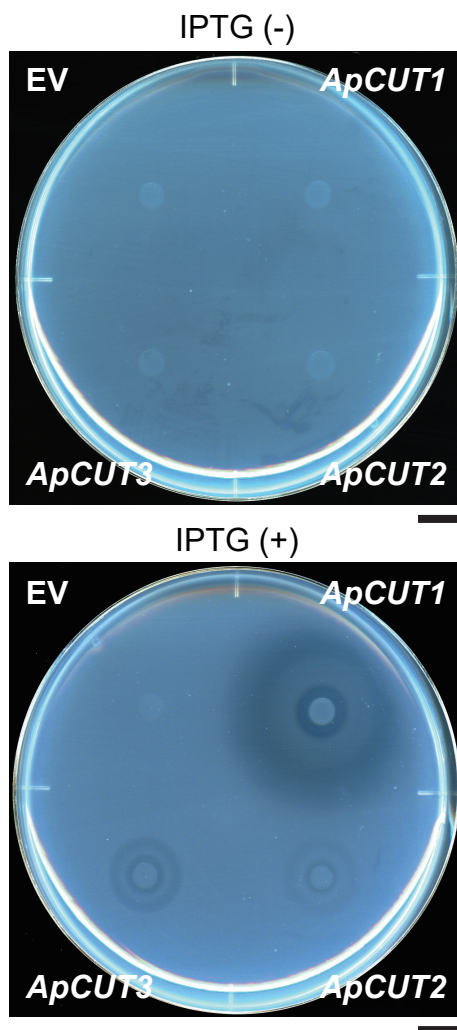


Supplementary Fig. S1 (continued)

