

Supplementary data

Comparative computational analysis of stigmasterol biosynthetic genes and proteins in plants

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Supplementary Table 1. Homology score of stigmasterol biosynthetic gene sequences among different plant species

Please add all Supplementary Figs and Tables here.

Name of the gene						
<i>smt2</i> (24-methylene sterol C- methyl transferase)		<i>smo2</i> (4-alpha methyl- delta7-sterol-4 alpha methyl sterol oxidase)	<i>ste1</i> (lathosterol oxidase)	<i>dwf5</i> (-7-dehydrocholesterol reductase)	<i>dwf1</i> (delta 24-sterol reductase)	<i>sterol c-22 desaturase</i> (CYP710A)
Plant	Nucleotide length (Base pair)					
<i>Arabidopsis</i>	1086 bp	801 bp	846 bp	1296 bp	1686 bp	1482 bp
	Homology Score (%)					

	<i>Cucumis</i> : 65.84 <i>Ricinus</i> : 76.15 <i>Populus</i> : 75.14 <i>Vitis</i> : 75.72 <i>Solanum</i> : 68.80 <i>Sorghum</i> : 59.67 <i>Oryza</i> : 57.73 <i>Setaria</i> : 58.93 <i>Cicer</i> : 75.46 <i>Brachypodium</i> : 59.48	<i>Cucumis</i> : 72.370 <i>Ricinus</i> : 73.66 <i>Populus</i> : 71.54 <i>Vitis</i> : 73.03 <i>Solanum</i> : 73.91 <i>Sorghum</i> : 61.67 <i>Oryza</i> : 63.29 <i>Setaria</i> : 60.42 <i>Cicer</i> : 71.04 <i>Brachypodium</i> : 61.79	<i>Cucumis</i> : 61.09 <i>Ricinus</i> : 65.82 <i>Populus</i> : 67.87 <i>Vitis</i> : 59.19 <i>Solanum</i> : 68.26 <i>Sorghum</i> : 62.69 <i>Oryza</i> : 62.79 <i>Setaria</i> : 63.41 <i>Cicer</i> : 64.88 <i>Brachypodium</i> : 61.33	<i>Cucumis</i> : 63.33 <i>Ricinus</i> : 72.99 <i>Populus</i> : 72.92 <i>Vitis</i> : 72.68 <i>Solanum</i> : 69.44 <i>Sorghum</i> : 67.82 <i>Oryza</i> : 67.90 <i>Setaria</i> : 67.28 <i>Cicer</i> : 69.75 <i>Brachypodium</i> : 69.21	<i>Cucumis</i> : 68.45 <i>Ricinus</i> : 71.71 <i>Populus</i> : 73.43 <i>Vitis</i> : 71.89 <i>Solanum</i> : 67.56 <i>Sorghum</i> : 62.99 <i>Oryza</i> : 72.65 <i>Setaria</i> : 69.69 <i>Cicer</i> : 72.12 <i>Brachypodium</i> : 69.69	<i>Cucumis</i> : 51.21 <i>Ricinus</i> : 51.66 <i>Populus</i> : 54.45 <i>Vitis</i> : 54.39 <i>Solanum</i> : 52.56 <i>Sorghum</i> : 50.47 <i>Oryza</i> : 48.31 <i>Setaria</i> : 50.94 <i>Cicer</i> : 54.45 <i>Brachypodium</i> : 51.01
<i>Cucumis</i>	1083 bp	789 bp	825 bp	1308 bp	1701 bp	1524 bp
	<i>Ricinus</i> : 67.22 <i>Populus</i> : 65.46 <i>Vitis</i> : 66.21 <i>Solanum</i> : 64.35 <i>Sorghum</i> : 53.46 <i>Oryza</i> : 52.078 <i>Setaria</i> : 53.74	<i>Ricinus</i> : 76.81 <i>Populus</i> : 75.92 <i>Vitis</i> : 74.52 <i>Solanum</i> : 73.64 <i>Sorghum</i> : 62.23 <i>Oryza</i> : 65.02 <i>Setaria</i> : 62.99	<i>Ricinus</i> : 61.45 <i>Populus</i> : 61.94 <i>Vitis</i> : 54.78 <i>Solanum</i> : 64.34 <i>Sorghum</i> : 60.85 <i>Oryza</i> : 59.76 <i>Setaria</i> : 59.52	<i>Ricinus</i> : 77.37 <i>Populus</i> : 76.29 <i>Vitis</i> : 76.29 <i>Solanum</i> : 71.88 <i>Sorghum</i> : 67.43 <i>Oryza</i> : 68.27 <i>Setaria</i> : 67.13	<i>Ricinus</i> : 76.19 <i>Populus</i> : 76.59 <i>Vitis</i> : 75.88 <i>Solanum</i> : 66.07 <i>Sorghum</i> : 60.78 <i>Oryza</i> : 67.64 <i>Setaria</i> : 64.73	<i>Ricinus</i> : 63.54 <i>Populus</i> : 61.74 <i>Vitis</i> : 62.07 <i>Solanum</i> : 59.56 <i>Sorghum</i> : 53.87 <i>Oryza</i> : 50.72 <i>Setaria</i> : 52.62

