

Supplemental Table 1: Identification of proteins associated with the biosynthesis of carotenoid in *Rhodotorula* and *Spirobolus*

Gene ID	Organism	Contig_ID	Enzyme	HMM profile	E-value
AEVR02~1972_g	Rhodotorula toruloides ATCC204091	AEVR02000018	phytoene desaturase	TIGR02734	5.30E-128
AEVR02~1975_g	Rhodotorula toruloides ATCC204091	AEVR02000018	Squalene/Phytoene synthase	PF00494.18	9.00E-040
AEVR02~1975_g	Rhodotorula toruloides ATCC204091	AEVR02000018	lycopene cyclase	TIGR03462	7.50E-035
AEVR02~2232_g	Rhodotorula toruloides ATCC204091	AEVR02000018	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.40E-047
AEVR02~241_g	Rhodotorula toruloides ATCC204091	AEVR02000013	Squalene/Phytoene synthase	PF00494.18	3.30E-039
AEVR02~3144_g	Rhodotorula toruloides ATCC204091	AEVR02000002	Geranyl pyrophosphate synthase (IspA)	PF00348.16	3.20E-096
AEVR02~5172_g	Rhodotorula toruloides ATCC204091	AEVR02000017	Squalene/Phytoene synthase	PF00494.18	2.60E-042
AJM01~194_g	Rhodotorula toruloides MTCC457	JH650665	Geranyl pyrophosphate synthase (IspA)	PF00348.16	6.80E-096
AJM01~3838_g	Rhodotorula toruloides MTCC457	JH650732	phytoene desaturase	TIGR02734	8.30E-130
AJM01~3841_g	Rhodotorula toruloides MTCC457	JH650732	Squalene/Phytoene synthase	PF00494.18	4.80E-040
AJM01~3841_g	Rhodotorula toruloides MTCC457	JH650732	lycopene cyclase	TIGR03462	1.80E-035
AJM01~7700_g	Rhodotorula toruloides MTCC457	JH650719	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.40E-047
AJM01~7732_g	Rhodotorula toruloides MTCC457	JH650719	Squalene/Phytoene synthase	PF00494.18	2.90E-044
AJM01~802_g	Rhodotorula toruloides MTCC457	AJM01000482	Squalene/Phytoene synthase	PF00494.18	3.20E-038
ALAU01~1654_g	Rhodotorula toruloides NP11	ALAU01000150	Geranyl pyrophosphate synthase (IspA)	PF00348.16	6.80E-096
ALAU01~1772_g	Rhodotorula toruloides NP11	ALAU01000186	Squalene/Phytoene synthase	PF00494.18	2.90E-044
ALAU01~5147_g	Rhodotorula toruloides NP11	ALAU01000174	Squalene/Phytoene synthase	PF00494.18	3.20E-038
ALAU01~5662_g	Rhodotorula toruloides NP11	ALAU01000209	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.80E-047
ALAU01~7694_g	Rhodotorula toruloides NP11	ALAU01000037	phytoene desaturase	TIGR02734	8.30E-130
ALAU01~7697_g	Rhodotorula toruloides NP11	ALAU01000037	Squalene/Phytoene synthase	PF00494.18	4.80E-040
ALAU01~7697_g	Rhodotorula toruloides NP11	ALAU01000037	lycopene cyclase	TIGR03462	1.80E-035
BCIY01~2014_g	Rhodotorula toruloides JCM10020	BCIY01000019	Squalene/Phytoene synthase	PF00494.18	2.90E-044
BCIY01~3431_g	Rhodotorula toruloides JCM10020	BCIY01000003	phytoene desaturase	TIGR02734	8.30E-130
BCIY01~3434_g	Rhodotorula toruloides JCM10020	BCIY01000003	Squalene/Phytoene synthase	PF00494.18	4.80E-040
BCIY01~3434_g	Rhodotorula toruloides JCM10020	BCIY01000003	lycopene cyclase	TIGR03462	1.80E-035
BCIY01~5908_g	Rhodotorula toruloides JCM10020	BCIY01000002	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.80E-047
BCIY01~5910_g	Rhodotorula toruloides JCM10020	BCIY01000002	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.80E-047
BCIY01~6299_g	Rhodotorula toruloides JCM10020	BCIY01000002	Squalene/Phytoene synthase	PF00494.18	3.20E-038
