Table I Arabidopsis RING and modified RING-domain-containing Proteins

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At1g01350[e]	HCa	29.2		
At1g02610	v	24		
At1g02860[c]	HCa	23	No[h]	
At1g03370	HCa	3		3 a.a. between metal ligand 4 and 5
At1g03770	HCa	1		
At1g04360	H2	24		ATL family member
At1g04790	H2	1		
At1g05120	HCa	8.1		
At1g05880	HCb	11.1		ARI12, 9 a.a. between metal ligand 7 and 8
At1g05890[b]	HCb	11.1		ARI5
At1g08050	H2	27.1		
At1g08190	H2	17.2		VSP1 homolog
At1g09060[c]	C2	12		5 a.a. between metal ligand 4 and 5
At1g10650	HCa	1	No[i]	3 a.a. between metal ligand 4 and 5
At1g11020	v	1		
At1g11100[a]	HCb	8.1		
At1g11950	C2	12		5 a.a. between metal ligand 4 and 5
At1g12470	H2	17.1		
At1g12760	H2	24	Yes[i]	
At1g13195	HCa	1		
At1g14200	H2	1		
At1g14260	v	24	Yes[i]	
At1g15100[d]	H2	25	Yes[g]	RHA2a
At1g17970	H2	1		
At1g18470	HCa	24		3 a.a. between metal ligand 4 and 5
At1g18660	HCa	14		
At1g18760[b]	D	1	Yes[i]	
At1g18770[b]	D	1		
At1g18780[b]	D	25	No[i]	
At1g18910[d]	H2	1		
At1g19030[e]	D	1		
At1g19310	HCa	24		
At1g19680	H2	1		
At1g20823	H2	25		
At1g21655	HCa	28.1		
At1g21960[b]	D	1		
At1g22500	H2	24	Yes[g]	ATL5-like
At1g22510	HCa	24		
At1g22670	H2	16		
At1g23980	H2	24		ATL4-like
At1g24440	HCa	1		
At1g24580	H2	1		
At1g26800	H2	25		

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At1g27010	H2	1		
At1g28040	H2	25		
At1g30860	HCa	6		3 a.a. between metal ligand 4 and 5
At1g32340[a]	HCb	11.2		
At1g32360	H2	24		ATL6
At1g32530	HCa	3		3 a.a. between metal ligand 4 and 5
At1g32740	HCa	6		3 a.a. between metal ligand 4 and 5
At1g33480	H2	24		
At1g35330	H2	24		
At1g35625	H2	16		
At1g35630	H2	16		
At1g36950[b]	S/T	1		
At1g45180	H2	1		
At1g45976	HCa	6		3 a.a. between metal ligand 4 and 5
At1g49200	H2	24		
At1g49210	H2	24	Yes[j]	
At1g49220	H2	24		
At1g49230	H2	24		
At1g49850	H2	1		RHY1a
At1g50410[a]	HCb	8.1		
At1g50440	v	1	Yes[h]	
At1g51930	H2	24		
At1g53010	H2	25		
At1g53190	H2	1		
At1g53820	H2	24		
At1g54150	HCa	24		
At1g55255	HCa	6		BRE1-like
At1g55530[c]	H2	6		
At1g57730	H2	1		
At1g57800a/b	HCa	26		
At1g57820a/b	HCa	26		
At1g59560	HCa	24		3 a.a. between metal ligand 4 and 5
At1g60360[c]	H2	1		
At1g60610	HCa	6	No[g]	3 a.a. between metal ligand 4 and 5
At1g61140[a]	HCb	8.1		
At1g61620	HCa	1	No[g]	
At1g62310[c]	C2	12		5 a.a. between metal ligand 4 and 5
At1g62370	HCa	1		
At1g63170	H2	24		
At1g63840	H2	24		BRH1-like
At1g63900	HCa	1	Yes[g]	3 a.a. between metal ligand 4 and 5
At1g65040	H2	24		
At1g65430[a]	HCb	11.1	Yes[f]	ARI8

