

# **Analysing the sweet- and sour- cherry cultivars by use of SSRs**

**Kompetenzzentrum Obstbau-Bodensee  
(KOB)**

*4<sup>th</sup> March 2014 in Budapest, Hungary*

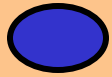


**The capability to distinguish among cherry cultivars in breeding, cultivation and germplasm collection is extremely important for scientific as well as for economic reasons.**

**Total samples (>100 sweet- and >30 sour cherries) were collected from:**

**-3 institutions - Weinsberg (lab no. **K or W**), Augustenberg (lab no. **L**) and Verexal (lab no. **V**)  
-2 nurseries Ganter (lab no. **Gt**) and Artus (lab no. **Ar**) and so on.**

**Total samples were analyzed by 15 SSRs usually used in KOB. 7 SSRs suggested by ECPGR only used for the samples of Weinsberg (40 sweet, 30 sour)**

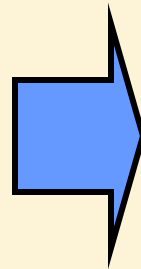


# Sampling

All non-contaminated parts of a tree excepting seeds and withered flowers are suitable for the analyzing the cultivars

## Non contaminated

- young fresh leaves
- leaves
- fruits
- one year shoots
- buds
- roots
- bark
- marmalade



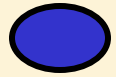
- a. frozen dried, stored in refrigerator at  $-32^{\circ}\text{C}$
- b. fresh tissue

DNA-Extraction with cocktail fruits and juice didn't succeed  
Fossil: very difficult

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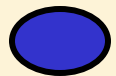
## DNA extracting

1: housekeeping method: CTAB, according to Neumüller (2004)

2: Qiagen Mini Plant Kit:

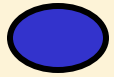
3: Epicenter Mini Plant Kit:

4: Omega Mini Plant Kit:



## Quantifying and dilution

DNA: 5-10 ng/ $\mu$ l



# SSR Primers used

Bppct 002	Empa002	<b><i>EmpaS01</i></b>	EmpaS30	UCD 98-021	UCP-CH36	UDP 98-403
Bppct 013	Empa003	<b><i>EmpaS02</i></b>	Empc11	UCD 98-411	UCP-CH39	<b><i>UDP 98-410</i></b>
Bppct 034	Empa026	<b><i>EmpaS06</i></b>	Empc117	UCP-CH11	<b><i>UDP 96-001</i></b>	<b><i>UDP 98-411</i></b>
<b>Bppct037</b>	Empa17	<b><i>EmpaS10</i></b>	<b><i>PceGA34</i></b>	UCP-CH12	UDP 96-005	<b><i>UDP 98-412</i></b>
Bppct040	<b><i>EmpaJ04</i></b>	<b><i>EmpaS11</i></b>	PMS3	<b><i>UCP-CH17</i></b>	UDP 96-015	
CH17	<b><i>EmpaJ05</i></b>	<b><i>EmpaS12</i></b>	PMS30	UCP-CH18	UDP 97-403	
<b>Cppct006</b>	<b><i>EmpaJ15</i></b>	<b><i>EmpaS14</i></b>	<b><i>Ps05c03</i></b>	UCP-CH21	UDP 98-005	
<b>Cppct022</b>	EmpaJ18	EmpaS3	UCD 97-403	UCP-CH31	UDP 98-021	

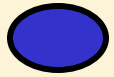
1. 52 SSRs in total tested in the lab of KOB

2. The primers which work very well, but are not unconditionally suitable for fingerprinting

3. 15 SSRs in bold and cursive usually used for identifying cherries in KOB



4. 16 SSRs in red suggested by ECPGR



## PCR buffer

1: Housekeeping buffer, according to Xuan et al. (2009)

2: GE buffer GE Taq Polymerase

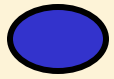
3: Ampli Taq Gold buffer

4: Fermentas Taq buffer

5: Quanta Biosciences

## Multiplex PCR:

- 3-4 Primer pairs in one PCR solution,
- compatible: less disturbance bands, less byproducts, stable, clearly amplified, well repeatable



