Zeitschrift: Mitteilungen der Schweizerischen Entomologischen Gesellschaft = Bulletin de la Société Entomologique Suisse = Journal of the Swiss Entomological Society

Herausgeber: Schweizerische Entomologische Gesellschaft

Band: 68 (1995)

Heft: 3-4

Artikel: Morphological studies on the Aphis fabae group (Homoptera, Aphididae)

Autor: Jörg, E. / Lampel, G.

DOI: https://doi.org/10.5169/seals-402606

MITTEILUNGEN DER SCHWEIZERISCHEN ENTOMOLOGISCHEN GESELLSCHAFT
BULLETIN DE LA SOCIÉTÉ ENTOMOLOGIQUE SUISSE
68, 387 – 412, 1995

Morphological studies on the *Aphis fabae* group (Homoptera, Aphididae)

E. JÖRG & G. LAMPEL

Zoologisches Institut der Universität Freiburg, Sektion Entomologie, CH-1700 Freiburg

The taxa of the *Aphis fabae* group s.str. are morphologically difficult to separate or inseparable by a general key based only on morphological characters. On the other hand, in combination with host plants, the members of the *A. fabae* group s.l. are easily distinguishable. Only by vertical starch gel electrophoresis it is possible to distinguish all the members of the whole *Aphis fabae* complex (*Aphis fabae* group s.str. and s.l.) (JÖRG & LAMPEL, 1995). The cited paper serves as a basis of the present paper, which deals with our morphological investigations on this complex.

Keywords: *Aphis fabae* group, morphology

INTRODUCTION

Until today, it is impossible to distinguish exactly all the members of the *Aphis fabae* group s.str. Morphological methods to separate the taxa were often tried (JANISCH, 1926; FRANSSEN, 1927, 1931; JONES, 1942; JACOB, 1945; DE FLUITER, 1949; STROYAN, 1984; HEIE, 1986).

Host plant tests, carried out e.g. by JANISCH (1926), IGLISCH (1968), MÜLLER (1982), THIEME (1987), and JÖRG & LAMPEL (1995), were in some cases unsatisfying too.

Isozyme electrophoresis was sometimes more successful (survey in JÖRG & LAMPEL, 1995). JÖRG & LAMPEL (1995) succeeded in distinguishing 18 members of the *Aphis fabae* group s.str. and s.l. by vertical starch gel electrophoresis. The cited work serves as a basis of the present paper. All investigated samples could be clearly separated from each other, and therefore, it is sure that really the mentioned taxa have been treated.

MATERIAL AND METHODS

The material used in this work is listed in JÖRG & LAMPEL (1995). Specimens were stored in ethanol (80%) and then treated according to HEINZE (1952). The prepared aphids were measured and the measures and some indices were used for comparison. The significance of differences of the indices was tested by the unpaired t-test (Student-test), working on a Macintosh computer with the StatView 4.0 data analysis program (SAGER, 1992).

RESULTS

Aphis fabae group s.str.

The following seven investigated taxa are members of this group (IGLISCH, 1968, 1970; MÜLLER, 1982; MÜLLER & STEINER, 1990, combined): *Aphis armata*

Tab. 1: Results of measurements of apterous viviparous females of *A. armata, A. euonymi, A. fabae, A. philadelphi*, and A. *solanella*.

Species	Apterous viviparous females															
	A. armata			*A. euonymi*			*A. fabae*			*A. philadelphi*			*A. solanella*			
Number of specimens investigated	32			35			63			28			81			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.50	1.96	2.56	1.34	1.89	2.66	1.39	1.75	2.10	1.81	2.17	2.48	1.30	2.07	2.75	mm
Total length of antenna	0.96	1.33	1.76	0.88	1.21	1.60	0.77	1.12	1.46	1.01	1.43	1.70	0.86	1.35	1.70	mm
Length of antennal joint III	240	338	480	193	289	426	180	275	380	233	355	433	193	336	473	µm
Length of antennal joint IV	160	230	346	100	184	293	100	177	260	140	260	333	120	234	326	µm
Length of antennal joint V	133	200	280	127	185	253	113	169	226	160	235	286	127	216	286	µm
Length of basal part of antennal joint VI	93	125	167	93	119	147	100	114	133	120	144	167	93	124	160	µm
Length of processus terminalis	220	323	406	260	326	386	193	291	366	246	338	393	226	342	413	µm
Basal diameter of antennal joint III	20	25	33	20	26	32	17	29	37	20	25	32	18	29	38	µm
Longest hair on antennal joint III	46	61	71	38	59	81	25	41	58	42	51	66	17	35	66	µm
Secondary rhinaria on antennal joint III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint IV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Length of apical rostral segment	113	133	153	107	129	153	100	123	140	133	149	153	120	143	167	µm
Accessory hairs on apical rostral segment	1	2	3	2	2	3	1	2	3	2	2	3	2	2	3	
Frons	186	212	246	173	210	246	173	198	220	193	219	233	180	216	266	µm
Joint II of hind tarsus	100	123	153	93	116	153	80	114	133	113	125	140	93	119	140	µm
Siphuncular length	186	259	393	133	237	373	120	222	326	186	268	346	167	335	453	µm
Caudal length	167	207	253	147	201	266	160	200	253	193	216	246	147	222	293	µm
Caudal hair number	11	15	21	8	13	22	7	13	21	13	16	23	9	15	23	
Ratios																
Apical rostral segment/Hind tarsus II	0.96	1.10	1.27	0.96	1.11	1.27	0.94	1.08	1.25	1.10	1.20	1.28	1.10	1.21	1.35	
Longest hair III/Basal diameter III	2.19	2.46	2.83	1.28	2.34	3.27	0.75	1.44	2.31	1.67	2.03	2.38	0.68	1.24	2.08	
Processus terminalis/Basal part VI	2.06	2.58	3.17	2.19	2.76	3.38	1.93	2.54	3.12	1.91	2.34	2.70	2.00	2.77	3.59	
Body/Apical rostral segment	11.8	14.7	17.5	11.9	14.5	18.1	11.2	14.2	17.4	12.3	14.5	16.4	10.7	14.4	18.0	
Siphunculi/Cauda	1.00	1.24	1.64	0.84	1.16	1.51	0.75	1.11	1.47	0.97	1.24	1.52	0.93	1.51	1.88	

HAUSMANN, 1802, *A. cirsiiacanthoidis* SCOPOLI, 1763, *A. euonymi* FABRICIUS, 1775, *A. fabae* SCOPOLI, 1763, *A. mordwilkoi* BÖRNER & JANISCH, 1922, *A. philadelphi* BÖRNER, 1921, and *A. solanella* THEOBALD, 1914. According to our investigations (JÖRG & LAMPEL, 1995), *A. barberae* ROBINSON, 1980, and *A. janischi* (BÖRNER, 1940) are synonyms of *A. mordwilkoi* and *A. cirsiiacanthoidis*, respectively, and therefore they are discussed together with these taxa.

Aphis armata HAUSMANN, 1802

All observed morphs were dull brownish-black to black in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. First antennal segment with (4)–5 hairs. Siphunculi and cauda brown. Abdomen with in general weakly (only sometimes well) developed marginal and some spinal sclerites, postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with strong reticulation; 4 marginal tubercles on abdominal segments I and VII, and (0)–1–3–(4–6) smaller ones on segments II–IV–(VI). According to THIEME (1989) and STROYAN (1984), *A. armata* has 0–4 marginal tubercles on segments II–IV. Abdominal tergite VIII bears (2–3)–4–5–(6–9) hairs. Frons nearly straight. Siphunculi squamous; cauda broad and blunt. Measurements see Tab. 1.

Alate viviparous female: Antennae brown. First antennal segment with (4)–5 hairs. Marginal and spinal sclerites well developed, also presiphuncular sclerites present. (0–1)–2–3–(4–6) marginal tubercles on segments II–IV (and VI); on tergite VIII (2–3)–4–6–(7) hairs. Frons straight. Measurements see Tab. 2.

Alate male: 0–(1) marginal tubercles on abdominal segments II–IV; tergite VIII with 2–3 hairs (MÜLLER & STEINER, 1989).

Tab. 2: Results of measurements of alate viviparous females of *A. armata, A. euonymi, A. fabae, A. philadelphi*, and *A. solanella*.

Species	Alate viviparous females															
	A. armata			*A. euonymi*			*A. fabae*			*A. philadelphi*			*A. solanella*			
Number of specimens investigated	21			21			56			24			76			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.52	2.01	2.45	1.58	2.03	2.46	1.33	1.76	2.27	1.78	2.10	2.66	1.26	2.03	2.54	mm
Total length of antenna	0.94	1.42	1.60	1.04	1.28	1.49	0.80	1.16	1.39	1.28	1.44	1.60	0.86	1.34	1.63	mm
Length of antennal joint III	240	336	393	233	314	393	213	290	380	293	346	400	180	331	433	µm
Length of antennal joint IV	147	255	293	147	217	286	113	191	260	226	267	306	127	231	300	µm
Length of antennal joint V	127	223	266	153	200	246	107	178	226	213	239	266	133	213	266	µm
Length of basal part of antennal joint VI	93	133	153	100	123	147	87	115	133	127	147	167	100	124	147	µm
Length of processus terminalis	240	370	420	300	337	373	206	300	366	286	345	406	260	339	406	µm
Basal diameter of antennal joint III	18	23	28	17	23	27	17	24	32	20	22	30	17	22	33	µm
Longest hair on antennal joint III	33	49	58	28	46	66	23	33	45	30	40	50	13	31	50	µm
Secondary rhinaria on antennal joint III	9	14	19	8	15	28	3	13	18	10	15	26	8	19	30	
Secondary rhinaria on antennal joint IV	0	2	6	0	2	9	0	1	6	0	1	4	0	4	14	
Secondary rhinaria on antennal joint V	0	0	1	0	0	0	0	0	1	0	0	0	0	0	3	
Length of apical rostral segment	113	132	147	107	128	147	100	119	133	133	144	160	113	135	160	µm
Accessory hairs on apical rostral segment	2	2	2	2	2	2	2	2	3	1	2	3	1	2	3	
Frons	160	186	226	167	187	206	153	169	186	180	191	213	140	183	200	µm
Joint II of hind tarsus	100	124	133	100	116	133	93	112	127	113	124	133	93	114	127	µm
Siphuncular length	147	211	260	133	221	333	107	172	233	173	220	266	153	248	346	µm
Caudal length	133	182	220	133	177	233	120	158	200	160	183	206	120	186	226	µm
Caudal hair number	12	15	19	12	15	20	7	12	21	11	17	22	10	15	21	
Ratios																
Apical rostral segment/Hind tarsus II	0.95	1.07	1.13	1.00	1.11	1.22	0.94	1.07	1.21	1.10	1.16	1.22	1.06	1.18	1.31	
Longest hair III/Basal diameter III	1.65	2.09	2.50	1.31	2.04	2.86	0.89	1.42	2.08	1.50	1.80	2.15	0.64	1.42	2.33	
Processus terminalis/Basal part VI	2.40	2.79	3.12	2.29	2.79	3.33	2.18	2.62	3.07	1.88	2.36	2.85	2.25	2.75	3.56	
Body/Apical rostral segment	13.4	15.2	17.2	13.7	15.8	17.8	11.7	14.7	18.0	12.8	14.6	17.3	11.2	15.0	19.4	
Siphunculi/Cauda	1.07	1.16	1.28	1.00	1.23	1.52	0.85	1.08	1.30	1.04	1.19	1.30	1.00	1.33	1.67	

Lives monoecious-holocyclically in the inflorescences and on the lower surface of leaves of different *Digitalis* spp., and is visited by ants.

Aphis cirsiiacanthoidis SCOPOLI, 1763

In this chapter *A. cirsiiacanthoidis* is treated together with *A. janischi* (cf. Discussion). The data given below are from twelve different *A. cirsiiacanthoidis* populations, with comparable data for *A. janischi* (three populations) in square brackets.

All morphs were dull black in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. First antennal segment with (3–4)–5–(6) [5–(6)] hairs. Siphunculi and cauda brown. Abdomen with often well developed marginal and spinal sclerites and with dorsal crossbands on segments VII–VIII, postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; 4 marginal tubercles present on abdominal segments I and VII, and 0–2–3–(4–6) [(0)–1–3–(4–7)] smaller ones on segments II–IV–(VI); tergite VIII with 2–4–6–(7–10) [3–6–(7–13)] hairs. Frons w-shaped. Siphunculi squamous; cauda blunt. Measurements see Tab. 3.

MÜLLER & STEINER (1990) published a determination key based on the number of hairs on antennal joint I. According to this key, *A. cirsiiacanthoidis* should have only 3 hairs (30 specimens measured). In our 113 examined specimens (*A. janischi* included), 3 was the minimal number (only one specimen), and more than 91 % had even 5 hairs on segment I. Furthermore, about 21 % of our specimens had more than 3 marginal tubercles on the abdominal segments II–IV–(VI). On HEIE's (1986) drawings, at least 3 tubercles on one side and 4 on both sides can be easily recognized. MÜLLER & STEINER (1990) give a range of 0–3. Thus, it is impossible to determine the Swiss material with this key.

Tab. 3: Comparison of the results of measurements of *A. janischi* and *A. cirsiiacanthoidis*.

