

Supplementary Information

Genome-Wide Analysis of the Class III Peroxidase Gene Family in *Physcomitrium patens* and a Search for Clues to Ancient Class III Peroxidase Functions

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Table S1 Class III peroxidases with reported *in planta* functions

Table S2 Embryophyte PRXs used to reconstruct the Maximum Likelihood phylogenetic tree:

Gene ID and sequence

(Supplementary tables are presented in separate Excel worksheets.)

Fig. S1 Amino acid sequence alignment of class III peroxidases from *P. patens*

Fig. S2 Expression of *PpPRX7*, *PpPRX9* and *PpPRX32* in different tissues of *P. patens*

Fig. S1 Amino acid sequence alignment of class III peroxidases from *P. patens*

Residues at the heme binding site are highlighted in pink with proximal (*P*) and distal (*D*) residues indicated on the tops of the columns, and Ca²⁺ binding residues (side chains only) are highlighted in yellow. The eight Cys residues (in cyan) that form four disulfide bonds are numbered 1 to 8 on the tops of the columns. Disulfide forming pairs are Cys1 and Cys4, Cys2 and Cys3, Cys5 and Cys8, and Cys6 and Cys7. Exon-intron junctions are highlighted in green. Class III PRX sequences from four algae and two vascular plants are also aligned for comparison. CbraPrx01 from *Chara braunii* S276 (Charophyceae), CatmPrx from *Chlorokybus atmophyticus* CCAC 0220 (Chlorokybophyceae), SsPrx03 from *Spirogyra* sp. (Zygnemataceae), KnitPrx from *Klebsormidium nitens* (Klebsormidiophyceae), HRPC from horseradish (isozyme C1, P00433.2), and PNP from peanut (cationic peroxidase 1, NP_001363143). Algal PRX sequences were obtained from RedOxiBase (<https://peroxibase.toulouse.inra.fr/>) and PhycoCosm (<https://phycocosm.jgi.doe.gov/phycocosm/home>).

PpPRX1	-----MG-----GGPTAM-----LSVLALLVASI-----	19
PpPRX38	-----MR-TTNMAAALTVR-----LPLLCILLMCL-----	23
PpPRX4	-----MG-KWSSKAL-----ATIFVTIAIAM-----	20
PpPRX49	-----MG-RWPSPAL-----LAIFVTIALAM-----	20
PpPRX50	-----MG-RWPSPAL-----LAIFVTIALAM-----	20
PpPRX25	-----MG-RWASTGF-----LAIFITIAIAI-----	20
PpPRX46	-----MA-SAWYVR-----LCVVV-IILSLD-----SFVSA	24
PpPRX6	-----MD-HPHRA-----SLLALLIVVVL-----	18
PpPRX23	-----MA-HHAM-----RATVIAVVLVA-----	17
PpPRX31	-----MA-RILRAS-----CIFALVCVIAI-----	19
PpPRX36	-----MS-----	2
PpPRX5	-----MS-IYQGGL-----VAALLAVAI SL-----	19
PpPRX33	MSEVNPSKRMP-NHRRGL-----ATALLTIAFVF-----	28
PpPRX12	-----MA-AFDPMGASKL-----QVLLMTVAVAM-----	23
PpPRX17	-----MG-AFDPMGPSKM-----QVLLMTVALAM-----	23
PpPRX7	-----ME-MRLHSKK-----RKPAL-----WTVMAMMIAQLI-----	26
PpPRX26	-----ME-SRHNLLQ-----RRPTL-----WTAVVLVILQLA-----	26
PpPRX14	-----ME-RRCKHLH-----WKAFLVT-----TPALLWFAMLL-----	27
PpPRX8	-----ME-SAAGRT-----QRALAVWL VIA-----	19
PpPRX11	-----MA-ISCR-----VWRLLLALCTL-----	17
PpPRX19	-----MA-GYR-----IWQLLFAVWAV-----	16
PpPRX24	-----MG-GLDFSRRSSAAE-----SCFVVVIALSL-----	25
PpPRX35	-----MA-GLRYGRTNRAT-----VAMASLLLAAL-----	24
PpPRX9	-----MA-IYKSHSPQCA-----VWMALTLVTCV-----	23
PpPRX15	-----MH-SGDRMRCLTRC-----SIFKAVAAMML-----	24
PpPRX37	-----MD-ACYSSST-----VVL LLLVLVLS CM-----	20
PpPRX16	-----MK-AMGASGAVM-----AVRVL SVVVLL-----	22
PpPRX48	-----MA-ISRAR-----ARVVVALILV-----	17
PpPRX47	-----MA-SFR-----AGAAVSLCLM-----	15
PpPRX2	-----MS-RSTKIGSDSQAPA-----PWL LT ILI ASS-----	26
PpPRX10	-----MA-EQRLRGG-----AWGVV LLLVRL-----	20
PpPRX18	-----MA-AQRGRGG-----AFH L L L L L VSL-----	20
PpPRX30	-----MA-RIHRDVSVLGSM-----ALVALCLYCGV-----	25
PpPRX3	-----MA-HFQIGEGFKWEAAF-----FCCWVLCWVAV-----	27
PpPRX32	-----MA-HFQIQERFIWGAVL-----CCCFVLCLFSA-----	27
PpPRX13	-----MK-SFLLIGV-----IYGLCALSASAWEC SFNGRRKVLQV	34
PpPRX29	-----MKSSLLLIGV-----ICSL LALSASAECPFSGR RNLLQA	35
PpPRX51	-----MD-----ATFFKLEHLIQP	14
PpPRX28	-----MK-NLGVIGVVYG-----LMALATLQVASAWCPFAGRRSLLQA	37
PpPRX22	-----MA-RIRFQQT-----LIVLLSLAAFF-----	20
PpPRX44	-----MS-----ILQT-----LALLLCLAVSF-----	17
PpPRX20	-----ME-----WGSVLILLLL-----	12
PpPRX21	-----MG-----RLLALELLTAA-----	13
PpPRX43	M-----MG-IWTAF-----KTLAAALLVA-----	19
PpPRX40	-----MA-SWTVT-----LLVGAAVAVVV-----	18
PpPRX42	-----MA-GWTAA-----LLGAAAAGVY MV-----	19
PpPRX34	-----MD-RL-----AALLIALFCLL-----	15
PpPRX39	-----MA-RLGS-----FVAVLVLVCAA-----	17
PpPRX41	-----MR-RDKHLRL-----LVTYIIFLLAAN--SFS--SLLGE	29
ChraPrx01	-----MN-RRVTWRSGLRKALLQLLLTVWWLICLSDL CVVA-----AKE	39
CatmPrx	-----MA-----SAVVVLLLLLS-----	13
SsPrx03	-----MG-SESKPSY-----FLALRTLDTQH-----	20
KnitPrx	-----MA-PPTF-----SWHILLTLLAV-----	17
HRPC	-----MHFSSSSTLF-----TCITLIPLVCL-----	21
PNP	-----MA-----LPISKVDFLIF-----	13

