

**Appendix 8.1.** Wound-inducible genes in plants.

Protein	Species	induced by		Comment	Reference
		wound	MeJA		
<b>Wound induction/manitenance</b>					
Prosystemin	<i>Lycopersicon esculentum</i>	Yes	Yes	Sys-	
temically induced	McGurl et al., 1992				
Lipoxygenase	<i>Glycine max</i>	Yes	Yes	Auxin repressible	Mason and Mullet, 1990
	<i>Pisium sativum</i>	Yes		Inducible by water deficit	Staswick et al., 1991
	<i>Triticum avestum</i>	Yes	Yes	Phosphate repressible; accumulates in protein inclusion bodies of plastids	Franceschi and Grimes 1991; Mason et al., 1992 Grimes et al., 1992; Sadka et al., 1994; DeWald et al., 1994; Bohland et al., 1997
AtLox1 (Lipoxygenase)	<i>Arabidopsis thaliana</i>		Yes	Inducible by ABA; inducible by both virulent and anvirulent microorganisms	Melan et al., 1993
AtLox2 (Lipoxygenase)	<i>Arabidopsis thaliana</i>	Yes	Yes	Systemically induced may be in chloroplast inducible by ABA	Bell & Mullet 1993
Allene oxide synthase	<i>Arabidopsis thaliana</i>	Yes	Yes		Herde et al., 1995
phospholipase D	<i>Ricinus communis</i>	Yes			Ryu & Wang, 1996
Leucine aminopeptidase	<i>Lycopersicon esculentum</i>	Yes	Yes	LAP-A found in plastid inducible by ABA	Gu et al., 1996
	<i>Solanum tuberosum</i>				Hildemann et al., 1992
Calmodulin	<i>Brassica napus</i>			Transient induction by touch stimulus	Oh, et al., 1996
Glutathione-S-transferase	<i>Arabidopsis thaliana</i>	Yes			Kim et al., 1994

Wound-inducible Genes

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**Appendix 8.1.** Wound-inducible genes in plants (continued).

Protein	Species	induced by		Comment	Reference
		wound	MeJA		
<b>Cell Wall Proteins</b>					
HGRPs — hydroxyproline 1987	<i>Phaseolus vulgaris</i>	Yes		Multiple forms, some	Lawton and Lamb,
rich glycoproteins — extensins	<i>Araucaria araucana</i>	Yes		induced by Agrobacterium infection or race-specific elicitor induction	Corbin et al., 1987
	<i>Prosopis chilensis</i>	Yes			Cardemil & Riquelme, 1991
Adams	<i>Nicotiana sylvestris</i>	Yes		et al., 1992	Parmentier et al., 1995
	<i>Helianthus annuus</i>	Yes			Sauer et al., 1990;
GRPs — glycine rich proteins	<i>Nicotiana sylvestris</i>	Yes		Multiple forms some systemic, some induced locally by Agrobacterium infection or ABA; some repressed by wounding	Parmentier et al., 1995
	<i>Lycopersicon esculentum</i>	Yes			Showalter et al., 1992
	<i>Petunia hybrida</i>	Yes			Condit et al., 1987
	<i>Phaseolus vulgaris</i>	Yes			Keller et al., 1988
	<i>Daucus carota</i>	Yes			Sturm 1992
Solanaceous Lectins	<i>Solanum tuberosum</i>	Yes		Developmentally expressed and wound- induced in tubers	Casalougué & Pont Lezica, 1985
AGPs — arabinogalactan proteins	<i>Acacia senegal</i>	Yes		arabinogalactan gums are secreted by wounded tissues	Clarke et al., 1979 Fincher et al., 1983
PRPs — proline rich proteins	<i>Glycine max</i>	Yes	Yes	Multiple forms, some developmentally expressed others wound-inducible	Keis-San Francisco and Tierney 1990
	<i>Phaseolus vulgaris</i>	Yes			Creelman et al., 1992
	<i>Daucus carota</i>	Yes			Sheng et al., 1991
	<i>Nicotiana tabacum</i>	Yes			Egbener et al., 1993