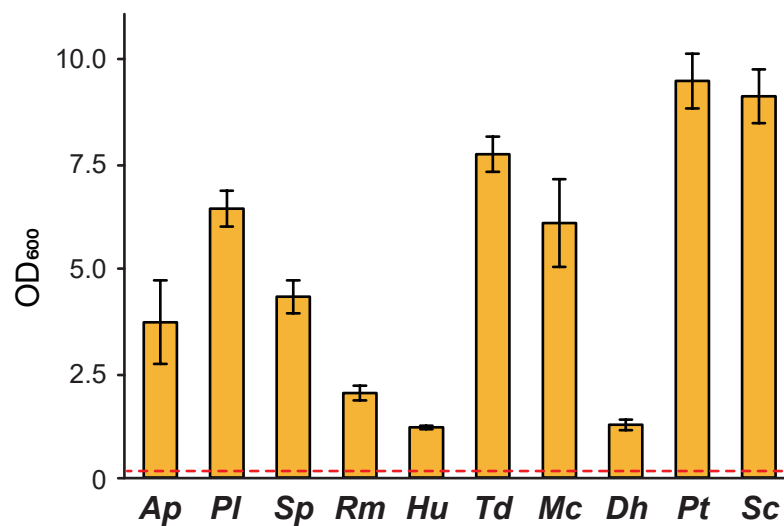
ApCut9	IGDDALCGGGDPN-QG---ISSTAATISSVSGSKIKAVIFMGDPDRIQIPGASYSVGT-SK-	166
ApCut8	IAGDILGGADI-----CAGLNPGLDPSTSPGNKIGAALIFGDNRHVADQSYNVLNGSS-	269
ApCut7	IVSDILGGGFGTFFQGCTTKPSPNLDVNSQVGKKVAVTTFGNTRHTANQPYNQFSGSS-	175
ApCut4	LVLQASSR-----L--GKKALEAIKAIILARNPYRIPGKSANVDSHGNT	107
AaCut2	ATVSALPK-----L--TGDSFDAVKAVFLIGNPMHKSGLCENVDTLGGK	153
CS2C1e1	ATVVALQQ-----LGTSGAAFNAVKGVFLIGNPDHKSGLTCNVDSNNGGT	167
ApCut1	ATVNALPK-----L--TGTANTAVKGVWVLDPLHKAAGLTCNIDSTGGT	156
ApCut3	ATVNAHPK-----L--TGANMDAVKGVFLIGDPEHRSGLACNVDANGGT	156
ApCut2	ATVDAMSK-----I--TGANFNAVKGVFLIGNPHHKSGLACNVDNNGGT	158
FsCut1	LAAASIED-----L--DSAIRDKIAGTVLFGYTKNLQNR-----	172
AoCutL	VMNGAIKR-----L--SADVQDKIKGVVLFYTRNAQER-----	162
ApCut6	VVHNALNS-----V--D--GSKIAAVTAFGDPMMNGQ-----	174
ApCut5	QVHGALQN-----L--Q---NGQVAVALTFGDPLQRM-----	172
BcCutA	LVHNAAKL-----L--PAETTAKISSAVIFGDPDNGD-----	151
:		
ApCut9	----NPGFDPR-----PSGF--TCSAYASRIQAYCDAADPYCSNG-----NNAATHQG	208
ApCut8	----VSSNDPR-----SPDSLARMNKFAGVLRSYCDQADPVCAAAG-PGFPTVDNHLN	317
ApCut7	----GNGIFPR-----PAYQLANLATWTAKYHDYCVAEDEPICAGG-----DNVEDHLN	219
ApCut4	DARGNIGMFVTQAITSNTPIQPFPESLGKSGKVLVDYCLENDIVCASDPACDCQIAADHLS	167
AaCut2	STDAYANGLEAYLG----GI----PDEWVSKTMDVCFNFGDGVCCDT--LTGIGITAQHLD	201
CS2C1e1	TTRNVNGLSVAYQ---GSV---PSGWVSKTLDVCAYGDGVCCDT--AHGFGINAQHLS	216
ApCut1	TTLNVNGISQYPGS---NSI----PSGWI SRTQDVCKYGDGVCCDT--THGQGINAQHLS	206
ApCut3	TTKNVNGLSAVLG----GI----PAAWVPKTMDVCAVGDGVCCDT--THGFGINAQHLS	204
ApCut2	TTKNVNGLTVLVG----SI----PANWVGKTLDVCAVGDGVCCDT--AHGFGITAQHLS	206
FsCut1	-----GRIPN-----YPADRTKVFCTNTGDLVCTG--S--LIVAAPHLA	206
AoCutL	-----GQIAN-----FPKDKVKVYCAVGDVLCGLG--T--LIVAPPHFS	196
ApCut6	-----TFKG-----VDDSKVVRVYCGSSDFVCCDM--SGKTQGTGSHIS	209
ApCut5	-----PFRN-----IDSGRTKIYCNLGDGVCCAG--A--FIISAHLS	205
BcCutA	-----PVQG-----VSADRTDITCHAGDNICCG--G--SLILLAHLT	184
* * *		
ApCut9	YGSEYQQAALKFVNSKLT-----	226
ApCut8	YFDRYTDDAAGWVKYMLGY-----	336
ApCut7	YFDLYSEVAASWVKEQVKAADVVSSTIVSPSSTFTSVATVPTDKAVPTTFSYSNNTATA	279
ApCut4	YGLVDSVQETAF-QHIVKVL A-----	187
AaCut2	YPLDANVQKMGA-DFVVKALTS-----	222
CS2C1e1	YPSDQGVQTMGY-KFAVNKLGGSA-----	239
ApCut1	YPNDATVQSMGA-KFVLGKLNA-----	227
ApCut3	YPPSSTVQSMGT-KYMVAQLNGSS-----	227
ApCut2	YKSDANVQNQGI-KFVLGKLRGT-----	228
FsCut1	YGPDARGPAPEFLIEKVRVARGSA-----	230
AoCutL	YLSDT-GDASDFLLSQLG-----	213
ApCut6	YGSNLAEAASRLAQ-IVGVKA-----	229
ApCut5	YATQDATPAAQFAKGVIGNI-----	225
BcCutA	YGMDDTTAA-AAFVKKAAGL-----	202
*		
ApCut9	-----	226
ApCut8	-----	336
ApCut7	PQVTNSAALSSIQSEVLEIPTADTTVTVTDCASVDTSAIASWTSFAFAATAVVSQSVAAS	339
ApCut4	-----	187
AaCut2	-----	222
CS2C1e1	-----	239
ApCut1	-----	227
ApCut3	-----	227
ApCut2	-----	228
FsCut1	-----	230
AoCutL	-----	213
ApCut6	-----	229
ApCut5	-----	225
BcCutA	-----	202
ApCut9	-----	226
ApCut8	-----	336
ApCut7	ATGAAATGSSGSKSSAPNGTHTLMPYTGAASSMSGAVTGLAIVLLGAFAMVL	394
ApCut4	-----	187
AaCut2	-----	222
CS2C1e1	-----	239
ApCut1	-----	227
ApCut3	-----	227
ApCut2	-----	228
FsCut1	-----	230
AoCutL	-----	213
ApCut6	-----	229
ApCut5	-----	225
BcCutA	-----	202