## PCR condition

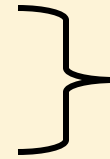
94°C 2 min

94°C 45 sec

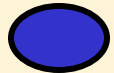
56°C 1 min

72°C 2 min

72°C 10 min



37 cycles

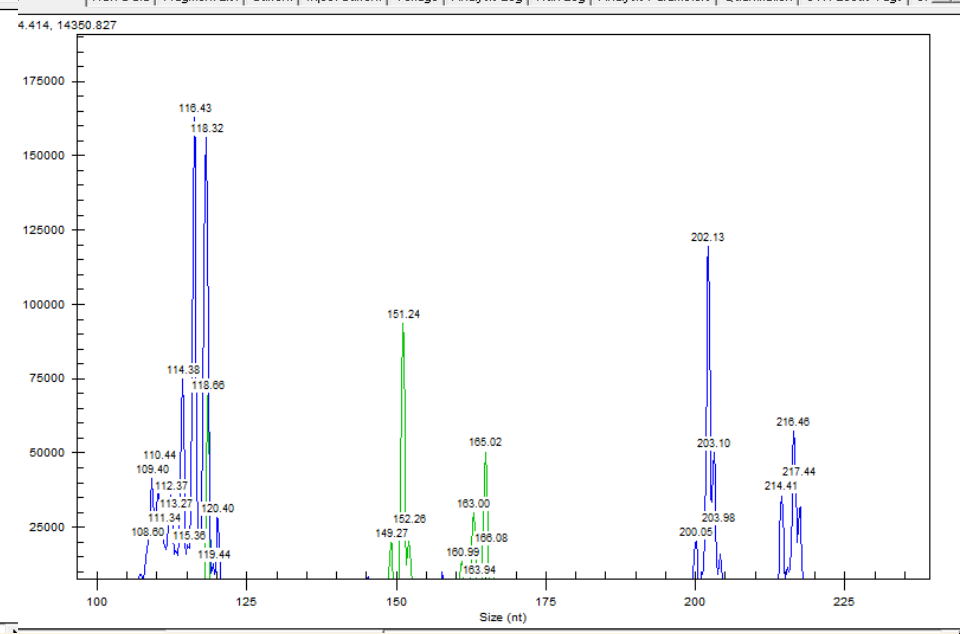
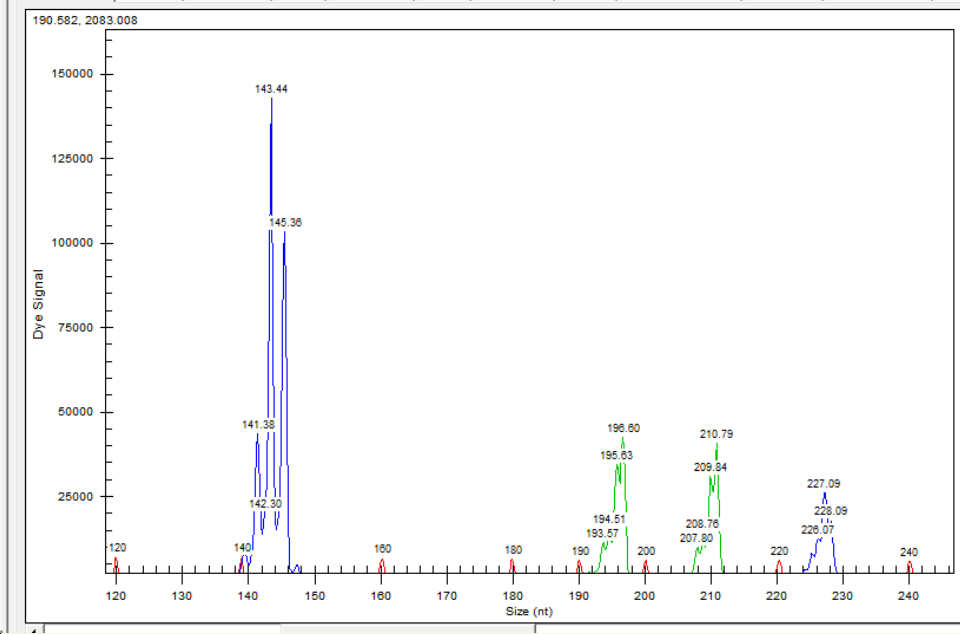
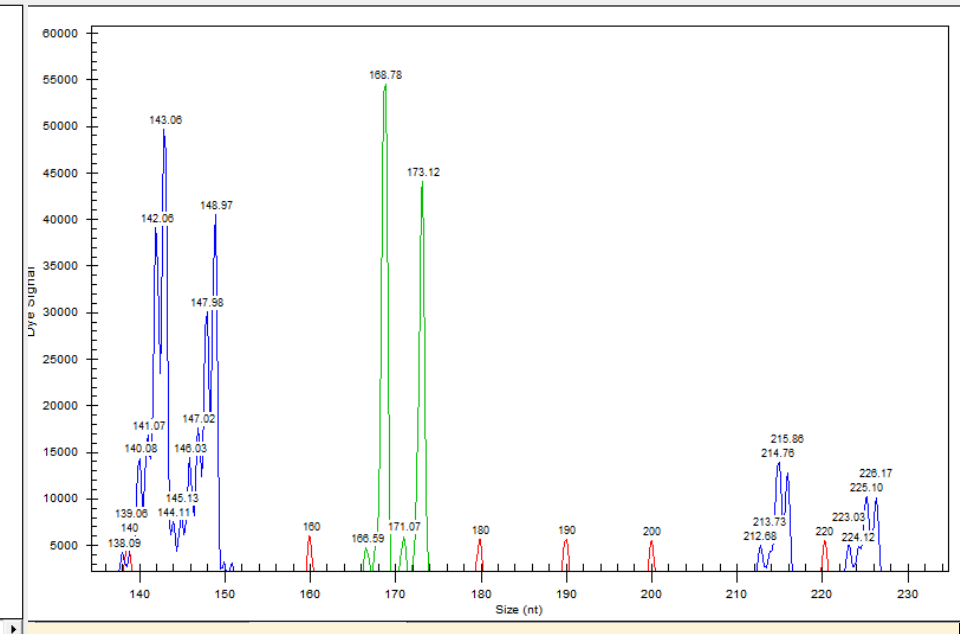
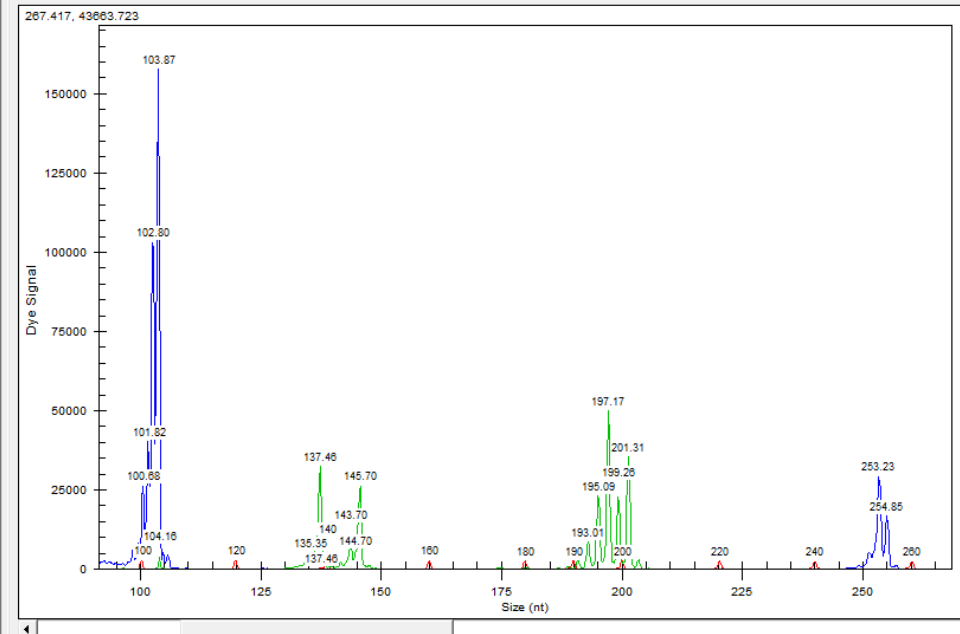