BCIY01~876_g	Rhodotorula toruloides JCM10020	BCIY01000015	Geranyl pyrophosphate synthase (IspA)	PF00348.16	6.80E-096
BCIZ01~154_g	Rhodotorula toruloides JCM10021	BCIZ01000012	Squalene/Phytoene synthase	PF00494.18	2.60E-042
BCIZ01~336_g	Rhodotorula toruloides JCM10021	BCIZ01000014	Squalene/Phytoene synthase	PF00494.18	3.30E-039
BCIZ01~3382_g	Rhodotorula toruloides JCM10021	BCIZ01000011	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.40E-047
BCIZ01~6297_g	Rhodotorula toruloides JCM10021	BCIZ01000006	Squalene/Phytoene synthase	PF00494.18	9.00E-040

BCIZ01~6297_g	Rhodotorula toruloides JCM10021	BCIZ01000006	lycopene cyclase	TIGR03462	7.50E-035
BCIZ01~6300_g	Rhodotorula toruloides JCM10021	BCIZ01000006	phytoene desaturase	TIGR02734	5.30E-128
BCIZ01~960_g	Rhodotorula toruloides JCM10021	BCIZ01000002	Geranyl pyrophosphate synthase (IspA)	PF00348.16	3.20E-096
BCJA01~3320_g	Rhodotorula toruloides JCM10049	BCJA01000017	Squalene/Phytoene synthase	PF00494.18	4.80E-040
BCJA01~3320_g	Rhodotorula toruloides JCM10049	BCJA01000017	lycopene cyclase	TIGR03462	1.80E-035
BCJA01~3323_g	Rhodotorula toruloides JCM10049	BCJA01000017	phytoene desaturase	TIGR02734	2.40E-129
BCJA01~379_g	Rhodotorula toruloides JCM10049	BCJA01000018	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.80E-047
BCJA01~4535_g	Rhodotorula toruloides JCM10049	BCJA01000013	Geranyl pyrophosphate synthase (IspA)	PF00348.16	2.00E-095
BCJA01~7178_g	Rhodotorula toruloides JCM10049	BCJA01000009	Squalene/Phytoene synthase	PF00494.18	3.20E-038
BCJA01~7433_g	Rhodotorula toruloides JCM10049	BCJA01000015	Squalene/Phytoene synthase	PF00494.18	2.90E-044
BCJE01~1158_g	Rhodotorula toruloides JCM10049	BCJE01000020	Squalene/Phytoene synthase	PF00494.18	1.60E-043
BCJE01~2664_g	Rhodotorula toruloides JCM10049	BCJE01000009	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.20E-047
BCJE01~2917_g	Rhodotorula toruloides JCM10049	BCJE01000009	Squalene/Phytoene synthase	PF00494.18	6.20E-040
BCJE01~2917_g	Rhodotorula toruloides JCM10049	BCJE01000009	lycopene cyclase	TIGR03462	2.40E-034
BCJE01~2920_g	Rhodotorula toruloides JCM10049	BCJE01000009	phytoene desaturase	TIGR02734	2.80E-128
BCJE01~4236_g	Rhodotorula toruloides JCM10049	BCJE01000012	Geranyl pyrophosphate synthase (IspA)	PF00348.16	1.50E-095
BCJE01~6808_g	Rhodotorula toruloides JCM10049	BCJE01000008	Squalene/Phytoene synthase	PF00494.18	1.10E-039
CENE01~1370_g	Sporidiobolus salmonicolor CBS6832	CENE01000012	Squalene/Phytoene synthase	PF00494.18	2.30E-044
CENE01~1370_g	Sporidiobolus salmonicolor CBS6832	CENE01000012	lycopene cyclase	TIGR03462	6.90E-035
CENE01~1371_g	Sporidiobolus salmonicolor CBS6832	CENE01000012	phytoene desaturase	TIGR02734	5.40E-125
CENE01~2336_g	Sporidiobolus salmonicolor CBS6832	CENE01000010	Squalene/Phytoene synthase	PF00494.18	3.50E-044
CENE01~2482_g	Sporidiobolus salmonicolor CBS6832	CENE01000016	Geranyl pyrophosphate synthase (IspA)	PF00348.16	1.20E-094
CENE01~4516_g	Sporidiobolus salmonicolor CBS6832	CENE01000001	Squalene/Phytoene synthase	PF00494.18	1.30E-036
CENE01~6711_g	Sporidiobolus salmonicolor CBS6832	CENE01000037	Isopentenyl-diphosphate delta-isomerase	TIGR02150	5.40E-048