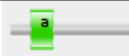
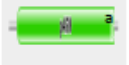
	<i>Cicer:</i> 67.41 <i>Brachypodium:</i> 52.35	<i>Cicer:</i> 73.64 <i>Brachypodium:</i> 62.99	<i>Cicer:</i> 62.06 <i>Brachypodium:</i> 58.42	<i>Cicer:</i> 74.08 <i>Brachypodium:</i> 67.81	<i>Cicer:</i> 74.36 <i>Brachypodium:</i> 66.01	<i>Cicer:</i> 62.47 <i>Brachypodium:</i> 55.05
Ricinus	1086 bp	810 bp	831 bp	1683 bp	1704 bp	480 bp
	<i>Populus:</i> 82.04 <i>Vitis:</i> 78.11 <i>Solanum:</i> 70.56 <i>Sorghum:</i> 59.58 <i>Oryza:</i> 58.56 <i>Setaria:</i> 60.31 <i>Cicer:</i> 75.37 <i>Brachypodium:</i> 58.93	<i>Populus:</i> 86.17 <i>Vitis:</i> 79.75 <i>Solanum:</i> 78.52 <i>Sorghum:</i> 59.85 <i>Oryza:</i> 62.08 <i>Setaria:</i> 60.72 <i>Cicer:</i> 79.38 <i>Brachypodium:</i> 62.56	<i>Populus:</i> 79.78 <i>Vitis:</i> 60.52 <i>Solanum:</i> 71.81 <i>Sorghum:</i> 65.46 <i>Oryza:</i> 65.21 <i>Setaria:</i> 64.49 <i>Cicer:</i> 69.31 <i>Brachypodium:</i> 64.12	<i>Populus:</i> 82.80 <i>Vitis:</i> 78.61 <i>Solanum:</i> 73.61 <i>Sorghum:</i> 64.39 <i>Oryza:</i> 65.85 <i>Setaria:</i> 63.53 <i>Cicer:</i> 74.93 <i>Brachypodium:</i> 66.01	<i>Populus:</i> 84.93 <i>Vitis:</i> 80.67 <i>Solanum:</i> 73.02 <i>Sorghum:</i> 63.69 <i>Oryza:</i> 73.50 <i>Setaria:</i> 70.59 <i>Cicer:</i> 79.28 <i>Brachypodium:</i> 71.58	<i>Populus:</i> 68.34 <i>Vitis:</i> 62.71 <i>Solanum:</i> 66.46 <i>Sorghum:</i> 50.83 <i>Oryza:</i> 51.04 <i>Setaria:</i> 51.04 <i>Cicer:</i> 62.50 <i>Brachypodium:</i> 53.13
Populus	1095 bp	810 bp	834 bp	1314 bp	1692 bp	1533 bp
	<i>Vitis:</i> 76.73 <i>Solanum:</i> 71.68 <i>Sorghum:</i> 57.17 <i>Oryza:</i> 57.88	<i>Vitis:</i> 79.63 <i>Solanum:</i> 78.02 <i>Sorghum:</i> 59.11 <i>Oryza:</i> 59.48	<i>Vitis:</i> 58.21 <i>Solanum:</i> 69.73 <i>Sorghum:</i> 64.62 <i>Oryza:</i> 63.03	<i>Vitis:</i> 78.31 <i>Solanum:</i> 74.33 <i>Sorghum:</i> 66.74 <i>Oryza:</i> 67.66	<i>Vitis:</i> 82.86 <i>Solanum:</i> 71.51 <i>Sorghum:</i> 63.31 <i>Oryza:</i> 74.97	<i>Vitis:</i> 60.78 <i>Solanum:</i> 59.36 <i>Sorghum:</i> 50.88 <i>Oryza:</i> 49.25