Transfer the PCR products to the sequencer for analyzing the fragments

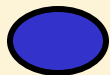
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# Alleles and PIC of 22 SSRs

SSR Name	sweet cherry			sour cherry		
	size range	alleles no.	PIC	size range	alleles no.	PIC
Bppct037	132-168	12	0.797	124-168	<b>19</b>	0.892
Cppct006	175-205	12	0.759	173-201	11	0.830
Cppct022	245-269	12	0.735	219-271	12	0.801
Empa002	104-121	6	<b>0.519</b>	98-133	13	0.801
Empa003	169-173	2	<b>0.445</b>	163-173	4	0.744
Empa026	203-258	<b>14</b>	0.638	179-234	13	0.787
Empa17	234-244	6	<b>0.373</b>	218-244	9	0.769
EMPaJ04	178-188	4	0.690	164-194	11	0.856
EMPaJ05	238-256	7	0.734	242-276	8	0.801
EMPaJ15	211-255	<b>13</b>	<b>0.874</b>	191-255	11	0.851
EMPaS01	222-238	5	0.620	222-238	7	0.712
EMPaS02	134-146	7	0.667	130-146	8	0.804
EMPaS06	200-226	9	0.849	176-236	9	0.847
EMPaS10	152-188	7	0.646	145-183	8	0.845
EMPaS11	61-105	8	0.746	63-121	9	0.811
EMPaS12	121-145	5	0.755	99-145	8	0.823
EMPaS14	196-210	3	0.593	166-212	7	0.771
UCD-CH17	189-215	10	0.805	155-205	<b>15</b>	<b>0.917</b>
UDP-96-001	103-123	4	0.658	97-123	6	0.765
UDP-98-410	121-135	5	0.613	127-139	5	0.615
UDP-98-411	151-175	6	0.752	129-163	8	0.825
UDP98-412	98-124	7	0.699	90-122	8	0.806

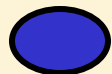
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EMPas12				EMPas14				EMPas01				UDP-96-001				EMPas10				Empa17			
sweet		sour		sweet		sour		sweet		sour		sweet		sour		sweet		sour		sweet		sour	
Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%
121	4.3	99	20.4	196	47.8	166	24.4	222	6.9	222	6.0	103	1.5	97	21.5	152	51.6	145	20.5	234	5.84	218	9.41
135	18.8	107	12.9	198	40.6	172	27.9	228	45.8	228	48.0	107	23.5	105	1.3	158	1.6	151	20.5	236	0.51	224	1.98
137	27.5	113	15.1	210	11.6	190	1.2	230	1.4	230	16.0	121	42.6	107	10.1	162	15.6	155	12.0	238	2.54	226	6.93
143	31.9	121	3.2			196	24.4	232	40.3	232	12.0	123	32.4	111	31.6	166	25.0	157	13.3	240	77.9	228	21.8
145	17.4	135	4.3			198	3.5	238	5.6	234	2.0			121	26.6	182	3.1	161	12.0	242	12.7	230	1.49
		137	25.8			210	17.4			236	6.0			123	8.9	184	1.6	165	14.5	244	0.51	234	6.93
		143	16.1			212	1.2			238	10.0					188	1.6	169	6.0			240	38.6
		145	2.2															183	1.2			242	12.4
																						244	0.5

Cpct006				Empa003				Cpct022				Empa026				Bpct037				Empa002			
sweet		sour		sweet		sour		sweet		sour		sweet		sour		sweet		sour		sweet		sour	
Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%	Allele	%
175	0.18	173	10.8	169	33.5	163	19.6	245	36.7	219	23	203	42.2	179	5.5	132	0.86	124	0.43	104	47.4	98	1.55
177	0.35	179	18.9	173	66.5	166	23.7	247	2.15	225	23.9	207	0.38	203	35	134	8.75	126	16.4	106	50.6	104	14.9
181	0.53	183	24.8			169	25.9	249	0.18	245	9.05	211	0.19	207	23.5	136	0.17	130	6.47	109	0.98	106	33
183	19.4	185	22.1			173	30.8	251	0.89	249	0.82	213	0.38	209	1.5	138	20.8	132	2.16	111	0.59	111	0.52
185	32.3	187	0.45					253	30.9	253	26.7	215	0.38	211	0.5	140	15.3	134	10.3	119	0.2	113	0.52
187	1.94	189	4.05					255	16.3	255	0.41	217	41.8	215	1	142	0.51	138	5.6	121	0.2	115	4.12
191	0.35	191	1.35					257	8.41	257	8.23	222	0.38	217	10	144	28.3	140	8.19			121	2.06
197	19.4	193	6.31					259	2.5	259	0.82	230	0.19	220	1	148	0.17	142	9.91			123	6.19
199	0.53	195	0.45					261	0.36	265	0.82	232	4.32	222	12.5	150	21.8	144	19.8			125	22.7
201	24.7	197	3.15					263	0.36	267	0.82	234	8.07	224	0.5	152	2.92	146	2.16			127	0.52
203	0.18	201	7.66					267	0.54	269	1.23	236	1.13	228	0.5	154	0.17	148	0.43			129	8.76
205	0.18							269	0.72	271	4.12	248	0.19	232	0.5	168	0.34	150	6.03			131	4.64
												256	0.19	234	8			152	3.88			133	0.52
												258	0.19			154	2.59						
																		156	0.43				
																		158	1.72				
																		160	1.29				
																		162	1.72				
																		168	0.43				