Species	Apterous viviparous females								Alate viviparous females							
	A. janischi			*A. janischi* HEIE (1986)			*A. cirsii-acanthoidis*			*A. janischi*			*A. cirsii-acanthoidis*			
Number of specimens investigated	24						89			7			51			
Characters	min	ø	max	min	max		min	ø	max	min	ø	max	min	ø	max	
Body length	1.98	2.49	2.72	1.8	2.7		1.52	2.07	2.67	1.97	2.22	2.70	1.70	2.14	2.61	mm
Total length of antenna	1.17	1.56	1.78				0.91	1.31	1.71	1.25	1.39	1.71	1.06	1.34	1.60	mm
Length of antennal joint III	280	418	519				213	333	466	266	315	453	253	335	406	µm
Length of antennal joint IV	173	288	380				107	222	340	213	252	340	167	239	326	µm
Length of antennal joint V	186	254	313				133	207	300	173	223	313	147	213	260	µm
Length of basal part of antennal joint VI	113	146	167				87	125	173	120	141	167	93	125	160	µm
Length of processus terminalis	286	341	373				213	316	393	333	347	366	260	325	393	µm
Basal diameter of antennal joint III	25	35	42				18	28	40	20	23	32	18	23	30	µm
Longest hair on antennal joint III	50	63	66				27	48	75	45	60	66	28	40	55	µm
Secondary rhinaria on antennal joint III	0	0	0				0	0	0	5	11	24	8	17	26	
Secondary rhinaria on antennal joint IV	0	0	0				0	0	0	0	1	4	0	2	8	
Secondary rhinaria on antennal joint V	0	0	0				0	0	0	0	0	0	0	0	2	
Length of apical rostral segment	147	160	173				120	141	160	147	153	160	107	137	160	µm
Accessory hairs on apical rostral segment	2	2	3	2	2	(3)	1	2	4	2	2	3	1	2	3	
Frons	206	237	253				160	211	260	200	205	213	160	183	200	µm
Joint II of hind tarsus	113	133	147				93	120	147	120	123	133	107	119	133	µm
Siphuncular length	233	332	413				147	280	386	213	252	300	160	238	300	µm
Caudal length	213	258	300				180	225	280	160	191	220	153	194	233	µm
Caudal hair number	13	19	26	15	19		10	16	25	17	20	23	10	15	19	
Ratios																
Apical rostral segment/Hind tarsus II	1.10	1.20	1.32	1.3	1.4		1.00	1.17	1.33	1.16	1.24	1.28	1.00	1.15	1.29	
Longest hair III/Basal diameter III	1.48	1.82	2.27	2.2	3.5		1.31	1.75	2.43	1.58	2.67	3.33	1.31	1.72	2.31	
Processus terminalis/Basal part VI	2.04	2.34	2.83	2.2	3.0		1.78	2.56	3.92	2.12	2.49	2.89	2.00	2.63	3.25	
Body/Apical rostral segment	13.0	15.6	17.9				11.7	14.6	17.6	12.8	14.5	16.9	13.0	15.7	18.0	
Siphunculi/Cauda	1.03	1.29	1.50	1.1	1.4	(2.0)	0.81	1.24	1.62	1.14	1.32	1.48	1.00	1.23	1.48	

Alate viviparous female: Antennae brown. First antennal segment with (3–4)–5–(6) [5–(6–7)] hairs. Marginal, spinal and presiphuncular sclerites well developed. 0–6 [(2–5)–6–(7)] marginal tubercles on abdominal segments II–IV–(V); tergite VIII with 2–5–(6) [2–8] hairs. Frons nearly straight. Measurements see Tab. 3.

The male is alate (IGLISCH, 1970).

According to IGLISCH's (1972) experiments, the primary hosts of *A. cirsiiacanthoidis* are the shrubs *Euonymus europaea* L., *Viburnum opulus* L., and *Philadelphus coronarius* L. Secondary hosts are mostly several *Cirsium* spp. and rarely *Solanum nigrum* L. emend. MILLER, which has been already reported by LAMPEL (1980), THIEME (1985, 1987), and JÖRG & LAMPEL (1995).

Aphis euonymi Fabricius, 1775

All observed morphs were dull reddish to blackish brown in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. Siphunculi and cauda brown. First antennal joint with (4)–5–(6) hairs. Abdomen with weakly (only sometimes well) developed marginal and some spinal sclerites, postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; always 4 small marginal tubercles on abdominal segments I and VII, and 0–(1–3) smaller ones on segments II–IV (four specimens with 1 tubercle on segment II or III, three with 2 tubercles on segments II–IV, and two specimens with 3 tubercles on segments III and IV). STROYAN's (1984) *A. euonymi* has 0 tubercles on the abdominal segments II–VI, but HEIE (1986) reported the possibility of up to 2 additional tubercles. Tergite VIII with (2–3)–4–(5–10) hairs. Frons nearly straight, sometimes with

Tab. 4: Comparison of the results of measurements of *A. barberae* and *A. mordwilkoi*.

Species	Apterous viviparous females									Alate viviparous females									
	A. barberae			*A. barberae* ROBINSON (1980)			*A. mordwilkoi*			*A. barberae*			*A. barberae* ROBINSON (1980)			*A. mordwilkoi*			
Number of specimens investigated	20						72			20						52			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.33	1.67	1.92	1.54		2.26	1.62	2.05	2.42	1.52	1.74	2.14	1.59		2.40	1.70	2.08	2.45	mm
Total length of antenna	0.90	1.09	1.28	0.98		1.57	0.91	1.31	1.57	1.07	1.17	1.28	1.29		1.72	1.09	1.35	1.49	mm
Length of antennal joint III	186	246	333	190		370	200	322	400	213	264	293	290		400	260	323	373	µm
Length of antennal joint IV	113	163	220	140		280	120	215	280	160	186	213	200		320	173	227	266	µm
Length of antennal joint V	133	164	200	140		260	113	210	266	160	184	213	190		310	167	217	260	µm
Length of basal part of antennal joint VI	100	110	127	90		140	100	130	153	107	119	133	120		150	107	132	147	µm
Length of processus terminalis	260	306	346	280		420	233	338	420	273	318	346	340		440	240	352	393	µm
Basal diameter of antennal joint III	17	23	30				17	27	33	17	20	22				17	22	27	µm
Longest hair on antennal joint III	42	56	68	20		60	38	58	70	33	42	55	20		40	25	48	58	µm
Secondary rhinaria on antennal joint III	0	0	0				0	0	0	8	12	16	10		23	9	14	21	
Secondary rhinaria on antennal joint IV	0	0	0				0	0	0	0	2	5	0		6	0	2	6	
Secondary rhinaria on antennal joint V	0	0	0				0	0	0	0	0	0	very rarely 1-3			0	0	0	
Length of apical rostral segment	120	132	140				127	152	173	120	131	140				133	147	160	µm
Accessory hairs on apical rostral segment	2	2	3		2		1	2	4	2	2	3		2		2	2	3	
Frons	180	199	220				186	218	253	167	178	186				160	194	233	µm
Joint II of hind tarsus	100	108	120	100		140	100	124	147	100	110	120	100		140	107	120	133	µm
Siphuncular length	140	200	266	150		330	153	283	380	133	165	200	160		280	153	232	280	µm
Caudal length	167	196	226	120		260	173	236	286	153	169	186	90		220	153	199	233	µm
Caudal hair number	10	15	19	10		19	11	17	27	9	15	19	12		22	12	17	26	
Ratios																			
Apical rostral segment/Hind tarsus II	1.12	1.23	1.33				1.10	1.23	1.38	1.06	1.19	1.33				1.05	1.23	1.44	
Longest hair III/Basal diameter III	1.92	2.47	3.17				1.67	2.19	2.73	1.67	2.17	2.73				1.36	2.20	3.09	
Processus terminalis/Basal part VI	2.29	2.80	3.13				2.09	2.61	3.24	2.28	2.69	3.06				2.20	2.66	3.17	
Body/Apical rostral segment	11.1	12.6	13.9				11.7	13.5	15.8	11.3	13.3	15.3				11.4	14.2	16.9	
Siphunculi/Cauda	0.84	1.02	1.22				0.86	1.19	1.49	0.87	0.98	1.07				0.88	1.16	1.33	

short antennal tubercles. Siphunculi squamous; cauda broad and blunt. Measurements see Tab. 1.

According to MÜLLER & STEINER (1990), as already discussed above for *A. cirsiiacanthoidis*, *A. euonymi* should also have only 3 hairs on antennal joint I. But our 35 examined specimens had at least 4, and more than 80 % of them 5 hairs on this segment. Furthermore, the specimens of MÜLLER & STEINER had no marginal tubercles on the abdominal segments II–IV; in contrast, about 25 % of our specimens had 1–3 of these tubercles. Therefore, the above mentioned key is not valid for the Swiss *A. euonymi* populations.

Alate viviparous female: Antennae brown. Antennal joint I with (4)–5–(6) hairs. Marginal and spinal sclerites well developed, also presiphuncular sclerites present. 0–(1–3) marginal tubercles on segments II–IV (five specimens with 1 tubercle on segment II or III, one specimen with 3 on segments II–IV). Tergite VIII with (3)–4–(5–6) hairs. Frons straight. Measurements see Tab. 2.

The male is alate (JONES, 1943; STROYAN, 1984; HEIE, 1986).

It lives mostly monoecious-holocyclically on young shoots of *Euonymus europaea* and is attended by ants. Occasionally it can feed on *Valeriana officinalis* L., *Dahlia* sp., *Sedum maximum* (L.) HOFFM. (MÜLLER & STEINER, 1986), *Valeriana dioica* L., *V. tripteris* L. (MÜLLER, 1975), and *Rumex obtusifolius* L., *Arctium lappa* L., and *Capsella bursa-pastoris* (L.) MEDIKUS (HEIE, 1986).

Aphis fabae SCOPOLI, 1763

All morphs are dull greenish black to black in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. First antennal segment with (3)–4–5–(6) (mostly 5) hairs. One spe-

Tab. 5: Results of measurements of apterous viviparous females of *A. cacaliasteris, A. hederae, A. ilicis, A. lantanae*, and *A. newtoni*.

Species	Apterous viviparous females																		
	A. cacaliasteris			*A. hederae*			*A. ilicis*			*A. lantanae*						*A. newtoni*			
										coriaria			*lantanae*						
Number of specimens investigated	18			40			11			18			10			27			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.44	1.86	2.70	1.14	1.57	1.98	1.70	1.97	2.26	1.87	2.04	2.24	1.41	1.53	1.65	1.25	1.56	1.90	mm
Total length of antenna	0.96	1.23	1.58	0.82	1.07	1.42	1.20	1.37	1.50	1.17	1.30	1.44	0.85	0.98	1.12	0.91	1.21	1.42	mm
Length of antennal joint III	233	310	406	206	293	366	286	351	400	253	290	326	173	232	313	186	260	346	µm
Length of antennal joint IV	160	238	340	93	184	266	173	229	273	147	194	240	120	145	180	120	187	240	µm
Length of antennal joint V	153	204	280	113	153	233	173	220	260	147	183	206	113	142	167	133	176	206	µm
Length of basal part of antennal joint VI	113	134	167	80	102	140	113	129	147	107	123	133	100	110	120	100	119	153	µm
Length of processus terminalis	180	231	280	220	257	333	300	332	400	353	401	433	220	252	293	280	370	433	µm
Basal diameter of antennal joint III	18	23	32	13	20	30	22	24	28	20	24	28	18	19	20	20	27	33	µm
Longest hair on antennal joint III	50	61	78	17	33	60	66	73	80	66	81	91	33	37	43	15	21	45	µm
Secondary rhinaria on antennal joint III	0	2	8	0	5	14	0	0	0	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint IV	2	7	12	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint V	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Length of apical rostral segment	107	121	140	113	130	147	133	140	147	147	152	160	113	125	133	93	106	120	µm
Accessory hairs on apical rostral segment	2	3	5	2	2	3	2	2	2	2	2	2	2	2	2	1	2	2	
Frons	173	199	246	167	197	233	193	208	220	206	221	253	167	178	186	167	188	206	µm
Joint II of hind tarsus	107	123	147	73	88	113	107	117	127	107	119	127	93	105	113	107	116	127	µm
Siphuncular length	133	184	260	173	265	393	200	269	333	206	257	293	133	147	173	140	187	226	µm
Caudal length	147	175	220	140	179	220	206	238	273	153	191	206	153	168	186	133	171	200	µm
Caudal hair number	14	17	23	5	10	13	14	16	18	13	17	21	10	13	18	8	11	13	
Ratios																			
Apical rostral segment/Hind tarsus II	0.94	0.98	1.05	1.24	1.48	1.67	1.11	1.19	1.25	1.21	1.29	1.44	1.06	1.19	1.29	0.83	0.91	1.00	
Longest Hair III/Basal diameter III	2.11	2.73	3.18	1.00	1.58	2.29	2.63	2.98	3.43	2.35	3.37	4.08	1.67	1.98	2.27	0.50	0.81	1.80	
Processus terminalis/Basal part VI	1.50	1.73	1.95	1.94	2.54	3.17	2.25	2.58	3.00	2.94	3.27	3.61	2.06	2.30	2.59	2.33	3.12	3.82	
Body/Apical rostral segment	12.7	15.2	19.3	9.5	12.1	14.2	12.7	14.1	15.4	12.1	13.4	14.9	10.7	12.3	13.6	12.5	14.7	17.0	
Siphunculi/Cauda	0.87	1.04	1.22	1.17	1.47	1.90	0.97	1.12	1.32	1.11	1.35	1.48	0.78	0.87	1.00	0.95	1.09	1.22	

cimen had on one antenna only 3 and two specimens had 6 hairs. Siphunculi and cauda brown. Abdomen with weakly developed marginal and some spinal sclerites, postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; 4 marginal tubercles present on abdominal segments I and VII, and 0–(1–5) smaller ones on segments II–IV. Tergite VIII bears (2–3)–4–(5–7) hairs. Frons w-shaped. Siphunculi squamous; cauda blunt. Measurements see Tab. 1.

Alate viviparous female: Antennae brown. First antennal segment with (4)–5–(6) hairs. Marginal and spinal sclerites well developed, also presiphuncular sclerites present. 0–1–(2–4) marginal tubercles on abdominal segments II–IV; tergite VIII with 2–6 (mostly 4) hairs. Frons nearly straight. Measurements see Tab. 2.

Alate male: Similar to alate viviparous female (HEIE, 1986).

Fundatrix: Antennae and tibiae pale with brown proximal and distal parts. Abdominal sclerites absent, with exception of crossbands on segments VII and VIII and stigmal plates. On abdominal segments II–IV 0–4 marginal tubercles present. Tergite VIII with 6–10 hairs. Measurements see Tab. 10.

