Appendix 1 - Prioritised list of endemic and exotic pathogens

Pathogens affecting vegetable crops and known to occur in Australia (endemic).

Those considered high priority due to their wide distribution and/or economic impacts are coded in blue, moderate in green and low in yellow. Where information is lacking on their distribution and/or economic impacts there is no color coding.

Pathogen Group	Pathogen genus	Pathogen species (subspp. etc)	Crops affected	Disease common name	Vector if known
Bacteria	*Acidovorax*	*A. avenae* supbsp. *citrulli*	Cucurbits	Bacterial fruit blotch	
	Agrobacterium	*A. tumefaciens*	Parsnip	Crown gall	
	Erwinia	*E. carotovora*	Asian vegetables, brassicas, cucurbits, lettuce	Soft rot, head rot	
	Pseudomonas	*Pseudomonas* spp.	Asian vegetables, brassicas	Soft rot, head rot	
		Pseudomonas spp.	Basil	Bacterial leaf spot	
		P. cichorii	Brassica, lettuce	Zonate leaf spot (brassica), bacterial rot and varnish spot (lettuce)	
		P. flectens	Bean	Pod twist	
		P. fluorescens	Mushroom	Bacterial blotch, brown blotch	
		P. marginalis	Lettuce, brassicas	Bacterial rot, varnish spot	
		P. syringae pv. *aptata*	Beetroot, silverbeet	Bacterial blight	
		P. syringae pv. *apii*	Celery	Bacterial blight	
		P. syringae pv. *coriandricola*	Coriander, parsley	Bacterial leaf spot	
		P. syringae pv. *lachrymans*	Cucurbits	Angular leaf spot	
		P. syringae pv. *maculicola*	Asian vegetables, brassicas	Bacterial leaf spot, peppery leaf spot	
		P. syringae pv. *phaseolicola*	bean	Halo blight	
		P. syringae pv. *pisi*	Pea	Bacterial blight	
		P. syringae pv. *porri*	Leek, shallot, onion	Bacterial leaf blight	
		P. syringae pv. *syringae*	Bean, brassicas	Bacterial brown spot	
		P. syringae pv. unknown	Rocket	Bacterial blight	
		P. viridiflava	Lettuce, celery, brassicas	Bacterial rot, varnish spot	
	Ralstonia	*R. solanacearum*	Capsicum, tomato, eggplant, brassicas	Bacterial wilt	
	Rhizomonas	*R. suberifaciens*	Lettuce	Corky root rot	

	Xanthomonas	*X. campestris* pv. *aberrans*	brassicas		
		X. campestris pv. *armoraciae*	brassicas		
		X. campestris pv. *campestris*	Asian vegetables, brassicas	Black rot, leaf scald	
		X. campestris pv. *carotae*	Carrot	Bacterial leaf blight	
		X. campestris pv. *cucurbitae*	Cucurbits	Bacterial spot	
		X. campestris pv. *phaseoli*	Bean	Common bacterial blight	
		X. campestris pv. *raphanus*	brassicas		
		X. campestris pv. *zeae*	Sweet corn	Bacterial leaf streak	
		X. euvesicatoria	Capsicum, chilli	Bacterial leaf spot	
Obligate bacteria	*Candidatus Phytoplasma*	*australiense* (subgroup 16SrXII-B)	Capsicum, potato		*Zeoliarus atkinsoni* and *Z. oppositus* (NZ vectors, Australian unknown)
		asteris (AY or subgroup 16SrI)	Wide, alliums, brassicas, carrots, beetroot, asparagus, celery, capsicum, coriander, pumpkin, lettuce, basil, parsley, bean, tomato, eggplant, potato, spinach,	yellow disease	*M. quadrilineatus* (major vector), many other leafhoppers reported
		aurantifolia (subgroup 16SRII)	Tomato, capsicum, lettuce, carrot, bean	Tomato big bud, witches broom	*H. phycitis*
	Candidatus Liberibacter	*brunswickensis*	Unknown hosts – found in the eggplant psyllid		*Acizzia solanicola*
Viruses[1]	*Alfamovirus*	AMV	Wide range, legumes, brassicas, lettuce, capsicum, chilli		aphids
	Carlavirus	CPMMV	Beans		*B .tabaci* biotype B, seed-borne in some legumes
	Caulimovirus	CaMV	Brassicas		Aphids, *M. persicae*
	Closterovirus	BYV	Beetroot, spinach		Aphids
	Crinivirus	BPYV	Cucumber, melons, pumpkin		*Trialeurodes vaporariorum*