	<i>Setaria</i> : 57.81 <i>Cicer</i> : 73.70 <i>Brachypodium</i> : 57.53	<i>Setaria</i> : 59.85 <i>Cicer</i> : 78.89 <i>Brachypodium</i> : 62.06	<i>Setaria</i> : 64.13 <i>Cicer</i> : 68.35 <i>Brachypodium</i> : 63.07	<i>Setaria</i> : 66.29 <i>Cicer</i> : 73.59 <i>Brachypodium</i> : 67.96	<i>Setaria</i> : 71.63 <i>Cicer</i> : 80.08 <i>Brachypodium</i> : 71.47	<i>Setaria</i> : 52.77 <i>Cicer</i> : 62.75 <i>Brachypodium</i> : 51.83
Vitis	1083 bp	1128 bp	816 bp	1686 bp	1692 bp	1530 bp
	<i>Solanum</i> : 70.10 <i>Sorghum</i> : 62.97 <i>Oryza</i> : 61.22 <i>Setaria</i> : 63.43 <i>Cicer</i> : 72.78 <i>Brachypodium</i> : 62.23	<i>Solanum</i> : 78.02 <i>Sorghum</i> : 63.07 <i>Oryza</i> : 62.33 <i>Setaria</i> : 64.93 <i>Cicer</i> : 74.39 <i>Brachypodium</i> : 64.93	<i>Solanum</i> : 60.42 <i>Sorghum</i> : 52.45 <i>Oryza</i> : 49.63 <i>Setaria</i> : 50.86 <i>Cicer</i> : 57.97 <i>Brachypodium</i> : 50.98	<i>Solanum</i> : 74.02 <i>Sorghum</i> : 66.59 <i>Oryza</i> : 68.74 <i>Setaria</i> : 66.01 <i>Cicer</i> : 73.31 <i>Brachypodium</i> : 67.77	<i>Solanum</i> : 71.87 <i>Sorghum</i> : 62.49 <i>Oryza</i> : 73.63 <i>Setaria</i> : 70.51 <i>Cicer</i> : 81.79 <i>Brachypodium</i> : 70.76	<i>Solanum</i> : 61.35 <i>Sorghum</i> : 58.82 <i>Oryza</i> : 56.93 <i>Setaria</i> : 59.93 <i>Cicer</i> : 65.75 <i>Brachypodium</i> : 59.47
Solanum	1077 bp	810 bp	816 bp	1305 bp	1701 bp	1506 bp
	<i>Sorghum</i> : 56.64 <i>Oryza</i> : 56.73 <i>Setaria</i> : 58.58 <i>Cicer</i> : 69.64 <i>Brachypodium</i> : 57.10	<i>Sorghum</i> : 60.96 <i>Oryza</i> : 61.21 <i>Setaria</i> : 60.59 <i>Cicer</i> : 74.19 <i>Brachypodium</i> : 62.31	<i>Sorghum</i> : 63.97 <i>Oryza</i> : 62.86 <i>Setaria</i> : 64.34 <i>Cicer</i> : 72.06 <i>Brachypodium</i> : 62.99	<i>Sorghum</i> : 66.82 <i>Oryza</i> : 68.05 <i>Setaria</i> : 67.43 <i>Cicer</i> : 70.04 <i>Brachypodium</i> : 66.97	<i>Sorghum</i> : 59.58 <i>Oryza</i> : 67.77 <i>Setaria</i> : 65.08 <i>Cicer</i> : 68.90 <i>Brachypodium</i> : 65.30	<i>Sorghum</i> : 49.93 <i>Oryza</i> : 48.41 <i>Setaria</i> : 49.00 <i>Cicer</i> : 60.96 <i>Brachypodium</i> : 50.46
Sorghum	1104 bp	807 bp	831 bp	1365 bp	1581 bp	1563 bp