PpPRX1	-----AALSTTVQAQ-LVENFY--	34
PpPRX38	-----ASVTTIQAQ-LSTNFY--	39
PpPRX4	-----NSITPAVAHSG-LKVGFY--	37
PpPRX49	-----NSIIPAAAHTG-LKVGFY--	37
PpPRX50	-----NSITPAAAHTG-LKVGFY--	37
PpPRX25	-----AIVMNLIIIPAGAHKG-LEVGFY--	41
PpPRX46	SKYD-----KVHHNSGTHHVPDGG-LRDNYF--	49
PpPRX6	-----AVSVSSAEGQ-LVYRYY--	34
PpPRX23	-----MLAVTGVDAT-LRYGFY--	33
PpPRX31	-----SLSVNQVDA--LDYNYF--	34
PpPRX36	-----TIPVNTEDGAD-LHYDFF--	19
PpPRX5	-----TCLSSHAEAQG-LAVGYF--	36
PpPRX33	-----VCLSSQAEAQG-LTVGFY--	45
PpPRX12	-----FFLSGEVEANSYN-LRPNYF--	42
PpPRX17	-----FLSGEVEATAYN-LRPHYF--	41
PpPRX7	-----FHPRMCTGGA-LRPGFY--	42
PpPRX26	-----LSCWMCTVDA-LQTGYF--	42
PpPRX14	-----VAMRLSSAEP-LRVGYF--	43
PpPRX8	-----QLLQIVAAQD-LQVDFY--	35
PpPRX11	-----GSVGMEVNAQ-FFNNFY--	34
PpPRX19	-----SGSGVEVSAQ-F-VGYF--	31
PpPRX24	-----LLVTQVRAQN-IGVGFY--	41
PpPRX35	-----VFQGHVQVGG-VAVGFY--	40
PpPRX9	-----GGKILSVAATWDDSH-LTPSFY--	44
PpPRX15	-----VVVVKICAAE-LDVAYF--	40
PpPRX37	-----QLVVQGSLDNQYG-LRKSYY--	39
PpPRX16	-----AVVSTVGAEAVVASGL-LTTDYF--	44
PpPRX48	-----KFVILVNAQV-LTTEFY--	33
PpPRX47	-----TLVTMLSVDA-LTTDFY--	31
PpPRX2	-----IAVQHVVHGA-VQVGFY--	42
PpPRX10	-----MSLLHGTKA-LRVGFY--	35
PpPRX18	-----MCVFHGTQG-LRVGFY--	35
PpPRX30	-----AGAVLNYPG-LRYDFY--	41
PpPRX3	-----SSNAEGRVNASTRPK-LNRLFY--	49
PpPRX32	-----RTEAQIGVATPRIVPK-LNTLFY--	49
PpPRX13	GAPDAAPP-----QQLEAPSPSAPSSPPLPPQSTVATRPTGADVHGEPP-LDYDFY--	84
PpPRX29	GAPGAAPPA-----QGGGAPAPAA-----VGPRPVGKDVGEPALDYDFY--	75
PpPRX51	RHPNRA-----LQLHRHFPHA-----PRGKDVGGGPP-LDYDFY--	47
PpPRX28	AAP-----APLP-----ARPTGPDPSNWTM-LNYDFYTA	65
PpPRX22	-----RVGDAGCPIA-----SLGRSLKQAPVPAQPA-LIFGFY--	53
PpPRX44	-----QPGDARCPLA-----ILGRSLKQADLPPQPP-LQFGFY--	50
PpPRX20	-----SSVILFSEGH-LSSDYF--	28
PpPRX21	-----FLLAAVADAE-LRYGYF--	29
PpPRX43	-----MILKPVVEAQ-LQYGYF--	35
PpPRX40	-----TNLAAVTDAAE-LQYGYF--	34
PpPRX42	-----LFLGTTVHAE-LQYGYF--	35
PpPRX34	-----ATVLKVESEG-LVYDYF--	31
PpPRX39	-----SFVNVADSAG-LVNNFY--	33
PpPRX41	AASE-----KNT-----KKGG-----DQNGDQNVAAPPAQASK-LRYNHY--	64
ChraPrx01	EESEVVHHVITISGKRRASGRLPFSSSS-----SSSSSSKPKYASTAVKGK-IDYSLYLP	93
CatmPrx	-----SFASQAAAAS-LTYKHYLK	31
SsPrx03	-----H-----SKILRNRDTR-LWKNHFVQ	39
KnitPrx	-----SWLNQTVIAISIVSP-LNVTYF--	38
HRPC	-----ILHASLSDAQ-LTPTFY--	37
PNP	-----MCLIGLGSAQ-LSSNFY--	29

	1	D	DD	2	3		
PpPRX1	---R-TSCP--SAETVITS	SAAGVLR	IHFHDC	CFV--	HGCD	78	
PpPRX38	---R-STCK--DAETIIS	AAAGIIR	MLFHD	CFV--	HGCD	82	
PpPRX4	---H-HSCP--EVETIVY	VAPGVL	RMAFH	DCV--	RGCD	80	
PpPRX49	---R-HSCP--QVEAIVY	VAPGIL	RMAFH	DCV--	RGCD	80	
PpPRX50	---R-HSCP--QVEAIVY	VAPGIL	RMAFH	DCV--	RGCD	80	
PpPRX25	---R-NSCP--EVETIVY	VAPGVL	RLAFH	DCV--	RGCD	84	
PpPRX46	---H-RSCP--HVEKII	IAPGIL	RMSFH	DCV--	RGCD	92	
PpPRX6	---K-QSCP--NVEKII	IAPGIL	RLIFH	DCV--	RGCD	77	
PpPRX23	---K-HSCP--NVESII	VAPGVL	RLIFH	DCV--	RGCD	77	
PpPRX31	---R-KSCP--QAESII	VAPGLL	RLIFH	DCV--	RGCD	77	
PpPRX36	---E-HNCP--EVENIV	IAPGVL	RMAYH	DCV--	RGCD	62	
PpPRX5	---T-NSCP--TVETII	TAPGVL	RLAFH	DCV--	RGCD	79	
PpPRX33	---E-NSCP--TVEAII	VAPGVL	RLSFH	DCV--	RGCD	88	
PpPRX12	---S-GKCGKYDVESII	VAPGLV	RMAFH	DCV--	RGCD	87	
PpPRX17	---R-GKCGRHDVEKII	VAPGIV	RLAYH	DYFV--	RGCD	86	
PpPRX7	---A-QTCP--NAENII	TAPGVL	RLHFH	DCV--	DGCD	85	
PpPRX26	---A-ATCP--NAEAI	TAPGVL	RLHFH	DCV--	DGCD	85	
PpPRX14	---D-LSCP--SAERII	IAAGVL	RLHFH	DCV--	EGCD	86	
PpPRX8	---G-GTCP--SAEKIV	NAPGLI	RLHFH	DCV--	RGCD	78	
PpPRX11	---TT-KGCD--SAEAI	VAPALI	RLMLF	HD	CFV--	EGCD	78
PpPRX19	---RT-KDCG--IAEAI	VAPALI	RLLLF	HD	CFV--	EGCD	75
PpPRX24	---D-QSCP--RAESI	VPAALL	RLLLF	HD	CFV--	EGCD	84
PpPRX35	---D-QTCP--QAESI	TPAALL	RLLLF	HD	CFV--	EGCD	83
PpPRX9	---D-NKCP--HLQKV	LPASVL	RLHFH	DCV--	NGCD	87	
PpPRX15	---D-FRCP--DALAI	APASLL	RLHFH	DCV--	NGCD	83	
PpPRX37	---G-VSCP--NAEEI	SAASLV	RLFFH	DCV--	SGCD	82	
PpPRX16	---A-RSCP--RLSSI	MAASLV	RLHFH	DCV--	HGCD	87	
PpPRX48	---D-ESCP--EIYSI	MAASLI	RLHFH	DCV--	NGCD	76	
PpPRX47	---A-KSCP--RIHSI	MAASLI	RLHFH	DCV--	HGCD	74	
PpPRX2	---D-ATCS--AAESI	IAASII	RLHFH	DCFA--	QGCD	85	
PpPRX10	---N-NICP--GTETI	ITPALL	RLFFH	DCV--	TGCD	78	
PpPRX18	---T-NTCP--NAETI	ITPALL	RLFFH	DCV--	VGCD	78	
PpPRX30	---K-NSCP--RADDI	GKNVAP	DLRLH	FHD	CFV--	RGCE	93
PpPRX3	---S-HSCP--RLEHV	SGAPLL	RMFFH	DCAV--	NGCD	92	
PpPRX32	---S-HSCP--GLQQV	SGAPLL	RMFFH	DCAV--	NGCD	92	
PpPRX13	---T-KSCP--SFQQI	TPAKLL	RLFFH	DCV--	MGCD	127	
PpPRX29	---T-TKCP--TFLQI	TPAQLL	RLFFH	DCV--	MGCD	118	
PpPRX51	---T-TMSP--SFQQI	TPAQLL	RLFFH	DCV--	MGCD	90	
PpPRX28	GLPE-NACP--SFQNI	TPAFLL	RLFFH	DCV--	MGCD	111	
PpPRX22	---D-LTCP--TLNSI	TPGKVL	RLFFH	DCFA--	AGCE	96	
PpPRX44	---D-ISCP--SLNAI	TPAKIL	RLFFH	DCFA--	AGCE	93	
PpPRX20	---K-STCP--NVERV	APASLL	RLSFH	DQV--	EKCD	71	
PpPRX21	---DSLGA--GVEDR	SSAAML	RLAFH	DQVGP	GGCD	75	
PpPRX43	---ETLGC--GVENL	ASAAML	RLAFH	DQVGP	GGCD	81	
PpPRX40	---DRVGC--GVENR	ASAAML	RLAFH	DQVGP	GGCD	80	
PpPRX42	---DSLGA--GVEDR	ASAAML	RLAFH	DQVGP	GGCD	81	
PpPRX34	---A-NSCP--NAEKI	IATSLI	RYVFH	DCF--	DSCD	73	
PpPRX39	---R-KSCP--NAEKI	IATSFIR	FGFHD	FFF--	NGAD	75	
PpPRX41	---RTTRCS--KVESV	LIAALL	RLFFH	DCFA--	NKQCD	109	
CbraPrx01	--SD-HDC---LLVAI	LAAAAL	RLGFH	D	CMTKGGCD	137	
CatmPrx	--RQ-HYCP--QFPCI	AAPGLL	RAFFH	DCV--	RGCD	75	
SsPrx03	--DRMKACP--QLENL	VSPAIL	RLFFH	DALV--	NGVD	84	
KnitPrx	---A-TSCP--QVHEV	VAGSVAR	LLFH	DCV--	EGCD	81	
HRPC	---D-NSCP--NVSNI	IAASIL	RLHFH	DCV--	NGCD	80	
PNP	---A-TKCP--NALSTI	MGASLL	RLHFH	DCV--	QGCD	72	