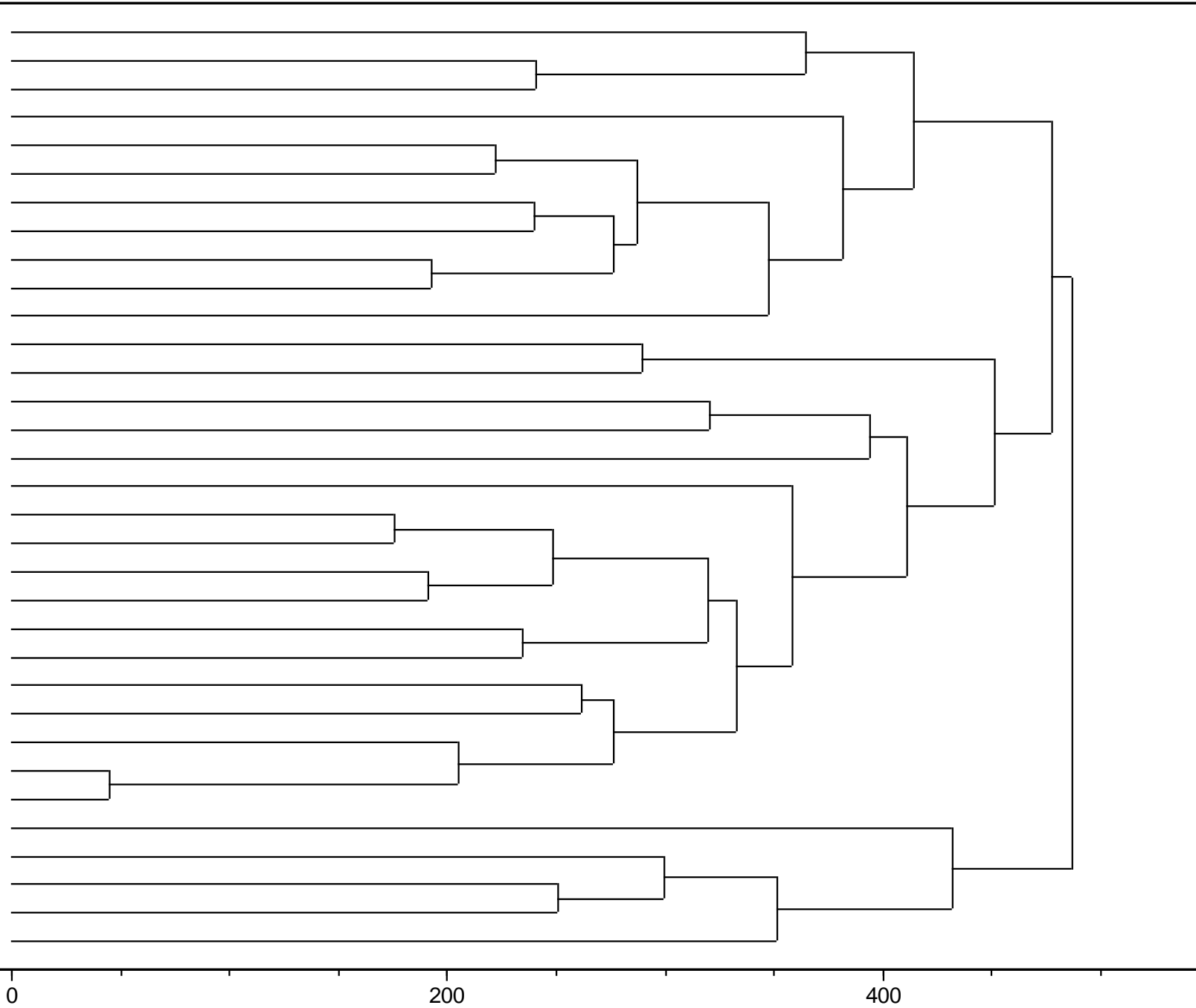


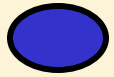
# Fingerprints of sweet cherry

Name	Lab.Nr	EMPaS11	EMPaS02	EMPaS06	UDP98-412	EMPaJ04	EMPaJ05	EMPaS12	EMPaS14	EMPaS01	UDP-96-001	EMPaS10	EMPaJ15	UDP-98-410	UDP-98-411	UCD-CH17
Buettners Rote Knorpel	K313	63 73	138 146	206 218	118 0	180 186	242 256	137 143	196 0	228 232	107 121	152 0	221 223	125 127	159 163	191 207
Charmes, Mainz (Klon E)	K315	73 101	136 144	204 206	116 118	186 188	244 246	135 145	196 198	228 0	123 0	152 182	249 253	127 135	151 163	189 0
Compact Lambert	K316	63 0	138 140	206 216	118 0	180 188	256 0	137 145	198 0	228 232	121 123	152 162	217 223	127 129	163 175	189 213
Compact Stella	K317	61 71	138 146	216 218	118 0	180 188	256 0	143 145	198 210	228 232	121 123	152 162	217 221	127 129	163 175	191 213
Doenissens Gelbe	K320	73 105	134 138	220 226	118 0	186 188	242 246	135 143	196 198	228 232	121 0	152 0	217 223	121 129	159 175	191 213
Gr. Schwarze Knorpel	K321	73 83	138 146	206 216	98 118	180 188	240 256	137 143	196 210	228 232	121 123	152 0	217 223	127 129	159 163	189 213
Hedelfinger Froschmaul	K322	63 73	138 140	206 216	98 118	186 188	256 0	137 0	196 198	228 232	123 0	152 162	217 223	127 129	159 163	189 213
Hudson	K323	63 73	138 142	202 204	118 0	186 188	246 256	135 143	196 198	228 0	121 0	152 162	217 223	129 0	163 0	189 201
Johanna	K324	73 0	138 142	202 0	118 124	180 188	246 256	137 145	198 0	228 232	107 121	152 166	239 249	121 127	159 165	201 205
Kassins Fruעה	K326	75 101	138 0	200 204	110 124	178 180	242 0	135 0	196 198	238 0	123 0	158 166	221 249	127 0	159 0	201 207
Katalin	K327	63 73	138 0	200 204	118 124	180 188	244 256	135 137	196 198	228 0	121 0	152 166	221 239	127 129	151 159	189 199
Kordia	K328	73 0	140 146	200 204	116 118	186 188	256 0	137 143	198 210	228 232	107 121	166 0	221 239	121 127	151 159	189 201
Lapins	K329	63 105	138 0	202 216	118 0	180 0	246 256	143 0	196 198	228 0	121 0	152 0	217 0	121 129	159 175	191 213
Linda	K330	73 0	138 0	202 206	118 124	180 188	256 0	137 0	196 198	228 232	121 123	152 166	217 239	127 0	163 165	191 207
Maibigarreau	K331	63 73	138 146	206 226	118 124	180 186	244 256	137 143	196 0	228 232	107 121	152 166	219 223	127 0	161 165	191 207
Margit	K332	73 0	138 0	202 218	118 124	180 186	240 256	137 0	196 0	228 232	107 121	152 0	223 255	127 0	159 0	189 207
Meckenheimer	K333	63 73	138 0	206 0	118 120	188 0	256 0	121 137	198 210	232 238	121 123	152 166	213 223	121 127	151 159	189 193
Nadino	K334	73 101	138 0	216 218	98 118	180 188	238 256	137 0	198 210	228 232	121 123	152 0	217 239	127 0	159 163	191 213
Nalina	K335	73 101	138 142	202 202	116 118	178 186	240 244	135 143	196 198	228 238	121 123	166 182	221 249	127 0	151 159	189 201
Namare	K336	63 83	138 146	216 218	118 0	186 188	240 256	137 0	196 210	228 232	107 121	152 0	217 221	127 0	159 163	191 213
Namosa	K337	63 83	138 0	216 218	118 0	186 188	240 256	137 145	196 0	228 232	107 123	152 162	217 221	127 0	159 0	191 215
Napoleon	K338	63 73	138 140	202 206	116 118	186 188	256 0	137 0	198 210	228 232	123 0	152 0	223 239	127 0	159 175	189 0
Oktavia	K340	73 101	138 142	202 0	118 0	180 0	246 256	143 145	196 198	228 0	121 0	152 162	239 249	121 127	159 165	201 205
