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Psyllids (Hemiptera, Psylloidea) captured in commercial apple and stone fruit orchards in southwest Germany, eastern France and northwest Switzerland

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Psyllids are vectors of important phytoplasma diseases of apple and stone fruits. From 2001 to 2007 psyllid captures were carried out in commercial apple and stone fruit orchards in southwest Germany (D), Alsace (F) and northwest Switzerland (CH). Psyllids were also collected from wild *Prunus* species in the neighbourhood of commercial stone fruit orchards. In total, data were obtained from 94 sites in 14 districts in Germany (Baden-Württemberg, Rheinland-Pfalz), France (Bas-Rhin) and Switzerland (Aargau, Solothurn). Twenty five psyllid species were captured on apple. The confirmed phytoplasma vector *Cacopsylla picta* and *C. melanoneura*, a vector in northwest Italy, were the most abundant species followed by *C. mali* and *C. pulchra*. Twenty one psyllid species were found on the stone fruit species *Prunus amygdalus* (almond), *P. armeniaca* (apricot), *P. persica* (peach), *P. domestica* (European plum), *P. cerasifera* (cherry plum) and *P. spinosa* (blackthorn). The most abundant species was again a phytoplasma vector species: *C. pruni*. This species as well as *C. melanoneura* were captured on all tested *Prunus* species. A detailed list of the abundance and geographic distribution of the psyllid species in the studied regions is given. This list will give valuable information to advisors and growers less experienced in psyllid identification on which psyllid species may occur in their orchard when looking for phytoplasma vector species.

Keywords: *Malus*, *Prunus*, phytoplasma, apple proliferation, European stone fruit yellows, *Cacopsylla picta*, *Cacopsylla pruni*, *Cacopsylla melanoneura*, distribution, Central Europe.

INTRODUCTION

Apple proliferation (AP) and European stone fruit yellows (ESFY) are serious diseases of *Malus* and *Prunus*, respectively, leading to important economic losses in Central and Southern Europe. Both diseases are caused by phytoplasmas: AP by '*Candidatus* Phytoplasma mali' and ESFY by '*Candidatus* Phytoplasma prunorum' (Seemüller & Schneider 2004). These are transmitted by psyllids in a persistent manner, i.e. '*Ca*. P. mali' by *Cacopsylla picta* (Foerster) (Frisinghelli *et al*. 2000) and, in northwest Italy, by *C. melanoneura* (Foerster) (Tedeschi *et al*. 2002) and '*Ca*. P. prunorum' by *C. pruni* (Scopoli) (Carraro *et al*. 1998).

AP has been known in southwest Germany and neighbouring regions for decades. It re-emerges from time to time in serious epidemics (Bliefernicht & Krczal 1995). The last epidemic started in 2000 (Harzer 2000). Jarausch *et al*. (2003, 2004) identified *C. picta* as vector of '*Ca*. P. mali' in Germany. ESFY is a serious disor-

Tab. 1. Numbers and types of orchards were psyllids were collected on apple (*Malus* x *domestica* Borkh.). Abbreviations: D = **Germany**: BW = Baden-Württemberg: FR = Freiburg/Breisgau, HD = Heidelberg, Rhein-Neckar-Kreis, KA = Karlsruhe, OG = Ortenaukreis (Offenburg); – RP = Rheinland-Pfalz: DÜW = Bad Dürkheim/Weinstrasse, MYK = Mayen-Koblenz, Andernach, MZ = Mainz, Mainz-Bingen, NW = Neustadt/Weinstrasse, SÜW = Südliche Weinstrasse (Landau); – F = **France**: BR = Bas-Rhin; – CH = **Switzerland**: AG = Aargau, SO = Solothurn.

Country	**state**	**district**	**type of orchard**				**total**
			commercial	**organic farming**	**abandonned**	**scattered**	
D	BW	HD	2			1	3
	BW	KA	1				1
	BW	OG	1			1	2
	BW	FR	1				1
	RP	MYK		1			1
	RP	MZ	4	1			5
	RP	DÜW	5	2	1	6	14
	RP	NW	5		2	5	12
	RP	SÜW	6				6
F	BR		2			1	3
CH	AG		1				1
	SO					1	1
total							50

der of apricots and Japanese plum in the Mediterranean Region and was only recently recognized as a problem in Switzerland (Ramel & Gugerli 2004) and Germany (Jarausch *et al.* 2007b). *C. pruni* was confirmed as vector of '*Ca.* P. prunorum' in both countries. However, nothing was known about the distribution of the vectors in commercial apple and stone fruit orchards in Germany, France and Switzerland. There was also a lack of information on the potential critical role played by wild *Prunus* species on the populations of *C. pruni* in orchards.