CWKI01~3571_g	Rhodospiridium toruloides IFO0880	CWKI01000008	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.40E-047
CWKI01~4059_g	Rhodospiridium toruloides IFO0880	CWKI01000013	Squalene/Phytoene synthase	PF00494.18	2.60E-042
CWKI01~429_g	Rhodospiridium toruloides IFO0880	CWKI01000003	Geranyl pyrophosphate synthase (IspA)	PF00348.16	3.20E-096
CWKI01~4399_g	Rhodospiridium toruloides IFO0880	CWKI01000001	phytoene desaturase	TIGR02734	5.30E-128
CWKI01~4402_g	Rhodospiridium toruloides IFO0880	CWKI01000001	Squalene/Phytoene synthase	PF00494.18	9.00E-040
CWKI01~4402_g	Rhodospiridium toruloides IFO0880	CWKI01000001	lycopene cyclase	TIGR03462	7.50E-035
CWKI01~7315_g	Rhodospiridium toruloides IFO0880	CWKI01000009	Squalene/Phytoene synthase	PF00494.18	3.30E-039
JTAO01~1854_g	Rhodotorula graminis WP1	JTAO01000278	Squalene/Phytoene synthase	PF00494.18	2.40E-043
JTAO01~2422_g	Rhodotorula graminis WP1	JTAO01000020	Squalene/Phytoene synthase	PF00494.18	1.70E-033
JTAO01~2538_g	Rhodotorula graminis WP1	JTAO01000149	Squalene/Phytoene synthase	PF00494.18	4.50E-045
JTAO01~2538_g	Rhodotorula graminis WP1	JTAO01000149	lycopene cyclase	TIGR03462	2.80E-035
JTAO01~2540_g	Rhodotorula graminis WP1	JTAO01000149	phytoene desaturase	TIGR02734	2.30E-124

JTAO01~5118_g	Rhodotorula graminis WP1	JTAO01000158	Isopentenyl-diphosphate delta-isomerase	TIGR02150	8.60E-047
JTAO01~901_g	Rhodotorula graminis WP1	JTAO01000169	Geranyl pyrophosphate synthase (IspA)	PF00348.16	2.00E-096
JWTJ~2884_g	Rhodotorula mucilaginosa C25t1	JWTJ01000382	Squalene/Phytoene synthase	PF00494.18	2.30E-042
JWTJ~2884_g	Rhodotorula mucilaginosa C25t1	JWTJ01000382	lycopene cyclase	TIGR03462	2.40E-034
JWTJ~2887_g	Rhodotorula mucilaginosa C25t1	JWTJ01000382	phytoene desaturase	TIGR02734	2.00E-116
JWTJ~3392_g	Rhodotorula mucilaginosa C25t1	JWTJ01000703	Isopentenyl-diphosphate delta-isomerase	TIGR02150	4.10E-048
JWTJ~4579_g	Rhodotorula mucilaginosa C25t1	JWTJ01000911	Geranyl pyrophosphate synthase (IspA)	PF00348.16	3.00E-090
JWTJ~6094_g	Rhodotorula mucilaginosa C25t1	JWTJ01000355	Squalene/Phytoene synthase	PF00494.18	2.00E-045
JWTJ~851_g	Rhodotorula mucilaginosa C25t1	JWTJ01000274	Squalene/Phytoene synthase	PF00494.18	6.60E-039
LCTU01~2895_g	Rhodotorula toruloides IFO0559	LCTU01000114	Squalene/Phytoene synthase	PF00494.18	2.90E-044
LCTU01~4115_g	Rhodotorula toruloides IFO0559	LCTU01000005	Geranyl pyrophosphate synthase (IspA)	PF00348.16	6.80E-096
LCTU01~5286_g	Rhodotorula toruloides IFO0559	LCTU01000048	phytoene desaturase	TIGR02734	8.30E-130
LCTU01~5289_g	Rhodotorula toruloides IFO0559	LCTU01000048	Squalene/Phytoene synthase	PF00494.18	4.80E-040
LCTU01~5289_g	Rhodotorula toruloides IFO0559	LCTU01000048	lycopene cyclase	TIGR03462	1.80E-035
LCTU01~6639_g	Rhodotorula toruloides IFO0559	LCTU01000033	Squalene/Phytoene synthase	PF00494.18	3.20E-038
LCTU01~7453_g	Rhodotorula toruloides IFO0559	LCTU01000052	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.80E-047
LCTV01~1457_g	Rhodotorula toruloides IFO0880	LCTV01000060	Geranyl pyrophosphate synthase (IspA)	PF00348.16	3.20E-096
LCTV01~3172_g	Rhodotorula toruloides IFO0880	LCTV01000039	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.40E-047