					(glasshouse whitefly)
	Cucumovirus	CMV	Wide, capsicum, brassicas		Aphids, seed-borne
	Cytorhabdovirus	BNYV	brassicas		*M. persicae*, *B. brassicae*
		LNYV	Lettuce		Sowthistle aphid
	Fabavirus	BBWV	Brassicas, legumes, Solanaceae		
	Ilarvirus	TSV	Brassicas, Solanaceae		thrips
	Necrovirus	TNV (needs a helper virus?)	Brassica, bean, cucurbits (may be strain specific)		*O. brassicae*
	Ophiovirus	LBVaV	Lettuce		*Olpidium* spp.
		MLBVV			
		RWMV	Capsicum		
	Polerovirus	BWYV	Brassicas, broad bean, pea		*M. persicae*, *S. avenae*
	Potexvirus	PVX	brassicas, Solanaceae		mechanical
	Potyvirus	JGMV	Sweet corn		Aphids
		LMV	Lettuce, mustard		Aphids
		PRSV	Pumpkin, zucchini, cucumber, melons	Mosaic disease	Aphids
		WMV			
		ZYMV			
		TuMV	Brassicas, lettuce		Aphids
	Tobamovirus	CGMMV	Cucumber, melons,		seed-borne
		ToMV	Wide range, tomato, capsicum, chilli		seed-borne
	Tombusvirus	MNSV – restricted to NSW and VIC	Cucumber, melon,		*Olpidium bornovanus*, seed-borne
	Tospovirus	CaCV	Capsicum, chilli, tomato		Western flower thrips (*F. occidentalis)*
		INSV – restricted to NSW	Wide range, lettuce, capsicum, tomato		Western flower thrips (*F. occidentalis)*

		IYSV	Leek, shallot, onion, garlic		Tobacco thrips (*F. fusca*)
		TSWV	Capsicum, chilli, tomato, eggplant, lettuce, endive, radicchio (very wide host range). brassicas		Tomato thrips (*F. schultzei*, major), Western flower thrips (*F. occidentalis*, minor)
	Unassigned	RYEV	radish		Seed borne, pollen and ovule

[1]Virus acronyms: AMV = alfalfa mosaic virus, BNYV = broccoli necrotic yellows virus, BPYV = beet pseudoyellows virus, BBWV = broad bean wilt virus, BWYV = beet western yellows virus, BYV = beet yellows virus, CaCV = capsicum chlorosis virus, CaMV = cauliflower mosaic virus, CGMMV = cucumber green mild mottle mosaic virus, CMV = cucumber mosaic virus, INSV = Impatiens necrotic spot virus, IYSV = Iris yellow spot virus, JGMV = johnson grass mosaic virus, LNYV = lettuce necrotic yellows virus, LBVaV = lettuce big vein associated virus, LMV = lettuce mosaic virus, MLBVV = Mirafiori lettuce big-vein virus, MNSV = melon necrotic spot virus, PRSV = papaya ringspot virus, PVX = potato virus X, RWMV = Ranunculus white mottle virus, RYEV = radish yellow edge virus, TNV = tobacco necrosis virus, TSWV = tomato spotted wilt virus, TSV = tobacco streak virus, TuMV = turnip mosaic virus, WMV = watermelon mosaic virus, ZYMV = zucchini yellow mosaic virus

Pathogens affecting vegetable crops and not known to occur in Australia (exotic).

There are multiple species of viruses and bacteria which affect vegetable crops and are not known to occur in Australia. These are grouped into genera, with some or all species listed where known. Where information is known on potential entry pathways and field spread, the species are given an estimated incursion risk rating based on the likelihood of entry, establishment and spread. Those pathogens chosen for contingency planning within the project are highlighted in blue. Information for the list was obtained from literature searches and cross-checked against the review documents complied by the Department of Agriculture and Water Resources (DAWR) available at: http://www.agriculture.gov.au/biosecurity/risk-analysis/plant. This list will be reviewed regularly and updated as needed.

Pathogen Group	Pathogen genus	Pathogen species (subspp. etc)	Vegetable crops affected	Field transmission	Seed transmission	Vegetative hosts	Testing of imported seed	Incursion risk
Bacteria	*Dickeya*	*D. partenii*	*Apium* spp.				DAWR recommends not required	
	Erwinia	*E. tracheiphila*	Zucchini, cucumbers, squash, pumpkin	*Acalymma vittatum*, *Diabrotica undecimpunctata*			DAWR recommends not required	
	Pantoea	*P. stewartii*	Sweet corn	*Chaetocnema pulicaria*, other beetles, grubs, wireworm, maggots				
	Rhizobium	*R. rhizogenes*	cucumber, tomato, melon, brassicas, carrot	Soil-borne			DAWR recommends not required	Uncertain, reported in 1986 to be here
	Pectobacterium	*P. wasabiae*	Brassicas				DAWR recommends not required	
	Pseudomonas	*P. syringae* pv. *apii*	Celery, parsley	Free-water	Confirmed		DAWR recommends not required	Regional pest in Western Australia
	Xanthomonas	*X. axonopodis* pv. *allii*	Onion, leek, chives, shallot, welsh onion	Free-water	confirmed			Moderate

