47.538192 E8.927592).

Route 3

Location: Sihlwald

Figure 6: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.399402 E8.553359) and the natural site on the right (coordinates: N47.257206 E8.559127).

Location: Zug

Figure 7: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.173747 E8.521946) and the natural site on the right (coordinates: N47.203557 E8.559578).

Location: Schwyz

Figure 8: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.035627 E8.644039) and the natural site on the right (coordinates: N47.055114 E8.624610).

Location: Einsiedeln

Figure 9: The trapping locations in the vicinity of the Untersee. On the left is the suburban site (coordinates: N47.140256 E8.746871) and the natural site on the right (coordinates: N47.129673 E8.727583).

Routes 2, 4

As only low yields of mosquitoes were obtained when sampling the locations of routes 1 and 3 in September 2013, it was decided to postpone the samplings at the locations of routes 2 and 4 to early summer 2014 and thus, the precise sites are not yet determined.

Additional samplings:

As the prospect of obtaining high mosquito yields was low, it was decided not to sample the locations of routes 2 and 4 (not cost-efficient), but rather do additional samplings at locations nearby at the Greifensee and the Pfäffikersee. At both locations two gravid traps were set side by side. Also mosquitoes were sampled at the Institute of Parasitology of the University of Zurich (IPZ) and the Zoo Zurich.

Location: Greifensee

Figure 10: One of the additional sampling sites at the shore of Greifensee (coordinates: N47.361201 E8.651693)

Location: Pfäffikersee

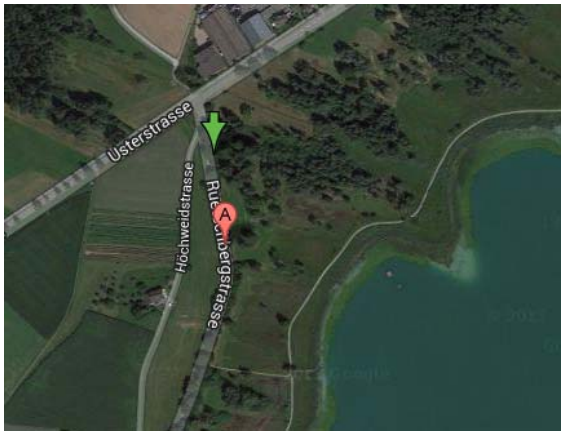

Figure 11. One of the additional sampling sites at the shore of Greifensee (coordinates: N47.362241 E8.767089)

Location: Institute of Parasitology

Figure 12: Two sites were chosen near the IPZ. The left one was closer to the IPZ (coordinates: N47.399402 E8.553359) and the right one was deeper in the forest (coordinates: N47.401319 E8.556481). Two gravid traps were run at both sites simultaneously.

Location: Zoo Zurich

Figure 13: Eight gravid traps were run at several locations inside the Zoo Zurich (coordinates: N47.385827 E8.574826).

Sampling method

Mosquitoes were lured to gravid traps containing hay infusion (100g hay, 0.8 g yeast, 0.8 g lactalbumin (Sigma), 20 L water; incubated for 5-7 days at 28 °C). The traps were placed in shaded sites (forest edges, bushes) and run at each location overnight (at IPZ sometimes also over the weekend). On the next day, the traps were collected and the containers with the mosquitoes were put into a styrofoam box containing cooling elements (chilled at -20 °C). The inside of the box had a temperature between 0 and 10 °C. At the IPZ, the mosquitoes were killed and stored

at -20 °C. The mosquitoes were identified with binoculars, sorted on a cooling table (Styrofoam box filled with dry ice, aluminium cover) and put in pools of maximum 10 into Collection Microtubes (Qiagen, Cat. No. 19560).

Results

Mosquito collection

More than 300 mosquitoes were caught during the sampling in late summer of 2013 (Table 2). Generally, there were more Culex (~2/3) than Aedes (~1/3) specimens present. Most mosquitoes were caught in mid-August. In late August and in September, the yields decreased and the percentage of *Ae. japonicus* in the collections increased. For details see table 2.

Table 2: Locations, dates and numbers of Aedes and Culex mosquitoes caught during the sampling in late summer of 2013. All the Culex were part of the *Culex pipiens/torrentium* complex and all the Aedes were *Aedes japonicus*, except the ones marked with * that were identified as *Aedes geniculatus*. "-" indicates that no trap was set at this site.

Location	**Date**	**Suburban Site**		**Natural Site**	
		Aedes	Culex	Aedes	Culex
Zoo Zürich	13.08.2013	0	97	-	-
Zoo Zürich	15.08.2013	10	3	-	-
IPZ Zürich	16.08.2013	8	16	-	-
IPZ Zürich	16. - 19.08.2013	35	56	-	-
IPZ Zürich	20.08.2013	5	4	-	-
Sihlwald	23.08.2013	-	-	0	0
Zug	23.08.2013	1	0	1	0
Schwyz	23.08.2013	1	0	1	0
Einsiedeln	23.08.2013	3	0	0	0
Schaffhausen	06.09.2013	1	1	0	0
Untersee	06.09.2013	0	0	0	3
Romanshorn	06.09.2013	0	1	0	0
Frauenfeld	06.09.2013	2*	0	0	0
Greifensee	20.09.2013	-	-	1	0
Pfäffikersee	20.09.2013	-	-	0	0
IPZ	several	3	58	-	-
		64	236	3	3

There are also more mosquitoes from the Zoo, but they have to be evaluated first (dates: 04.09.2013 and 08.10.2013). There are approximately 50 more.

Discussion

Most of the mosquitoes were caught in mid-August. Later, especially during the sampling at the specified locations, mosquito numbers were very low. It is striking that almost no Culex were caught at later time points. The period of end of August and beginning of September was very warm, but also very dry. This might have affected the catch. Additionally high peaks of many mosquito populations are in June and July, explaining the low numbers caught in late summer and early fall. There can still be some local variations of numbers, but these spots could have been missed. At the suburban site of Schaffhausen, many family gardens are in the vicinity, and many water filled containers can be found there, being perfect mosquito breeding habuitats. However, it is possible that the number of breeding sites was too high and therefore the catch low. Most other locations were protected sites in or near forest areas. These should have at least yielded tree hole breeding mosquito species. The presence of many other insects in the traps (not shown) indicates that the traps technically worked well. Repeated trapping at the locations of route 1 and 3 in summer 2014 will indicate whether they are as suitable as was estimated.

Estimated costs

Costs for survey conducted in fall 2013

To set up traps at different locations in Switzerland, a car was required (rented via the Mobility car share company). The investigator returned to Zürich at the evening (thus no hotel costs incurred)

Route		km	Cost (CHF)
Route 1	Set traps	250	190.-
	Collect traps	200	160.-
Route 3	Collect traps	200	160.-
	Collect traps	150	130.-
Greifensee	Set traps	75	75.-
	Collect traps	50	50.-
Total		925	765.-

To do the tasks, an intern was hired for three months with a 30% employment. This resulted in a net cost of 3420.- CHF. Combined with the driving costs, the total will be around 4200.- CHF for 2013.

Costs for surveys to be conducted in spring/early summer 2014

Route		km	Cost (CHF)
Route 1	Set traps	250	190.-
	Collect traps	200	160.-
Route 2	Set traps	300	210.-
	Collect traps	250	190.-
Route 3	Collect traps	200	160.-
	Collect traps	150	130.-
Route 4	Set traps	230	180.-
	Collect traps	180	150.-
Total		1760	1370.-

To do the rest of the routes, another intern would be hired in spring 2014. The trips could be done in two to three weeks, resulting in 2000-3000.- CHF additional hiring costs.