				Yasuda et al., 1997
<b>Inhibition of Photosynthetic Translation</b>				
JIP 60	<i>Hordeum vulgare</i>	Yes	Rbosome inactivation protein	Chaudhry et al., 1994
GRP — single stranded nucleic acid binding protein	<i>Daucus carota</i>	Yes		Sturm, 1992
Elongation Factor 1 subunit a	<i>Solanum tuberosum</i>	Yes	Biphasic response	Morelli et al., 1994
Chaperonin 60b	<i>Arabidopsis thaliana</i>	Repressed	RUBISCO binding protein	Zabaleta et al., 1994
<b>Ethylene Regulation</b>				
S-adenosylmethionine synthase	<i>Arabidopsis thaliana</i>	Yes		Kim et al., 1994
ACC synthase	<i>Lycopersicon esculentum</i> <i>Glycine max</i> <i>Cucumis melo</i>	Yes Yes Yes	Also ethylene induced	Liu et al., 1993 Lincoln et al., 1993 Diallinas & Kanellis, 1994
ACC oxidase	<i>Cucumis melo</i>	Yes		Diallinas & Kanellis, 1994
ACO1	<i>Lycopersicon esculentum</i> <i>Vigna radiata</i>	Yes Yes	Repressed	Barry, et al., 1996 Kim and Yang, 1994
TOM13	<i>Lycopersicon esculentum</i>	Yes	Induced by ethylene biosynthesis	Holdsworth et al., 1988
Pch313	<i>Prunus persica</i>	Yes	Induced by ethylene biosynthesis	Callahan et al., 1992

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**Appindix 8.1.** Wound-inducible genes in plants (continued).

Protein	Species	induced by		Comment	Reference
		wound	MeJA		
<i>Sn1 and Sn2</i> (ethylene-related)	<i>Capsicum annum</i>	Yes		<i>Sn1</i> shows developmental expression in fruit; homology with latex proteins	Pozueta-Romero et al., 1995
<b>Secondary Metabolism/Phytoalexin Biosynthesis</b>					
Phynylalanine ammonia lyase	<i>Phaseolus vulgaris</i> <i>Cucumis melo</i>	Yes		Inducible with H <sub>2</sub> O <sub>2</sub> fruit developmental expression	Mehdy, 1994
Cinnamate 4-hydroxylase	<i>Helianthus tuberosus</i> <i>Arabidopsis thaliana</i> <i>Pisum sativum</i>	Yes Yes Yes			Bell-LeLong et al., 1997 Teutsch et al., 1993 Frank et al., 1996
4-Coumarate:CoA ligase	<i>Nicotiana tabacum</i> <i>Petroselinum crispum</i>	Yes	Yes	Constitutively expressed in old stem	Lee & Douglas, 1996 Ellard-Ivey & Douglas, 1996
Chalcone synthase	<i>Phaseolus vulgaris</i> <i>Cucumis melo</i>  <i>Petunia hybrida</i> <i>Picea abies</i>	Yes Yes  Yes		Inducible with H <sub>2</sub> O <sub>2</sub>	Mehdy, 1994 Diallinas & Kanellis, 1994 Vogt et al., 1994 Brignolas et al., 1995
Chalcone isomerase	<i>Phaseolus vulgaris</i> <i>Cucumis melo</i>			Inducible with H <sub>2</sub> O <sub>2</sub>	Mehdy, 1994 Diallinas and Kanellis, 1994
Caffeic acid methyl transferase	<i>Hordeum vulgare</i>	Yes	Yes	Not inducible by ABA	Lee et al., 1996