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At1g66040a/b	HCa	26		
At1g66050a/b	HCa	26		
At1g66610	HCa	21		
At1g66620	HCa	21		
At1g66630[d]	HCa	21		
At1g66650	HCa	21		
At1g67180	HCa	5		
At1g67800	HCa	27.2		
At1g68070	H2	24		
At1g68180	H2	24	Yes[i]	
At1g68820	HCa	24		3 a.a. between metal ligand 4 and 5
At1g69330	HCa	24		
At1g70910	H2	1		
At1g71980	H2	16		
At1g72175	HCa	24		
At1g72200	H2	24		ATL3-like
At1g72220	H2	24		ATL3
At1g72310	H2	24		ATL3-related
At1g73760	H2	1		
At1g73950	HCa	24		3 a.a. between metal ligand 4 and 5
At1g74370	HCa	24	Yes[g]	
At1g74410	H2	24	No[g]	
At1g74620	H2	1		
At1g74760[d]	H2	1	No[h]	
At1g74870[c]	C2	1		
At1g74990	HCa	1		
At1g75400	H2	6		
At1g76410	H2	25		
At1g77770	HCa	29.1		
At1g79110	HCa	6		3 a.a. between metal ligand 4 and 5
At1g79380	HCa	27.2		
At1g79810[d]	HCa	18		TED3
At1g80400	H2	24		
At2g01150[d]	H2	25		RHA2b
At2g01275	v	24		
At2g01735	H2	24		RIE1
At2g02960	v	24		
At2g03000	H2	1		
At2g04240	H2	25		
At2g05170	H2	6		
At2g11348[e]	D	1		
At2g14835	HCa	24		
At2g15260	H2	1		
At2g15530	H2	1		
At2g15580	H2	1	No[g]	
At2g16090[a]	HCb	11.1		ARI12
At2g17450	H2	25		
At2g17730	H2	25		

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At2g18650	H2	24		
At2g18670	H2	24	No[g]	
At2g19610[a]	HCb	11.1		3 a.a. between metal ligand 7 and 8
At2g20030	H2	24		ATL6-like
At2g20650	H2	24		
At2g21380	HCa	13		3 a.a. between metal ligand 4 and 5
At2g21420	HCb	11.1		5 a.a. between metal ligand 7 and 8
At2g21500	H2	1		
At2g22010	HCa	22		
At2g22120	v	24		
At2g22680	H2	27.1	Yes[i]	
At2g22690	S/T	15	No[h]	
At2g23780	HCa	24		
At2g24480	H2	1		
At2g25360[a]	HCb	11.1		ARI2-like
At2g25380	HCa	11.1		
At2g25410	H2	25		
At2g26000	H2	29.4		
At2g26130[a]	HCb	11.1		
At2g26350	HCa	18		PEX10
At2g27940	H2	24		
At2g28530[c]	C2	20	Yes[f]	4 a.a. between metal ligand 4 and 5
At2g28840	HCa	4.1	No[j]	
At2g28920	H2	24		
At2g29840[b]	D	1		
At2g30580	HCa	1		
At2g31510[a]	HCb	11.1		ARI7
At2g31760[a]	HCb	11.1		ARI0
At2g31770[a]	HCb	11.1		ARI9
At2g31780[a]	HCb	11.1		ARI11
At2g32950	HCa	28.1		COP1
At2g34000	D[2]	25	Yes[i]	
At2g34200	v	1		
At2g34920	HCa	1		3 a.a. between metal ligand 4 and 5
At2g34990	H2	24		ATL family member
At2g35000	H2	24	Yes[g]	ATL family member
At2g35330	HCa	3		3 a.a. between metal ligand 4 and 5
At2g35420	H2	25		ATL6-like
At2g35910	H2	24		
At2g37150[b]	HCa	1		
At2g37580	H2	24		ATL family member
At2g37950	v	24		
At2g38190	HCa	1		3 a.a. between metal ligand 4 and 5