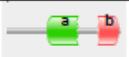
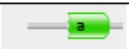
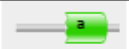
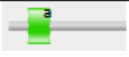
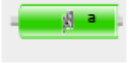
	<i>Oryza</i> : 92.03 <i>Setaria</i> : 94.29 <i>Cicer</i> : 56.02 <i>Brachypodium</i> :89.40	<i>Oryza</i> : 79.18 <i>Setaria</i> : 91.33 <i>Cicer</i> : 59.60 <i>Brachypodium</i> : 86.57	<i>Oryza</i> : 84 <i>Setaria</i> : 88.77 <i>Cicer</i> :60.65 <i>Brachypodium</i> : 83.27	<i>Oryza</i> : 87.88 <i>Setaria</i> : 92.31 <i>Cicer</i> : 63.59 <i>Brachypodium</i> : 86.27	<i>Oryza</i> : 75.46 <i>Setaria</i> : 76.09 <i>Cicer</i> : 62.68 <i>Brachypodium</i> : 75.20	<i>Oryza</i> : 77.73 <i>Setaria</i> : 90.41 <i>Cicer</i> : 55.04 <i>Brachypodium</i> : 84.18
<i>Oryza</i>	1092 bp	807 bp	825 bp	1353 bp	819 bp	1536 bp
	<i>Setaria</i> : 92.86 <i>Cicer</i> : 56.39 <i>Brachypodium</i> : 91.48	<i>Setaria</i> : 78.31 <i>Cicer</i> : 60.97 <i>Brachypodium</i> : 79.23	<i>Setaria</i> : 82.91 <i>Cicer</i> : 58.06 <i>Brachypodium</i> : 86.30	<i>Setaria</i> : 88.25 <i>Cicer</i> : 65.85 <i>Brachypodium</i> : 88.77	<i>Setaria</i> : 84.86 <i>Cicer</i> : 73.75 <i>Brachypodium</i> : 85.35	<i>Setaria</i> : 79.54 <i>Cicer</i> : 50.98 <i>Brachypodium</i> : 78.95
<i>Setaria</i>	1104 bp	807 bp	828 bp	1371 bp	1755 bp	1533 bp
	<i>Cicer</i> : 56.85 <i>Brachypodium</i> : 90.85	<i>Cicer</i> : 58.49 <i>Brachypodium</i> :87.44	<i>Cicer</i> : 59.54 <i>Brachypodium</i> : 84.29	<i>Cicer</i> : 62.66 <i>Brachypodium</i> : 86.19	<i>Cicer</i> : 69.54 <i>Brachypodium</i> : 85.35	<i>Cicer</i> : 53.69 <i>Brachypodium</i> : 84.51
<i>Cicer</i>	1080 bp	816 bp	840 bp	1692 bp	1704 bp	1548 bp
	<i>Brachypodium</i> : 56.02	<i>Brachypodium</i> :61.19	<i>Brachypodium</i> : 58.45	<i>Brachypodium</i> :65.35	<i>Brachypodium</i> :70.11	<i>Brachypodium</i> :54.31
<i>Brachypodium</i>	1107 bp	804 bp	843 bp	1362 bp	1686 bp	1530 bp

Supplementary Table 2. Pfam structure analysis of stigmasterol biosynthetic proteins in plants.