Ritterkirsche	K341	63 0	138 144	200 204	118 0	180 186	240 242	143 145	196 198	228 230	121 123	162 166	227 239	129 0	163 0	189 203
Rivan	K342	63 0	138 0	200 216	120 124	178 188	256 0	121 137	196 198	228 232	123 0	166 0	211 237	127 135	159 163	189 201
Schwarze Koenigin	K343	63 73	138 0	204 220	116 120	180 186	256 0	145 0	196 0	222 232	103 123	166 0	211 239	127 0	163 175	189 193
Star	K344	63 101	138 144	216 218	118 0	186 188	240 256	135 145	198 0	232 0	107 123	152 0	215 219	127 129	159 175	191 213
Sumpaca @ Celeste	K345	73 105	138 0	204 218	118 0	180 0	256 0	143 0	196 210	228 0	121 0	152 0	215 219	121 0	159 163	189 191
Summit	K346	63 105	138 0	202 206	118 0	180 0	256 0	135 143	196 198	228 0	121 0	152 0	221 239	121 0	151 159	189 0
Techlowan	K347	73 105	138 146	206 218	110 116	186 0	256 0	143 0	196 198	228 232	107 121	152 166	215 221	121 127	159 0	189 191
Unterlaender	K348	73 83	138 0	206 216	98 116	186 188	240 256	137 0	196 0	228 232	123 0	152 162	215 0	127 0	159 175	189 213
Woelflsteiner	K349	63 73	144 0	204 0	116 122	180 0	238 256	137 143	196 198	228 232	107 121	152 166	219 239	127 0	163 175	189 207
Zum Felde Fruעה Schw	K350	63 101	138 142	202 216	118 120	180 188	246 256	121 135	196 198	222 228	121 123	166 184	213 223	121 0	151 175	189 191



R-10  
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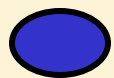


# Fingerprints of sweet cherry

Name	Lab.	Loci 1		Loci 2		Loci 3		Loci 4		Loci 5		Loci 6		Loci 7		Loci 8	
Dollenseppler	L256	63	73	142	144	216	220	118	120	180	182	256		121		196	210
Dollenseppler?	Gt7	63	73	142	144	216	220	118	120	180	182	256		121		196	210
Dollenseppler?	Gt8	63	73	142	144	216	220	118	120	180	182	256		121		196	210
Dollenseppler?	Gt9	63	73	142	144	216	220	118	120	180	182	256		121		196	210
Dollenseppler?	Gt6	63	73	144		204		116	122	180	182	238	256	137	143	196	198
Woelflisteiner	K349	63	73	144		204		116	122	180	182	238	256	137	143	196	198

Name	Lab.	Loci 9		Loci 10		Loci 11		Loci 12		Loci 13		Loci 14		Loci 15	
Dollenseppler	L256	222	228	121	123	162	166	223	239	127	129	140	163	202	204
Dollenseppler?	Gt7	222	228	121	123	162	166	223	239	127	129	140	163	202	204
Dollenseppler?	Gt8	222	228	121	123	162	166	223	239	127	129	140	163	202	204
Dollenseppler?	Gt9	222	228	121	123	162	166	223	239	127	129	140	163	202	204
Dollenseppler?	Gt6	228	232	107	121	152	166	219	239	127		163	175	189	207
Woelflisteiner	K349	228	232	107	121	152	166	219	239	127		163	175	189	207



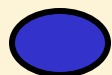


# Fingerprints of sweet cherry

Name	Lab.Nr.	EMPaS11	EMPaS02	EMPaS06	UDP98-412	EMPaJ04
Regina?	W255	105	138	216 218	110 118	180 186
Staccato 61690	W266	105	138	216 218	110 118	180 186
Sweetheart 61690	W267	105	138	216 218	110 118	180 186

Name	Lab.Nr.	EMPaJ05	EMPaS12	EMPaS14	EMPaS01	UDP-96-001
Regina?	W255	244	143	196 198	228 232	107 121
Staccato 61690	W266	244	143	196 198	228 232	107 121
Sweetheart 61690	W267	244	143	196 198	228 232	107 121

Name	Lab.Nr.	EMPaS10	EMPaJ15	UDP-98-410	UDP-98-411	UCD-CH17
Regina?	W255	152	215	121 127	159	191 213
Staccato 61690	W266	152	215	121 127	159	191 213
Sweetheart 61690	W267	152	215	121 127	159 175	191 213