		D	4	5	
PpPRX1	ASVLIDSP----	SEKDAPPNG-SLQ--	GFEVIDAAKTAIEKRC	CPG--IVSCADITAMAS	128
PpPRX38	ASVLIDSP----	SEKDAAPNQ-SLQ--	GFDVIDEAKAAVEAKC	CPG--IVSCSDVLALAA	132
PpPRX4	ASVLE----	GPNTERTALFNR-GLH--	GFEAVDAAKRAVESAC	PG--IVSAADILQFAA	131
PpPRX49	ASVLE----	GPNTERRARTNT-GLH--	GFDAIDAAKRAVENAC	PG--VVSAADVLQFAA	131
PpPRX50	ASVLE----	GPNTERRARTNT-GLH--	GFDAIDAAKRAVENAC	PG--VVSAADVLQFAA	131
PpPRX25	AFVLLD----	GPNTERKSVLNG-GLH--	GYDAVDAAKRATEKAC	PG--IVSAPDVLQFAA	131
PpPRX46	CSLLLK----	GNNTERSSRSNA-NLH--	GFEALNAAKDAVEKAC	PG--VVSCSDVLQYAT	135
PpPRX6	ASVLLA----	GKDTERTSLTNA-NLH--	GFEAIDAIKAAVEKAC	PN--TVSCADILAYAS	128
PpPRX23	ASVLLA----	GNNTERAALNNQ-GLH--	GFEAIDAVKDAVEKEC	PG--VVSCADILAFAS	127
PpPRX31	ASVLLS----	GRRSERASAINA-RLH--	GFQVIDAAKHYLEDAC	PR--TVSCADILAYAS	128
PpPRX36	ASLLE----	GPDSEKSHPINA-PMH--	GFEAIDAAKEEVEKAC	PG--VVSCADVLQFAV	113
PpPRX5	ASVLLD----	GVDSEKAAAVNV-NLH--	GFDAIDAAKTAVEDAC	PG--TVSCADILQYAA	130
PpPRX33	ASVLLD----	GEEAEKTAAINV-NLH--	GFEAIDAAKAAVEAAC	PN--TVSCADILQFAA	139
PpPRX12	ASLLLD----	IPNSEKTATINL-GLRASAFNAIDAAKTAVESV	CPG--VVSCADVLQYAT	140	
PpPRX17	ASLLLD----	TPNSEKTAPINR-GLRAIAFNAIDTAKAAVESV	CPG--VVSCADVLQYAT	139	
PpPRX7	GSVLE----	GPTSEKTAPPNS-SLR--	GFEVIDAAKAELEATC	PG--VVSCADILAYCA	136
PpPRX26	GSVLLD----	GPRSEKTASPNL-TLR--	GFEVIDAAKADLELAC	SG--IVSCADILAYAA	136
PpPRX14	GSVLLD----	NPNSEKTSPPNF-SLR--	GFEVVDAAKADLEALC	PG--VVSCADILAFGA	137
PpPRX8	ASVLLD----	GPKSEKVASPNF-SLR--	GFEVVDAAKAELEKQC	PG--IVSCADILAFAA	129
PpPRX11	GSLLLDPTPQNPNVEKLALPNL-SVR--	GFEVIDAAKMQLKTC	PR--TVSCADIVALAA	133	
PpPRX19	ASILLDPSPENPNVEKRSGPNL-SVR--	GFEVIDAAKTQLEKTC	PL--TVSCADIVALAA	130	
PpPRX24	GSLLLDPSPENPDVEKAASPNL-TVR--	GYDVIDAAKARLEVECP	Q--TVSCADIVALAA	139	
PpPRX35	ASILLDATPQNPNIEKMAAPNL-TVR--	GFEVIDGAKARLEAAC	PG--TVSCADIVALAA	138	
PpPRX9	GSILLDDRP-GFVGEKSAAPNLNSAR--	GFELIDDIKQDVEALC	PD--TVSCADILTIAA	142	
PpPRX15	GSNLLDDRP-GFVGEKTAAPNLNSAR--	GFEIIDEIKQQLEDAC	PK--TVSCADIVAAAA	138	
PpPRX37	GSVLLDNST-TAMSEKEARPNTINTLR--	GFGIERIKESLENAC	SE--TVSCADILALAA	137	
PpPRX16	GSILLDDTA-TFIEGKTAANNNSAR--	GFEVIDGIKAKLEEAC	PK--TVSCADILALAS	142	
PpPRX48	GSLLDDPILGGTEKLSRSLNSTR--	GFEVIDTIKTRLESAC	PN--TVSCADLLAIAA	132	
PpPRX47	GSILLDSIP-GMDSEKFAPPNDRSAR--	GFEAIDAIKVALEKAC	PR--TVSCADILAIAY	129	
PpPRX2	ASIMLT----	GTGERDAPPNL-SVR--	GYGVINDAKAQLESSC	PG--VVSCADIIALAA	136
PpPRX10	ASLLINSTP-TNSAEKDAGANL-TVR--	GFDLIDTAKAAVERVC	PG--MVSCADIIALAT	132	
PpPRX18	ASLLINSTP-KNSAEKDAGANL-TVR--	GYDLIDAAKAAVEKAC	PG--KVSCADIIALAT	132	
PpPRX30	GSVLM-----	KPGSEKTAPPNG-RLE--	GFDVDDIKAALEGECP	PG--TVSCADLLAFAA	144
PpPRX3	ASVLIDSTP-NNTAERDAIPNQ-TVR--	GYHIVDDIKSQVEVMC	PG--IVSCADIIALAS	146	
PpPRX32	GSVLIASPT-NNTAERDAVPNL-TVR--	GYDIVDDIKSQVEAMC	PG--IVSCADIIALAS	146	
PpPRX13	ASLLLNSTV-VNLAERDHANF-TVD--	KYSVIDSIKAELEKAC	QA--IVSCADTLGAAA	181	
PpPRX29	ASLLLKSTK-VNLAERDHPNPF-TVD--	KFTVIDAIKAELEKAC	PG--IVSCADILGAAA	172	
PpPRX51	ASLLLKSTV-LNLAERDHPSNF-TVD--	KFSVIDAIKAELEKAC	PG--IVSCADIVGAAA	144	
PpPRX28	ASVLINSTL-LNLAEKDQTKSF-SLN--	KFNVVDDIKTALEVAC	PG--VVSCADILAAAA	165	
PpPRX22	ASILLNSTA-EFAAEKDAPISV-TLD--	KFQVIEDIKSEVETAC	PG--IVSCADILALAA	150	
PpPRX44	ASILLNSTS-TVLAEKDAPISQ-TLD--	KYDVNIENIKWTVETAC	PG--IVSCADILALAA	147	
PpPRX20	ASILLDSVSNIDINGERESGGNF-GIR--	RLDIIDRVKQDLEKEC	PG--VVSCADIVAMAG	126	
PpPRX21	GSIMME----	GDGEMDAGSNF-GVK--	RLDIINSVKSDMEDMC	PL--TVSCADIIMAG	126
PpPRX43	GSIMVE----	GNGREM DAGGNF-GVK--	RLDIINSVKADLERMC	PM--TVSCADIIMAG	132
PpPRX40	GSIMIE----	GNGGEMSSGNF-GVK--	RLDIINSVKADMEKMC	PT--TVSCADIIMAG	131
PpPRX42	ASIMID----	EDAGEMASGNF-GIK--	RLDIINSVKADMEDNCP	N--TVSCADIIMAG	132
PpPRX34	ASVLLESSK-GVPAEKESHQV-GMR--	NGKWNNIKKAVEDSC	PG--VVSCADVLALGG	127	
PpPRX39	ASFFLLSAP-GKTSEKDSHSMV-GMR--	NEKYVNNIKAEVEKVC	PG--VVSCADILAVGS	129	
PpPRX41	ASLLIKKMPKNEKTELHSGSNV-GIK--	GLAFMDYLTQKVVES	CNGSNIVSCADILALAA	166	
CbraPrx01	ASVLTA-----	GEMAHPINR-RLKV-MVGVINEIQRRAEAC	KV--VPTKADTIAAAV	186	
CatmPrx	ASLLLDPVA-----	-----	G--KVSCADILAQAA	97	
SsPrx03	GSILLNGTG-TNLAEKDNPDVK-HLR--	GFDALERVKATVEAS	CPR--KISCADTLTMT	138	
KnitPrx	ASVLLNSTA-SISGEKDQFQSM-TLA--	GFDVIDDIKAHIETVC	PS--TVSCADIVALAS	135	
HRPC	ASILLDNTP-SFRTEKDQFQSM-SAR--	GFPVIDRMKAAVESAC	PR--TVSCADLLTIAA	135	
PNP	ASVLLDDTS-NFTGEKTAGPNANSIR--	GFEVIDTIKSQVESLC	PG--VVSCADILAVAA	127	