Supplementary Fig. S2



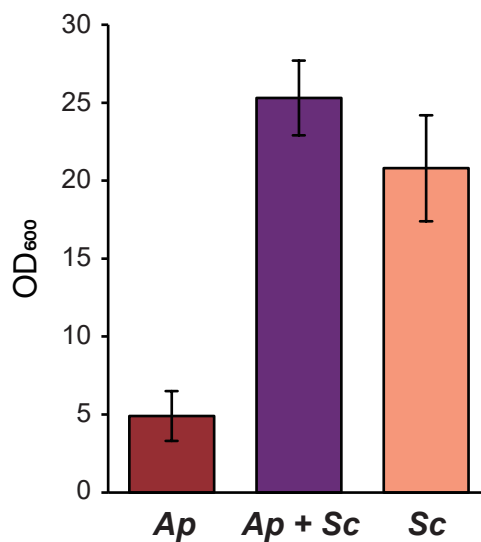
Supplementary Fig. S2 PCL-plate clearing assay of the extracts of ApCut1- to ApCut3-expressing *E. coli* cells. EV, empty vector. Bar, 1 cm.

Supplementary Fig. S3



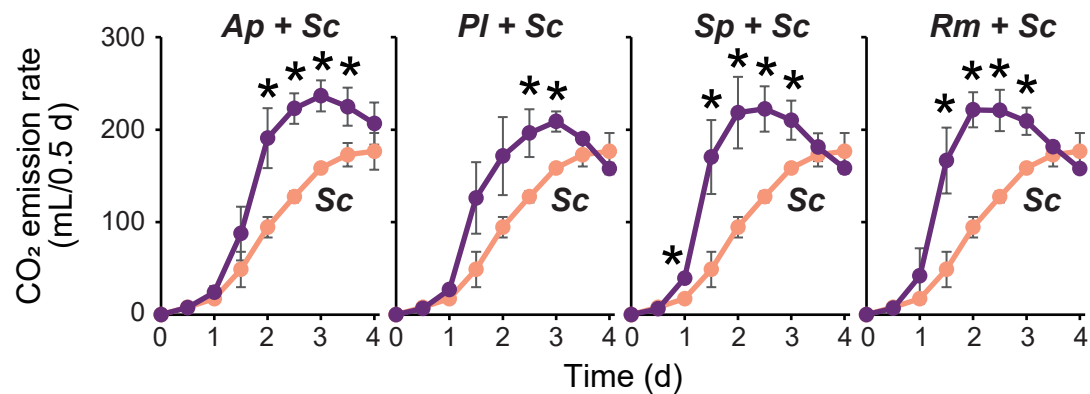
Supplementary Fig. S3 Growth of grape-skin residents and *S. cerevisiae* in YNB medium containing 10% (w/v) glucose as a sole carbon source. The graph indicates OD₆₀₀ values after the 6-d fermentation test in YNB medium containing 10% (w/v) glucose. A red dashed line shows the initial OD₆₀₀ value (OD₆₀₀ = 0.1). Data represent mean values and standard deviations from three independent experiments. *Ap*, *A. pullulans*; *Pl*, *P. laurentii*; *Sp*, *S. pararoseus*; *Rm*, *R. mucilaginosa*; *Hu*, *H. uvarum*; *Td*, *T. delbrueckii*; *Mc*, *M. caribbica*; *Dh*, *D. hansenii*; *Pt*, *P. terricola*; *Sc*, *S. cerevisiae*.