# Fingerprints of sour cherry

Name	lab.Nr	EMPaS11	EMPaS02	EMPaS06	UDP98-412	EMPaJ04	EMPaJ05	EMPaS12	
Achat	W271	63 73 0 0	136 0 0 0	176 200 202 220	90 94 110 118 0	166 180 184 186	254 0 0 0	99 107 137 143	
Beutelsbacher Rexelle	K351	73 77 103 0	145 0 0 0	176 218 220 0	90 110 116 0 0	168 180 182 194	242 254 256 0	99 107 121 137	
Favorit	K355	63 73 81 0	130 138 144 146	176 202 204 0	94 116 118 0 0	180 184 186 0	246 256 0 0	99 135 143 145	
Gerema 5a	K356	63 73 121 0	134 144 146 0	176 200 204 0	90 94 116 118 0	180 184 186 0	242 256 0 0	99 113 137 143	
Heimanns Rubin	K358	73 77 101 0	144 0 0 0	176 218 220 0	90 110 116 0 0	168 180 182 194	242 254 256 0	99 107 121 137	
IV 2/152	K359	63 73 81 0	138 146 0 0	202 220 236 0	90 94 118 0 0	184 186 188 0	254 274 276 0	99 107 137 143	
Kantorjanosi 3	K361	63 69 121 0	134 138 146 0	176 200 204 218	90 94 118 120 0	164 166 186 188	254 256 274 276	99 107 137 143	
Karbeol	K362	63 69 73 121	136 138 144 0	176 200 204 218	90 94 96 116 118	166 186 0 0	254 276 0 0	107 113 137 143	
Koenigin Hortense	K363	63 73 81 83	130 140 142 0	200 202 212 0	94 116 118 0 0	180 184 190 0	242 246 256 0	113 137 143 145	
Koroese Weichsel	K364	63 69 121 0	134 138 146 0	176 200 204 218	90 94 118 120 0	164 166 186 0	256 276 0 0	99 107 137 143	
Korund	K365	63 69 73 0	134 138 144 0	176 200 204 218	90 94 116 118 0	166 180 186 188	242 256 276 0	99 113 137 0	
Lava Sa	K366	63 101 0 0	144 146 0 0	176 202 218 220	90 116 0 0 0	180 184 0 0	242 254 256 0	107 113 137 143	
Ludwigs Fruehe	K367	73 81 0 0	136 144 0 0	176 202 220 0	94 116 0 0 0	166 180 184 0	242 256 0 0	99 113 137 143	
Maliga Erleke	K368	63 69 73 0	134 144 146 0	200 202 0 0	90 94 116 0 0	180 184 186 0	246 256 258 0	99 135 143 0	
Morellenfeuer Hannover	K369	63 69 73 0	136 138 144 0	200 204 218 0	90 94 116 120 0	166 180 184 186	242 256 276 0	99 113 137 0	
Morina	K370	63 73 0 0	134 136 144 146	176 202 0 0	94 116 118 0 0	166 186 0 0	256 276 0 0	99 113 137 143	
Safir	K372	63 73 101 0	134 144 0 0	176 202 220 0	90 94 116 0 0	168 180 184 194	242 256 0 0	99 113 137 0	
Schwaebische Weinweichsel	K379	73 101 0 0	144 0 0 0	176 180 202 220	94 116 0 0 0	166 180 184 186	242 256 0 0	113 137 143 0	
Stevensbaer	K380	63 73 101 0	136 144 0 0	180 200 204 0	90 94 116 122 0	164 172 180 0	242 256 0 0	113 135 137 0	
Topas	K381	63 69 101 0	136 138 144 0	176 202 218 220	90 94 120 0 0	166 180 182 0	242 254 256 0	99 113 137 0	

Name	lab.Nr	EMPaS14	EMPaS01	UDP-96-001	EMPaS10	EMPaJ15	UDP-98-4	UDP-98-411	UCD-CH17	
Achat	W271	172 196 0 0	228 232 0 0	97 111 121 0	145 161 169 0	195 239 249 0	127 0	129 137 163 0	175 183 201 203	
Beutelsbacher Rexelle	K351	166 172 198 212	228 230 0 0	97 111 121 0	145 151 169 0	195 249 251 253	127 135	129 153 159 163	175 189 193 195	
Favorit	K355	166 172 196 0	228 0 0 0	111 121 0 0	157 161 165 0	195 219 221 253	127 135	129 149 153 163	177 201 205 0	
Gerema 5a	K356	166 196 210 0	228 232 234 0	107 111 121 0	145 151 155 157	195 221 249 253	127 135	137 149 153 163	179 187 201 0	
Heimanns Rubin	K358	166 172 196 210	228 0 0 0	97 111 121 0	145 151 169 0	195 249 253 0	127 135	129 153 159 163	175 189 193 195	
IV 2/152	K359	172 196 198 0	228 232 0 0	105 111 121 0	151 157 0 0	195 239 251 255	127 0	139 151 163 0	177 189 201 0	
Kantorjanosi 3	K361	166 172 196 0	227 231 0 0	97 107 111 121	155 157 161 0	191 195 239 253	127 0	129 139 163 0	177 183 203 205	
Karbeol	K362	166 172 196 210	228 230 0 0	97 107 111 121	145 155 161 165	191 195 247 249	127 0	129 153 163 0	155 183 199 205	
Koenigin Hortense	K363	172 196 0 0	228 0 0 0	111 121 0 0	151 157 165 183	195 219 225 0	127 129	149 151 159 0	199 205 0 0	
Koroese Weichsel	K364	166 172 196 0	228 0 0 0	97 107 111 121	155 157 161 0	191 195 239 253	127 0	129 137 163 0	177 183 201 203	
Korund	K365	166 172 196 210	228 230 0 0	97 111 121 0	145 155 161 165	191 195 221 239	127 0	129 149 153 163	155 183 187 203	
Lava Sa	K366	166 172 196 210	228 0 0 0	111 121 0 0	145 151 157 0	195 249 0 0	127 135	129 149 153 159	179 193 195 0	
Ludwigs Fruehe	K367	166 172 196 0	228 0 0 0	97 111 121 0	145 151 165 0	191 195 225 251	127 129	129 149 153 163	171 179 189 199	
Maliga Erleke	K368	172 196 198 210	222 228 0 0	111 121 123 0	151 155 157 165	195 219 239 0	127 0	151 163 0 0	177 199 205 0	
Morellenfeuer Hannover	K369	172 196 210 0	228 232 0 0	107 111 0 0	145 155 161 165	191 195 221 239	127 129	129 151 163 0	179 183 199 205	
Morina	K370	166 172 196 0	228 230 236 0	97 107 111 123	145 151 161 0	191 195 221 239	127 135	129 137 151 163	179 187 205 0	
Safir	K372	166 172 210 0	228 236 238 0	97 111 121 123	145 165 169 0	195 249 0 0	127 129	129 149 153 159	157 175 189 199	
Schwaebische Weinweichsel	K379	166 196 210 0	228 230 236 238	97 111 121 123	145 151 165 0	191 195 219 255	127 135	129 149 153 163	171 179 189 205	
Stevensbaer	K380	166 172 210 0	222 230 238 0	97 111 123 0	145 151 165 0	191 195 219 221	135 139	129 149 153 163	175 179 187 205	
Topas	K381	166 172 196 210	228 0 0 0	111 121 0 0	151 155 161 0	191 195 221 253	127 135	153 163 0 0	183 193 195 205	