It is a (sub-)heteroecious-holocyclic, polyphagous species. IGLISCH (1972) could show that its primary host is *Euonymus europaea*. The most important secondary hosts are *Vicia faba* L., *Phaseolus* sp., *Chenopodium* sp., and *Beta vulgaris* L. In literature, *Papaver* sp. is also mentioned. During our own investigations (JÖRG & LAMPEL, 1995), we found on this plant genus *A. cirsiiacanthoidis*, not *A. fabae*.

Aphis mordwilkoi BÖRNER & JANISCH, 1922

A. barberae is treated together with *A. mordwilkoi* (cf. Discussion). The given data are from eight *A. mordwilkoi* populations and in square brackets from two *A. barberae* populations.

Tab. 6: Results of measurements of alate viviparous females of *A. hederae, A. ilicis, A. lantanae*, and *A. newtoni*.

Species	Alate viviparous females															
	A. hederae			*A. ilicis*			*A. lantanae*						*A. newtoni*			
							coriaria			*lantanae*						
Number of specimens investigated	30			10			1			7			18			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.17	1.82	2.46	1.57	1.78	1.95		2.26		1.33	1.46	1.65	1.49	1.73	2.05	mm
Total length of antenna	0.88	1.18	1.55	1.15	1.22	1.30	1.33	1.34	1.34	0.88	0.97	1.10	1.25	1.34	1.44	mm
Length of antennal joint III	220	319	460	280	312	340	326	330	333	220	245	273	266	314	360	µm
Length of antennal joint IV	120	204	300	167	192	220	193	206	220	140	147	160	180	225	266	µm
Length of antennal joint V	127	179	253	180	202	220	186	196	206	120	141	160	180	200	220	µm
Length of basal part of antennal joint VI	80	113	133	100	119	133	133	133	133	100	108	127	113	122	133	µm
Length of processus terminalis	213	278	380	293	304	313	373	386	400	213	244	293	340	385	420	µm
Basal diameter of antennal joint III	15	19	30	18	19	20	25	25	25	15	17	20	15	21	30	µm
Longest hair on antennal joint III	17	30	58	50	56	65	75	75	75	30	33	37	12	26	46	µm
Secondary rhinaria on antennal joint III	9	15	23	8	11	13	20	21	22	9	12	14	12	15	18	
Secondary rhinaria on antennal joint IV	0	3	6	0	0	0	3	3	3	0	2	5	3	6	8	
Secondary rhinaria on antennal joint V	0	0	1	0	0	0	0	1	1	0	0	1	0	1	3	
Length of apical rostral segment	113	131	147	107	117	127	147	147	147	113	117	120	93	100	113	µm
Accessory hairs on apical rostral segment	1	2	4	1	2	2		2		1	2	3	2	2	2	
Frons	160	181	220	153	166	173		193		153	161	167	160	173	193	µm
Joint II of hind tarsus	73	90	120	100	107	113	127	127	127	87	99	107	113	119	127	µm
Siphuncular length	167	271	446	147	172	193	213	216	220	113	123	133	147	171	206	µm
Caudal length	107	157	200	173	186	200		167		133	147	160	140	158	173	µm
Caudal hair number	8	10	12	15	16	17		15		12	14	18	8	11	13	
Ratios																
Apical rostral segment/Hind tarsus II	1.22	1.46	1.67	1.00	1.09	1.19	1.16	1.16	1.16	1.06	1.18	1.31	0.78	0.84	0.94	
Longest Hair III/Basal diameter III	1.00	1.54	2.92	2.67	2.94	3.25	3.00	3.00	3.00	1.80	2.06	2.22	0.54	1.25	1.93	
Processus terminalis/Basal part VI	1.89	2.48	3.17	2.20	2.58	3.00	2.80	2.90	3.00	2.00	2.25	2.59	2.68	3.16	3.53	
Body/Apical rostral segment	10.3	13.7	17.0	13.8	15.2	16.4		15.4		11.7	12.5	13.7	16.0	17.3	19.1	
Siphunculi/Cauda	1.25	1.70	2.26	0.80	0.93	1.04	1.28	1.30	1.32	0.75	0.84	0.91	1.00	1.07	1.19	

All observed morphs were dull black in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. First antennal segment with (4)–5–(6) [(4)–5–(6)] hairs. Siphunculi and cauda brown. Abdomen with well developed marginal and some spinal sclerites, postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; 4 marginal tubercles present on abdominal segments I and VII, and 0–2–(3–5) [0–(1–3)] smaller ones on segments II–IV. For *A. barberae*, ROBINSON (1980) states that marginal tubercles are present on "abdominal segments I and VII, rarely on other abdominal segments." (2)–3–5–(6–9) [2–4–(5)] hairs are present on abdominal tergite VIII (ROBINSON, 1980: 2–5). Frons nearly straight. Siphunculi squamous; cauda blunt. Measurements see Tab. 4.

Alate viviparous female: Antennae brown. First antennal segment with (3–4)–5–(6) [(4)–5] hairs. Marginal and spinal sclerites well developed, also presiphuncular sclerites present. 0–2–(3–4) [0–1–(2)] marginal tubercles on abdominal segments II–IV (ROBINSON, 1980: "occasionally on abdominal segments II–VI"); tergite VIII with (2–3)–4–(5–8) [2–4–(5)] hairs (ROBINSON, 1980: 2–4). Frons nearly straight. Measurements see Tab. 4.

Male alate, with 2–4 hairs on abdominal tergite VIII (ROBINSON, 1980).

It is a heteroecious-holocyclic, polyphagous species. According to BÖRNER & JANISCH (1922), the primary host is *Viburnum opulus*. Secondary hosts are numerous herbaceous plants. The most important are: *Aegopodium podagraria* L., *Aethusa cynapium* L., *Anthriscus sylvestris* (L.) HOFFM., *Arctium lappa* L., *A. nemorosum* LEJEUNE, *Cynara cardunculus scolymus* (L.) BEGER, *Epipactis palustris* (L.) CRANTZ, *Tropaeolum majus* L., and *T. minus* L. (JÖRG & LAMPEL, 1995).

Tab. 7: Results of measurements of apterous viviparous females of *A. rumicis, A. sambuci, A. tripolii, A. vaccinii, A. veratri*, and *A. viburni*.

Species	Apterous viviparous females																		
	A. rumicis			*A. sambuci*			*A. tripolii*			*A. vaccinii*			*A. veratri*			*A. viburni*			
Number of specimens investigated	39			29			15			39			32			19			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.74	2.03	2.32	1.79	2.66	3.18	1.58	1.85	2.26	1.33	1.67	2.10	1.63	1.93	2.50	1.36	1.65	1.92	mm
Total length of antenna	1.12	1.30	1.44	1.18	1.51	1.79	0.64	0.91	1.26	0.88	1.14	1.52	1.07	1.29	1.62	0.96	1.16	1.36	mm
Length of antennal joint III	240	344	413	253	384	493	140	221	326	213	296	413	200	277	366	193	267	340	µm
Length of antennal joint IV	180	230	273	167	255	333	100	160	253	133	197	286	127	183	273	140	187	240	µm
Length of antennal joint V	180	218	253	180	253	313	100	143	200	127	182	246	147	186	240	140	175	206	µm
Length of basal part of antennal joint VI	100	114	127	127	164	193	80	98	120	93	112	140	113	127	153	100	110	120	µm
Length of processus terminalis	233	282	333	253	304	386	140	191	253	193	255	340	280	414	513	293	338	393	µm
Basal diameter of antennal joint III	22	27	33	25	34	45	20	24	28	15	23	32	23	31	45	20	23	25	µm
Longest hair on antennal joint III	22	35	46	15	41	61	10	13	13	18	33	50	38	54	66	61	71	83	µm
Secondary rhinaria on antennal joint III	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	
Secondary rhinaria on antennal joint IV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Length of apical rostral segment	107	117	127	147	156	173	87	101	113	100	107	120	127	138	147	133	135	140	µm
Accessory hairs on apical rostral segment	1	2	3	1	2	3	2	2	2	1	2	3	1	2	3	2	2	3	
Frons	200	217	240	220	252	293	153	186	213	167	188	220	186	213	253	173	191	206	µm
Joint II of hind tarsus	107	119	133	107	142	167	80	93	107	93	109	127	93	109	127	107	115	120	µm
Siphuncular length	206	277	320	386	566	699	167	226	300	127	192	293	213	296	386	147	209	260	µm
Caudal length	167	203	233	153	199	226	153	193	233	160	192	240	140	169	193	147	186	246	µm
Caudal hair number	11	14	17	8	15	24	4	7	10	9	14	19	9	14	18	11	14	17	
Ratios																			
Apical rostral segment/Hind tarsus II	0.85	0.99	1.06	0.92	1.12	1.41	1.00	1.09	1.15	0.83	0.98	1.14	1.11	1.27	1.47	1.11	1.17	1.25	
Longest Hair III/Basal diameter III	0.81	1.29	1.79	0.59	1.18	1.78	0.38	0.52	0.67	0.93	1.42	2.25	1.22	1.72	2.25	2.67	3.08	3.50	
Processus terminalis/Basal part VI	2.06	2.49	2.94	1.36	1.88	2.47	1.62	1.94	2.24	1.76	2.28	2.75	2.42	3.27	4.06	2.71	3.08	3.56	
Body/Apical rostral segment	15.4	17.2	19.1	11.7	17.1	21.6	16.1	18.3	21.0	12.5	15.7	19.9	11.9	14.0	17.0	10.2	12.3	14.4	
Siphunculi/Cauda	1.12	1.36	1.57	2.42	2.84	3.23	1.04	1.17	1.30	0.79	0.99	1.29	1.25	1.76	2.23	0.96	1.12	1.30	

Aphis philadelphi BÖRNER, 1921

All observed morphs were dull black in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. (4)–5–(6) hairs on first antennal segment. Siphunculi and cauda brown. Abdomen with often well developed dark marginal and spinal sclerites, pre- and postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; 4 marginal tubercles on abdominal segments I and VII, (0–1)–2–4–(5) smaller ones on segments II–IV; tergite VIII with (2)–3–4–(5–6) hairs. Frons nearly straight, often with very short antennal tubercles. Siphunculi squamous; cauda blunt. Measurements see Tab. 1.

Alate viviparous female: Antennae brown. (4)–5–(6) hairs on first antennal segment. Abdominal sclerites darker. (1)–2–(3–5) marginal tubercles on segments II–IV–(V); on tergite VIII 3–5–(6) hairs. Measurements see Tab. 2.

One alate male, mating a female, could be observed.

Fundatrix: Antennae and tibiae pale with brown proximal and distal parts. Abdominal sclerites absent, with exception of crossbands on segments VII and VIII and stigmal plates. 0–5 marginal tubercles on segments II–IV; tergite VIII with 3–7 hairs. Measurements see Tab. 10.

This species lives monoecious-holocyclically in curled leaves of *Philadelphus coronarius*. It can be reared on *Cirsium arvense* (L.) SCOP., *Tropaeolum majus*, *Euonymus europaea*, and *Viburnum opulus* (JÖRG & LAMPEL, 1995).

Aphis solanella THEOBALD, 1914

All morphs are dull black in life.

Tab. 8: Results of measurements of alate viviparous females of *A. rumicis, A. sambuci, A. tripolii, A. vaccinii, A. veratri*, and *A. viburni*.

	Alate viviparous females																		
Species	*A. rumicis*			*A. sambuci*			*A. tripolii*			*A. vaccinii*			*A. veratri*			*A. viburni*			
Number of specimens investigated	34			7			10			22			15			13			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.89	2.16	2.54	1.71	1.86	2.11	1.58	1.72	1.90	1.31	1.75	2.18	1.81	2.04	2.18	1.50	1.68	1.87	mm
Total length of antenna	1.22	1.39	1.60	1.22	1.29	1.41	0.93	0.97	1.02	1.02	1.21	1.42	1.33	1.50	1.60	1.09	1.17	1.25	mm
Length of antennal joint III	273	354	420	240	273	313	220	251	286	273	310	373	286	335	366	233	274	313	µm
Length of antennal joint IV	220	263	320	186	210	233	140	161	180	160	218	286	186	232	260	167	191	220	µm
Length of antennal joint V	193	237	280	193	215	246	133	143	153	153	202	253	180	207	240	160	179	200	µm
Length of basal part of antennal joint VI	100	117	153	133	142	153	93	99	107	100	117	133	120	133	147	107	112	120	µm
Length of processus terminalis	266	315	386	333	359	386	186	205	220	233	272	340	446	490	526	286	327	353	µm
Basal diameter of antennal joint III	20	24	30	18	23	27	15	18	23	17	20	25	23	30	35	18	22	25	µm
Longest hair on antennal joint III	22	34	46	15	24	33	7	10	12	17	28	42	45	52	66	50	53	58	µm
Secondary rhinaria on antennal joint III	5	9	20	17	21	25	7	10	14	8	13	19	6	7	10	8	14	20	
Secondary rhinaria on antennal joint IV	0	0	4	0	1	7	0	3	6	0	1	3	0	0	0	0	3	6	
Secondary rhinaria on antennal joint V	0	0	0	0	0	0	0	2	3	0	0	1	0	0	0	0	0	0	
Length of apical rostral segment	107	118	140	140	147	153	93	100	107	93	105	113	133	139	140	113	119	120	µm
Accessory hairs on apical rostral segment	2	2	3	2	2	2	1	2	3	1	2	2	2	2	3	2	2	2	
Frons	167	186	200	173	183	200	140	155	167	153	167	180	180	191	206	160	168	173	µm
Joint II of hind tarsus	113	120	147	113	122	133	87	90	93	93	111	127	107	111	113	100	107	120	µm
Siphuncular length	200	237	320	300	343	393	147	173	186	127	169	220	240	302	333	140	164	193	µm
Caudal length	147	177	206	120	131	147	133	143	160	133	163	193	133	160	180	133	153	167	µm
Caudal hair number	11	14	16	10	13	17	7	7	10	9	14	19	11	14	18	12	13	18	
Ratios																			
Apical rostral segment/Hind tarsus II	0.82	0.98	1.17	1.10	1.20	1.35	1.00	1.11	1.15	0.89	0.95	1.00	1.18	1.25	1.31	1.00	1.11	1.20	
Longest Hair III/Basal diameter III	0.88	1.45	2.00	0.67	1.05	1.43	0.38	0.60	0.78	0.67	1.39	2.08	1.42	1.73	2.06	2.00	2.49	2.92	
Processus terminalis/Basal part VI	2.33	2.71	3.27	2.41	2.53	2.65	1.87	2.07	2.21	2.00	2.32	2.68	3.23	3.71	4.28	2.56	2.93	3.19	
Body/Apical rostral segment	15.7	18.4	21.2	11.7	12.7	13.8	15.9	17.3	19.1	13.1	16.6	20.4	13.6	14.7	15.9	12.7	14.1	15.6	
Siphunculi/Cauda	1.13	1.34	1.55	2.30	2.61	2.95	1.05	1.21	1.30	0.85	1.03	1.20	1.68	1.89	2.14	1.00	1.08	1.19	