Supplementary Fig. S4



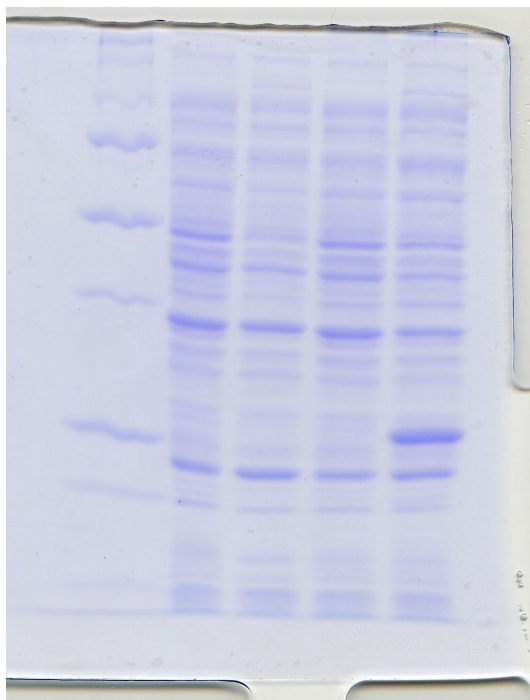
Supplementary Fig. S4 Growth in coculture of *A. pullulans* and *S. cerevisiae* in YNB medium containing 10% glucose as a sole carbon source. The graph indicates OD₆₀₀ values after the 6-d fermentation test in YNB medium containing 10% (w/v) glucose. Data represent mean values and standard deviations from three independent experiments. *Ap*, inoculated with *A. pullulans* (red); *Ap + Sc*, coinoculated with *A. pullulans* and *S. cerevisiae* (violet); *Sc*, inoculated with *S. cerevisiae* (pink).

Supplementary Fig. S5

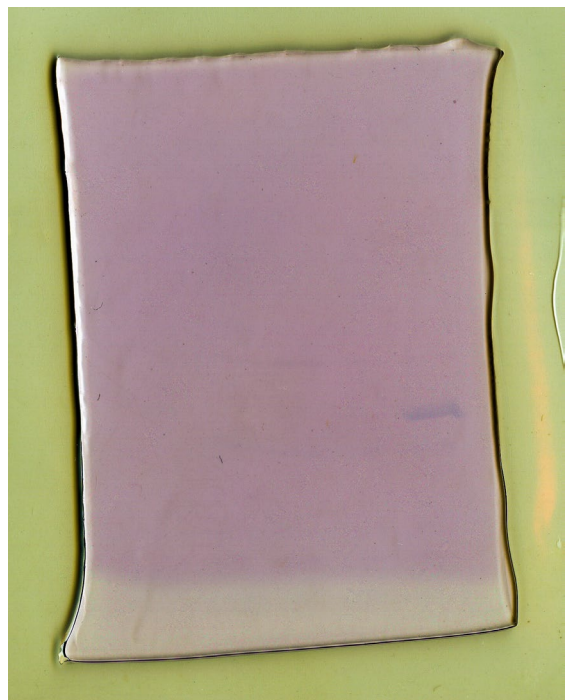


Supplementary Fig. S5 Alcoholic fermentation of intact grapes in coculture of grape-skin residents and *S. cerevisiae*. Carbon dioxide emission rates in a mixture of equal weight of YNB medium and intact grape berries are shown. Data represent mean values and standard deviations from two independent experiments. *Sc*, inoculated with *S. cerevisiae* (pink); *Ap + Sc*, coinoculated with *A. pullulans* and *S. cerevisiae*, *Pl + Sc*, coinoculated with *P. laurentii* and *S. cerevisiae*, *Sp + Sc*, coinoculated with *S. pararoseus* and *S. cerevisiae*, *Rm + Sc*, coinoculated with *R. mucilaginosa* and *S. cerevisiae* (violet). Asterisks indicate statistically significant increases of carbon dioxide emission compared with *Sc* (t test, $p < 0.05$).

Supplementary Fig. S6



CBB staining



His-detect

Supplementary Fig. S6 Full-length gel images of Fig. 8b.

Supplementary Table S1 Yeasts or yeast-like microorganisms isolated from grapes in this study*.