Two issues are crucial for the successful application of control measures against the vector species: 1 – the knowledge on abundance and geographical distribution of the vectors and 2 – the correct identification of the vectors by advisors and growers. The identification of psyllids is often demanding for the non-specialist. For this reason Burckhardt (2007) designed a simplified electronic identification key available on the internet. Knowing which psyllid species occur in a particular area greatly simplifies identifying specimens to species.

The present paper lists psyllid species found during vector monitoring in apple and stone fruit orchards in southwest Germany, eastern France and northwest Switzerland. This information reflects the current distribution of the vector species in this area.

MATERIAL AND METHODS

From 2001 to 2007 psyllids were monitored in 50 apple orchards in southwest Germany, eastern France and northwest Switzerland (Tab. 1) and in 44 stone fruit orchards in southwest Germany (Tab. 2). The orchards were situated in **Germany** (= D) in the following 2 states (Bundesland) and 11 districts (Stadt-/Landkreis, cited according to official car registration numbers): Baden-Württemberg (BW): Freiburg/Breisgau (= FR), Heidelberg, Rhein-Neckar-Kreis (= HD), Karlsruhe (= KA),

Tab. 2. Numbers and types of orchards in Germany (Rheinland-Pfalz) were psyllids were collected on various *Prunus* species. Abbreviations: DÜW = Bad Dürkheim/Weinstrasse, GER = Germersheim, MYK = Mayen-Koblenz, Andernach, MZ = Mainz, Mainz-Bingen, NW = Neustadt/Weinstrasse, RP = Rhein-Pfalz-Kreis, SÜW = Südliche Weinstrasse (Landau).

***Prunus* species**	**district**	**type of orchard**			**total**
		commercial	**scattered**	**wild plants**	
P. amygdalus Batsch	NW		3		3
P. armeniaca L.	MYK	3			3
	MZ	6			6
	NW	2			2
	RP	1			1
	GER	1			1
P. cerasifera Ehrh.	MZ			1	1
	DÜW			1	1
	NW			3	3
P. domestica L.	MYK	4			4
	NW	1			1
P. insititia Linnaeus	NW	1			1
P. persica (L.) Batsch	MYK	1			1
	NW	2			2
	RP	2			2
	GER	1			1
P. spinosa L.	MYK			2	2
	MZ			1	1
	DÜW			1	1
	NW			3	3
	SÜW			1	1
P. cerasifera and *P. spinosa*	MYK			1	1
	NW			1	1
Prunus rootstock suckers	NW	1			1
total					44

Ortenaukreis (Offenburg) (= OG); – Rheinland-Pfalz (= RP): Bad Dürkheim/Weinstrasse (= DÜW), Germersheim (= GER), Mayen-Koblenz, Andernach (= MYK), Mainz, Mainz-Bingen (= MZ), Neustadt/Weinstrasse (= NW), Rhein-Pfalz-Kreis (= RP), Südliche Weinstrasse (Landau) (= SÜW); in **France** (= F) in the state (département) Bas-Rhin (= BR); and in **Switzerland** (= CH) in the states (cantons) Aargau (= AG) and Solothurn (= SO).

The psyllids were collected using the beating tray method described by Müther & Vogt (2002). One hundred branches were sampled per sampling date and orchard. Psyllid collections were done in reference orchards and wild locations near Neustadt at weekly intervals during 2001–2005. Psyllid captures in all other sites were done in the period from March to July when the vector species are present on their host plant. These captures were performed weekly for reference orchards of every district and irregularly in the other sites.

RESULTS

Faunal composition

Malus. In total 25 psyllid species of 8 genera were collected (Tab. 3). Three species, i.e. *Cacopsylla mali*, *C. melanoneura* and *C. picta* were represented by high numbers of individuals (> 1000). The remainder of species was represented by 100–1000 specimens (1 species), 10–100 specimens (8 species) and < 10 specimens (13 species). Most species develop on woody plants (22 species) and only 3 on herbs (*Aphalara polygoni*, *Bactericera femoralis* and *Trioza urticae*). The species developing on woody Rosaceae are best represented in terms of individuals (11'073) comprising 10 *Cacopsylla* spp.: *C. affinis*, *C. breviantennata*, *C. crataegi*, *C. mali*, *C. melanoneura*, *C. picta*, *C. pruni*, *C. pyri*, *C. pyricola* and *C. pyrisuga*. The second most important component is an assemblage of 4 species associated with Salicaceae (*Bactericera albiventris*, *Cacopsylla brunneipennis*, *C. pulchra* and *C. saliceti*), represented by 220 specimens. Fifteen species overwinter as adults on conifers.