PpPRX1	QIAVKKLSGG--KITWKVP-----LGRRDGLVSS-AADVA-GKLPAPTANVATLKSIFA	178
PpPRX38	QISVRLISDG--TITYPVA-----LGRRDGLVSN-ALLVT-GRLEPPPTASATTLKLLFK	182
PpPRX4	RDSVVLGAG---GYGWRVP-----AGRRDGVSL-AEEATQMNLPAPNATVSQILRMFG	180
PpPRX49	RDAVVLAG---GYGWHVP-----AGRRDGTVSI-MEEA--LNLPAFSMTVSQILIDVFG	178
PpPRX50	RDAVVLAG---GYGWHVP-----AGRRDGTVSI-MEEA--LNLPAFSMTVSQILIDVFG	178
PpPRX25	RDSVILAN-----WRLPMEARARWASRRDDFPFH-GGNGC-EPRPSEHDPVSTR-SKVP	185
PpPRX46	RDVVLGAG---GFGWNVP-----GGRRDGTVSK-VEDVNLTNLPSPRANATNLIQLFE	192
PpPRX6	RDTVRLTG---GSSWKVY-----GGRDGLISN-AVEVA-QNLPPSTAKVPELVATFA	176
PpPRX23	RDVILTK---GVGWEVP-----AGRMDGRISL-STEPL-QELPPSTFTSQQLISIFA	175
PpPRX31	RDAVVLTG---GKGWRVI-----AGRRDGRISN-KIEPE-QNIPTAFASVNELVSTFA	176
PpPRX36	RDVVLITG---GCDWRVL-----AGRRDGLVSN-STEVP-KNILAPDKKVSDDLQAFQ	161
PpPRX5	RDSVLLTG---GEGWDVS-----GGRRDGTSS-SADFP-LELPLQTMTPPELLANFA	178
PpPRX33	RDSVLTG---GEGWDVS-----GGRRDSLVS-YVDPP-LGLPLQTDTVSELLANFA	187
PpPRX12	RDSVLLTK---GKGWTVY-----GGRDGTVSN-AADFP-NNLPVPTMTFTQMIPLFA	188
PpPRX17	RDSVLLIK---GKGWTVY-----GGRDGTVSN-SADFP-INLPVETQTSSQMIPIFV	187
PpPRX7	RDAVIMTG---GLGWPVE-----AGRLDGRSSD-ASRAN-AEIPDPSFNVAQLIDSFA	184
PpPRX26	RDAVVLTG---GLGWAVE-----AGRLDGRVSD-AGRAF-AEIPDPSFSSAQLAAVFA	184
PpPRX14	RDAVELMG---GLGWRVR-----AGRYDGRVSS-AARAL-AEIPDPRTVVEEITALFA	185
PpPRX8	RDSIELTG---GKRWEVP-----AGRRDGNVSI-NAEAE-AMLPSQLNVQQLTDSFT	177
PpPRX11	RDAVLLTG---GQHFDMP-----TGRLDGMVST-ADNAN-NNLVSTRSSATELTRKFL	181
PpPRX19	RDAIVLTG---GRHFEMP-----TGRLDGMVSS-TASAD-ANLVSTESSARELTQKFL	178
PpPRX24	RDSAVLAGLNFQGLPLTMA-----TGRWDGRVSS-RNAAE-AALPSSSKSNVQQLTAQFS	191
PpPRX35	RDGAVLAGLNFEGRLTMA-----TGRWDGRVSS-MSAAA-AALPSSSKSNVQQLTAQFG	190
PpPRX9	RDSVALSG---GPYWEVQ-----LGRRDSLTA-KTDAE-NSIPQPTFTVTQLVASFN	190
PpPRX15	RDAVFLSG---GPFWDVE-----LGRRDALTTS-SQAAV-NSIPSPRFNVQQLIKSFN	186
PpPRX37	RDSVVQTG---GPHYDVL-----LGRRDSIAN-YTGAN-AVLPSKFNVTTLTKKFL	185
PpPRX16	RDSAVEVGL---SERYPVF-----VGRLDLNAS-RDEAN-LRLPSPRANYSELKKNFE	191
PpPRX48	RDSAVQVGL---TDTPVY-----FGRRDSLTA-IDEAN-LRLPTPNSNYSVLKANFE	181
PpPRX47	RDSAVEVGL---VPEYPVP-----FGRRDSLRAAPIAEVN-LRLPGPDFDISTLKASFA	179
PpPRX2	RDSVEILG---GATYGAE-----TGRFDGA---APAAS-VNIPSPNSAVAEATPFFT	181
PpPRX10	RDAVRLSG---GPNFAMP-----TGRRDGRVSR-ADN---VNLPGPTVSVADATRIFN	178
PpPRX18	RDVIALSG---GPKFAMP-----TGRRDGRVSK-ASN---VNLPGPSLSVADATRAFT	178
PpPRX30	RDGVRLTG---GFFYRVF-----AGRRDGYDSI-AAEAT-KNLDPDRMNVDQLTLNFK	192
PpPRX3	RDAVVLGAG---GPTWHVE-----LGRRDGRISR-ADQAG-SQLPSSQSTAESLITQFA	194
PpPRX32	RDAVVQAG---GPTWSVE-----LGRRDGRVSR-ADQAG-SMLPSSQSTAESLIVQFA	194
PpPRX13	AEAVEQAG---GPHVDLA-----YGRRDGLESF-APAAK-TNLPAGTLQVAGLLENFQ	229
PpPRX29	AEAVEQAG---GPHIDLA-----FGRRDGLDSF-ALAAK-TNLPGSTLKVVGLVENFA	220
PpPRX51	VEAVEQAG---GPHIDLA-----YGRRDGLDSF-GQAAK-TNLPGSTLQVEGLRENFA	192
PpPRX28	VECVEQSG---GPHIDLA-----YGRRDGLESF-AAAAA-TYMPGGFLRVQGLIESFQ	213
PpPRX22	AKAVELAG---GPILVTE-----TGRRDGVVSY-LAGAT-ASMPLSTQKIPDLEAMFV	198
PpPRX44	AKSVELAG---GPILQTE-----TGRRDGVVSY-LAGAT-ASMPLSIQKIDDLLAMFV	195
PpPRX20	RDAVSYTG---GPEIPIP-----LGRKDATTAS-SENAD-DQLPPASSTVSTMLQVFS	174
PpPRX21	RDAVAYNG---GPEIQIP-----LGRKDADFSS-ATEAE-AKLPPATSNVDRVLNVFA	174
PpPRX43	RDAVAFSG---GPEIQIP-----LGRKDADFSS-ASEAD-AKLPPSTSSVDITLSVFA	180
PpPRX40	RDAVAFNG---GPDIKIP-----LGRKDAVSSS-ATEAD-AKLPPATSSIDRVFNVFG	179
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PpPRX34	AAGAQLG---GPAIKLK-----TGRKDSRVSL-KSVAD-TGIPTQSNVSFVLDFYS	175
PpPRX39	AAAVQLG---GPYIHVK-----TGRKDTRNSM-KSSAD--TIPRPQDGVTKVLTFYK	176
PpPRX41	RDAYVLASK---RPAYPVL-----LGRLDGMVSL-VKAD--SLPGARTPINTIVSVFK	214
CbraPrx01	IASAEFYGLSC-ARYCPFK-----LGRRDVHPSS-KGDDP-GTLPSTVDSVSIVLEKMG	237
CatmPrx	VEAVHRVG---GPKISLR-----MGRLDGNVSL-ADDVL-RFLPSPFNTDQLIATFE	145
SsPrx03	KFAVIKSG---GPEIDFN-----LGRLDGFSSN-LELAK-LLTPRHFSATALLNIFF	186
KnitPrx	TESIFQSG---GPNISMP-----LGRVDGRVSS-KAAAL-AAMPNVMTMNVTVLNASFA	183
HRPC	QQSVTLGAG---GPSWRVP-----LGRRDSLQAF-LDLAN-ANLPAPFFTLPLKDSFR	183
PNP	RDSVVLAG---GASWNVL-----LGRRDSTAS-LSSAN-SDLPAPFFNLSGLISAFS	175