No.	Grape variety	Grape species	Isolated from	Yeast species	Family	Category
1	Delaware	<i>Vitis</i> hybrid	Enrichment culture in water	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
2	Delaware	<i>Vitis</i> hybrid	Enrichment culture in water	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
3	Delaware	<i>Vitis</i> hybrid	Enrichment culture in 5% sucrose	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
4	Delaware	<i>Vitis</i> hybrid	Enrichment culture in 5% sucrose	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
5	Delaware	<i>Vitis</i> hybrid	Enrichment culture in 5% sucrose	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
6	Delaware	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
7	Delaware	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
8	Delaware	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
9	Delaware	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
10	Delaware	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Tremella yokohamensis</i> (<i>Cryptococcus yokohamensis</i>)	Tremellaceae	Basidiomycetous yeast
11	Delaware	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Tremella yokohamensis</i> (<i>Cryptococcus yokohamensis</i>)	Tremellaceae	Basidiomycetous yeast
12	Kyoho	<i>Vitis</i> hybrid	Juice (stem)	<i>Moesziomyces aphidis</i>	Ustilaginaceae	Basidiomycetous yeast
13	Kyoho	<i>Vitis</i> hybrid	Juice (stem)	<i>Moesziomyces aphidis</i>	Ustilaginaceae	Basidiomycetous yeast
14	Kyoho	<i>Vitis</i> hybrid	Juice (stem)	<i>Moesziomyces aphidis</i>	Ustilaginaceae	Basidiomycetous yeast
15	Kyoho	<i>Vitis</i> hybrid	Juice (stem)	<i>Moesziomyces aphidis</i>	Ustilaginaceae	Basidiomycetous yeast
16	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Moesziomyces aphidis</i>	Ustilaginaceae	Basidiomycetous yeast
17	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Moesziomyces aphidis</i>	Ustilaginaceae	Basidiomycetous yeast
18	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Sporidiobolus pararoseus</i> (<i>Sporobolomyces shibatanus</i>)	Sporidiobolaceae	Basidiomycetous yeast
19	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Sporidiobolus pararoseus</i> (<i>Sporobolomyces shibatanus</i>)	Sporidiobolaceae	Basidiomycetous yeast
20	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Sporidiobolus pararoseus</i> (<i>Sporobolomyces shibatanus</i>)	Sporidiobolaceae	Basidiomycetous yeast
21	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Sporidiobolus pararoseus</i> (<i>Sporobolomyces shibatanus</i>)	Sporidiobolaceae	Basidiomycetous yeast
22	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
23	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
24	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Aureobasidium pullulans</i>	Dothioraceae	Yeast-like fungus
25	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Rhodotorula mucilaginosa</i>	Sporidiobolaceae	Basidiomycetous yeast
26	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
27	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
28	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
29	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Debaryomyces hansenii</i> (<i>Candida famata</i>)	Saccharomycetaceae	Ascomycetous yeast
30	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Debaryomyces hansenii</i> (<i>Candida famata</i>)	Saccharomycetaceae	Ascomycetous yeast
31	Shine Muscat	<i>Vitis</i> hybrid	Juice	<i>Debaryomyces hansenii</i> (<i>Candida famata</i>)	Saccharomycetaceae	Ascomycetous yeast
32	Shine Muscat	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
33	Shine Muscat	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
34	Shine Muscat	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Papiliotrema aurea</i> (<i>Cryptococcus aureus</i>)	Tremellaceae	Basidiomycetous yeast
35	Shine Muscat	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Papiliotrema aurea</i> (<i>Cryptococcus aureus</i>)	Tremellaceae	Basidiomycetous yeast
36	Kyoho	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
37	Kyoho	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporobolomyces</i> sp.	Sporidiobolaceae	Basidiomycetous yeast
38	Kyoho	<i>Vitis</i> hybrid	Juice	<i>Sporidiobolus pararoseus</i> (<i>Sporobolomyces shibatanus</i>)	Sporidiobolaceae	Basidiomycetous yeast
39	Shine Muscat	<i>Vitis</i> hybrid	Fermented juice	<i>Meyerozyma caribbica</i> (<i>Candida fermentati</i>)	Saccharomycetaceae	Ascomycetous yeast