Prunus. In total 21 psyllid species of 6 genera were collected (Tab. 4). One species, i.e. *Cacopsylla pruni* was represented by high numbers of individuals (> 1000). The remainder of species was represented by 100–1000 specimens (1 species), 10–100 specimens (7 species) and < 10 specimens (12 species). Nineteen species develop on woody plants and only 2 on herbs (*Aphalara freji* and *Trioza urticae*). The species developing on woody Rosaceae were best represented in terms of individuals (4737) comprising 10 *Cacopsylla* spp.: *C. affinis*, *C. crataegi*, *C. mali*, *C. peregrina*, *C. melanoneura*, *C. picta*, *C. pruni*, *C. pyri*, *C. pyricola* and *C. pyrisuga*. There were 5 species associated with Salicaceae (*Bactericera albiventris*, *Cacopsylla ambigua*, *C. brunneipennis*, *C. pulchra* and *C. saliceti*), represented by 101 specimens. Thirteen species overwinter as adults on conifers.

By far the largest number of adult *C. pruni* were collected on *Prunus spinosa* (> 1000 inididuals), followed by *P. armeniaca*, *P. cerasifera* and *P. domestica* (100–1000 individuals), *P. persica* (10–100 individuals) and *P. amygdalus* and *P. insititia* (1–10 individuals).

Distribution and abundance

Malus. The confirmed vector species of AP, *C. picta*, and the AP-vector in northwest Italy, *C. melanoneura*, were detected in all surveyed districts in southwest Germany, Alsace and northwest Switzerland. *C. mali*, whose host plant is apple, was found in 8 out of 12 districts. This species was very abundant in untreated orchards. The majority of the other species were captured occasionally in few districts only. Exceptions were two very common *Trioza* species: *T. remota* and *T. urticae*. The pear psyllid *C. pyrisuga* was also regularly captured (7 out of 12 districts) despite its low abundance. *C. pulchra*, developing on *Salix* spp., was found in important numbers in southwest Germany.

Prunus. The confirmed vector species of ESFY, *C. pruni*, was most abundant and was detected in 6 out of 7 surveyed districts of southwest Germany as well as on all examined *Prunus* species. *C. melanoneura* was the second most abundant species which was detected in all 7 districts and on almost all *Prunus* species. All other species were found more irregularly in lower numbers of specimens. Particular high numbers of *C. pruni* were captured on wild *P. spinosa* and on hedges where *P. spinosa* was present.

Tab. 3. Psyllids found in orchards on *Malus* x *domestica* Borkh. (= syn. *Malus pumila* Mill.). Abbreviations: D = **Germany**: BW = Baden-Württemberg: FR = Freiburg/Breisgau, HD = Heidelberg, Rhein-Neckar-Kreis, KA = Karlsruhe, OG = Ortenaukreis (Offenburg); – RP = Rheinland-Pfalz: DÜW = Bad Dürkheim/Weinstrasse, MYK = Mayen-Koblenz, Andernach, MZ = Mainz, Mainz-Bingen, NW = Neustadt/Weinstrasse, SÜW = Südliche Weinstrasse (Landau); – F = **France**: BR = Bas-Rhin; – CH = **Switzerland**: AG = Aargau, SO = Solothurn.