HMG CoA reductase	<i>Solanum tuberosum</i> <i>Camptotheca acuminata</i>	Yes Yes	Yes inhibited	Different isozymes expressed depending upon signal	Choi et al., 1994 Maldonado-Mendoza et al, 1994; Burnett et al., 1993; Choi et al., 1992
Threonine dehydratase	<i>Solanum tuberosum</i>	Yes	Yes	ABA inducible	Hildmann et al., 1992
polyphenol oxidase	<i>Lycopersicon esculentum</i>	Yes	Yes	Activated by systemin	Constabel et al., 1995
Stilbene synthase	<i>Picea abies</i>	Yes			Brignolas et al., 1995
Myrosinase-binding proteins	<i>Brassica napus</i>	Yes	Yes	Similar to ENOD8 constitutively expressed in seed	Taipalensuu et al., 1996 Taipalensuu et al., 1997
Glutamine synthase	<i>Phaseolus vulgaris</i>	Yes			Daniell, 1992; Watson and Cullimore, 1996
Malic enzyme	<i>Lycopersicon esculentum</i>	Yes		Induced by glutathione and dithiothreitol	Carollo & Adams, 1996
DAHPS	<i>Solanum tuberosum</i>	Yes		First step of aromatic amino acid synthesis may be chloroplast targeted; Mn <sup>+2</sup> isozyme induced; Co <sup>+2</sup> isozyme not induced	Dyer et al., 1989 Keith et al., 1991
3-Deoxy-D-arabino-	<i>Arabidopsis thaliana</i>	Yes			Muday & Herrmann, 1992
2-Oxoglutarate-dependent dioxygenase	<i>Lycopersicon esculentum</i>	Yes		Repressed by auxin repressed by GA3 induced by ABA	Jacobsen & Olszewski, 1996
Bergaptol methyltransferase	<i>Petroselinum crispum</i>	Yes	Yes	Induced by fungal elicitor	Ellard-Ivey & Douglas, 1996

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Glutamate decarboxylase	<i>Glycine max</i>	Yes		Induced by rapid increase in cytosolic Ca <sup>+2</sup>	Wallace et al., 1984 Knight et al., 1991
<b>Proteinaceous Plant Defences</b>					
Proteinase inhibitor I	<i>Lycopersicon esculentum</i>	Yes	Yes	Auxin repressible, sucrose induced	Numerous
	<i>Solanum tuberosum</i>	Yes	Yes	Constitutive expression in tubers; developmentally expressed in fruits of wild species	See text
Proteinase inhibitor II	<i>Lycopersicon esculentum</i>	Yes	Yes	ABA and inducible	Numerous
	<i>Solanum tuberosum</i>	Yes	Yes	Auxin repressible; phosphate repressible; constitutive expression in tubers & flower buds	See text
Trypsin Inhibitor 1966	<i>Salix viminalis</i>	Yes			Saarikoski et al.,
Cathepsin D Inhibitor	<i>Solanum brevidens</i>	Yes	Yes	Inducible by chitinase	Hansen & Hannapel, 1992
	<i>Solanum tuberosum</i>	Yes	Yes	Auxin repressible not sucrose induced constitutive expression in tubers & flower buds	Liu et al., 1997 Ishikawa, et al., 1994
Papain Inhibitor	<i>Lycopersicon esculentum</i>	No	Yes		Bolter, 1993
Bowman Birk Inhibitor	<i>Medicago sativa</i>	Yes			Brown & Ryan, 1984

Maize Proteinase Inhibitor	<i>Zea mays</i>	Yes	Yes	Systemically induced induced by fungal elicitors, ABA	Cordero et al., 1994
Cysteine proteinase inhibitor	<i>Glycine max</i>	Yes	Yes	Both wounding and MJ induction requires ethylene	Botella et al., 1996
Alpha amylase inhibitor	<i>Hordeum vulgare</i>	Yes	Inhibited		Medina et al., 1993
Cysteine Proteinase	<i>Nicotiana tabacum</i>	Yes		mRNA shows a circadian rhythm	Linthorst et al., 1993
Aspartic protease carboxypeptidase	<i>Lycopersicon esculentum</i>	Yes			Schaller & Ryan, 1996
	<i>Lycopersicon esculentum</i>	Yes		Copper ions lowered wound-induction of carboxypeptidase	Mehta et al., 1996
<i>WIP1</i>	<i>Zea mays</i>	Yes			Rohrmeier & Lehle, 1993
<i>win4</i>	<i>Populus sp.</i>	Yes	Yes	Systemic expression after wounding identity with vegetative storage proteins	Davis et al., 1993
<i>SRG</i> 1997 (Stress Response Gene)	<i>Medicago sativa</i>	Yes		Induced by <i>Colletotrichum trifolii</i> elicitor; similar to a variety of stress-induced genes	Truesdell & Dickman,
<i>AoPR1</i>	<i>Asparagus officinalis</i>	Yes			Warner et al., 1992
<i>Wun1</i>	<i>Solanum tuberosum</i>	Yes		Induced by invading nematodes; induced by <i>Phytophthora</i>	Logemann & Schell, 1989; Hansen et al., 1996