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. First antennal segment with (4)–5–(6) hairs. According to MÜLLER & STEINER (1990), *A. solanella* should have only 3 hairs on the first antennal joint (28 specimens measured). In our own investigations about 81 % of 81 measured specimens had 5 hairs. As discussed above for *A. cirsiiacanthoidis* and *A. euonymi*, the determination key of MÜLLER & STEINER (1990) is also not usable for Swiss *A. solanella* material. Siphunculi and cauda brown. Abdomen with weakly developed marginal and spinal sclerites, postsiphuncular and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; abdomen with 4 marginal tubercles on segments I and VII, and 0–5–(6) smaller ones on segments II–IV. Two specimens had only 1, and eight only 2 tubercles on these segments. For British material, STROYAN (1984) gives a range of 3–7, and HEIE (1986) points out that about 40–50 % of all specimens are without tubercles on segments II–IV. Tergite VIII with (2)–3–4–(5–8) hairs. Frons w-shaped. Siphunculi squamous; cauda blunt. Measurements see Tab. 1.

Alate viviparous female: Antennae brown. First antennal segment with (3–4)–5–(6) hairs. Marginal sclerites and dorsal crossbands well developed, presiphuncular sclerites are also present. 0–5–(6) marginal tubercles on segments II–IV; tergite VIII with (2–3)–4–(5–7) hairs. Measurements see Tab. 2.

The male is alate (IGLISCH, 1970).

It is a heteroecious-holocyclic, oligophagous species. According to the investigations made by IGLISCH (1972), the primary host is *Euonymus europaea*. The most important secondary host is *Solanum nigrum*, but very often, *Cirsium* spp. are also settled (STROYAN, 1984; JÖRG & LAMPEL, 1995).

Tab. 9: Results of measurements of oviparous females and males of *A. cacaliasteris, A. vaccinii*, and *A. veratri*.

	Oviparous females									Males									
Species	*A. cacaliasteris*			*A. vaccinii*			*A. veratri*			*A. cacaliasteris*			*A. vaccinii*			*A. veratri*			
Number of specimens investigated	4			4			19			10			1			21			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	2.06	2.16	2.34	1.10	1.39	1.76	1.50	1.65	1.78	1.74	1.88	2.02		1.46		1.34	1.46	1.55	mm
Total length of antenna	1.17	1.23	1.30	0.64	0.78	1.04	1.09	1.14	1.23	1.44	1.48	1.52	1.26	1.27	1.28	1.14	1.24	1.36	mm
Length of antennal joint III	286	300	320	133	174	240	186	214	240	386	411	433	326	333	340	200	244	280	µm
Length of antennal joint IV	206	241	273	80	116	167	147	180	213	280	294	313	253	253	253	186	231	280	µm
Length of antennal joint V	206	216	233	107	131	173	140	163	193	213	239	253	213	213	213	147	185	226	µm
Length of basal part of antennal joint VI	127	134	140	87	97	107	107	118	127	140	156	167	113	113	113	93	108	120	µm
Length of processus terminalis	213	221	226	147	186	273	326	363	406	253	274	293	273	273	273	333	360	393	µm
Basal diameter of antennal joint III	25	27	28	17	20	23	23	28	33	22	25	27	20	21	22	23	28	33	µm
Longest hair on antennal joint III	61	65	66	12	21	33	33	45	53	50	55	66	25	27	28	37	46	55	µm
Secondary rhinaria on antennal joint III	0	2	5	0	0	0	0	0	0	34	40	48	28	30	31	1	4	11	
Secondary rhinaria on antennal joint IV	5	8	10	0	0	0	0	0	0	16	23	28	16	17	17	3	7	12	
Secondary rhinaria on antennal joint V	0	0	0	0	0	0	0	0	0	3	6	9	3	6	9	0	2	6	
Length of apical rostral segment	120	122	127	80	87	100	113	120	127	120	124	127		93		113	118	120	µm
Accessory hairs on apical rostral segment	2	3	4	2	2	2	2	2	4	2	3	4		1		2	2	4	
Frons	200	203	206	153	163	180	180	199	220	173	180	186		167		180	198	220	µm
Joint II of hind tarsus	120	122	127	80	94	113	93	100	107	120	122	127	100	100	100	93	101	107	µm
Siphuncular length	180	194	200	87	115	167	193	220	240	133	138	147	113	120	127	167	194	226	µm
Caudal length	180	193	206	107	120	153	140	153	167	133	141	147		140		120	137	153	µm
Caudal hair number	19	20	22	12	15	21	14	17	18	14	15	17		14		12	14	18	
Ratios																			
Apical rostral segment/Hind tarsus II	1.00	1.00	1.00	0.86	0.93	1.08	1.13	1.20	1.27	0.95	1.02	1.06	0.93	0.93	0.93	1.13	1.18	1.29	
Longest Hair III/Basal diameter III	2.18	2.44	2.67	0.64	1.03	1.46	1.32	1.63	2.00	2.00	2.26	2.50	1.25	1.28	1.31	1.20	1.65	2.06	
Processus terminalis/Basal part VI	1.60	1.65	1.70	1.57	1.90	2.56	2.68	3.07	3.47	1.56	1.76	2.00	2.41	2.41	2.41	2.78	3.36	3.93	
Body/Apical rostral segment	17.2	17.7	18.5	12.8	16.1	18.6	12.5	13.7	14.8	14.2	15.1	16.0		15.6		11.7	12.3	12.9	
Siphunculi/Cauda	0.96	1.01	1.11	0.81	0.94	1.09	1.30	1.44	1.57	0.91	0.98	1.10	0.81	0.86	0.90	1.19	1.41	1.62	

Aphis fabae group s.l.

The species of the *A. fabae* group s.l. (see JÖRG & LAMPEL, 1995) *Aphis cacaliasteris* HILLE RIS LAMBERS, 1947, *A. hederae* KALTENBACH, 1843, *A. ilicis* KALTENBACH, 1843, *A. lantanae* KOCH, 1854, *A. newtoni* THEOBALD, 1927, *A. rumicis* LINNAEUS, 1758, *A. sambuci* LINNAEUS, 1758, *A. vaccinii* (BÖRNER, 1940), *A. veratri* WALKER, 1852, and *A. viburni* SCOPOLI, 1763, are sufficiently characterized by their morphology in combination with their host plants. By its morphology (see below), especially the green colour, and its genetic identity (JÖRG & LAMPEL, 1995), *A. tripolii* LAING, 1920, must be excluded from the *A. fabae* group s.l.

Aphis cacaliasteris HILLE RIS LAMBERS, 1947

All observed morphs dull black in life.

Prepared material:

Apterous viviparous female: Antennae dark brown, proximal part of joint III pale. First antennal segment with 5–6 hairs. Tibiae, siphunculi, and cauda dark brown. Abdomen with small marginal, postsiphuncular and intersegmental pleural muscle sclerites and crossbands on segments VII and VIII; dorsal cuticle with reticulation, most visible on sclerotic areas; 4 large marginal tubercles always present on abdominal segments I and VII, and 0–7 smaller ones on segments II–VI (LAMPEL, 1984: 0–1); tergite VIII with 7–11 hairs. Frons nearly straight. Siphunculi squamous, nearly cylindrical; cauda blunt. Measurements see Tab. 5.

Alate viviparous female: Abdomen with rather great marginal sclerites, one great spinal sclerite on segment VI, and crossbands on segments VII and VIII (HILLE RIS LAMBERS, 1946–47).

Tab. 10: Results of measurements of fundatrices of *A. fabae, A. philadelphi*, and *A. sambuci*.

Species	Fundatrices									
	A. fabae			*A. philadelphi*			*A. sambuci*			
Number of specimens investigated	4			5			3			
Characters	min	ø	max	min	ø	max	min	ø	max	
Body length	1.55	1.88	2.10	1.84	1.92	2.06	2.34	2.71	3.02	mm
Total length of antenna	0.64	0.82	0.91	0.74	0.80	0.85	0.88	0.99	1.07	mm
Length of antennal joint III	213	326	400	273	304	333	333	387	426	µm
Length of antennal joint IV	100	147	173	133	158	167	160	178	186	µm
Length of basal part of antennal joint V	100	118	133	120	125	133	140	150	160	µm
Length of processus terminalis	133	144	167	87	111	140	127	141	160	µm
Basal diameter of antennal joint III	22	26	30	18	20	22	27	32	40	µm
Longest hair on antennal joint III	17	29	40	33	36	42	42	44	50	µm
Secondary rhinaria on antennal joint III	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint IV	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint V	0	0	0	0	0	0	0	0	0	
Length of apical rostral segment	100	117	127	113	116	120	133	138	147	µm
Accessory hairs on apical rostral segment	2	2	2	1	2	2	2	2	2	
Frons	167	193	206	186	192	200	220	229	240	µm
Joint II of hind tarsus	93	102	107	100	103	107	120	120	120	µm
Siphuncular length	100	191	260	140	159	180	260	316	366	µm
Caudal length	127	175	193	173	184	206	167	189	200	µm
Caudal hair number	9	12	14	15	16	18	8	13	16	
Ratios										
Apical rostral segment/Hind tarsus II	1.07	1.14	1.20	1.13	1.13	1.13	1.11	1.11	1.11	
Longest Hair III/Basal diameter III	0.69	1.13	1.60	1.54	1.78	2.00	1.25	1.42	1.69	
Processus terminalis/Basal part VI	1.17	1.22	1.33	0.65	0.89	1.17	0.87	0.94	1.14	
Body/Apical rostral segment	14.9	16.1	17.5	15.7	16.6	17.2	17.5	19.7	20.8	
Siphunculi/Cauda	0.79	1.07	1.34	0.81	0.87	0.92	1.56	1.67	1.83	

Oviparous female: First antennal segment with 5–6 hairs. Cauda pale brown. Abdomen sometimes with additional spinal sclerites on segment VI; 1–5 marginal tubercles on segments II–VI (LAMPEL, 1984: 0–1); tergite VIII with 10–13 hairs. Measurements see Tab. 9.

Alate male: Antennal segment III completely dark brown. First antennal segment with (4)–5–6–(7–8) hairs. Abdominal sclerites stronger developed; 0–2 marginal tubercles on segments II–VI (LAMPEL, 1984: 0–1); tergite VIII with 5–9 hairs. Measurements see Tab. 9.

Lives monoecious-holocyclically on stems, inflorescences, and the lower surface of leaves of *Senecio fuchsii* GMEL., visited by ants. According to LAMPEL (1984) it feeds also on other *Senecio* spp., and *Adenostyles* spp.

Aphis hederae KALTENBACH, 1843

Apterous and alate viviparous females dull dark brown in life; larvae bright brown.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with exception of proximal and distal parts. (4)–5–(6) hairs on first antennal segment. Siphunculi and cauda brown. Abdomen with sometimes weakly developed spinal sclerites on segments VI–VIII and intersegmental pleural muscle sclerites; occasionally with darker marginal and postsiphuncular sclerites; stigmal plates well developed; dorsal cuticle reticulate; 4 marginal tubercles normally present on abdominal segments I and VII, 0–5 smaller ones on segments II–IV and VI; tergite VIII with 2–(3–4) hairs. Frons with distinct antennal tubercles. Siphunculi squamous; cauda blunt. Measurements see Tab. 5.

Alate viviparous female: Antennae completely brown. (4)–5 hairs on first antennal segment. Abdomen with well developed marginal and postsiphuncular

Tab. 11: Comparison of measurements of one clone of *A. fabae* and *A. mordwilkoi*, respectively.

