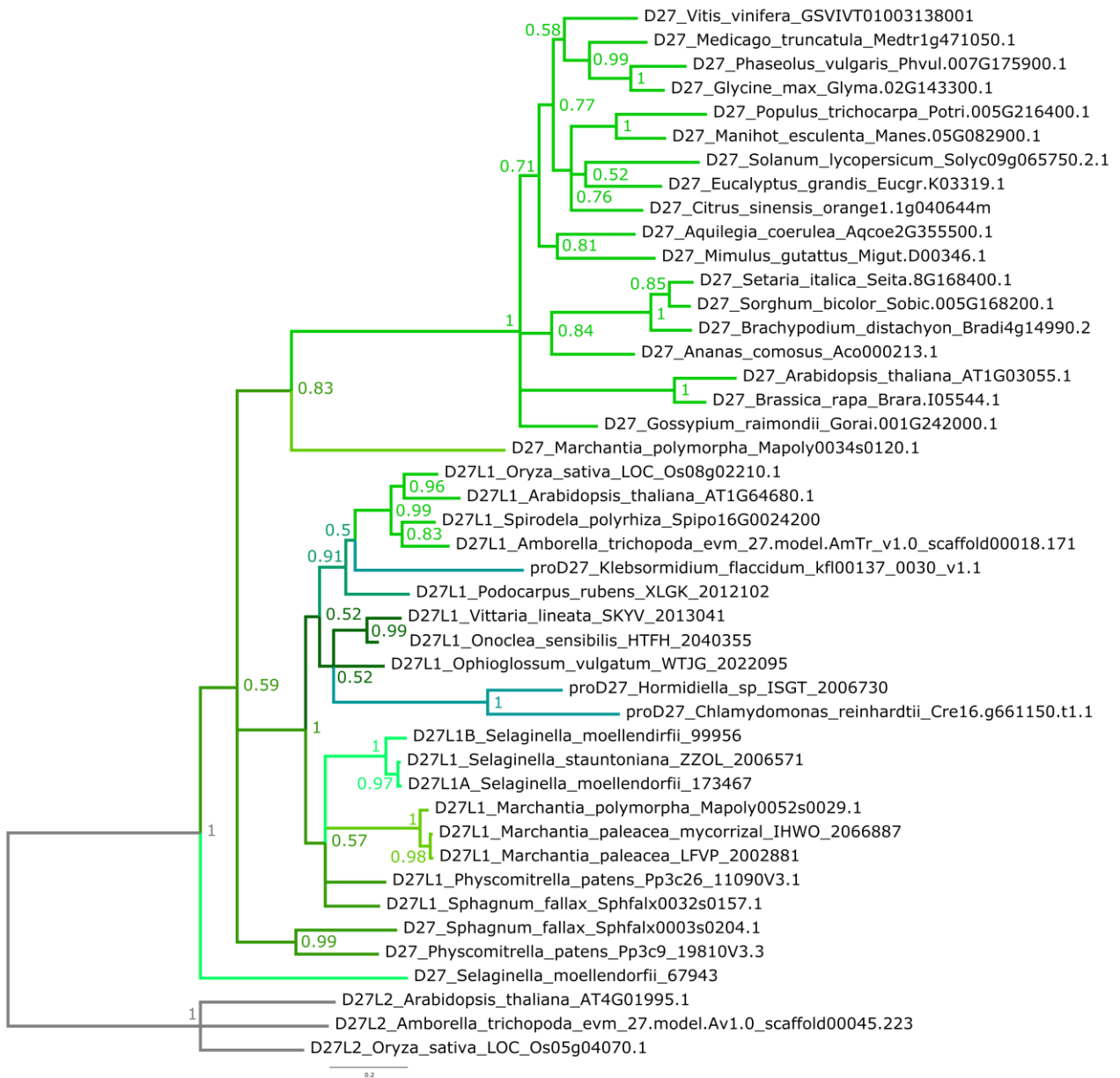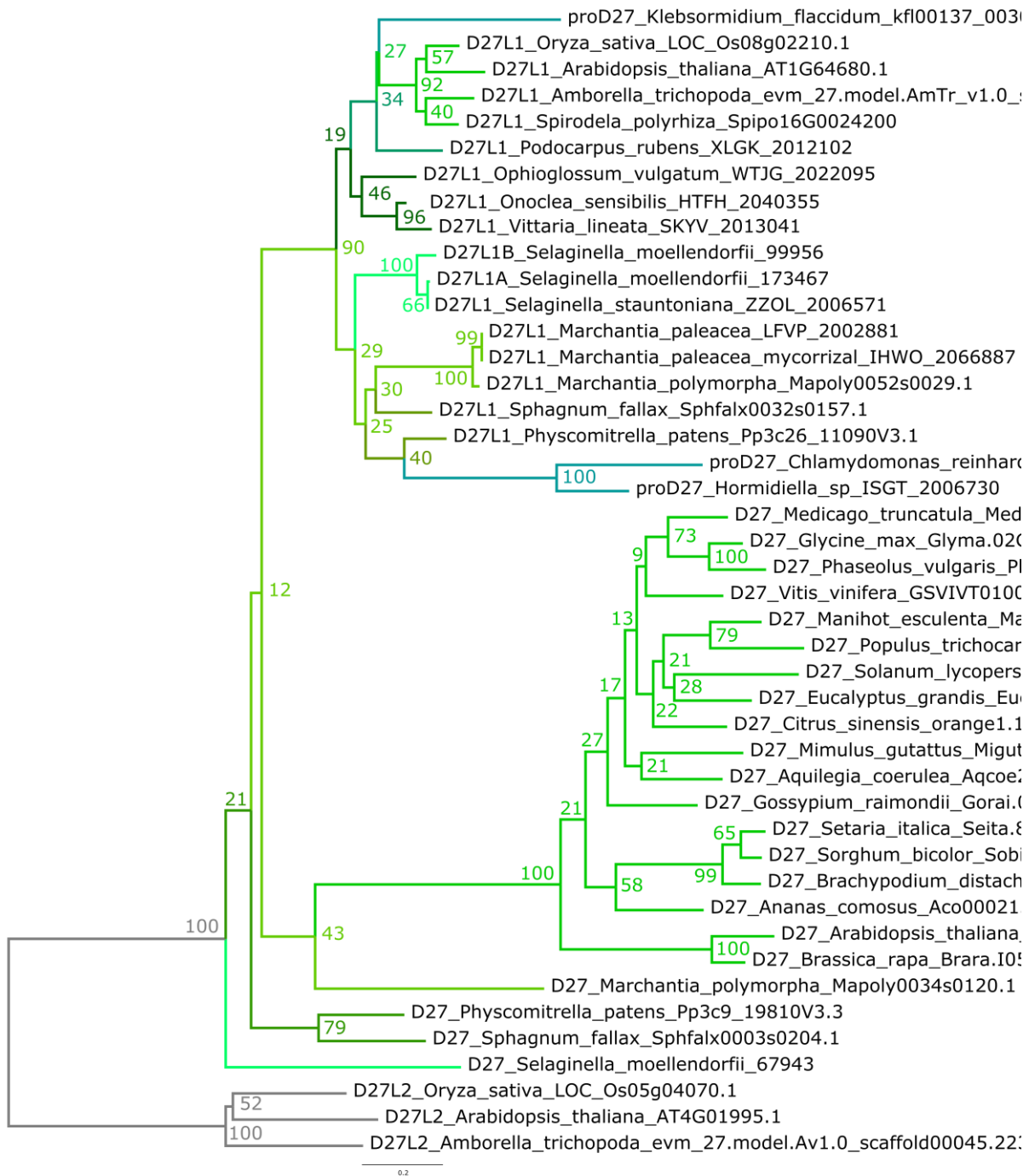## Additional File 3A: Full nucleotide-level ML phylogeny for D27 family