	P	6	
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PpPRX38	AVGLST-EDMVVLs-GAHSIGKARCSFF	RNRLTT-----PSDANMDPDYAESLKRQ	231
PpPRX4	AKGLSA-SEMVVLs-GAHTIGRAP	CVTF-DDRVQT-----SPVDPTLAPNFAASLKRQ	230
PpPRX49	RKGLSP-SQMVLs-GAHTIGKAP	CVTF-DDRVQT-----TPVDPTLAPSFATFLKGQ	228
PpPRX50	RKGLSP-SQMVLs-GAHTIGKAP	CVTF-DDRVQT-----TPVDPTLAPSFATFLKGQ	228
PpPRX25	GEGLER-SLMVVLs-GFHTIGKAP	CLTF-DDRVQT-----NPVDPTLAPSFASLKKQ	235
PpPRX46	SKGRTL-AQMVLs-GAHTIGKAT	CITF-DNRLHSDIPEP---YADP-YSPSFKLYLKSQ	245
PpPRX6	QKGLTP-QQMVDLS-GSHTLGVTHC	VHL-RDRIFT-----PIDPTMPKSLKQLQRV	225
PpPRX23	GKGLTA-KQMVDLS-GSHTLGITHC	LHL-RDRIFT-----TIDPTIPKNLLRQLQRK	224
PpPRX31	QQGLNT-EDMVVLs-GAHTIGVTHC	NHI-SDRIYN-----PVDKTMPKDLLKSLQKS	225
PpPRX36	KKGFNA-AQMVTLT-GAHTIGRASW	FAF-DVRIHNFSGDQ--SKVDPSLPPLFASILKKK	216
PpPRX5	AKNLNA-AHMVALS-GSHSIGVAHC	QTF-VDRLYNYPNSAT--GSDPSLPADLLEFLKTQ	233
PpPRX33	EKNLNA-AHMVALS-GGHSIGIAHC	QYV-TDRLYDYPSSDT--GSDPTLPSDMQATLKTE	242
PpPRX12	GKGLSA-DDLVALS-GSHTIGIAHC	IFV-NPRIYG-----NNTDPTIPADFLASLKSQ	238
PpPRX17	SKGLSA-DDLVALS-GGHTIGIAHC	TFV-SPRIYG-----NNTDPKIPADFLASLKRQ	237
PpPRX7	RKGLTR-SDMIVLS-GAHTIGRANCK	SV-ATRLYP-----VQDPRLSEPLAAELKSG	233
PpPRX26	RKGLTT-SDMIVLS-GAHSIGRAHC	DVS-KTRLYP-----VQDPNLREPLAAELRSG	233
PpPRX14	RKGLSK-SDMIVLS-GAHTIGRAHC	ASV-TPRLYP-----VQDPQMSQAMAAFLRTA	234
PpPRX8	RKGLSQ-SDMITLS-GAHTIGRIHC	STV-VARLYP-----ETDPSLDEDLAVQLKTL	226
PpPRX11	EQQLGQ-DDMITLS-GAHTVGKTT	CGQI-TSRLYNFP GTT--NGVDPTLDFDYALHLQQL	236
PpPRX19	AQGLGQ-DEMITLS-GAHTIGRTTC	AGV-TPRLYNFP GSP--NGVDPTLDFDYALHLQV	233
PpPRX24	NKGLSQ-DEMVTLS-GAHSIGVAHC	SNF-MDRLYDFPGSP--NGVDPTLDPDYAAELQAK	246
PpPRX35	AKGLSQ-DEMVTLS-GAHTIGKAHC	VNF-MDRLYDFGSA--TGVDPTLDANYAAELQTQ	245
PpPRX9	AVGLNE-KDVVALS-GSHSFGKARCT	SF-QNRLGNQASGSQSPGSDPFLESSYLAKLQTL	247
PpPRX15	AVGLDK-KDVVALS-GSHTIGIARCA	SF-QARLYNQNGSG---RPDSSLEKHYLAELQNR	240
PpPRX37	DVGLTS-EDMVTLS-GAHTIGKTHCT	SI-TTRLYNQSGTT---KPDPAIPAEMLRKLQTK	239
PpPRX16	FQGLNE-VDLIALS-GAHTIGKVRCC	QIV--RLF-----LNDTDTNAEFRSNLAKE	237
PpPRX48	FQGLDE-TDLIALS-GAHTIGRVRC	IVI-TVSNS-----STDPNINAAFRDTLIKA	229
PpPRX47	NQSLDE-RDLVALS-GAHTIGRVRC	QFV--RLF-----LNDPGTNADFKKELARL	225
PpPRX2	NLGLTQ-DDMVNLL-GAHTVGVSQC	QFV-VDRLYNFQGTG---LPDPSLDATYLAVLQSR	235
PpPRX10	AQGLTR-NDMVTLL-GAHSVGIHC	SFF-HERLWNFEGTG---SADPSMDPNLVMRLKAI	232
PpPRX18	AQGMTQ-NDMVTLL-GAHTVGITHC	SFF-DDRLWNFQGTG---RADPSMDANLVKQLKSV	232
PpPRX30	NQGLTR-DEMVLs-GAHTIGDVACH	HI-DNRLYTPGNN---GVVPSLPRAFVKKLKGI	246
PpPRX3	ALGLTP-RDMATLS-GAHTFGRVHC	AQV-ARRFFGFNSTT---GYDPLLSDTYATKLRTM	248
PpPRX32	AMGLTP-RDMATLS-GAHTFGRVHC	AQV-ARRFFGFNSTT---GYDPLLSETYAIKLRS	248
PpPRX13	NVGLNL-TDVVVLs-GGHTIGQARCS	SF-ADRFTP-----GVKNPFPDVSFGENLYTY	279
PpPRX29	NVGLNK-TDMVVLs-GGHTIGQARCS	TF-ADRFAP-----GVKNPFPDTKFGEALQTY	270
PpPRX51	NVGLNL-TDMVVLs-GGHTIGQARCS	SF-ADRFAP-----AAKNPFPDTIFGQELNAY	242
PpPRX28	MAGLDE-VDLVALS-GAHTLGQARCS	EFIERFIS-----PGSNSFRSDYGLALQSY	264
PpPRX22	QAGLDI-NDLVILs-GAHTIGEVHC	SNF-ADRFDP-----AANSPPGDVSFGQELLAF	248
PpPRX44	QAGLDL-TDLVILs-GAHTIGEVHC	TNF-ADRFDP-----AANSPPDPSPFGEQLRAY	245
PpPRX20	RYGMTA-AETVGIL-GAHTLGIGHC	VNV-VDRLYP-----TRDPALSTGLYLQLRVL	223
PpPRX21	PFGMSI-AESVAIL-GAHTLGVGHC	KNI-QDRLQL-----NSPTAPNSVVYRTQLRAA	224
PpPRX43	PFGMSL-AESVASL-GAHTLGGGHC	KNI-QDRLRF-----NSPTAPTSLLYRTQLRAA	230
PpPRX40	AFGMTH-EESVAIL-GAHTIGVGHC	KSI-QDRLQS-----NSPTAPNSLVFRTQLTAA	229
PpPRX42	PFGMT-P-EIVAIL-GAHSIGVGHC	KNI-QDRLQS-----NSPTAPNSLVFRTQLMAA	230
PpPRX34	KMGINT-EETVALL-GAHTIGRAHC	VSF-EERIYP-----TVDPKMDPVFASMLKYR	224
PpPRX39	NIGINP-REAVALM-GAHTIGRAHC	TSF-IERIFP-----KVDPKMDPVFAEKLKRR	225
PpPRX41	DAGFTT-EEAVILs-GAHTIGEAKC	KFF-NDRLHNFLNTK---KPDRTMDPALVEQLKKI	268
CbraPrx01	SLGFSP-KEVALYSLGSHSIGQAS	CFLF-EDRLNKRQCRL---PRDERLDNGRACDLVKV	292
CatmPrx	AVGLGA-DDVVPLs-GGHTFGETHC	VAV-RPRLDA-----PGGDPALTPSHAFLQET	195
SsPrx03	LLGLSQ-VDLVALS-GAHTIGVAHC	ESV-RTRIYP-----TIDTKYEPQFGISVRKS	235
KnitPrx	AVGLTL-GDMVILs-GAHTFGKAHC	SNV-VDRLLP-----VDPTLDPALAQNLTTQ	231
HRPC	NVGLNRSSDLVALS-GGHTFGKNQC	RFI-MDRLYNFSNTG---LPDPTLNTTYLQTLRGL	238
PNP	NKGFTT-KELVTLS-GAHTIGQAQC	TAF-RTRIYN-----ESNIDPTYAKSLQAN	222