Psyllid species	**number of specimens**	**country**	**state**	**district**	**number of sites**
Aphalara polygoni (Foerster) = syn. *A. rumicicola* Klimaszewski	2	D	RP	DÜW	1
		D	BW	KA	1
Arytainilla spartiophila (Foerster)	3	D	RP	NW	1
Bactericera albiventris (Foerster)	15	D	RP	DÜW, NW, SÜW	7
		D	BW	HD	1
Bactericera femoralis (Foerster)	1	D	RP	DÜW	1
Cacopsylla affinis (Löw)	9	D	RP	DÜW, NW, SÜW	6
		D	BW	HD, OG	2
Cacopsylla breviantennata (Flor)	1	CH	AG		1
Cacopsylla brunneipennis (Zetterstedt)	5	D	RP	NW	1
Cacopsylla crataegi (Schrank)	11	D	RP	DÜW, SÜW	6
		D	BW	HD, KA	2
Cacopsylla mali (Schmidberger)	5187	D	RP	DÜW, MYK, MZ, NW, SÜW	15
		D	BW	HD, KA	2
		CH	SO		1
Cacopsylla melanoneura (Foerster)	4272	D	RP	DÜW, MYK, MZ, NW, SÜW	32
		D	BW	FR, HD, KA, OG	7
		F	BR		3
		CH	AG		1
		CH	SO		1
Cacopsylla picta (Foerster)	1506	D	RP	DÜW, MYK, MZ, NW, SÜW	33
		D	BW	FR, HD, KA, OG	7
		F	BR		3
		CH	AG		1
		CH	SO		1
Cacopsylla pruni (Scopoli)	22	D	RP	DÜW, NW, SÜW	11
		CH	AG		1
Cacopsylla pulchra (Zetterstedt)	166	D	RP	DÜW, NW, SÜW	12
		D	BW	HD	1
Cacopsylla pyri (Linnaeus)	41	D	RP	NW, SÜW	4
		D	BW	KA, OG	2
		CH	AG		1

Cacopsylla pyricola (Foerster)	4	D	BW	HD, KA	2
Cacopsylla pyrisuga (Foerster)	20	D	RP	DÜW, NW, SÜW	11
		D	BW	HD, OG	2
		CH	AG		1
		CH	SO		1
Cacopsylla rhamnicola (Scott)	3	D	RP	DÜW	1
		D	BW	OG	1
Cacopsylla saliceti (Foerster)	38	D	RP	DÜW, NW, SÜW	4
		F	BR		3
Psylla alni (Linnaeus)	1	D	RP	SÜW	1
Psyllopsis fraxini (Linnaeus)	1	F	BR		1
Psyllopsis fraxinicola (Foerster)	1	D	BW	KA	1
Rhinocola aceris (Linnaeus)	1	D	BW	KA	1
Trioza remota Foerster	67	D	RP	DÜW, MZ, NW, SÜW	13
		D	BW	HD, KA, OG	5
		CH	AG		1
		CH	SO		1
Trioza rhamni (Schrank)	2	D	AG		1
Trioza urticae (Linnaeus)	68	D	RP	DÜW, NW, SÜW	10
		D	BW	HD, KA, OG	3
		CH	AG		1
		CH	SO		1

DISCUSSION

In total 25 psyllid species of 8 genera were collected on apple and 21 psyllid species of 6 genera on *Prunus* spp., respectively. They all represent common and wide-spread species in Central Europe (Burckhardt 2004). By far the most individuals collected on apple belong to *Cacopsylla mali*, *C. melanoneura* and *C. picta* which develop only or also on apple. A comparable result was found on *Prunus* spp. were the vast majority of individuals were *C. pruni* which develops only on this host genus. This result was expected. Fifteen species collected on apple and thirteen species collected on *Prunus* spp. overwinter as adults on conifers. Adults of these species migrate in summer/autumn from their host plants to conifers and in the following spring back to their hosts over long distances (Čermák & Lauterer 2008). In spring, before reaching their host plants, they may be found accidentally also on other plants. The polyvoltine species *C. pyri* and *C. pyricola* which overwinter on their host, *Pyrus* spp., have short distance migratory phases and accordingly the two species have been found predominantly in stone fruit orchards where pear orchards were in the surroundings. The findings of the vast majority of species are accidental, suggesting that additional similar sampling effort would add more species.

Tab. 4. Psyllids collected on different *Prunus* species in and around orchards in Germany (Rheinland-Pfalz). Abbreviations: DÜW = Bad Dürkheim/Weinstrasse, GER = Germersheim, MYK = Mayen-Koblenz, Andernach, MZ = Mainz, Mainz-Bingen, NW = Neustadt/Weinstrasse, RP =Rhein-Pfalz-Kreis, SÜW = Südliche Weinstrasse (Landau).