	Alate viviparous females of one *A. fabae* clone						Apterous viviparous females of one *A. mordwilkoi* clone									
Host plant	*Vicia faba*			*Vicia faba*			*Viburnum opulus*			*Tropaeolum majus*			*Rumex crispus*			
Date of collection	10.5.89			6.9.89			6.7.89			11.12.89			23.1.90			
Number of specimens investigated	16			11			20			10			10			
Characters	min	ø	max	min	ø	max	min	ø	max	min	ø	max	min	ø	max	
Body length	1.46	1.81	2.08	1.33	1.52	1.76	1.71	1.95	2.14	1.95	2.07	2.34	1.10	1.41	1.70	mm
Total length of antenna	1.01	1.21	1.38	0.80	0.97	1.09	0.94	1.11	1.33	0.99	1.31	1.49	0.66	0.82	1.12	mm
Length of antennal joint III	260	311	353	213	242	280	200	256	333	266	312	360	127	183	300	µm
Length of antennal joint IV	140	203	253	113	147	180	133	173	220	180	217	260	80	112	180	µm
Length of antennal joint V	147	188	220	107	138	160	140	179	220	113	206	246	93	122	173	µm
Length of basal part of antennal joint VI	100	120	133	87	99	113	93	115	133	100	120	133	80	93	113	µm
Length of processus terminalis	246	308	360	206	263	306	273	316	366	233	361	406	193	236	286	µm
Basal diameter of antennal joint III	18	25	30	17	20	25	18	22	27	25	28	32	17	20	27	µm
Longest hair on antennal joint III	28	36	43	23	27	33	27	42	55	46	61	70	25	40	66	µm
Secondary rhinaria on antennal joint III	9	14	18	3	11	16	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint IV	0	1	6	0	2	5	0	0	0	0	0	0	0	0	0	
Secondary rhinaria on antennal joint V	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
Length of apical rostral segment	107	121	127	100	110	120	127	134	147	147	152	153	113	127	147	µm
Accessory hairs on apical rostral segment	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Frons	153	168	180	153	161	173	180	193	200	200	209	213	153	168	193	µm
Joint II of hind tarsus	93	115	127	93	104	113	100	112	120	120	126	133	87	96	107	µm
Siphuncular length	127	186	233	107	133	173	147	175	206	260	298	353	87	129	213	µm
Caudal length	133	164	193	120	126	140	160	182	200	206	226	253	120	153	200	µm
Caudal hair number	9	12	16	7	10	13	11	13	16	16	18	20	11	14	17	
Ratios																
Apical rostral segment/Hind tarsus II	0.94	1.05	1.21	0.94	1.06	1.13	1.12	1.20	1.33	1.15	1.20	1.28	1.27	1.32	1.38	
Longest hair III/Basal diameter III	1.11	1.42	1.86	1.07	1.41	1.82	1.45	1.90	2.31	1.75	2.19	2.47	1.25	1.93	2.58	
Processus terminalis/Basal part VI	2.18	2.56	2.84	2.20	2.65	3.07	2.39	2.75	3.14	2.72	3.03	3.24	2.27	2.55	2.77	
Body/Apical rostral segment	13.7	14.9	16.4	11.7	13.8	15.2	13.2	14.6	15.9	12.7	13.6	15.3	9.8	11.0	12.1	
Siphunculi/Cauda	0.95	1.13	1.27	0.85	1.05	1.30	0.85	0.96	1.07	1.22	1.31	1.49	0.68	0.83	1.07	

sclerites; 0–5 marginal tubercles on abdominal segments II–IV and VI; on tergite VIII 2–(3) hairs. Frons straight. Measurements see Tab. 6.

Male apterous, oviparous female with barely swollen hind tibiae and few scent plaques (STROYAN, 1984).

Lives monoecious-holocyclically on young shoots of *Hedera helix* L. and is often visited by ants.

Aphis ilicis KALTENBACH, 1843

Colour in life: Apterous viviparous females dull dark-brown, alate viviparous females with dull black thorax and light-brown abdomen, larvae dull light-brown.

Prepared material:

Apterous viviparous female: Antennae pale with exception of the proximal and distal parts, tibiae pale with brown distal area. First antennal segment with 5–(6) hairs. Siphunculi and cauda dark-brown. Abdomen with distinct spinal, marginal and postsiphuncular sclerites on segments VI–VIII and intersegmental pleural muscle sclerites; dorsal cuticle with distinct reticulation; 4 marginal tubercles present on abdominal segments I and VII, and 3–6 smaller tubercles on segments II–IV–(V); tergite VIII with (2–3)–4 hairs. Frons straight. Siphunculi squamous; cauda broad and blunt. Measurements see Tab. 5.

Alate viviparous female: Antennae completely brown. First antennal segment with (4)–5–(6) hairs. Abdomen with 3–5 marginal tubercles on segments II–IV; on tergite VIII (2–3)–4 hairs. Measurements see Tab. 6.

According to FRANSSEN (1931) and STROYAN (1984), the males are alate.

It lives monoecious-holocyclically in young curled leaves of *Ilex aquifolium* L. and is visited by ants.

Tab. 12: Comparison of measurements of one clone of *A. sambuci* on two distinct host plants.

	Apterous viviparous females of one *A. sambuci* clone						
Host plant	*Sambucus nigra*			*Rumex crispus*			
Date of collection	3.7.89			23.1.90			
Number of specimens investigated	8			11			
Characters	min	ø	max	min	ø	max	
Body length	1.79	1.94	2.13	1.38	1.48	1.63	mm
Total length of antenna	1.18	1.26	1.41	0.85	0.95	1.04	mm
Length of antennal joint III	253	284	326	167	199	233	µm
Length of antennal joint IV	167	205	240	107	134	160	µm
Length of antennal joint V	180	204	240	120	148	180	µm
Length of basal part of antennal joint VI	127	138	167	100	112	120	µm
Length of processus terminalis	293	316	346	233	252	273	µm
Basal diameter of antennal joint III	25	26	28	17	20	25	µm
Longest hair on antennal joint III	15	16	17	12	13	15	µm
Secondary rhinaria on antennal joint III	0	0	0	0	0	0	
Secondary rhinaria on antennal joint IV	0	0	0	0	0	0	
Secondary rhinaria on antennal joint V	0	0	0	0	0	0	
Length of apical rostral segment	147	155	167	133	139	147	µm
Accessory hairs on apical rostral segment	2	2	3	2	2	4	
Frons	220	222	233	186	199	206	µm
Joint II of hind tarsus	107	115	127	87	89	100	µm
Siphuncular length	386	443	519	240	288	353	µm
Caudal length	153	163	173	100	118	127	µm
Caudal hair number	8	10	12	9	12	13	
Ratios							
Apical rostral segment/Hind tarsus II	1.28	1.35	1.41	1.47	1.57	1.69	
Longest hair III/Basal diameter III	0.59	0.63	0.67	0.53	0.64	0.73	
Processus terminalis/Basal part VI	2.13	2.32	2.47	2.06	2.26	2.41	
Body/Apical rostral segment	11.7	12.5	13.3	9.9	10.6	11.3	
Siphunculi/Cauda	2.42	2.71	3.00	2.11	2.44	2.79	

Aphis lantanae KOCH, 1854

According to STROYAN (1984), two forms (subspecies) (*A. coriaria* BÖRNER, 1952, and *A. lantanae* KOCH, 1854 s.str.) can be distinguished morphologically. By electrophoresis, no differences could be detected between the two taxa, and therefore, according to EASTOP & HILLE RIS LAMBERS (1976), all specimens have been simply called *A. lantanae* in JÖRG & LAMPEL (1995). Nevertheless, two forms are clearly distinguishable by morphological characters in our material, e.g. by the length of the processus terminalis of the antennae and the siphuncular length. But in opposition to STROYAN (1984), our *A. coriaria* has always a longer processus terminalis than *A. lantanae* s.str. (cf. Tab. 5 and 6).

– *A. lantanae* form "*coriaria*"

Apterous and alate viviparous females are dull dark-brown and larvae dull light-brown in life.

Prepared material:

Apterous viviparous female: Body lemon-shaped. Antennae and tibiae pale with exception of proximal and distal parts. (4)–5–(6) hairs on first antennal segment. Siphunculi pale with a distal brown zone, cauda brown. Abdomen with sclerites, united to crossbands on segments I–VIII, postsiphuncular sclerites, and intersegmental pleural muscle sclerites; dorsal cuticle with reticulation; 4 marginal tubercles always present on abdominal segments I and VII, (1–5)–6–7 smaller ones on segments II–IV (and VI); tergite VIII with 3–13 hairs. Frons nearly straight. Siphunculi squamous; cauda broad and blunt.

Alate viviparous female: Antennae dark-brown, tibiae brown with paler median part. First antennal segment with 4 and 5 hairs. Siphunculi brown. Margin-

Tab. 13: Unpaired t-test for the ratio Apical rostral segment/Hind tarsus II of apterous viviparous females of the *Aphis fabae* group s.str. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
armata, cirsiiacanthoidis	233	-6.708	<.0001	ss
armata, euonymi	124	-1.500	.1361	ns
armata, fabae	172	1.298	.1961	ns
armata, mordwilkoi	197	-14.132	<.0001	ss
armata, philadelphi	112	-8.790	<.0001	ss
armata, solanella	215	-11.419	<.0001	ss
cirsiiacanthoidis, euonymi	243	5.372	<.0001	ss
cirsiiacanthoidis, fabae	291	10.669	<.0001	ss
cirsiiacanthoidis, mordwilkoi	316	-6.989	<.0001	ss
cirsiiacanthoidis, philadelphi	231	-1.906	.0578	ns
cirsiiacanthoidis, solanella	334	-4.326	<.0001	ss
euonymi, fabae	182	3.308	.0011	ss
euonymi, mordwilkoi	207	-12.583	<.0001	ss
euonymi, philadelphi	122	-7.175	<.0001	ss
euonymi, solanella	225	-9.913	<.0001	ss
fabae, mordwilkoi	255	-20.465	<.0001	ss
fabae, philadelphi	170	-12.523	<.0001	ss
fabae, solanella	273	-17.021	<.0001	ss
mordwilkoi, philadelphi	195	3.980	<.0001	ss
mordwilkoi, solanella	298	3.141	.0019	ss
philadelphi, solanella	213	-1.370	.1720	ns
Species	Mean	Variance	Std. Dev.	Std. Err.
armata	1.095	.005	.071	.009
cirsiiacanthoidis	1.174	.006	.080	.006
euonymi	1.115	.005	.072	.009
fabae	1.082	.003	.059	.005
mordwilkoi	1.230	.003	.056	.005
philadelphi	1.196	.002	.048	.006
solanella	1.208	.004	.062	.005

al and spinal sclerites (no crossbands on segments I–VI) present on all abdominal segments; 6 marginal tubercles on segments II–IV; 5 hairs on tergite VIII.

The males are apterous or alatiform (STROYAN, 1984).

– *A. lantanae* form "*lantanae*"

Apterous viviparous females and larvae dull greenish-black, alate viviparous females shiny greenish black in life.

Prepared material:

Apterous viviparous female: Siphunculi completely brown and shorter than in *A. coriaria*, cauda narrow and blunt. (4)–5 hairs on first antennal segment. Abdominal crossbands only on segments VII and VIII, sometimes some weak marginal sclerites; without dorsal reticulation; (1–3)–4–(5–6) marginal tubercles on segments II–IV; on tergite VIII 2–3–4–(5–6) hairs.

Alate viviparous female: Antennae completely brown. First antennal segment with (4)–5 hairs. Marginal sclerites more distinct and present on all abdominal segments; (1)–2–3–(4) marginal tubercles on segments II–IV; 2–3–(4) hairs on tergite VIII.

The male is alate (STROYAN, 1984).

Both forms live monoecious-holocyclically on *Viburnum lantana* L. in curled leaves, in the inflorescences and infructescences. Often they are attended by ants.

Aphis newtoni THEOBALD, 1927

Apterous viviparous females dull black, greenish-black, or brown, alate viviparous females with black head and thorax and dull greenish-grey abdomen, larvae dull greenish-brown or light-brown in life.

Tab. 14: Unpaired t-test for the ratio Longest hair III/Basal diameter III of apterous viviparous females of the *Aphis fabae* group s.str. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
armata, cirsiiacanthoidis	229	18.127	<.0001	ss
armata, euonymi	126	1.699	.0918	ns
armata, fabae	176	22.567	<.0001	ss
armata, mordwilkoi	198	7.513	<.0001	ss
armata, philadelphi	112	12.419	<.0001	ss
armata, solanella	218	26.463	<.0001	ss
cirsiiacanthoidis, euonymi	241	-11.227	<.0001	ss
cirsiiacanthoidis, fabae	291	8.994	<.0001	ss
cirsiiacanthoidis, mordwilkoi	313	-14.661	<.0001	ss
cirsiiacanthoidis, philadelphi	227	-6.893	<.0001	ss
cirsiiacanthoidis, solanella	333	15.233	<.0001	ss
euonymi, fabae	188	14.632	<.0001	ss
euonymi, mordwilkoi	210	2.731	.0068	ss
euonymi, philadelphi	124	4.159	<.0001	ss
euonymi, solanella	230	19.052	<.0001	ss
fabae, mordwilkoi	260	-21.500	<.0001	ss
fabae, philadelphi	174	-12.739	<.0001	ss
fabae, solanella	280	4.856	<.0001	ss
mordwilkoi, philadelphi	196	4.454	<.0001	ss
mordwilkoi, solanella	302	27.894	<.0001	ss
philadelphi, solanella	216	16.690	<.0001	ss
Species	Mean	Variance	Std. Dev.	Std. Err.
armata	2.461	.032	.179	.023
cirsiiacanthoidis	1.753	.078	.279	.021
euonymi	2.337	.278	.528	.063
fabae	1.435	.104	.323	.029
mordwilkoi	2.192	.061	.247	.021
philadelphi	2.029	.037	.192	.026
solanella	1.243	.111	.333	.026

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts. First antennal segment with 5–(6) hairs. Siphunculi and cauda brown. Abdomen with marginal sclerites on segments I–VI, postsiphuncular sclerites, and intersegmental pleural muscle sclerites, crossbands on segments VII and VIII, occasionally some spinal sclerites; dorsal cuticle reticulate; 4 great marginal tubercles on abdominal segments I and VII, and (5)–6 great tubercles on segments II–IV–(V); tergite VIII with 3–5–(6) hairs. Frons straight. Siphunculi squamous; cauda blunt. Measurements see Tab. 5.

Alate viviparous female: Antennae brown. (4)–5–(6) hairs on first antennal segment. 6–(7–8) great marginal tubercles on segments II–IV–(V); on tergite VIII 2–4 hairs. Measurements see Tab. 6.

Male apterous (STROYAN, 1984; HEIE, 1986).

Lives monoecious-holocyclically on different *Iris* spp., mainly on the basal parts of the leaves and sometimes also in the inflorescences and infructescences, and is visited by ants.