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At2g38920	HCa	23		
At2g38970	H2	27.1		
At2g39100	HCa	1		
At2g39720[c]	H2	30		RHC2a
At2g40770	HCa	8.1		
At2g40830	H2	1		RHC1a
At2g41980	HCa	21		
At2g42030	HCa	1		
At2g42160	HCa	29.4		3 a.a. between metal ligand 4 and 5
At2g42350	H2	24		
At2g42360	H2	24	Yes[i]	
At2g44330[c]	H2	1	Yes[i]	
At2g44410	HCa	6		
At2g44580a/b	HCb	2.1		
At2g44950	HCa	3		BRE1 orthologue
At2g45530	v	24		
At2g46160	H2	24		ATL6-like
At2g46495a/b	HCb	2.1		Also containsa transmembran e domain
At2g47090	HCa	29.1		3 a.a. between metal ligand 4 and 5
At2g47560	H2	25		ATL family member
At2g47700	H2	1	Yes[j]	
At3g01650	HCa	27.2		
At3g02290	H2	1		
At3g02340	H2	1		
At3g03550	H2	24		
At3g05200	H2	24	Yes[j]	ATL6 related
At3g05250	HCa	1	Yes[f]	
At3g05545	H2	1	Yes[f]	
At3g05670	HCa	2.1		
At3g05870[c]	H2	1		APC11
At3g06140	HCa	24		3 a.a. between metal ligand 4 and 5
At3g06330[c]	v	24	Yes[h]	
At3g07120	HCa	1		
At3g07200	HCa	1		
At3g07610[c]	C2	12		5 a.a. between metal ligand 4 and 5
At3g08505	HCa	29.2		
At3g09760	v	24	Yes[h]	
At3g09770	HCa	1	Yes[g]	3 a.a. between metal ligand 4 and 5
At3g10810	H2	24		
At3g10910	H2	25		
At3g11110	H2	24		
At3g12920	HCa	1		3 a.a. between metal ligand 4 and 5
At3g13228	D	1		

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At3g13430	H2	1		
At3g14250[a]	HCb	11.1		
At3g14320	H2	25		
At3g14970	H2	1		
At3g15070	H2	1		
At3g15740	H2	1		
At3g16090	H2	24		
At3g16600[a]	HCb	8.1		
At3g16720	H2	24	No[h]	ATL2
At3g18290[c, d]	H2	9		
At3g18773	H2	24		
At3g18930	H2	24		
At3g19140	S/T	24	No[i]	ATL3-like
At3g19910[c]	H2	1		
At3g19950[c]	H2	1		
At3g20010[a]	HCb	8.1		RUSH-1alpha like
At3g23060	HCa	1		
At3g23280[d]	HCa	4.1	Yes[f]	3 a.a. between metal ligand 4 and 5
At3g24800a/b	HCa	2.2		PRT1
At3g25030	HCa	1		
At3g26730	HCa	1		
At3g27330	HCa	1		
At3g27710[a]	HCb	11.1		ARI3
At3g28620	H2	1		
At3g28880	HCa	4.1		3 a.a. between metal ligand 4 and 5
At3g29270	HCa	24	Yes[j]	
At3g30460	H2	1		
At3g30733[e]	HCa	1		
At3g42830[a, c]	H2	1		Rbx1b, Asp a.a. at metal ligand 8
At3g43180[1]	HCb	2		3 a.a. between metal ligand 7 and 8
At3g43430	H2	25		
At3g43750[a]	HCb	11.1		
At3g45470[a]	HCb	11.1		
At3g45480[a]	HCb	11.1		
At3g45510[a]	HCb	11.1		
At3g45540[a]	HCb	11.1		
At3g45555	HCb	11.1	No[i]	
At3g45560[a]	HCb	1		
At3g45570[a]	HCb	11.1		
At3g45580[a]	HCb	11.1		
At3g45630[c]	C2	20		4 a.a. between metal ligand 4 and 5
At3g46620	H2	30		
At3g47160	HCa	1	Yes[f]	
At3g47180	H2	1		
At3g47550	v	1		
At3g47990	H2	24		

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At3g48030	H2	10		
At3g48070[c]	C2	1	Yes[f]	
At3g53410	HCa	1		3 a.a. between metal ligand 4 and 5
At3g53690[a]	HCb	11.1		
At3g54360	HCa	1		
At3g54460[a]	HCb	8.3		
At3g54780	H2	27.1		
At3g55530	H2	24		
At3g56575	H2	1		
At3g58030	HCa	1		
At3g58040	HCa	21		
At3g58720	H2	1		
At3g60080[c]	H2	25		
At3g60220	H2	24	Yes[g]	ATL4
At3g60300	H2	1	No[f]	
At3g61180	H2	24		
At3g61460	H2	24		BRH1
At3g61550	H2	25		
At3g61790	HCa	21		ATL6-like
At3g62240	HCa	29.1		3 a.a. between metal ligand 4 and 5
At3g62690	H2	25		ATL5
At3g62970[c]	H2	1		
At3g63530	H2	1		
At4g00070[c, e]	HCb	1		
At4g00305	H2	1		
At4g00335	H2	1		RHB1a
At4g00990	C2	12		5 a.a. between metal ligand4 and 5metal ligand
At4g01020[a]	HCb	8.2		
At4g01023	HCa	6		
At4g01270	H2	6		
At4g02075	v	24	Yes[h]	
At4g03000	HCa	6		3 a.a. between metal ligand 4 and 5
At4g03510	HCa	24		RMA1
At4g03965[e]	HCa	1		
At4g05350	H2	1		
At4g08460	HCa	1		
At4g08590	HCa	26		
At4g09100	H2	24		
At4g09110	H2	24		ATL6-like
At4g09120	H2	24		ATL6-like
At4g09130	H2	24		ATL6-like
At4g09560	H2	16		
At4g10150	H2	24		
At4g10160	H2	24	Yes[f]	
At4g10940[c]	HCa	1		3 a.a. between metal ligand 4 and 5
At4g11360	H2	1	Yes[g]	RHA1b