40	Shine Muscat	<i>Vitis</i> hybrid	Fermented juice	<i>Meyerozyma caribbica</i> (<i>Candida fermentati</i>)	Saccharomycetaceae	Ascomycetous yeast
41	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Meyerozyma caribbica</i> (<i>Candida fermentati</i>)	Saccharomycetaceae	Ascomycetous yeast
42	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Meyerozyma caribbica</i> (<i>Candida fermentati</i>)	Saccharomycetaceae	Ascomycetous yeast
43	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Pichia terricola</i>	Saccharomycetaceae	Ascomycetous yeast
44	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Pichia terricola</i>	Saccharomycetaceae	Ascomycetous yeast
45	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
46	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
47	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
48	Pinot noir	<i>Vitis vinifera</i>	Juice	<i>Zygoascus meyeriae</i> (<i>Candida hellenica</i>)	Saccharomycetaceae	Ascomycetous yeast
49	Pinot noir	<i>Vitis vinifera</i>	Fermented juice	<i>Pichia manshurica</i>	Saccharomycetaceae	Ascomycetous yeast
50	Pinot noir	<i>Vitis vinifera</i>	Fermented juice	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
51	Pinot noir	<i>Vitis vinifera</i>	Fermented juice	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
52	Pinot noir	<i>Vitis vinifera</i>	Fermented juice	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
53	Pinot noir	<i>Vitis vinifera</i>	Fermented juice	<i>Meyerozyma caribbica</i> (<i>Candida fermentati</i>)	Saccharomycetaceae	Ascomycetous yeast
54	Pinot noir	<i>Vitis vinifera</i>	Fermented juice	<i>Torulasporea delbrueckii</i> (<i>Candida colliculosa</i>)	Saccharomycetaceae	Ascomycetous yeast
55	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Meyerozyma caribbica</i> (<i>Candida fermentati</i>)	Saccharomycetaceae	Ascomycetous yeast
56	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Meyerozyma guilliermondii</i> (<i>Candida guilliermondii</i>)	Saccharomycetaceae	Ascomycetous yeast
57	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
58	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
59	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
60	Seto Giants	<i>Vitis</i> hybrid	Surface-washed suspensions	<i>Sporidiobolus pararoseus</i> (<i>Sporobolomyces shibatanus</i>)	Sporidiobolaceae	Basidiomycetous yeast
61	Seto Giants	<i>Vitis</i> hybrid	Fermented juice	<i>Rhodotorula paludigena</i>	Sporidiobolaceae	Basidiomycetous yeast
62	Seto Giants	<i>Vitis</i> hybrid	Fermented juice	<i>Rhodotorula paludigena</i>	Sporidiobolaceae	Basidiomycetous yeast
63	Muscat of Alexandria	<i>Vitis vinifera</i>	Fermented juice	<i>Trichosporon asahii</i>	Trichosporonaceae	Basidiomycetous yeast
64	Muscat of Alexandria	<i>Vitis vinifera</i>	Fermented juice	<i>Trichosporon asahii</i>	Trichosporonaceae	Basidiomycetous yeast
65	Gorbi	<i>Vitis</i> hybrid	Fermented juice	<i>Meyerozyma guilliermondii</i> (<i>Candida guilliermondii</i>)	Saccharomycetaceae	Ascomycetous yeast
66	Gorbi	<i>Vitis</i> hybrid	Fermented juice	<i>Meyerozyma guilliermondii</i> (<i>Candida guilliermondii</i>)	Saccharomycetaceae	Ascomycetous yeast
67	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
68	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
69	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
70	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Papiliotrema laurentii</i> (<i>Cryptococcus laurentii</i>)	Tremellaceae	Basidiomycetous yeast
71	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Papiliotrema laurentii</i> (<i>Cryptococcus laurentii</i>)	Tremellaceae	Basidiomycetous yeast
72	Pinot noir	<i>Vitis vinifera</i>	Surface-washed suspensions	<i>Papiliotrema flavescens</i> (<i>Cryptococcus flavescens</i>)	Tremellaceae	Basidiomycetous yeast
73	Pinot noir	<i>Vitis vinifera</i>	Enrichment culture in water	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
74	Pinot noir	<i>Vitis vinifera</i>	Enrichment culture in water	<i>Hanseniaspora uvarum</i>	Saccharomycetaceae	Ascomycetous yeast
75	Pinot noir	<i>Vitis vinifera</i>	Enrichment culture in water	<i>Papiliotrema laurentii</i> (<i>Cryptococcus laurentii</i>)	Tremellaceae	Basidiomycetous yeast
76	Pinot noir	<i>Vitis vinifera</i>	Enrichment culture in water	<i>Papiliotrema laurentii</i> (<i>Cryptococcus laurentii</i>)	Tremellaceae	Basidiomycetous yeast

*All clones shared >99% nucleotide identity in the rRNA gene ITS region, based on NCBI BLAST searches.