Aphis rumicis LINNAEUS, 1758

Apterous viviparous females dull brownish-black to black, alate viviparous females with black head and thorax, larvae dull light- to dark-brown.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with brown proximal and distal parts, sometimes whole antennae brown. First antennal segment with (4)–5 hairs. Siphunculi and cauda brown. Abdomen with well-developed marginal, postsiphuncular and intersegmental pleural muscle sclerites and with some spinal

Tab. 15: Unpaired t-test for the ratio Processus terminalis/Basal part VI of apterous viviparous females of the *Aphis fabae* group s.str. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
armata, cirsiiacanthoidis	226	.558	.5776	ns
armata, euonymi	117	-3.532	.0006	ss
armata, fabae	168	1.021	.3088	ns
armata, mordwilkoi	188	-.675	.5004	ns
armata, philadelphi	106	5.179	<.0001	ss
armata, solanella	207	-3.923	.0001	ss
cirsiiacanthoidis, euonymi	239	-4.695	<.0001	ss
cirsiiacanthoidis, fabae	290	.573	.5668	ns
cirsiiacanthoidis, mordwilkoi	310	-1.673	.0953	ns
cirsiiacanthoidis, philadelphi	228	4.810	<.0001	ss
cirsiiacanthoidis, solanella	329	-6.323	<.0001	ss
euonymi, fabae	181	5.272	<.0001	ss
euonymi, mordwilkoi	201	3.762	.0002	ss
euonymi, philadelphi	119	9.388	<.0001	ss
euonymi, solanella	220	-.357	.7212	ns
fabae, mordwilkoi	252	-2.237	.0262	s
fabae, philadelphi	170	4.609	<.0001	ss
fabae, solanella	271	-6.463	<.0001	ss
mordwilkoi, philadelphi	190	6.885	<.0001	ss
mordwilkoi, solanella	291	-4.778	<.0001	ss
philadelphi, solanella	209	-9.367	<.0001	ss
Species	Mean	Variance	Std. Dev.	Std. Err.
armata	2.582	.074	.272	.037
cirsiiacanthoidis	2.556	.095	.309	.023
euonymi	2.758	.072	.269	.033
fabae	2.535	.077	.277	.026
mordwilkoi	2.611	.067	.258	.022
philadelphi	2.342	.043	.207	.028
solanella	2.774	.102	.319	.026

sclerites; dorsal cuticle with strong reticulation; 4 marginal tubercles on abdominal segments I and VII, and 0–(5–6) smaller ones on segments II–IV (and VI); tergite VIII with (3–4)–5–8–(9) hairs. Frons nearly straight, sometimes with small antennal tubercles. Siphunculi squamous; cauda blunt. Measurements see Tab. 7.

Alate viviparous female: Antennae brown. First antennal segment with 5–(6) hairs. Spinal sclerites well-developed. 0–1–(2–6) marginal tubercles on segments II–IV; on tergite VIII 2–7 hairs. Measurements see Tab. 8.

The male is apterous (JONES, 1942; STROYAN, 1984; HEIE, 1986), smaller than any other morph, and its abdomen shows a well-developed sclerotic pattern (JONES, 1942).

Lives monoecious-holocyclically mainly in longitudinally curled leaves, rarely outside also, and in the inflorescences of *Rumex crispus* L., attended by ants. According to MÜLLER (1969) it feeds also on *R. obtusifolius* L. and *R. maritimus* L., and according to STROYAN (1984) sometimes also on *Rheum rhaponticum* L.

Aphis sambuci LINNAEUS, 1758

The dull greenish-black so-called *A. sambuci sambuci* and the olive-brown so-called *A. sambuci picta* subspecies (IGLISCH, 1969) were distinguishable neither by electrophoresis (JÖRG & LAMPEL, 1995) nor by morphological data. Specimens from secondary hosts are dull green to bluish-green.

Prepared material:

Apterous viviparous female: Antennae, tibiae, siphunculi, and cauda brown. (5)–6–9–(10–11) hairs on first antennal segment. Abdomen with stigmal plates, often with postsiphuncular sclerites and crossbands on segments VII and VIII, and rarely with intersegmental pleural muscle sclerites; dorsal cuticle without reticula-

Tab. 16: Unpaired t-test for the ratio Body/Apical rostral segment of apterous viviparous females of the *Aphis fabae* group s.str. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
armata, cirsiiacanthoidis	119	.348	.7285	ns
armata, euonymi	65	.441	.6609	ns
armata, fabae	93	1.611	.1106	ns
armata, mordwilkoi	102	4.662	<.0001	ss
armata, philadelphi	58	.603	.5486	ns
armata, solanella	111	.905	.3676	ns
cirsiiacanthoidis, euonymi	122	.277	.7821	ns
cirsiiacanthoidis, fabae	150	1.801	.0737	ns
cirsiiacanthoidis, mordwilkoi	159	5.989	<.0001	ss
cirsiiacanthoidis, philadelphi	115	.429	.6685	ns
cirsiiacanthoidis, solanella	168	.984	.3263	ns
euonymi, fabae	96	1.005	.3174	ns
euonymi, mordwilkoi	105	3.967	.0001	ss
euonymi, philadelphi	61	.103	.9185	ns
euonymi, solanella	114	.444	.6580	ns
fabae, mordwilkoi	133	3.900	.0002	ss
fabae, philadelphi	89	-.976	.3319	ns
fabae, solanella	142	-.485	.6282	ns
mordwilkoi, philadelphi	98	-4.346	<.0001	ss
mordwilkoi, solanella	151	-3.554	.0005	ss
philadelphi, solanella	107	.337	.7371	ns
Species	Mean	Variance	Std. Dev.	Std. Err.
armata	14.725	2.629	1.621	.287
cirsiiacanthoidis	14.625	1.718	1.311	.139
euonymi	14.545	2.899	1.703	.288
fabae	14.246	1.494	1.222	.154
mordwilkoi	13.482	1.115	1.056	.124
philadelphi	14.507	1.145	1.070	.202
solanella	14.380	3.606	1.899	.211

tion; always 10 great marginal tubercles on abdominal segments I–IV and VII, occasionally on segment V 1–2 additional tubercles; tergite VIII with (2)–3–4–(5–6) hairs. Frons straight. Siphunculi squamous; cauda blunt. Measurements see Tab. 7.

Alate viviparous female: Antennae brown. 7–9–(11) hairs on first antennal segment. Spinal sclerites on segments I and VI–VIII. 8–(9) great marginal tubercles on segments I–IV–(V) and VII; 2–4 hairs on tergite VIII. Measurements see Tab. 8.

Fundatrix: Spinal sclerites on segments VI–VIII, sometimes additional sclerites on other segments. 10–12 marginal tubercles on segments I–V and VII; tergite VIII with 2–4 hairs. Cauda broad and blunt. Measurements see Tab. 10.

Male alate and similar to alate viviparous female, but smaller (HEIE, 1986).

To fulfil the whole life cycle, it is necessary to migrate from the primary host *Sambucus nigra* L. to the roots of herbaceous plants like *Rumex* spp., *Saxifraga* spp., and some Caryophyllaceae (MÜLLER, 1969), because males are only produced on secondary hosts or in colonies founded on *Sambucus* by virgino-gynoparae, coming back from secondary hosts (IGLISCH, 1966; LAMPEL, 1968; HEIE, 1986).

Aphis tripolii LANG, 1920

Apterous and alate viviparous female and alate male dull green in life, larvae dull light-green. Head and thorax of alatae black.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with a brown area distally, siphunculi pale to pale brown, and cauda pale. First antennal segment with (4)–5–(6) hairs. Abdomen without visible sclerites; dorsal cuticle reticulate; always 4 marginal tubercles on abdominal segments I and VII, and (1–5)–6 smaller ones

Tab. 17: Unpaired t-test for the ratio Siphunculi/Cauda of apterous viviparous females of the *Aphis fabae* group s.str. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
armata, cirsiiacanthoidis	239	-.017	.9868	ns
armata, euonymi	131	2.853	.0050	ss
armata, fabae	187	5.321	<.0001	ss
armata, mordwilkoi	204	2.227	.0270	s
armata, philadelphi	117	.060	.9523	ns
armata, solanella	221	-8.595	<.0001	ss
cirsiiacanthoidis, euonymi	246	3.187	.0016	ss
cirsiiacanthoidis, fabae	302	6.496	<.0001	ss
cirsiiacanthoidis, mordwilkoi	319	2.773	.0059	ss
cirsiiacanthoidis, philadelphi	232	.078	.9383	ns
cirsiiacanthoidis, solanella	336	-11.995	<.0001	ss
euonymi, fabae	194	2.206	.0285	s
euonymi, mordwilkoi	211	-1.141	.2550	ns
euonymi, philadelphi	124	-3.013	.0031	ss
euonymi, solanella	228	-11.701	<.0001	ss
fabae, mordwilkoi	267	-4.065	<.0001	ss
fabae, philadelphi	180	-5.422	<.0001	ss
fabae, solanella	284	-16.874	<.0001	ss
mordwilkoi, philadelphi	197	-2.215	.0279	s
mordwilkoi, solanella	301	-14.267	<.0001	ss
philadelphi, solanella	214	-8.504	<.0001	ss
Species	Mean	Variance	Std. Dev.	Std. Err.
armata	1.240	.026	.162	.020
cirsiiacanthoidis	1.240	.034	.184	.014
euonymi	1.161	.025	.157	.019
fabae	1.109	.025	.158	.014
mordwilkoi	1.187	.024	.155	.013
philadelphi	1.238	.015	.124	.017
solanella	1.507	.050	.224	.018

on segments II–IV; tergite VIII with 2–(3) hairs. Frons nearly straight. Siphunculi squamous; cauda long, narrow, and blunt. Measurements see Tab. 7.

Alate viviparous female: Antennae and siphunculi brown, tibiae pale with brown proximal and distal parts. First antennal segment with 5–(6) hairs. Dorsal cuticle without reticulation. 6 marginal tubercles on abdominal segments II–IV; 2–3 hairs on tergite VIII. Measurements see Tab. 8.

Alate male: Antennae brown, siphunculi and cauda pale brown. First antennal segment with (4)–5 hairs. Marginal and postsiphuncular sclerites present. Dorsal cuticle without reticulation. 0 marginal tubercles on segments II–IV; 2 hairs on tergite VIII.

Lives monoecious-holocyclically on the upper stem, the leaves and in the inflorescences of *Aster tripolium* L.

Aphis vaccinii (BÖRNER, 1940)

Adults dull dark-brown to black, larvae dull dark-brown in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with a brown area proximally and distally, siphunculi and cauda brown. (3–4)–5 hairs on first antennal segment. Abdomen with well-developed marginal and spinal sclerites on all segments and with intersegmental pleural muscle sclerites; dorsal cuticle reticulate; 4 marginal tubercles on abdominal segments I and VII, and 0–(1–5) smaller ones on segments II–IV; tergite VIII with 2–4–(5–9) hairs. Frons nearly straight. Siphunculi squamous; cauda blunt. Measurements see Tab. 7.

Alate viviparous female: Antennae brown. First antennal segment with (3–4)–5 hairs. Abdomen with pre- and postsiphuncular sclerites, dorsal cuticle not reticu-

Tab. 18: Unpaired t-test for the ratio Apical rostral segment/Hind tarsus II of apterous viviparous females of *A. barberae, A. mordwilkoi, A. janischi*, and *A. cirsiiacanthoidis*. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
barberae, mordwilkoi	178	-.136	.8922	ns
janischi, cirsiiacanthoidis	218	-2.172	.0310	s
Species	Mean	Variance	Std. Dev.	Std. Err.
barberae	1.228	.003	.057	.009
mordwilkoi	1.230	.003	.056	.005
janischi	1.202	.003	.052	.008
cirsiiacanthoidis	1.174	.006	.080	.006

late. (0)–1–4–(5–6) marginal tubercles on abdominal segments II–IV; 2–3–(4) hairs on tergite VIII. Cauda slightly pointed. Measurements see Tab. 8.

Oviparous female: Antennae and tibiae pale with a brown area proximally and distally (hind tibiae completely brown with numerous scent plaques), siphunculi and cauda brown. (4)–5 hairs on first antennal segment. Abdominal sclerites less distinct, dorsal cuticle reticulate. 0–1 marginal tubercle on segments II–IV; 13–15–(16–33) hairs on tergite VIII. Measurements see Tab. 9.

Alate male: Antennae, siphunculi and cauda brown, tibiae pale with brown proximal and distal parts. First antennal segment with 5 and 6 hairs. Marginal, spinal and postsiphuncular sclerites well-developed. Dorsal cuticle without reticulation. 0 marginal tubercle on abdominal segments II–IV; 5 hairs on tergite VIII. Measurements see Tab. 9.

Lives monoecious-holocyclically on young shoots of *Vaccinium uliginosum* L., often together with the green species *Acyrthosiphon knechteli* (BÖRNER, 1950), rarely on *V. myrtillus* L., and is visited by ants. According to FIDLER (1951) and HEIE (1986) it feeds also on *V. vacillans* KALM. and *Andromeda polifolia* L. After BÖRNER (1952) it lives "usually only in bogs". We detected a strong preference of sun-exposed plants.

Aphis veratri WALKER, 1852

All observed morphs dull dark greenish-brown in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with proximal and distal brown parts, siphunculi and cauda brown. First antennal segment with 5–10 hairs.