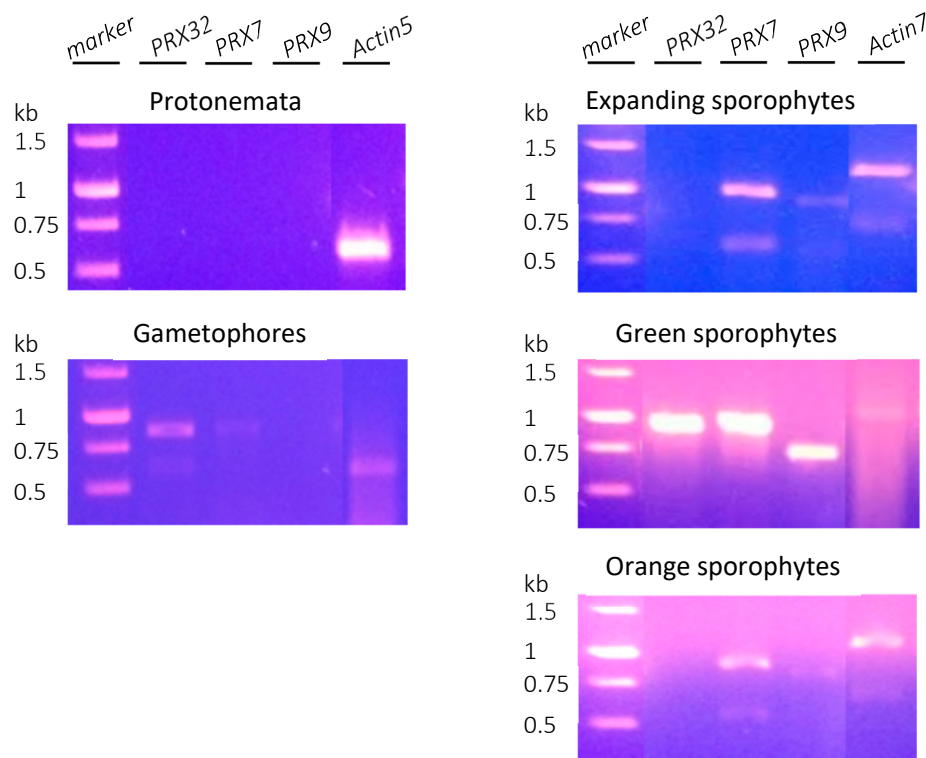
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PpPRX38	CPADKP-----NNLVLDVTTPTNLDS EYKQLQVNGKLLTS	DQNLQSDPET---Q	279	
PpPRX4	CPYPGI-----GSTSVNMDSTTRRFD	SQYKDIIRGRGLLTS	DQGLLYDSRT---K	278
PpPRX49	CPYAAI-----QSTSVMDS-TAHTFD	SQYFKDIIAGRGLLTS	DQSLLYDSRT---S	276
PpPRX50	CPYAAI-----QSTSVMDS-TAHTFD	SQYFKDIIAGRGLLTS	DQSLLYDSRT---S	276
PpPRX25	CLYAQI-----TSTKVALLDSTPRRFD	TQYFKDIIQGRGVLIS	DQELLYDSRT---V	283
PpPRX46	CPNPNM-----FVRVNLDSTPEKFD	GRYFHDLVHHRGLLTS	DQTLMSDSRT---R	292
PpPRX6	CPKITS-----PTPLVIDRLTPHKFD	TQYQNIASGQGLMTS	DQDLFNDST---R	273
PpPRX23	CPSNTS-----LTPLQIDRYTGNKFD	TQYFRNIVRGRGLMTS	DQDLFRDPAT---K	272
PpPRX31	CPKASS-----PTSLVMDRKSVMKFD	TEYFRNIRAGYGLMTS	DQGLYREDFT---R	273
PpPRX36	CPSANL-----TKWVNLEVITPRRFD	TQYKNIHKIGLLTS	DMSMVA DSHT---Q	264
PpPRX5	CPDSAA-----TPEINIDEVSPGTF	DSQYFDNIIRNRGVIAS	DQHLMDHTST---Q	281
PpPRX33	CPNAAA-----TPELNVD E VTPDTF	DSQYFNINIVKGRGLLAS	DQRLMDDKAT---S	290
PpPRX12	CPADSVTTN---PPVGAPINLDRVSPTKFD	SQYFQNIIDRKGLLTS	DQSLLDST---R	292
PpPRX17	CPADSVTTN---PPIGAPIDLVLSPTKFD	SQYFQNIIRKGLLTS	DQSLLDST---R	291
PpPRX7	CPQQGG-----SATFNLDSTPDRFD	NNYANVVNVRGIMNS	DQVLFDDPST---R	280
PpPRX26	CPQQGG-----SATFSLDSTPNQFD	NAYYIDVVNRGIMRS	DQALFDDPST---R	280
PpPRX14	CPQQGG-----SAATFSLDSTTPYRFD	NMYTNLIANRGLLHS	DQALINDMST---R	283
PpPRX8	CPQVGG-----SSSSTFNLDPTPELFD	NMYSNLFSGKGVLSQ	DQILFESWST---K	276
PpPRX11	CPQNGN-----PNDPVPLDPVSPNTFD	NMYTNGVTGRVLFPS	DNVLFADHQT---Q	285
PpPRX19	CPQGGN-----PNSVVQLDPVSPNTFD	NMYTNGVTGRVLFAS	DIALFADHQT---E	282
PpPRX24	CPRGNP-----NPNTVVNDPQTPFVID	NNFYNSNGFAGKVLFS	DMALFNDFET---Q	296
PpPRX35	CPRGNP-----NQNTVVDLPATPFVMD	NNYRNGFAGKVLFGS	DMALFHDFT---Q	295
PpPRX9	CPSNGD-----GNTTVNLDHFTPVHFD	NQYKQLQAAKGLLNS	DAVLHTTNGQ--SN	297
PpPRX15	CPQSGD-----GNQTAFLDPCTPTTFD	NQYKDLQAGRGLLFS	DEVLETTSGT--TL	290
PpPRX37	CPNDPT-----DLKTTLVLDDETPEVFD	NQYFKNLLNKRGIYS	DQILADTEGF--NL	290
PpPRX16	CPAGGD-----DFKLQNLDLKTPKFD	NNYFKNLRRGEGIRS	DQTLWSTPGI--NQ	287
PpPRX48	CDTANG-----TIDPPLQNLDPKTPKFD	NNYFKNLRRGEGVLS	DQTLQSTPGP--NV	281
PpPRX47	CAPTVD-----AFTLQNLDLKTPKFD	NNYFKNLRRGEGIRS	DQVLWSSEGT--HQ	275
PpPRX2	CPNVAG-----DVTTVALDQGSSESD	TGYFTNIQASKGVLRID	DQEIANDAST---S	284
PpPRX10	CPQQGV-----GLGSPVNLDQATPNIMD	NFTFYNQLIARKGILQLD	QRVATDRTT---T	282
PpPRX18	CPQRGV-----GLGRPVNLDQGTPNIVD	KVFYSQLLAKKGILQLD	QRLATDRAT---S	282
PpPRX30	CPRPNL-----FDITVMDQVTPIRFD	SQYKNLASKTSVLSS	DQVLYDDVRT---R	295
PpPRX3	CPQPVD-----GTSRIPT E PITPDQFD	DEHYTAVLQDRGILTS	DSSLLVNAKT---G	297
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PpPRX13	CVEGNT-----IGLDRRMSLDNSTTVFD	NGYFRSLVAGRGILTS	DNILFTDPRT---K	330
PpPRX29	CTDGNT-----AGLDRRMTLDANSTTVFD	NGYFRSIVAGRGILTS	DHVLFTDPST---K	321
PpPRX51	CVEGNT-----LGLDRRMTLDANSTTVFD	NGYFQSIVAGRGILTS	DNVLTDPNRT---K	293
PpPRX28	CAEGKN-----LGLDRKVTLDNSTSTIFD	NGYFQTLVDGRGVLTSD	NDLTLDNRT---A	315
PpPRX22	CTRNGAGDI---ATLNLKTFMDLQTPNSFD	ISYYVNLIIGRGVMTS	DQVLFNDLRT---Q	302
PpPRX44	CTRGGTGDM---ATLNLRTFIDLQSPNSFD	ISYFVNLIIVGRGVMTS	DQALFNDQRT---Q	299
PpPRX20	CPTKEP-----LNLTIPLNDLSVYSFD	NRKYFKDVLGGRGLFRAD	ANLVGDART---K	272
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SsPrx03	CPIVDPSQNPPLLDPNATLKLDQ-TSTVFD	NSYFQGLRSNRGLMTS	DNNLNADPRL---N	291
KnitPrx	CNPRVN-----DPTITVPLDVATNATFD	NQYKQLQGRGVLAS	DEVLAHDNRT---V	281
HRPC	CPLNGN-----LSALVDFDLRTPITFD	NKYVNLEEQKGLIQSD	DQELFSSPNATDTI	290
PNP	CPSVGG-----DTNLSPFVDTTPNKF	DNAYYINLRNKKGLLHS	DQQLFNGVST---D	271