Maximum likelihood (ML) tree under the MGK+F3X4+R5 codon model in IQtree. Topology rooted with the *D27L2* clade. Bootstrap values are shown at each node of the tree.

1

D27_Vitis_vinifera_GSVIVT01003138001
0.58
D27_Medicago_truncatula_Medtr1g471050.1
0.99
D27_Phaseolus_vulgaris_Phvul.007G175900.1
1
D27_Glycine_max_Glyma.02G143300.1
0.77
D27_Populus_trichocarpa_Potri.005G216400.1
1
D27_Manihot_esculenta_Manes.05G082900.1
D27_Solanum_lycopersicum_Solyc09g065750.2.1
0.52
D27_Eucalyptus_grandis_Eucgr.K03319.1
0.76
D27_Citrus_sinensis_orange1.1g040644m
0.71
D27_Aquilegia_coerulea_Aqcoe2G355500.1
0.81
D27_Mimulus_gutattus_Migut.D00346.1
0.85
D27_Setaria_italica_Seita.8G168400.1
D27_Sorghum_bicolor_Sobic.005G168200.1
1
D27_Brachypodium_distachyon_Bradi4g14990.2
0.84
D27_Ananas_comosus_Aco000213.1
1
D27_Arabidopsis_thaliana_AT1G03055.1
1
D27_Brassica_rapa_Brara.I05544.1
0.83
D27_Gossypium_raimondii_Gorai.001G242000.1
D27_Marchantia_polymorpha_Mapoly0034s0120.1
D27L1_Oryza_sativa_LOC_Os08g02210.1
0.96
D27L1_Arabidopsis_thaliana_AT1G64680.1
0.99
D27L1_Spirodela_polyrhiza_Spipo16G0024200
0.5
0.83
D27L1_Amborella_trichopoda_evm_27.model.AmTr_v1.0_scaffold00018.171
0.91
proD27_Klebsormidium_flaccidum_kfl00137_0030_v1.1
D27L1_Podocarpus_rubens_XLGK_2012102
0.52
D27L1_Vittaria_lineata_SKYV_2013041
0.99
D27L1_Onoclea_sensibilis_HTFH_2040355
D27L1_Ophioglossum_vulgatum_WTJG_2022095
0.52
proD27_Hormidiella_sp_ISGT_2006730
1
proD27_Chlamydomonas_reinhardtii_Cre16.g661150.t1.1
0.59
1
1
D27L1B_Selaginella_moellendirfii_99956
D27L1_Selaginella_stauntoniana_ZZOL_2006571
0.97
D27L1A_Selaginella_moellendorfii_173467
1
D27L1_Marchantia_polymorpha_Mapoly0052s0029.1
D27L1_Marchantia_paleacea_mycorrizal_IHWO_2066887
0.57
0.98
D27L1_Marchantia_paleacea_LFVP_2002881
D27L1_Physcomitrella_patens_Pp3c26_11090V3.1
D27L1_Sphagnum_fallax_Sphfalx0032s0157.1
D27_Sphagnum_fallax_Sphfalx0003s0204.1
0.99
D27_Physcomitrella_patens_Pp3c9_19810V3.3
D27_Selaginella_moellendorfii_67943
1
D27L2_Arabidopsis_thaliana_AT4G01995.1
1
D27L2_Amborella_trichopoda_evm_27.model.Av1.0_scaffold00045.223
D27L2_Oryza_sativa_LOC_Os05g04070.1
0.2

Additional File 3B: Full amino acid-level Bayesian inference phylogeny for D27 family

Bayesian inference tree under the CAT + LG codon model in PhyloBayes. Topology rooted with the *D27L2* clade. Bootstrap values are shown at each node of the tree.

Additional File 3C: Full amino acid-level ML phylogeny for D27 family

Maximum likelihood (ML) tree with the amino acid dataset under the PROTCATLGX model in RAxML. Topology rooted at the D27L2 clade. Bootstrap values are shown at each node of the tree.