R-12

R-9

R-14

R-2

R-5

R-6

R-7

R-11

R-15

R-8

R-10

R-3

R-13

R-20

R-1

R-17

R-18

R-16

R-4

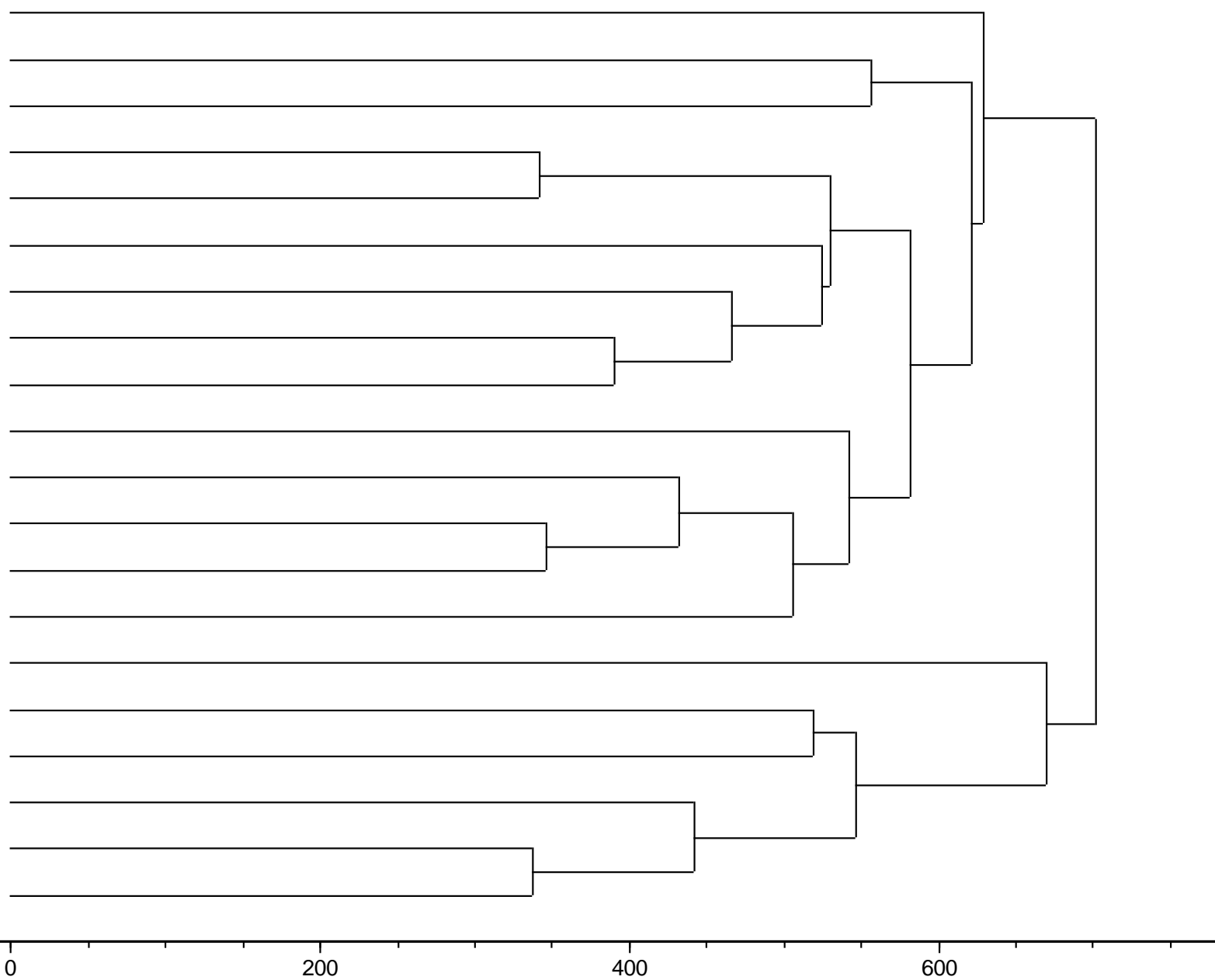
R-19

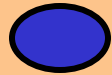
0

200

400

600





# Fingerprints of sour cherry

Name	lab.Nr.	EMPaS11		EMPaS02			EMPaS06				UDP98-412				EMPaS04		
Ujfehertoi fuertes	K382	63	69	134	138	146	176	200	204	220	90	94	118	120	166	186	
Ungarische Langtraubige	K383	63	69	134	138	146	176	200	204	220	90	94	118	120	166	188	
18-1//18-3 Ungarische Traubige (=Ujfehertoi fűrtos)	W270	63	69	134	138	146	176	202	204	220	90	94	118	120	166	186	188