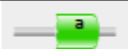
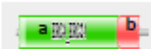
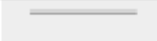
Arabidopsis thaliana										
Amino acid	Structural domain	Family	Envelope		Alignment		Hidden Markov Model		Bit score	E- value
			Start	End	Start	End	From	To		
SMT2		a. Methyl transf 11	128	126	128	224	1	93	77.5	6.4e-22
		b. Sterol MT C	289	355	292	355	4	67	57.0	1.1e-15
SMO2		a. FA hydroxylase	112	225	113	225	2	114	72.6	2.6e-20
STE1		a. FA hydroxylase	132	243	133	243	2	114	46.8	2.6e-12
DWF5		a. ERG4ERG24	23	431	62	431	66	432	282.9	2.6e-84

DWF1		a. FAD binding 4	93	200	110	199	48	138	57.2	9.6e-16
Sterol C-22 desaturase		a. P450	37	476	38	460	1	437	171.2	2.3e-50

Cucumis sativus

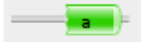
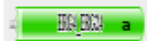
SMT2		a. SMT2 Methyl transf 11	128	226	128	225	1	94	69.3	3e-11
		b. Sterol MTC	290	355	294	355	6	67	53.4	1.7e-14
SMO2		a. FA hydroxylase	112	225	113	225	2	114	75.4	4.3e-21
STE1		a. FA hydroxylase	132	243	133	243	2	114	46.7	3.4e-12
DWF5		a. ERG4ERG24	16	435	58	435	61	432	285.7	4.7e-85
DWF1		a. FAD binding 4	92	199	109	198	48	138	139	2.6e-16
Sterol c-22 desaturase		a. P450	37	489	38	472	1	437	172.0	1.6e-50

Ricinus communis

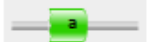
SMT2		a. Methyl transf11	128	226	128	224	1	93	77.5	7.8e-22
		b. Sterol MT C	289	355	291	355	3	67	59.4	2.3e-16
SMO2		a. FA hydroxylase	112	225	113	225	2	114	71.1	9.1e-20
STE1		a. FA hydroxylase	133	263	134	244	2	114	45.3	9.2e-12
DWF5		a. ERG4ERG24	12	433	40	425	44	423	272.4	4.1e-81
		b. DUF1754	427	523	427	521	1	95	58.3	8.3e-16
DWF1		a. FAD binding 4	93	199	109	198	48	138	61.0	7.5e-17
Sterol C-22 desaturase		a. P450	38	157	38	149	1	116	14.3	0.011

Populus trichocarpa

SMT2		a. Methyl transf 11	128	226	128	224	1	93	74.8	5.4e-21
		b. Sterol MTC	289	355	292	355	4	67	58.4	5e-16

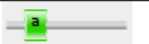
SMO2		a. FA hydroxylase	112	225	113	235	2	114	43.9	2.6e-11
STE1		a. FA hydroxylase	131	261	132	242	2	114	43.9	2.6e-11
DWF1		a. ERG4ERG24	20	437	41	437	45	432	284.3	1.2e-84
DWF5		a. FAD binding 4	92	199	109	198	48	138	59.4	2.5e-16
Sterol c-22 desaturase		a. P450	42	484	118	464	80	429	166.3	8.1e-49

Vitis vinifera

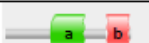
SMT2		a. Methyltrans11	128	226	128	224	1	93	76.9	1.2e-21
		b. Sterol MTC	289	355	292	355	4	67	55.0	5.5e-15
SMO2		a. FA hydroxylase	129	246	130	239	2	113	45.0	1.2e-11
STE1		a. FA hydroxylase	129	246	130	239	2	113	45.0	1.2e-18
DWF5		a. ERG4ERG24	17	433	43	424	47	422	268.	1e-79

[illegible]

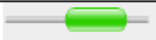
Sorghum bicolor

SMT2		a. Methyltransf 11	133	232	133	231	1	94	77.2	9.6e-22
		b. Sterol MTC	295	361	298	360	4	66	52.9	2.5e-14
SMO2		a. FA hydroxylase	115	228	116	228	2	114	70.8	1.2e-19
STE1		a. FA hydroxylase	115	246	136	246	2	114	47.5	1.9e-12
DWF5		a. ERG4ERG24	41	454	83	454	65	432	280.8	1.4e-83
DWF1		a. FAD binding4	81	177	92	176	53	138	54.1	1.1e-14
Sterol c-22 desaturase		a. P450	50	501	55	483	6	435	147.6	4.7e-43