***Prunus* species**	**psyllid species**	**number of specimens**	**district**	**number of sites**
P. amygdalus Batsch	*Cacopsylla melanoneura* (Foerster)	2	NW	1
	Cacopsylla pruni (Scopoli)	10	NW	4
	Psylla buxi (Linnaeus)	1	NW	1
P. armeniaca L.	*Cacopsylla affinis* (Löw)	1	NW	1
	Cacopsylla crataegi (Schrank)	2	MZ, NW	1
	Cacopsylla mali (Schmidberger)	5	MZ	1
	Cacopsylla melanoneura (Foerster)	28	GER, MZ, NW, RP	5
	Cacopsylla peregrina (Foerster)	8	GER, MZ	3
	Cacopsylla picta (Foerster)	1	MZ	1
	Cacopsylla pruni (Scopoli)	539	DÜW, GER, MYK, MZ, NW	11
	Cacopsylla pulchra (Zetterstedt)	10	GER, NW	3
	Cacopsylla pyri (Linnaeus)	26	GER	1
	Cacopsylla pyricola (Foerster)	4	GER, NW	2
	Cacopsylla saliceti (Foerster)	3	NW	1
	Trioza remota Foerster	10	GER, MZ, NW	4
P. cerasifera Ehrh.	*Bactericera albiventris* (Foerster)	1	NW	1
	Cacopsylla affinis (Löw)	1	NW	1
	Cacopsylla melanoneura (Foerster)	211	DÜW, MZ, NW	6
	Cacopsylla pruni (Scopoli)	310	DÜW, MZ, NW	6
	Cacopsylla pulchra (Zetterstedt)	11	NW	3
	Cacopsylla pyri (Linnaeus)	5	NW	1
	Cacopsylla rhamnicola (Scott)	4	NW	1
	Cacopsylla saliceti (Foerster)	1	NW	1
	Trioza remota Foerster	1	NW	1
	Trioza urticae (Linnaeus)	4	NW	2
P. domestica L.	*Cacopsylla melanoneura* (Foerster)	7	NW	1
	Cacopsylla pruni (Scopoli)	348	MYK, NW	5
	Cacopsylla pulchra (Zetterstedt)	5	NW	1
	Trioza remota Foerster	1	NW	1
P. insititia Linnaeus	*Cacopsylla pruni* (Scopoli)	8	NW	1
P. persica (L.) Batsch	*Bactericera albiventris* (Foerster)	1	GER	1
	Cacopsylla affinis (Löw)	1	NW	1
	Cacopsylla melanoneura (Foerster)	33	NW, RP	3

	Cacopsylla pruni (Scopoli)	54	DÜW, GER, MYK, NW	6
	Cacopsylla pulchra (Zetterstedt)	14	GER, NW	3
	Cacopsylla pyri (Linnaeus)	41	GER	2
	Cacopsylla rhamnicola (Scott)	2	GER, NW	2
	Cacopsylla saliceti (Foerster)	7	NW, RP	2
	Trioza remota Foerster	10	GER, NW	2
P. spinosa L.	*Bactericera albiventris* (Foerster)	1	MZ	1
	Cacopsylla affinis (Löw)	1	NW	1
	Cacopsylla crataegi (Schrank)	3	DÜW, MZ, SÜW	3
	Cacopsylla melanoneura (Foerster)	318	DÜW, MZ, NW, SÜW	6
	Cacopsylla picta (Foerster)	1	MZ	1
	Cacopsylla pruni (Scopoli)	1217	DÜW, MYK, NW, SÜW	8
	Cacopsylla pulchra (Zetterstedt)	12	NW	2
	Cacopsylla pyricola (Foerster)	2	NW	1
	Cacopsylla pyrisuga (Foerster)	1	NW	1
	Cacopsylla saliceti (Foerster)	1	NW	1
	Rhinocola aceris (Linnaeus)	1	NW	1
	Trioza urticae (Linnaeus)	3	NW	2
sites with *P. spinosa* and *P. cerasifera*	*Aphalara freji* Burckhardt & Lauterer	1	MYK	1
	Cacopsylla affinis (Löw)	3	NW	1
	Cacopsylla ambigua (Foerster)	1	MYK	1
	Cacopsylla brunneipennis (Zetterstedt)	2	MYK, NW	2
	Cacopsylla crataegi (Schrank)	2	NW	1
	Cacopsylla mali (Schmidberger)	7	MYK, NW	2
	Cacopsylla melanoneura (Foerster)	55	MYK, NW	2
	Cacopsylla picta (Foerster)	1	NW	1
	Cacopsylla pruni (Scopoli)	1109	NW	2
	Cacopsylla pulchra (Zetterstedt)	31	MYK, NW	2
	Cacopsylla pyri (Linnaeus)	2	NW	1
	Cacopsylla pyrisuga (Foerster)	3	NW	1
	Cacopsylla rhamnicola (Schott)	4	NW	1
	Rhinocola aceris (Linnaeus)	1	MYK	1