Tab. 19: Unpaired t-test for the ratio Longest hair III/Basal diameter III of apterous viviparous females of *A. barberae, A. mordwilkoi, A. janischi*, and *A. cirsiiacanthoidis*. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
barberae, mordwilkoi	180	6.173	<.0001	ss
janischi, cirsiiacanthoidis	216	-1.572	.1175	ns
Species	Mean	Variance	Std. Dev.	Std. Err.
barberae	2.473	.079	.280	.044
mordwilkoi	2.192	.061	.247	.021
janischi	1.821	.028	.167	.025
cirsiiacanthoidis	1.753	.078	.279	.021

Tab. 20: Unpaired t-test for the ratio Processus terminalis/Basal part VI of apterous viviparous females of *A. barberae, A. mordwilkoi, A. janischi*, and *A. cirsiiacanthoidis*. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
barberae, mordwilkoi	173	4.227	<.0001	ss
janischi, cirsiiacanthoidis	216	4.375	<.0001	ss
Species	Mean	Variance	Std. Dev.	Std. Err.
barberae	2.802	.041	.201	.033
mordwilkoi	2.611	.067	.258	.022
janischi	2.341	.031	.176	.027
cirsiiacanthoidis	2.556	.095	.309	.023

Abdomen with some weak marginal sclerites, well-developed crossbands on segments VII and VIII and stigmal plates; dorsal cuticle weakly reticulate, most distinct on sclerotic areas; 4 marginal tubercles on abdominal segments I and VII, and (2–3)–4–6–(7) smaller ones on segments II–IV–(V); tergite VIII with 5–7–(8–10) hairs. Frons nearly straight. Siphunculi squamous and slightly constricted; cauda broad and blunt. Measurements see Tab. 7.

Alate viviparous female: Antennae sometimes completely brown. First antennal segment with (5–6)–7–(8) hairs. Abdomen with well-developed marginal, intersegmental muscle and postsiphuncular sclerites, sometimes with additional spinal sclerites on segments I–VI, dorsal cuticle reticulate. (2–4)–5–6 marginal tubercles on segments II–IV–(V); (6–7)–8–(9–12) hairs on tergite VIII. Measurements see Tab. 8.

Oviparous female: Like apterous viviparous female, but antennae always brown, hind tibiae hardly swollen, with scent plaques. First antennal segment with 5–7 hairs. (2–3)–4–6 marginal tubercles on segments II–IV–(V); 12–19 hairs on tergite VIII. Measurements see Tab. 9.

Apterous male: Like apterous viviparous female, but antennae brown. (5)–6–(7) hairs on first antennal segment. 2–5 marginal tubercles on segments II–IV (and VI); (4–5)–6–(7–8) hairs on tergite VIII. Measurements see Tab. 9.

Lives monoecious-holocyclically on the lower surface of leaves of *Veratrum album* L. and is attended by ants. Due to beginning senescence, the infested leaves are often brownish-yellow. *A. cirsiiacanthoidis*, which can be also found on *V. album* (MÜLLER & HORATSCHEK, 1980; JÖRG & LAMPEL, 1995), feeds sometimes

Tab. 21: Unpaired t-test for the ratio Body/Apical rostral segment of apterous viviparous females of *A. barberae, A. mordwilkoi, A. janischi*, and *A. cirsiiacanthoidis*. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
barberae, mordwilkoi	90	-3.359	.0011	ss
janischi, cirsiiacanthoidis	110	-3.410	.0009	ss
Species	Mean	Variance	Std. Dev.	Std. Err.
barberae	12.608	.850	.922	.206
mordwilkoi	13.482	1.115	1.056	.124
janischi	15.641	1.243	1.115	.232
cirsiiacanthoidis	14.625	1.718	1.311	.139

Tab. 22: Unpaired t-test for the ratio Siphunculi/Cauda of apterous viviparous females of *A. barberae, A. mordwilkoi, A. janischi*, and *A. cirsiiacanthoidis*. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
barberae, mordwilkoi	181	-6.460	<.0001	ss
janischi, cirsiiacanthoidis	224	-1.654	.0995	ns
Species	Mean	Variance	Std. Dev.	Std. Err.
barberae	1.019	.010	.099	.016
mordwilkoi	1.187	.024	.155	.013
janischi	1.287	.017	.132	.019
cirsiiacanthoidis	1.240	.034	.184	.014

also on the lower surface of leaves, but mostly on the upper stem and in the inflorescences. *A. veratri* could never be found on these parts of the plant.

Aphis viburni SCOPOLI, 1763

All observed morphs dull black in life.

Prepared material:

Apterous viviparous female: Antennae and tibiae pale with proximal and distal brown areas, siphunculi and cauda brown. 5–6–(7) hairs on first antennal segment. Abdomen with pale marginal, intersegmental muscle and postsiphuncular sclerites and with crossbands on segments VII and VIII, occasionally with spinal sclerites on other segments; dorsal cuticle with reticulation; always 4 marginal tubercles on abdominal segments I and VII, and at least 6, mostly 7–8–(9–10), slightly smaller ones on segments II–VI; tergite VIII with (2–3)–4–(5) hairs. Frons nearly straight. Siphunculi squamous; cauda blunt. Measurements see Tab. 7.

Alate viviparous female: Antennae brown. First antennal segment with (4)–5–6 hairs. Marginal, pre-, and postsiphonal sclerites great and brown, crossbands on segments I and VI–VIII. (6)–8–(9) marginal tubercles on segments II–VI; 2–4 hairs on tergite VIII. Measurements see Tab. 8.

Tab. 23: Unpaired t-test for the ratio Apical rostral segment/Hind tarsus II of one clone of *A. fabae, A. mordwilkoi*, and *A. sambuci*, respectively. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
fabae 10.5.89, *fabae* 6.9.89	49	-.395	.6948	ns
mordwilkoi on *Viburnum*, *mordwilkoi* on *Tropaeolum*	58	.001	.9992	ns
mordwilkoi on *Viburnum*, *mordwilkoi* on *Rumex*	58	-8.146	<.0001	ss
mordwilkoi on *Tropaeolum*, *mordwilkoi* on *Rumex*	38	9.797	<.0001	ss
sambuci on *Sambucus*, *sambuci* on *Rumex*	36	-12.096	<.0001	ss
Clone	Mean	Variance	Std. Dev.	Std. Err.
fabae 10.5.89	1.053	.003	.050	.009
fabae 6.9.89	1.060	.004	.062	.014
mordwilkoi on *Viburnum*	1.204	.003	.058	.009
mordwilkoi on *Tropaeolum*	1.204	.001	.038	.008
mordwilkoi on *Rumex*	1.322	.001	.038	.008
sambuci on *Sambucus*	1.349	.002	.042	.011
sambuci on *Rumex*	1.566	.004	.062	.013

Tab. 24: Unpaired t-test for the ratio Longest hair III/Basal diameter III of one clone of *A. fabae, A. mordwilkoi*, and *A. sambuci*, respectively. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
fabae 10.5.89, *fabae* 6.9.89	48	.045	.9644	ns
mordwilkoi on *Viburnum*, *mordwilkoi* on *Tropaeolum*	57	-5.587	<.0001	ss
mordwilkoi on *Viburnum*, *mordwilkoi* on *Rumex*	57	-.402	.6889	ns
mordwilkoi on *Tropaeolum*, *mordwilkoi* on *Rumex*	38	-2.721	.0098	ss
sambuci on *Sambucus*, *sambuci* on *Rumex*	36	-.833	.4101	ns
Clone	Mean	Variance	Std. Dev.	Std. Err.
fabae 10.5.89	1.417	.036	.189	.034
fabae 6.9.89	1.414	.059	.243	.056
mordwilkoi on *Viburnum*	1.904	.039	.197	.032
mordwilkoi on *Tropaeolum*	2.194	.030	.172	.039
mordwilkoi on *Rumex*	1.934	.153	.391	.087
sambuci on *Sambucus*	.627	.001	.031	.008
sambuci on *Rumex*	.641	.004	.063	.013

Apterous male: Abdomen showing often the complete dorsal pattern of the alate viviparous female (JONES, 1945).

Lives without host-alternation (MÜLLER, 1969) in curled leaves of *Viburnum opulus* and is visited by ants.

DISCUSSION

Since, due to different host plants, the age of clones (cf. Tab. 11 and 12) or other influences, high significant differences often already occur in absolute values, t-tests have been made only with the ratios.

Tab. 23–27 show that, comparing the ratios inside three clones, significant differences very often appear. Already SHAPOSHNIKOV (1986) reported, that within one clone of *Dysaphis foeniculus* (THEOBALD), due to different host plants, the allome-

Tab. 25: Unpaired t-test for the ratio Processus terminalis/Basal part VI of one clone of *A. fabae, A. mordwilkoi*, and *A. sambuci*, respectively. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
fabae 10.5.89, *fabae* 6.9.89	44	-.926	.3596	ns
mordwilkoi on *Viburnum*, *mordwilkoi* on *Tropaeolum*	56	-6.514	<.0001	ss
mordwilkoi on *Viburnum*, *mordwilkoi* on *Rumex*	56	4.258	<.0001	ss
mordwilkoi on *Tropaeolum*, *mordwilkoi* on *Rumex*	34	-9.869	<.0001	ss
sambuci on *Sambucus*, *sambuci* on *Rumex*	35	1.610	.1165	ns
Clone	Mean	Variance	Std. Dev.	Std. Err.
fabae 10.5.89	2.559	.049	.221	.044
fabae 6.9.89	2.626	.076	.276	.060
mordwilkoi on *Viburnum*	2.748	.026	.162	.026
mordwilkoi on *Tropaeolum*	3.032	.018	.133	.031
mordwilkoi on *Rumex*	2.554	.024	.156	.037
sambuci on *Sambucus*	2.319	.011	.103	.027
sambuci on *Rumex*	2.257	.015	.124	.026

Tab. 26: Unpaired t-test for the ratio Body/Apical rostral segment of one clone of *A. fabae, A. mordwilkoi*, and *A. sambuci*, respectively. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
fabae 10.5.89, *fabae* 6.9.89	25	2.762	.0106	s
mordwilkoi on *Viburnum*, *mordwilkoi* on *Tropaeolum*	28	3.081	.0046	ss
mordwilkoi on *Viburnum*, *mordwilkoi* on *Rumex*	28	11.244	<.0001	ss
mordwilkoi on *Tropaeolum*, *mordwilkoi* on *Rumex*	18	-7.491	<.0001	ss
sambuci on *Sambucus*, *sambuci* on *Rumex*	17	7.311	<.0001	ss
Clone	Mean	Variance	Std. Dev.	Std. Err.
fabae 10.5.89	14.931	1.052	1.026	.256
fabae 6.9.89	13.844	.947	.973	.293
mordwilkoi on *Viburnum*	14.555	.635	.797	.178
mordwilkoi on *Tropaeolum*	13.634	.513	.716	.227
mordwilkoi on *Rumex*	11.043	.683	.826	.261
sambuci on *Sambucus*	12.503	.412	.642	.227
sambuci on *Rumex*	10.632	.227	.477	.144

try of some parts of the body can change. He drew the conclusion that according to this fact, not infrequently new species have been described erroneously. *A. mordwilkoi* and *A. sambuci* showed in our tests similar phenomena as *D. foeniculus* (cf. Tab. 11 and 12). It must be pointed out that the host plants used in our tests are the plants on which the aphids normally can be found in nature (THIEME, 1988; JÖRG & LAMPEL, 1995). BLACKMAN *et al.* (1987) made the observation that variation can also occur in relation to the age of a clone. Such a variation could be detected by us in a clone of *A. fabae* (Tab. 11). In this clone the ratios Body/Apical rostral segment and Siphunculi/Cauda are significantly different on two different dates (cf. Tab. 26 and 27).

A. barberae and *A. mordwilkoi* show in four of the five ratios significant differences (Tab. 18–22), but one *A. mordwilkoi* clone shows on three different host

Tab. 27: Unpaired t-test for the ratio Siphunculi/Cauda of one clone of *A. fabae, A. mordwilkoi*, and *A. sambuci*, respectively. Hypothesized difference = 0. DF: Degrees of freedom, ss: difference highly significant, s: difference significant, ns: difference not significant.

Combination	DF	t-Value	P-Value	Signif.
fabae 10.5.89, *fabae* 6.9.89	52	2.845	.0063	ss
mordwilkoi on *Viburnum*, *mordwilkoi* on *Tropaeolum*	58	-19.563	<.0001	ss
mordwilkoi on *Viburnum*, *mordwilkoi* on *Rumex*	58	5.888	<.0001	ss
mordwilkoi on *Tropaeolum*, *mordwilkoi* on *Rumex*	38	-17.507	<.0001	ss
sambuci on *Sambucus*, *sambuci* on *Rumex*	36	4.815	<.0001	ss
Clone	Mean	Variance	Std. Dev.	Std. Err.
fabae 10.5.89	1.129	.007	.085	.015
fabae 6.9.89	1.043	.019	.137	.029
mordwilkoi on *Viburnum*	.957	.004	.064	.010
mordwilkoi on *Tropaeolum*	1.313	.005	.070	.016
mordwilkoi on *Rumex*	.831	.010	.101	.023
sambuci on *Sambucus*	2.713	.035	.187	.047
sambuci on *Rumex*	2.440	.026	.161	.034

plants also significant differences. That means that the variation within one clone of *A. mordwilkoi* is as great as is the variation between *A. mordwilkoi* and *A. barberae*. In addition, it must be mentioned that the spans of all measured values are strongly overlapping (see Tab. 4). Therefore, and according especially to our electrophoretic results and host plant tests (JÖRG & LAMPEL, 1995), we regard *A. barberae* nevertheless as a synonym of *A. mordwilkoi*. The rearing of a clone of *A. sambuci* on two distinct host plants results in three significantly different ratios.

A. janischi and *A. cirsiiacanthoidis* are in three ratios significantly different (Tab. 18–22). But here also, the spans of the values are strongly overlapping (see Tab. 3). The sometimes slightly higher values of *A. janischi* may probably result from nutritional influences of the host plant *Cirsium oleraceum* (L.) SCOP., on which *A. janischi* has been found. Higher values could also be detected for *A. mordwilkoi*, which has been reared on *Tropaeolum majus* (see Tab. 11), and *A. sambuci*, which has been kept on *Sambucus nigra* (Tab. 12). According to our electrophoretic results (JÖRG & LAMPEL, 1995) and the statements above made, we insist on regarding *A. janischi* as a synonym of *A. cirsiiacanthoidis*.