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At4g11370	H2	1		RHA1a
At4g11680	H2	24	Yes[h]	
At4g12140	H2	1		
At4g12150[c, e]	H2	1		
At4g12190	H2	1		
At4g12210	H2	1		
At4g13100	HCa	1		
At4g13490	H2	1		
At4g14220	H2	1	Yes[g]	RHF1a
At4g14365	HCa	4.1	No[f]	3 a.a. between metal ligand 4 and 5
At4g15975	H2	24		
At4g17245	H2	24		
At4g17680	HCa	6		3 a.a. between metal ligand 4 and 5
At4g17910	H2	19		
At4g17920	H2	24		ATL6-like
At4g18110	H2	1		
At4g19670[c]	HCb	11.1		ARI-like
At4g19700	HCa	1		3 a.a. between metal ligand 4 and 5
At4g21070	HCa	5	Yes[f]	
At4g22250	HCa	1		
At4g23450	H2	1	Yes[g]	
At4g25230[d]	H2	7		
At4g26400[c]	H2	1		
At4g26580	H2	24		
At4g27470	HCa	24	Yes[g]	
At4g27880	HCa	21		
At4g28270	HCa	24		
At4g28370	H2	24		
At4g28890	H2	24	Yes[g]	
At4g30370	H2	25		
At4g30400	H2	24		
At4g31450	H2	1		
At4g32600	H2	24		
At4g33565	H2	24		
At4g33940	HCa	25		
At4g34040	H2	1		
At4g34100	v	1		
At4g34370[a]	HCb	11.1		ARI1
At4g35070	HCa	1		3 a.a. between metal ligand 4 and 5
At4g35480	H2	24		RHA3b
At4g35840	H2	25		
At4g37880[c]	S/T	15		
At4g37890	H2	27.1		
At4g38140	H2	24		
At4g39050	HCa	13		3 a.a. between metal ligand 4 and 5
At4g39140	H2	1	No[g]	

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At4g40070	H2	24		
At5g01070[e]	v	1		
At5g01160	HCa	29.1		
At5g01450	HCa	24		3 a.a. between metal ligand 4 and 5
At5g01520	HCa	1	No[g]	
At5g01880	H2	25		
At5g01960	HCa	24		
At5g01980	H2	24		
At5g02750	H2	1		
At5g03180	v	24		
At5g03200	HCa	1		3 a.a. between metal ligand 4 and 5
At5g03450	G	6		
At5g05130	HCa	8.1		
At5g05280	H2	24		
At5g05530	H2	1		
At5g05810	H2	24		
At5g05830	v	24		
At5g05910	H2	25		
At5g06420	HCa	29.2		
At5g06490	H2	24		ATL6-like
At5g07040	H2	24		
At5g07225	H2	1		
At5g07270	HCa	4.1	Yes[f]	
At5g07640[a]	HCb	11.1		
At5g08139	H2	1		
At5g08750	v	24		
At5g10370[a]	HCb	8.2		
At5g10380	H2	24		
At5g10650	H2	1		
At5g12310	HCa	1		
At5g13530	HCa	4.2		
At5g14420	HCa	27.2	Yes[j]	
At5g15790[c]	H2	1		
At5g15820	H2	1		
At5g17600	H2	24		
At5g18260	H2	1		
At5g18650	H2	1		
At5g18760	v	24		
At5g19080	HCa	1		3 a.a. between metal ligand 4 and 5
At5g19430	HCa	1		
At5g20570	H2	1		Rbx1a, Asp a.a. at metal ligand 8
At5g20885	H2	24		
At5g20910	H2	6	Yes[g]	ABI3 interacting protein 2
At5g22000	H2	1		RHF2a
At5g22750	HCa	8.1		RAD5
At5g22920	H2	1	No[g]	