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PpPRX4	RDVHAN----KGSFA-----YRNFAQAMVAMSRIEVLTG---RSGEIRRQ	VGEVNKY---	323
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PpPRX37	DLVNLNLAN---DQNAF-----FDAFVKSMTRMGNISPLMG---TSGEIRKR	CDRVN-----	335
PpPRX16	AIVWDFAR---NQKTF-----FRQFAFSTIKMGNIIRPPAG---TKGEIREN	CRVNSAP--	335
PpPRX48	GIVKDFAK---NKENF-----FTQYGLSSIKMGYIRPLTG---DQGEIRKN	CRVNSAPSS	331
PpPRX47	KITKDFAE---NQENF-----FRQFIESSIKMGKIKPPPG---SPSEIRLN	CHQANPRP--	323
PpPRX2	GRVNTLAA---SPSTF-----GTDFATSMIAMGRIAVL-----TSGSVRSD	CEETA-----	326
PpPRX10	ARVNVLAS---PRSTF-----TAAFAASLIRLGNVRVIEG---SGGEIRKI	CSRIN-----	327
PpPRX18	QRTRTLAG---PTSPF-----TKDFVAAI IKLGNVVKVLEG---TKGEIRKI	CSRIN-----	327
PpPRX30	PLVRVLE---SKLAF-----LSKFGPAMVRMGNI NVLTG---NQGEVRLN	CRKNSPGSA	344
PpPRX3	RYVKEYAQ---NRTVF-----FERFAAAMLKMGRFGVKLG---TEGEIRRV	CSAVN-----	342
PpPRX32	RYVTEYAN---NRSVF-----FERFTAAMLKMGRVGVKLG---SEGEIRRV	CSVVN-----	342
PpPRX13	PLVTQFAE---NQDAF-----FTAFKESMAKMGRIVVLTG---TQQQIRKQ	CWVRNPIDAN	380
PpPRX29	PLVTLFAA---NQDAF-----FAAFKESMAKMGRIGVLTG---TQQQIRKQ	CWVRNPVDIT	371
PpPRX51	SLVTTFAQ---DQTVF-----FDAFKELMAKMGRIGVLTG---TQQQIRKQ	CWVRNPIDPA	343
PpPRX28	PLVQLYAS---DQNAF-----FTAFASMRKMSKIGILT---TQQQVRKK	CYVRNSVDVV	365
PpPRX22	PMVREFAA---NRTL F-----FESFQASMLKMGR LHVLTG---TNGVIRKQ	CGVYP-----	347
PpPRX44	PLVRAFAG---NRTL F-----FESFQASMLKMGR LHVLTG---TSGVIRRQ	CGVYP-----	344
PpPRX20	PLVAKFAS---DQSLF-----FKTFASAYVKLVSAQVLTG---SRGEVRTN	CRVNAQD--	320
PpPRX21	PIVTLYAS---NQGAF-----FSAFQSAYVKLTS-RAMTG---NQGSVRST	CTL-----	314
PpPRX43	PIVSLYAT---NEAAL-----FAAFQSAYVTLTS-RAMTG---TQGSVRST	CHL-----	320
PpPRX40	PIVNTYAA---NKGAF-----FAAFQSAYVKLTS-RALKG---NQGSVRST	CLH-----	319
PpPRX42	PIVNTYAS---NEGAF-----FASFASAYVKLTS-RAVTG---NRGSVRST	COL-----	320
PpPRX34	LFVVEYAK---DNALW-----HKNFATAFTKLSEHNPLTG---TQGEVRKH	CSYTL-----	323
PpPRX39	KYVIEFSQ---NEAAW-----REVFTVAFKKLSEYKVLTG---RQGEIRKR	CMYVN-----	321
PpPRX41	QFVTGLASG---TEENF-----LSKF EKAMAKLGNLGATTN---YKGNIRRV	CSVLN-----	364
CbraPrx01	GVVRQYASGKGRSF-----HGDYLVVLVKSLSIGI-NG---PKSVAPRK	YRLTT-----	385
CatmPrx	DQVLLYAR---DRAAF-----FTNFTPSLRMSKLGVKLG---EEGEIRTN	CRRVN-----	296
SsPrx03	SQVAKFAS---NQSAF-----FNQFRLSMKKLSEINLR-----SVGNVRRK	CYKLN-----	334
KnitPrx	KLVRQMA---NERAF-----FKNFSHAWVRMSMIGVKTG---QEGEIRRN	CGVVNRR---	328
HRPC	PLVRSFAN---STQTF-----FNAFVEAMDRMGNI TPLTG---TQQQIRLN	CRVVNSNSSL	341
PNP	SQVTAYSN---NAATF-----NTDFGNAMIKMGNLSPLTG---TSGQIRTN	CRKTN-----	316