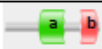
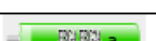
Oryza sativa

SMT2		a. Methyltransf 11	133	231	133	230	1	94	75.8	2.1e-21
		b. Sterol MTC	294	360	297	359	4	66	51.3	6.6e-14

a

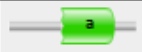
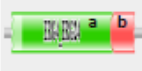
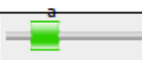
SMO2		a. FA hydroxylase	114	227	114	227	1	114	71.7	4.9e-20
STE1		a. FA hydroxylase	133	244	134	244	2	114	46.0	4.8e-12
DWF5		a. ERG4ERG24	43	450	79	450	65	432	276.0	3.4e-82
DWF1		a. Plasmid toxin	210	267	238	263	44	69	13.7	0.032
Sterol c-22 desaturase		a. P450	50	499	50	481	1	435	153.5	6.1e-45

Setaria italica

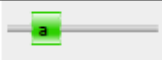
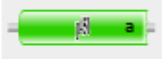
SMT2		a. Methyltransf11	133	231	133	230	1	94	77.5	7.8e-22
		b. Sterol MTC	294	360	297	360	4	67	52.3	3.8e-14
SMO2		a. FA hydroxylase	115	228	116	228	1	114	71.4	7.4e-20
STE1		a. FA hydroxylase	134	254	135	245	2	114	45.6	3.6e-12
DWF5		a. ERG4ERG24	44	456	85	456	65	432	277.0	2e-82
DWF1		a. FAD binding 4	116	224	134	223	48	138	63.0	1.9e-17

Sterol c-22 desaturase		a. P450	42	489	42	469	1	431	151.8	2.1e-44
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Cicer arietinum

SMT2		a. Methyltransf 11	128	226	128	224	1	93	76.0	2.3e-21
		b. Sterol MTC	290	355	293	354	5	66	52.4	3.7e-14
SMO2		a. FA hydroxylase	112	225	113	225	2	114	73.4	1.8e-20
STE1		a. FA hydroxylase	137	248	138	248	2	114	45.5	8e-12
DWF5		a. ERG4ERG24	31	435	72	427	72	423	264.8	1e-78
		b. DUF1754	429	526	429	523	1	94	56.3	3.6e-15
DWF1		a. FAD binding 4	92	199	109	198	48	138	60.2	1.4e-16
Sterol c-22 desaturase		a. P450	44	483	44	464	1	429	73.0	7.5e-51

Brachypodium distachyon^b

SMT2		a. Methyltransf 11	133	231	133	230	1	94	77.6	7.3e-22
		b. Sterol MTC	294	360	297	360	4	67	52.0	4.9e-14
SMO2		a. FA hydroxylase	114	227	115	227	2	114	72.0	5e-20
STE1		a. FA hydroxylase	139	258	140	250	2	114	42.9	5e-11
DWF5		a. ERG4ERG24	43	453	82	453	65	432	287.5	1.3e-85
DWF1		a. FAD binding 4	91	200	110	199	48	138	59.5	2.2e-16
Sterol c-22 desaturase		a. P450	39	485	39	468	1	431	144.4	3.5e-42

Supplementary Table 3. Protein motif Prosite Scan results of stigmasterol biosynthetic proteins in plants