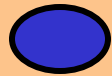
Name	lab.Nr.	EMPaS05		EMPaS12				EMPaS14			EMPaS01		UDP-96-001				
Ujfehertoi fuertes	K382	254	276	99	107	137	143	166	172	196	228	232	97	107	111	121	
Ungarische Langtraubige	K383	254	276	99	107	137	143	166	172	196	228	232	97	107	111	121	
18-1//18-3 Ungarische Traubige (=Ujfehertoi fűrtos)	W270	254	276	99	107	137	143	166	172	196	228	232	97	111			

Name	lab.Nr.	EMPaS10			EMPaS15				UDP-98-411			UCD-CH17				UDP-98-410	
Ujfehertoi fuertes	K382	155	157	161	191	195	239	253	129	137	163	177	183	203	205	127	
Ungarische Langtraubige	K383	155	157	161	191	195	239	253	129	137	163	177	183	201	205	127	
18-1//18-3 Ungarische Traubige (=Ujfehertoi fűrtos)	W270	155	157	161	191	195	239	253	129	137	163	177	183	201	205	127	

**KOB**



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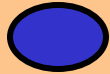


# Fingerprints of sour cherry

Name	lab.Nr.	EMPaS11			EMPaS02		EMPaS06			UDP98-412			EMPaJ04			
Roehrigs Weichsel	K371	73	77	101	144	0	176	218	220	90	110	116	166	180	182	194
H. Rubin Klon Mainz	K357	73	77	101	144	0	176	218	220	90	110	116	168	180	182	194
Heimanns Rubin	K358	73	77	101	144	0	176	218	220	90	110	116	168	180	182	194

Name	lab.Nr.	EMPaJ05			EMPaS12				UDP-98-410		EMPaS14				UDP-96-001		
Roehrigs Weichsel	K371	242	256	258	99	107	137	0	127	135	166	172	196	210	97	111	121
H. Rubin Klon Mainz	K357	242	254	256	99	107	137	0	127	135	166	172	190	210	97	111	121
Heimanns Rubin	K358	242	254	256	99	107	121	137	127	135	166	172	196	210	97	111	121

Name	lab.Nr.	EMPaS10			EMPaJ15			UDP-98-411				UCD-CH17				EMPaS01	
Roehrigs Weichsel	K371	145	151	169	195	249	253	129	153	159	163	175	189	193	195	228	0
H. Rubin Klon Mainz	K357	145	151	169	195	249	253	129	153	159	163	175	189	193	195	228	0
Heimanns Rubin	K358	145	151	169	195	249	253	129	153	159	163	175	189	193	195	228	0

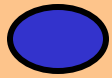


# Fingerprints of sour cherry

Name	lab.Nr.	EMPaS11			EMPaS02			EMPaS06				UDP98-412				EMPaJ04				EMPaJ05			EMPaS12				UDP-98-410
Cigany 59	K352	63	73	103	138	144		180	202	204	236	90	94	116	122	164	168	180	186	242	254	256	113	121	135	137	137
Ciganymeggy 7	K353	63	73	103	138	144		180	202	204	236	90	94	116	122	164	168	180	186	242	254	256	113	121	135	137	137
Ciganymeggy C 404	K354	63	73	103	138	144		180	202	204	236	90	94	116	122	164	168	180	186	242	254	256	113	121	135	137	137
Schattenmorelle 52 WB Klon C	K373	63	73		134	136	144	176	200	202		94	116			166	180	184	186	242	256		113	137		129	135
Schattenmorelle Bonn 226/175	K374	63	73		134	136	144	176	200	202		94	116			166	180	184	186	242	256		113	137		129	135
Schattenmorelle Bon 226/80	K375	63	73		134	136	144	176	200	202		94	116			166	180	184	186	242	256		113	137		129	135
Schattenmorelle Mainz Klon A	K376	63	73		134	136	144	176	200	202		94	116			166	180	184	186	242	256		113	137		129	135
Schattenmorelle Scharoe	K377	63	73		134	136	144	176	200	202		94	116			166	180	184	186	242	256		113	137		129	135
Schattenmorelle Vowi	K378	63	73		134	136	144	176	200	202		94	116			166	180	184	186	242	256		113	137		129	135

Name	lab.Nr.	EMPaS14				EMPaS01			UDP-96-001				EMPaS10			EMPaJ15				UDP-98-411				UCD-CH17			
Cigany 59	K352	166	172	210	212	222	230	238	97	111	123		145	151	165	191	195	219	221	129	149	153	163	179	187	205	
Ciganymeggy 7	K353	166	172	210	212	222	230	238	97	111	123		145	151	165	191	195	219	221	129	149	153	163	179	187	205	
Ciganymeggy C 404	K354	166	172	210	212	222	230	238	97	111	123		145	151	165	191	195	219	221	129	149	153	163	179	187	205	
Schattenmorelle 52 WB Klon C	K373	166	172	196	210	228	230	238	97	111	121	123	145	151	165	191	195	221	249	129	149	153		157	179	187	199
Schattenmorelle Bonn 226/175	K374	166	172	196	210	228	230	238	97	111	121	123	145	151	165	191	195	221	249	129	149	153		157	179	187	199
Schattenmorelle Bon 226/80	K375	166	172	196	210	228	230	238	97	111	121	123	145	151	165	191	195	221	249	129	149	153		157	179	187	199
Schattenmorelle Mainz Klon A	K376	166	172	196	210	228	230	238	97	111	121	123	145	151	165	191	195	221	249	129	149	153		157	179	187	199
Schattenmorelle Scharoe	K377	166	172	196	210	228	230	238	97	111	121	123	145	151	165	191	195	221	249	129	149	153		157	179	187	199
Schattenmorelle Vowi	K378	166	172	196	210	228	230	238	97	111	121	123	145	151	165	191	195	221	249	129	149	153		157	179	187	199





# Summary and suggestion

**1: at least 15 SSRs are necessary for identifying the cultivars, more than these should be used to clarify the doubtful cultivars**

**2: it is difficult to analyze the cherry cultivars totally automatically**

**3: it is necessary to select the primers for the analyses of phylogeny research and fingerprinting or to use SNP as additional complement**

Ko



KOMPETENZ ZENTRUM  
Obstbau Bodensee

***Many thanks for your attention!***