PpPRX1	-----	
PpPRX38	-----	
PpPRX4	-----	
PpPRX49	-----	
PpPRX50	-----	
PpPRX25	-----	
PpPRX46	-----	
PpPRX6	-----	
PpPRX23	-----	
PpPRX31	-----	
PpPRX36	-----	
PpPRX5	-----	
PpPRX33	-----	
PpPRX12	-----	
PpPRX17	-----	
PpPRX7	-----	
PpPRX26	-----	
PpPRX14	-----	
PpPRX8	P---SPL-----	330
PpPRX11	S---TNN-----	342
PpPRX19	T---ANMSRSAHN-----HGA	348
PpPRX24	-----	
PpPRX35	-----	
PpPRX9	-----	
PpPRX15	G-----GT-----	343
PpPRX37	-----L-----	336
PpPRX16	----LVASE-----	339
PpPRX48	----LVAYQ-----	336
PpPRX47	-LIEQVVAVE-----	332
PpPRX2	-----	
PpPRX10	-----	
PpPRX18	-----	
PpPRX30	-----	
PpPRX3	-----	
PpPRX32	-----	
PpPRX13	L---RPEANMDFAPQSTKFCRQKP----CNPTCSDPAS	411
PpPRX29	T---TPDANMDFAPVSSEFCKPAS----CDATCASPTS	402
PpPRX51	T---TPDANMEFAPASLEFCTPNP----CPATCSSNTA	374
PpPRX28	K---SPNSNTEFSPISPTICKPAPQVDQKCDGT-----	395
PpPRX22	-----	
PpPRX44	-----	
PpPRX20	-----	
PpPRX21	-----	
PpPRX43	-----	
PpPRX40	-----	
PpPRX42	-----	
PpPRX34	-----	
PpPRX39	-----	
PpPRX41	-----	
ChraPrx01	-----	
CatmPrx	-----	
SsPrx03	-----	
KnitPrx	-----	
HRPC	H---DMVEVVDFVSSM-----	353
PNP	-----	

Fig. S2 Expression of *PpPRX7*, *PpPRX9* and *PpPRX32* in different tissues of *P. patens*

Expression patterns of selected *PpPRX* genes were studied with RT-PCR. All three *PpPRX* genes were most strongly expressed during the green stage sporophyte development. Expression of the three genes was not detected in protonemata under the conditions employed. The touchdown PCR program began at 95°C for 4 min, followed by five cycles of 94°C for 15 s, 65°C for 30 s and 70°C for 1.5 min. The annealing temperature was 60°C for the next 5 cycles, 55°C for a further 5 cycles and 50°C for the final 23 cycles. *P. patens Actin3* and *Actin5* were used as references. For developmental stages of sporophytes, refer to Daku et al. (2016) *PLoS ONE* 11: e0146817.

**List of RT-PCR primers**

Primer name	Sequence (5' → 3')	Amplicon size (bp)
PpPRX7 RT-F	ATACGGGCGGCTATGGAGTGGGG	856
PpPRX7 RT-R	ACCGAAGCGCAAGATGCCCAAGC	
PpPRX9 RT-F	ATCCATCTTGCTCGACGACAGAC	711
PpPRX9 RT-F	TTAATCGACCCCATCTTGAGCAC	
PpPRX32 RT-F	TGTCCCAACTTGACGGTGCGAGG	825
PpPRX32 RT-F	TCTCGACGGGTGGACAATGCTGTG	
PpActin5-F ^a	CCTTTGGTGTGCGACAATGGAT	570
PpActin5-R	GCGCTCCGTCAGTATCTTCATC	
PpActin7-F ^a	ATGGCTGGAGAGGGTGAGGATGTCC	1,077
PpActin7-R	CCACATCTGCTGGAACGTACTCAGCG	

^a Gene IDs of *P. patens Actin5* and *Actin7* are Phpat.010G066200 and Phpat.003G133100 respectively.