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<i>win2</i> (chitin binding protein)	<i>Solanum tuberosum</i>	Yes		Systemic induction required both wounding and ethylene	Stanford et al., 1990 Weiss and Bevan, 1991
Anionic peroxidase (tap1 & tap2)	<i>Lycopersicon esculentum</i>	Yes		Induced by Verticillium elicitor and ABA	Mohan et al., 1993 Diehn et al., 1993 Curtis et al., 1997
	<i>Glycine max</i>	Yes	Yes		
	<i>Stylosanthes humilis</i>	Yes			
Chitinase	<i>Populus sp</i>	Yes		Systemically induced in <i>Populus</i>	Clarke et al., 1994 Grosset et al., 1990
	<i>Nicotiana tabacum</i>	Yes			
-1,3-Glucanase	<i>Nicotiana tabacum</i>	Yes		Not affected by chitosan Accumulates in fruit during ripening induced by powdery mildew	Grosset et al., 1990 Grosset et al., 1990 Lewinsohn et al., 1992
Osmotin	<i>Nicotiana tabacum</i>	Yes			
(-)-Pinene synthase	<i>Abies grandis</i>	Yes			
J1-Defensin	<i>Capsicum annuum</i>	Yes			Meyer et al., 1996
Thionin	<i>Hordeum vulgare</i>	Yes	Yes		Andresen et al., 1992 Bohlmann & Apel, 1991
<b>Storage Proteins</b>					
VSP - vegetative storage protein - (acid phosphatase)	<i>Glycine max</i>	Yes	Yes	Auxin repressible Sucrose induced; phosphate repressible	Numerous See text
	<i>Arabidopsis thaliana</i>	Yes	Yes		
Sporamin	<i>Ipomoea batatas</i>	Yes	No	Inducible by chitosan, sucrose, polygalacturonase, and ABA; repressed by gibberellic acid	Ohto et al., 1992
-amylase	<i>Ipomoea batatas</i>	Yes	No	Sucrose induced	Ohto et al., 1992

class-I patatin	<i>Solanum tuberosum</i>			inducible by Glutamine and sucrose ; phosphate repressible; constitutive expression in tubers	Peña-Cortes et al., 1992
Early Flowering Protein	<i>Asparagus officinalis</i>	Yes		induced by thiocarbamates	Yeo et al., 1996
Bark Storage Protein	<i>Populus deltoides</i>	Yes			Davis et al., 1993
<b>Return to Normal Physiology</b>					
-fructosidase	<i>Arabidopsis thaliana</i>	Yes		Sucrose induced	Sturm and Chrispeels, 1990
	<i>Daucus carota</i>	Yes		Induced by ABA	Kaufman et al., 1973
	<i>Pisum sativum</i>	Yes	Yes		Tymowska-Lalanne et al., 1996; Zhang et al., 1996
<i>STP4</i> — (monosaccharide transporter)	<i>Arabidopsis thaliana</i>	Yes		inducible by chitin and bacterial elicitor	Truernit et al., 1996
<b>Proteins of Unknown Involvement</b>					
37 kD protein	<i>Hordeum vulgare</i>	Yes		Induced by <i>Agrobacterium tumefaciens</i>	Leopold et al., 1996
NT16	<i>Nicotiana tabacum</i>	Yes			Yasuda et al., 1997
Nopaline Synthase	<i>Agrobacterium tumefaciens</i>	Yes	Yes	Auxin repressible; inducible by salicylic acid	Kim et al., 1993
Mannopine Synthase	<i>Agrobacterium tumefaciens</i>	Yes			Guevara-García et al., 1993