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At5g23110[c]	HCa	1		
At5g24870	H2	1		
At5g25560[c]	H2	1		
At5g27420	H2	24		ATL6-like
At5g37200	H2	1		
At5g37230	H2	1		
At5g37250	H2	1		
At5g37270	H2	1	Yes[i]	
At5g37280	H2	1		
At5g37560	HCb	11.1		
At5g37870	HCa	21		
At5g37890	HCa	21		
At5g37910	HCa	21		
At5g37930	HCa	21		
At5g38070[c]	v	24	Yes[h]	
At5g38895	H2	1		
At5g39550a/b	HCa	26		
At5g40250	H2	24		
At5g41350	H2	1		
At5g41400	H2	25		
At5g41430	H2	25		
At5g41440	H2	25		
At5g41450	H2	24		
At5g42200	H2	25	Yes[i]	
At5g42940	H2	1		
At5g43200	H2	1		
At5g43420	H2	25		ATL4-like
At5g43530	HCa	8.1		
At5g44280	HCa	6		
At5g44690	HCa	1		3 a.a. between metal ligand 4 and 5
At5g45100	HCa	6		3 a.a. between metal ligand 4 and 5
At5g45290[c]	H2	1		
At5g46650	H2	24		ATL6-like
At5g47050	HCa	6		3 a.a. between metal ligand 4 and 5
At5g47610	H2	24		
At5g48655	HCa	1		
At5g49665	H2	27.1		
At5g51450[d]	H2	7		
At5g53360	HCa	21		SINAT5
At5g53910[b, d]	D	1	Yes[i]	
At5g54990	H2	1		
At5g55970	H2	24		
At5g56340[c]	H2	1		
At5g57740	HCa	4.1		
At5g57750	H2	24		ATL4-like
At5g57820	H2	1		
At5g58580	H2	25		ATL5-like
At5g58787	HCa	1		
At5g59000	v	24		

Table I continued

AGI Loci	RING Type	Group No.	Activity with UBC8	Comments
At5g59550	H2	30		
At5g60250[a]	HCb	11.1		
At5g60580	v	24		
At5g60710	H2	27.1		
At5g60820	H2	6		
At5g62460	v	24		
At5g62910[c]	C2	1		
At5g63750[a]	HCb	11.1		ARI13
At5g63760[a]	HCb	11.1		ARI15
At5g63780	v	24		
At5g63970[c]	HCa	27.2		
At5g64920	H2	6		CIP8
At5g65683	H2	27.1		
At5g66070	H2	24		
At5g66160	H2	16		
At5g67120	H2	1		

Arabidopsis proteins that contain RING and modified RING domains. AGI (Arabidopsis Genome Initiative) loci/code- unique gene identification number. a/b indicate the presence of two RING domains. RING type – Indicates the type of RING domain found in each protein. The different types of RING domains are illustrated in figure 1A. Group No. – Specifies the group to which each protein belongs as determined by domain organization. See table 2 for description of each group. E3 activity – ***in vitro*** ubiquitin ligase activity of selected proteins was tested using Arabidopsis ***At***UBC8. yes – polyubiquitination; no – no polyubiquitination observed (see figure 4). Abbreviations: a.a. – amino acids; metal ligand – metal ligand [a]Proteins with RING domain previously characterized as incomplete/metal ligand at position 6 or 7 missing or substituted. [b] Previously characterized as incomplete RING/ metal ligand at position 4 or 5 missing or substituted. [c] RING domains previously determined to be false positive due to a difference in ligand spacing. [d] Previously thought not to be a RING domain due to the presence of an aromatic residue two a.a. upstream of metal ligand 7. [e]Please refer to supplemental Table III and V. ORF for each gene was isolated by RT-PCR from RNA isolated from [f]10 day old seedlings, [g] leaf from 2-4 weeks old plants or a [h]mixture of RNA from leaf, seedlings and flowers (from 6-7 week old plants). Otherwise the ORF was isolated from [i]leaf (from 2-4 weeks old plants) DNA or from [j]EST clones obtained from ABRC (Arabidopsis Biological Resource Center).