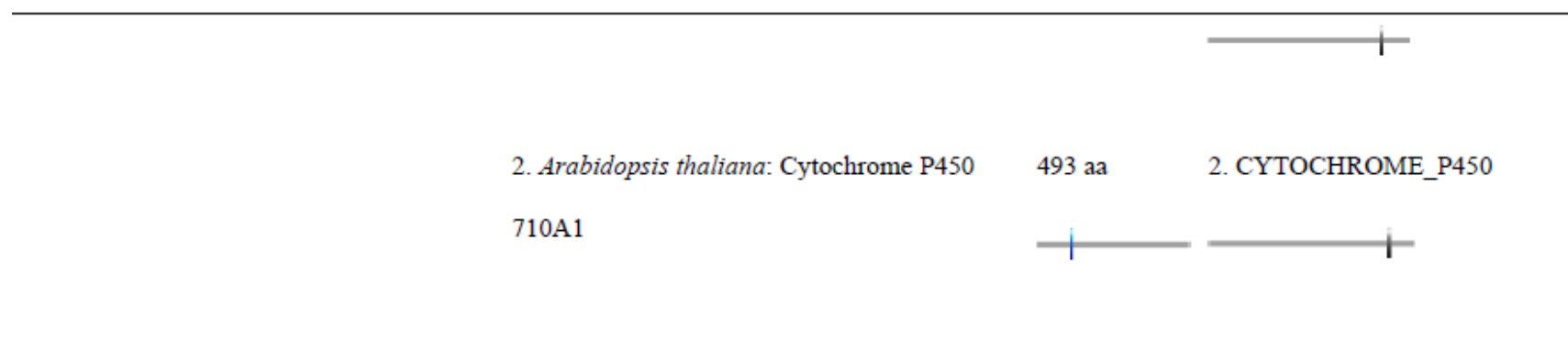
Protein	Motif pattern	No. of hits	Structure	Hits for all prosite motifs on sequence
SMT2	VDTFYNLVTDIYE WG WG QSFHF	1. <i>Arabidopsis thaliana</i> : 24 methylenesterol C-methyltransferase 2 (361 aa)		 SMT2_ARATH
		2. <i>Oryza sativa subsp. Japonica</i> : 24-methylenesterol C-methyltransferase 2 (363 aa)		 SMT2_ORYSJ
		3. <i>Arabidopsis thaliana</i> : 24-methylenesterol C-methyltransferase 3 (359 aa)		 SAM_MT_ERG6_SMT
SMO2	HHEYATPFGLTSE YAHPAEILFLGFA	1. <i>Arabidopsis thaliana</i> : Methylsterol monooxygenase 2 (272 aa)		No hits