Inside the *A. fabae* group s.str., *A. armata* is the species with the highest degree of difficulty to be separated from the other ones. In comparison with *A. cirsiiacanthoidis*, *A. euonymi*, and *A. fabae*, only two ratios are significantly different, with *A. philadelphi* three, and with *A. mordwilkoi* and *A. solanella* four. The comparison of *A. cirsiiacanthoidis* with *A. philadelphi* results also only in two distinct ratios; *A. cirsiiacanthoidis/A. fabae* and *A. philadelphi/A. solanella* have three different ratios. All other comparisons result in four to five significantly different ratios (Tab. 13–17), but the spans of the values are also in nearly all cases strongly overlapping (see Tab. 1–4). Thus, for the *A. fabae* group s.str. it is impossible to erect a simple determination key based on morphological and biological (host plants) data (cf. JÖRG & LAMPEL, 1995). Perhaps, future studies will result in keys based on discriminant analysis of the morphological data of the investigated populations, as it has been done by BINAZZI & DE SILVA (1993) for two *Cinara* species.

For all combinations, the differences of the ratios of the members of the *A. fabae* group s.l. are in most cases highly significant (t-tests). But as the measured values are overlapping very often (see Tab. 5–8), it is also not possible to erect a general determination table for all species using only morphological characters. Easily determinable by some characters are *A. tripolii* (green colour, siphunculi pale, longest hair on antennal segment III of apterae 10–13 µm), *A. lantanae coriaria* (siphunculi only proximal pigmented, longest hair on antennal segment III at least 66 µm), *A. sambuci* (ratio Siphunculi/Cauda of apterae > 2.11), *A. cacaliasteris* (2–12 secondary rhinaria on antennal joint IV in apterae in combination with the ratio Apical rostral segment/Hind tarsus II 0.94–1.05), and partly *A. hederae* (up to 5 secondary rhinaria on antennal joint IV in combination with the ratio Apical rostral segment/Hind tarsus II 1.24–1.67). On the other hand, using the combination of host plant and morphology, all species of the *A. fabae* group s.l. are easily distinguishable from each other. This fact has been already used, e.g. by MÜLLER (1969), STROYAN (1984), and HEIE (1986). Unfortunately MÜLLER's key is not useful for all the Swiss material, because the spans given in this key do not always correspond with our values. To quote as an illustration, his ratio Siphunculi/Cauda for *A. sambuci* is simply 3, our ratio ranges between 2.42 and 3.23. The body length is 2.2–3.2 mm, our measured values are 1.79–3.18 mm. According to MÜLLER (1969), *A. vaccinii* and *A. rumicis* do not have any marginal tubercles on abdominal segments II–IV. We counted sometimes up to 5 tubercles for the first and even up to 6 for the latter species.

To draw some conclusions from the preceding work of JÖRG & LAMPEL (1995) and the present paper, one can state that it is possible to distinguish electrophoretically the members of the *A. fabae* group s.str. and s.l., but it is impossible to determine all the members of the mentioned groups by a general key based only on morphological characters. Host plant tests are only partly useful, and very difficult to standardize. By morphology in combination with host plants, the members of the *A. fabae* group s.l. are easily distinguishable.

ACKNOWLEDGEMENTS

We thank Dr. Robert J. LAMB, Agriculture Canada, Research Station, Winnipeg, Ulrike LILIENFEIN, Institut für Geobotanik der Universität Düsseldorf, and Dr. Hans MEYER, Zoologisches Institut der Universität Kiel, for providing living aphid material. Thanks also to Ludwika SYGNARSKI for mounting the aphids and realizing most measurements.
This study was supported by the Swiss National Science Foundation grants 31–8857.86 and 31–27801.89.

ZUSAMMENFASSUNG

Morphologische Studien über die *Aphis fabae*-Gruppe (Homoptera, Aphididae) – Die Taxa der *Aphis-fabae*-Gruppe s.str. sind mit morphologischen Bestimmungsschlüsseln nur schwer oder gar nicht unterscheidbar. Die Mitglieder der *Aphis fabae*-Gruppe s.l. sind hingegen in Kombination mit ihren Wirtspflanzen leicht bestimmbar. Nur mit Hilfe der vertikalen Stärke-Gel-Elektrophorese ist es möglich, die Mitglieder des gesamten *A. fabae*-Komplexes (*A. fabae*-Gruppe s.str. und s.l.) zu unterscheiden (JÖRG & LAMPEL, 1995). Die zitierte Arbeit diente als Basis für die vorliegende Arbeit, in welcher die Resultate unserer morphologischen Untersuchungen über diesen Komplex präsentiert werden.

REFERENCES

BINAZZI, A. & DE SILVA, J. 1993. Contributions to the knowledge of the conifer aphid fauna. XVI. On the identity of *Cinara montanicola* (BÖRNER) with notes on *Cinara pini* (LINNAEUS) (Homoptera Aphidoidea Lachnidae). *Redia 76:* 83–110.

BLACKMAN, R.L.; EASTOP, V.F.; FRAZER, B.D. & RAWORTH, D.A. 1987. The strawberry aphid complex, *Chaetosiphon (Pentatrichopus)* spp. (Hemiptera: Aphididae): taxonomic significance of variations in karyotype, chaetotaxy and morphology. *Bull. ent. Res. 77:* 201–212.

BÖRNER, C. 1952. Europae centralis Aphides. *Schrift. Thüring. Landesarbeitsgemeinschaft Heilpflanzenkunde u. -beschaffung, 4*, and *Mitt. Thüring. Bot. Ges., Beiheft 3*, Weimar, 488 pp.

BÖRNER, C. & JANISCH, R. 1922. Zur Lebensgeschichte und Bekämpfung der "Schwarzen Blattläuse". *Nachrichtenbl. dtsch. Pflanzenschutzdienst 2(8):* 65–67.

EASTOP, V.F. & HILLE RIS LAMBERS, D. 1976. *Survey of the world's aphids*. W. Junk, The Hague, 573 pp.

FIDLER, J.H. 1951. *Aphis vaccinii* (BÖRNER) (Hemiptera, Aphididae) new to the British Isles. A redescription and comparison with *Aphis callunae* THEOBALD. *Proc. R. Ent. Soc. Lond. (B) 20:* 37–43.

FLUITER, H.J. DE 1949. Over de voedselplanten van de zwarte bonenluis, *Aphis (Doralis) fabae* SCOP. *Tijdschr. Plantenziekten 55:* 69–87.

FRANSSEN, C.J.H. 1927. *Aphis fabae* SCOP. en aanverwante soorten in Nederland. *Tijdschr. Plantenziekten 33:* 193–284.

FRANSSEN, C.J.H. 1931. Die Biologie und Systematik der europäischen "Schwarzen Blattläuse" unter besonderer Berücksichtigung der "Niederländischen Arten". *Z. ang. Ent. 17:* 106–145.

HEIE, O.E. 1986. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark III. *Fauna Entomol. Scand. 17*: 1–314.

HEINZE, K. 1952. Polyvinyl-Lactophenol-Gemisch als Einbettungsmittel für Blattläuse. *Naturwissenschaften 39:* 285–286.

HILLE RIS LAMBERS, D. 1946–47. Neue Blattläuse aus der Schweiz (Homopt., Aphidae). *Mitt. Schweiz. Ent. Ges. 20:* 323–331.

IGLISCH, I. 1966. Untersuchungen über die Biologie und phytopathologische Bedeutung der Holunderblattlaus, *Aphis sambuci* L., einer der *Aphis-fabae*-Gruppe nahe verwandten Art (Homoptera: Aphididae). *Mitt. Biol. Bundesanst. Land- Forstwirtsch. Berl.-Dahlem 119:* 1–32.

IGLISCH, I. 1968. Über die Entstehung der Rassen der "Schwarzen Blattläuse" (*Aphis fabae* SCOP. und verwandte Arten), über ihre phytopathologische Bedeutung und über die Aussichten für erfolgversprechende Bekämpfungsmaßnahmen (Homoptera: Aphididae). *Mitt. Biol. Bundesanst. Land- Forstwirtsch. Berl.-Dahlem 131:* 1–34.

IGLISCH, I. 1969. Über Subspezies der "Schwarzen Holunderblattlaus", *Aphis sambuci* L., zum Wirtsspektrum dieser Formen und über ihren Verwandtschaftskreis (Homoptera: Aphididae). *Z. ang. Ent. 63:* 320–335.

IGLISCH, I. 1970. Zur Aufstellung eines Verwandtschaftsbildes der "Schwarzen Blattläuse", *Aphis fabae* Scop. und verwandter Arten, nach biologischen Merkmalen (Homoptera: Aphididae). *Z. ang. Ent. 65:* 304–308.

IGLISCH, I. 1972. Zum Verhalten der "Schwarzen Blattläuse" (Arten und Rassen der *Aphis-fabae*-Gruppe sensu stricto) auf ihren Primärwirtspflanzen im Lauf der Vegetationsperiode (Homoptera: Aphididae). *Z. ang. Zool. 59:* 153–160.

JACOB, F.H. 1945. Note on the classification of the British species of "black aphides" (Hemiptera, Aphididae). *Proc. R. Ent. Soc. Lond., Ser. B, Taxon. 14:* 102–110.

JANISCH, R. 1926. Lebensweise und Systematik der "Schwarzen Blattläuse". *Arb. Biol. Reichsanst. Land- Forstwirtsch. 14:* 291–366.

JÖRG, E. & LAMPEL, G. 1995. Enzyme electrophoretic studies on the *Aphis fabae* group (Homoptera, Aphididae). *J. Appl. Ent.* 119.

JONES, M.G. 1942. A description of *Aphis (Doralis) rumicis*, L., and comparison with *Aphis (Doralis) fabae*, SCOP. *Bull. ent. Res. 33:* 5–20.

JONES, M.G. 1943. A brown *Aphis, Aphis (Doralis) cognatella*, sp.n., found on spindle tree. *Bull. ent. Res. 34:* 213–224.

JONES, M.G. 1945. The *Viburnum Aphis, Aphis (Doralis) viburni*, SCOP. *Bull. ent. Res. 36:* 1–13.

LAMPEL, G. 1968. *Die Biologie des Blattlaus-Generationswechsels*. Gustav Fischer, Jena, 264 pp.

LAMPEL, G. 1980. Für die Schweiz neue Blattlaus-Arten (Homoptera, Aphidina) 2. *Mitt. Schweiz. Ent. Ges. 53:* 229–281.

LAMPEL, G. 1984. Beitrag zur Kenntnis von *Aphis cacaliasteris* HRL., 1947 (Homoptera, Aphidina, Aphididae). *Mitt. Schweiz. Ent. Ges. 57:* 357–366.

MÜLLER, F.P. 1969. Aphidina – Blattläuse, Aphiden. *In*: STRESEMANN, E. (ed.), *Exkursionsfauna von Deutschland, Insekten*. Zweiter Halbband, Wirbellose II/2, pp. 51–141. Volk und Wissen, Berlin.

MÜLLER, F.P. 1975. Untersuchungen zur Biologie von *Aphis evonymi* F. (Homoptera: Aphididae) im Freiland-Insektarium. *Arch. Freunde Naturg. Mecklb. 15:* 90–99.

MÜLLER, F.P. 1982. Das Problem *Aphis fabae*. *Z. ang. Ent. 94:* 432–446.

MÜLLER, F.P. & HORATSCHEK, A. 1980. Zur Taxonomie der Blattlaus *Aphis veratri* WALKER, 1852. *Mitt. naturwiss. Ver. Steiermark 110:* 163–170.

MÜLLER, F.P. & STEINER, H. 1986. Beitrag zur vergleichenden Morphologie und Bionomie von *Aphis euonymi* F. *Dtsch. ent. Z. 33:* 257–262.

MÜLLER, F.P. & STEINER, H. 1989. *Aphis armata* HAUSMANN, 1802, ein Doppelgänger der Schwarzen Rüben- und Bohnenblattlaus *Aphis fabae* SCOP. (Insecta, Homoptera: Aphididae). *Reichenbachia 27(5):* 27–32.

MÜLLER, F.P. & STEINER, H. 1990. Weitere vergleichend morphologische Untersuchungen im Formenkreis von *Aphis fabae* (Homoptera: Aphididae). *Beitr. Ent. 40:* 247–254.

ROBINSON, A.G. 1980. A new species of *Aphis* L. (Homoptera: Aphididae) from *Nasturtium*. *Can. Ent. 112:* 123–125.

SAGER, S. 1992. *StatView*. Abacus Concepts, Inc., Berkeley, 466 pp.

SHAPOSHNIKOV, G. Kh. 1986. New species of the genus *Dysaphis* BÖRNER (Homoptera, Aphidinea) and peculiarities of the taxonomic work with aphids [in Russian with English summary]. *Rev. Ent. URSS 65:* 535–550.

STROYAN, H.L.G. 1984. *Aphids – Pterocommatinae and Aphidinae (Aphidini), Homoptera, Aphididae*. Handbooks for the identification of British insects, 2, Part 6. R. Ent. Soc. Lond., 232 pp.

THIEME, T. 1985. Untersuchungen über die Wirtspflanzen des Komplexes der Schwarzen Bohnen- oder Rübenblattlaus *Aphis fabae* SCOP. (Homoptera: Aphididae) Teil 2. *Wiss. Z. Wilhelm-Pieck-Univ. Rostock, Naturwiss. Reihe 34(6):* 90–92.

THIEME, T. 1987. Members of the complex of *Aphis fabae* Scop. and their host plants. *In*: HOLMAN, J.; PELIKAN, J.; DIXON, A.F.G. & WEISMANN, L. (eds.), *Population Structure, Genetics and Taxonomy of Aphids and Thysanoptera*, pp. 314–323. SPB Academic Publishing, The Hague.

THIEME, T. 1988. Zur Biologie von *Aphis fabae mordwilkowi* BÖRNER UND JANISCH, 1922 (Hom., Aphididae). *J. Appl. Ent. 105:* 510–515.

THIEME, T. 1989. Zur Biologie und Morphologie von *Aphis armata* HAUSMANN, 1802 (Hom., Aphididae). *J. Appl. Ent. 107:* 113–117.

(received March 25, 1995; accepted August 22, 1995)