LCTV01~4540_g	Rhodotorula toruloides IFO0880	LCTV01000049	phytoene desaturase	TIGR02734	5.30E-128
LCTV01~4543_g	Rhodotorula toruloides IFO0880	LCTV01000049	Squalene/Phytoene synthase	PF00494.18	9.00E-040
LCTV01~4543_g	Rhodotorula toruloides IFO0880	LCTV01000049	lycopene cyclase	TIGR03462	7.50E-035
LCTV01~6573_g	Rhodotorula toruloides IFO0880	LCTV01000052	Squalene/Phytoene synthase	PF00494.18	3.30E-039
LCTV01~7437_g	Rhodotorula toruloides IFO0880	LCTV01000013	Squalene/Phytoene synthase	PF00494.18	2.60E-042
LNKU01~12_g	Rhodotorula toruloides ATCC10657	LNKU01000018	Squalene/Phytoene synthase	PF00494.18	2.60E-042
LNKU01~2063_g	Rhodotorula toruloides ATCC10657	LNKU01000020	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.40E-047
LNKU01~6064_g	Rhodotorula toruloides ATCC10657	LNKU01000010	phytoene desaturase	TIGR02734	5.30E-128
LNKU01~6067_g	Rhodotorula toruloides ATCC10657	LNKU01000010	Squalene/Phytoene synthase	PF00494.18	9.00E-040
LNKU01~6067_g	Rhodotorula toruloides ATCC10657	LNKU01000010	lycopene cyclase	TIGR03462	7.50E-035
LNKU01~6619_g	Rhodotorula toruloides ATCC10657	LNKU01000001	Squalene/Phytoene synthase	PF00494.18	3.30E-039
LNKU01~7567_g	Rhodotorula toruloides ATCC10657	LNKU01000008	Geranyl pyrophosphate synthase (IspA)	PF00348.16	3.20E-096
LNQQ01~3286_g	Rhodotorula toruloides ATCC10788	LNQQ01000010	Geranyl pyrophosphate synthase (IspA)	PF00348.16	6.80E-096
LNQQ01~5924_g	Rhodotorula toruloides ATCC10788	LNQQ01000001	Isopentenyl-diphosphate delta-isomerase	TIGR02150	1.80E-047
LNQQ01~6309_g	Rhodotorula toruloides ATCC10788	LNQQ01000001	Squalene/Phytoene synthase	PF00494.18	3.20E-038
LNQQ01~6976_g	Rhodotorula toruloides ATCC10788	LNQQ01000004	Squalene/Phytoene synthase	PF00494.18	4.80E-040
LNQQ01~6976_g	Rhodotorula toruloides ATCC10788	LNQQ01000004	lycopene cyclase	TIGR03462	1.80E-035
LNQQ01~6979_g	Rhodotorula toruloides ATCC10788	LNQQ01000004	phytoene desaturase	TIGR02734	8.30E-130

LNQQ01~7604_g	Rhodotorula toruloides ATCC10788	LNQQ01000012	Squalene/Phytoene synthase	PF00494.18	2.90E-044
LQXB01~1689_g	Rhodotorula sp JG 1b	LQXB01000011	Squalene/Phytoene synthase	PF00494.18	4.50E-039
LQXB01~2317_g	Rhodotorula sp JG 1b	LQXB01000016	Squalene/Phytoene synthase	PF00494.18	7.10E-044
LQXB01~2317_g	Rhodotorula sp JG 1b	LQXB01000016	lycopene cyclase	TIGR03462	6.40E-032
LQXB01~2320_g	Rhodotorula sp JG 1b	LQXB01000016	phytoene desaturase	TIGR02734	9.90E-126
LQXB01~3209_g	Rhodotorula sp JG 1b	LQXB01000027	Isopentenyl-diphosphate delta-isomerase	TIGR02150	4.00E-048
LQXB01~3984_g	Rhodotorula sp JG 1b	LQXB01000047	Geranyl pyrophosphate synthase (IspA)	PF00348.16	5.20E-093
LQXB01~864_g	Rhodotorula sp JG 1b	LQXB01000026	Squalene/Phytoene synthase	PF00494.18	7.40E-046
NIUW01~4583_g	Rhodotorula mucilaginosa RIT389	NIUW01000001	Squalene/Phytoene synthase	PF00494.18	7.10E-039
NIUW01~5781_g	Rhodotorula mucilaginosa RIT389	NIUW01000009	Isopentenyl-diphosphate delta-isomerase	TIGR02150	3.90E-048
NIUW01~713_g	Rhodotorula mucilaginosa RIT389	NIUW01000053	Squalene/Phytoene synthase	PF00494.18	4.20E-044
NIUW01~713_g	Rhodotorula mucilaginosa RIT389	NIUW01000053	lycopene cyclase	TIGR03462	3.00E-032