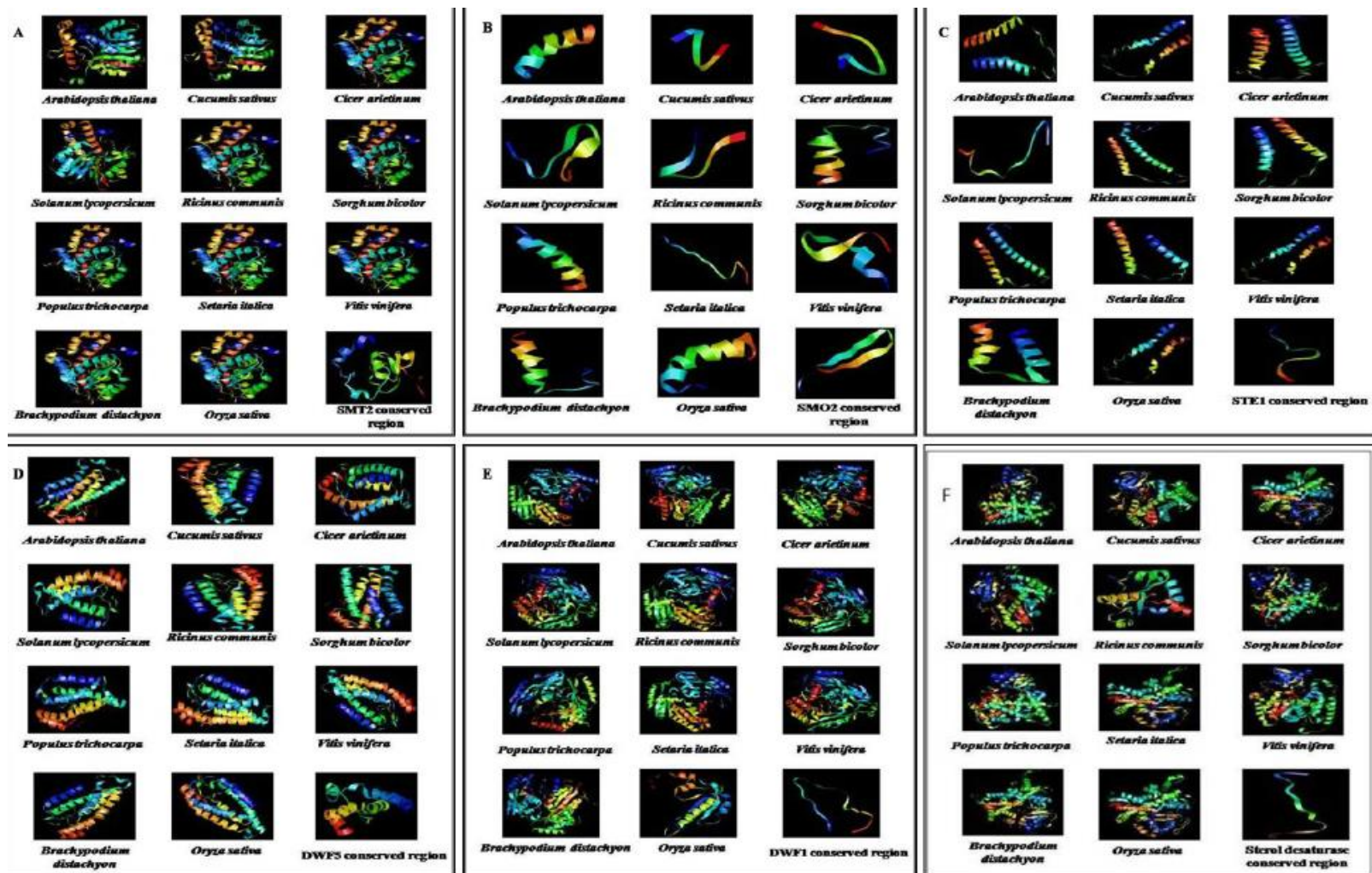
T

2. <i>Arabidopsis thaliana</i> : Isoform 2 of Methylsterol monooxygenase 2-1 (260 aa)		No hits
3. <i>Arabidopsis thaliana</i> : Isoform 3 of Methylsterol monooxygenase 2-1(253 aa)		No hits
4. <i>Arabidopsis thaliana</i> : Isoform 4 of Methylsterol monooxygenase 2-1. (177 aa)		No hits
5. <i>Arabidopsis thaliana</i> Isoform 5 of Methylsterol monooxygenase 2-1.		No hits
6. <i>Arabidopsis thaliana</i> : Methylsterol monooxygenase 2-2.		No hits
7. <i>Arabidopsis thaliana</i> Isoform 2 of Methylsterol monooxygenase 2-2.		No hits

STE1	LHDIKPLYK	1. <i>Arabidopsis thaliana</i> : Delta(7)-sterol- C5(6)-desaturase 1 (281 aa)		No hits
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		2. <i>Nicotiana tabacum</i> : Delta(7)-sterol-C5(6)-desaturase (271 aa)		No hits
DWF5	FDIKVFTNCRFGM MSWAVLA	1. <i>Arabidopsis thaliana</i> : 7-dehydrocholesterol reductase (432 aa)		1. STEROL_REDUCT_1: PS01017 2. STEROL_REDUCT_2: PS01018 
DWF1	LYWEGKLI	1. <i>Arabidopsis thaliana</i> : Delta(24)-sterol reductase (561 aa)		1. FAD_PCMH :PS51387 
		2. <i>Pisum sativum</i> : Delta(24)-sterol reductase (567 aa)		2. FAD_PCMH 
Sterol c-22 desaturase	HPFGKKLFG	1. <i>Arabidopsis thaliana</i> : Cytochrome P450 710A1	495aa 	1. CYTOCHROME_P450 :PS00086





Supplementary Fig. 1. Protein model construction using PHYRE2

A) 24-Methylene sterol c-methyl transferase (SMT2)

B) 4- α methyl- Δ^7 -sterol-4 α methyl sterol oxidase (SMO2)

C) Δ^7 -sterol-C5(6)-desaturase 1 (STE1)

D) 7-dehydrocholesterol reductase (DWF5)

E) Δ^24 -sterol reductase (DWF1)

F) Cytochrome P450 family 710, subfamily A (Sterol c-22 desaturase)