	Trioza urticae (Linnaeus)	15	NW	1
rootstock suckers of different *Prunus domestica* and other *Prunus* hybrids	*Cacopsylla melanoneura* (Foerster)	11	NW	1
	Cacopsylla pruni (Scopoli)	356	NW	1

The psyllid captures were focused on the detection of the known vector species of AP and ESFY in the different regions. The population dynamics of *C. picta* and *C. melanoneura* on apple as well as those of *C. pruni* on *Prunus* were studied in the years 2001–2005 by regular insect captures during the entire year. These data have been published by Jarausch (2003) and Mayer *et al.* (2009) and demonstrate that overwintered adults of *C. melanoneura* are the first to remigrate from conifers to the orchards in February to beginning of March, followed by overwintered adults of *C. picta* which can be found from the middle of March onwards. The data for *C. melanoneura* were confirmed by Mayer & Gross (2007). Emerging adult *C. melanoneura* and *C. picta* were observed from April to June or May to July, respectively. From the end of May onwards emerging adults of *C. mali* can be found (Jarausch 2003) and may be confused with emerging adult *C. picta*. The population dynamics of *C. pruni* on *Prunus* are similar to those described for *C. picta* (Jarausch *et al.* 2007b).

The psyllid captures in the other regions and districts were restricted to the period (March to July) when the vector species are present on their respective host plant. Other psyllid species with a different life cycle may, therefore, be underrepresented in the captures. The data of psyllid collections made during the entire year in reference orchards near Neustadt indicate that no other psyllid species are dominant on *Malus* and *Prunus*. An exception is the situation, when the dominant psyllid species have been eradicated by insecticides and other psyllid species from the surroundings colonize the fruit trees for a short period of time (P. Lauterer, unpublished data). Thus, with the obvious exception of *C. mali* developing on apple, the phytoplasma vector species are the predominant species in apple and stone fruit orchards. *C. mali* is not abundant in treated commercial apple orchards but may occur in high population densities in untreated orchards. The larvae can cause direct damage to apple flowers (Burckhardt 1994). Young adults of *C. picta* and emerging adults of *C. mali* can be found during the same period on apple and, therefore, may be mis-identified by inexperienced persons.

The presented data are of high practical relevance because *C. picta* and *C. pruni* were found to be infected by the respective phytoplasma in different regions of the study. About 10 % of the field-captured overwintered adults of *C. picta* were tested positive by PCR for '*Ca.* P. mali' and successful transmission trials suggest that a high portion of these PCR-positive specimens were indeed infectious (Jarausch *et al.* 2007b). '*Ca.* P. prunorum' infected individuals of *C. pruni* were identified in all studied regions and a natural infection rate of the overwintered adults ranging from 1–3 % was determined (Jarausch *et al.* 2007a, b). Successful transmission trials demonstrated again the infectivity of these individuals (Jarausch *et al.* 2007a). Data about the host plant preference of *C. pruni* with respect to different *Prunus* species have been presented by Jarausch *et al.* (2007b) and confirm the data presented here: about 10-fold higher population densities were found on wild *P. spinosa* and *P. cerasifera* than on cultivated *P. armeniaca* or *P. persica*. In this regard, root stock suckers of *P. cerasifera* or *P. domestica* genotype are of particular concern because they are better colonised by *C. pruni* than the grafted cultivar of either apricot or peach. They play, therefore, an important role in the disease spread.

C. melanoneura has been identified as the most widespread species which was captured in all districts. The species can be found on many different woody plant species during its migration phases but has not been found on non-host plants during its reproduction period. Other work has shown that the population of *C. melanoneura* in Germany, Alsace and northern Switzerland has no capacity to transmit '*Ca.* P. mali' and is, therefore, regarded as non-vector (Mayer *et al.* 2009). These authors also showed that the highest population density of *C. melanoneura* in the area of the present study is found on wild *Crataegus monogyna*. Thus, despite its high abundance, this species seems to represent no risk for the spread of AP in the studied area.

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