		X. campestris pv. *coriandri*	Coriander	Free-water	Probable		DAWR recommends not required	
Obligate Bacteria	*Candidatus* Liberibacter	*Ca. L. solanacearum* haplotypes CLsoA and CLsoB (syn *psyllaurous*)	Potato, tomato, capsicum, eggplant, tomatillo	*Bactericera cockerelli*				
		Ca. L. solanacearum haplotypes CLsoC, CLsoD and CLsoE	Carrots, celery, parsley, parsnip	*Trioza apicalis* (carrots), *Bactericera trigonica* (celery)	Confirmed? Contentious		DAWR recommends testing or hot water treatment	
	Candidatus Phytoplasma	*Ca. P. asteris* (subgroup 16SrI, aster yellows group)	Cucurbits, celery, carrots, coriander, dill, chervil, parsnip, brassicas		Very unlikely[2]		DAWR recommends not required	DAWR lists this as exotic?
		Ca. P. pruni (subgroup 16SrIII, X disease group)	Carrots				DAWR recommends not required	
		Ca. P. solani (subgroup 16SrXII-A, Stolbur group)	Carrots, celery, parsley, beetroot, capsicum, bean, tomato, brassicas, eggplant, potato			Strawberry, *Prunus* spp., blackberry, blueberry	DAWR recommends not required	Check if imported vegetative material gets tested.
		Ca. P. trifolii (subgroup 16SrVI-A, Clover proliferation group)	Carrots, beetroot, potato, tomato, pepper, chilli, brassicas	*M. fascifrons,*			DAWR recommends not required	
		Ca. P. ulmi (subgroup 16SrV, Elms yellows group)	Carrots	*Macropsis mendax*, *Philaenus spumarius*, *Allygidius atomarius*		Blackberry, cherry, grapevine, peach	DAWR recommends not required	Check if imported vegetative material gets tested.
Viruses[4]	*Anulavirus*	PZSV	Capsicum, tomato,	Pollen	confirmed			

	Begomovirus	Many	Solanaceae, cucurbits, legumes, Apiaceae, brassicas	*Bemisia tabaci* biotype B	No/poor evidence, very unlikely[2]	Very likely	Not required	High
	Betacarmovirus	TCV	brassicas	*Phyllotreta* spp., *Psylliodes* spp.			DAWR recommends not required	
	Carlavirus	CoLV	brassicas				DAWR recommends not required	
		MYaV	Cucurbits	Probably aphids			DAWR recommends not required	
		MuVNV	Cucurbits, legumes	*M. persicae*			DAWR recommends not required	
	Closterovirus	CYLV	Carrots	*Cavariella* spp.			DAWR recommends not required	
	Comovirus	RaMV	brassicas	*Phyllotreta spp., Epitrix hirtipennis and Diabrotica undecimpunctata*			DAWR recommends not required	
	Crinivirus	BnYDV	Beans, pea, lentil, broad bean	*B. tabaci* biotype Q				Low (vector absent)
		CCYV	Cucurbits, potentially much wider	*B. tabaci* biotypes B and Q				
		CYSDV	Cucumber, zucchini, melon	*B. tabaci* biotypes A, B and Q			DAWR recommends not required	
		LCV	lettuce	*B. tabaci* biotype A and B				
		LIYV	Wide, cucurbits, beetroot, lettuce, carrots,	*B. tabaci* biotype A			DAWR recommends not required	

		PYVV	potato	*T. vaporariorum*				
		SPCSV	sweet potato	*B. tabaci* biotype B, *B. afer*, *T. vaporariorum*				
		TICV	Tomato, lettuce, artichoke, potato	*T. vaporariorum*				
		ToCV	Tomato, capsicum, potato, tomatillo	*B. tabaci* biotype A, B and Q, *T. vaporariorum, T. abutilonea*				
	Cucumovirus	PSV	Bean, pea	*A. craccivora*, *A. spiraecola* and *M. persicae*	seed-borne in peanut			
	Curtovirus	BCTV	Cucurbits, beetroot, beans, celery, spinach, capsicum, tomato, brassicas	Beet leafhopper			DAWR recommends not required	
	Ipomovirus	CVYV	cucurbits	*B. tabaci*			DAWR recommends not required	
	Luteovirus	CeYSV	Celery, parsley				DAWR recommends not required	
	Necrovirus	TNV	Brassicas, solanaceae, cucurbits (may be strain specific)	*O. brassicae*	Confirmed		DAWR recommends not required	Present in QLD and Victoria, contention over presence of brassica strains
	Nepovirus	ArMV	Cucurbits, brassicas	Nematodes, soil-borne	confirmed		DAWR recommends not required	Present in WA only

		AYRSV	Cucurbits, fennel, dill	Nematodes, soil-borne			DAWR recommends not required	
		ChYMV	Parsley	Nematodes, soil-borne	Confirmed in chicory		DAWR recommends not required	
		GCMV	Celery	unknown			DAWR recommends not required	
		MMMV	cucurbits	Nematodes, soil-borne			DAWR recommends not required	
		SLRSV	Celery, parsnip, parsley, asparagus	*Xiphinema diversicaudatum*, *X. coxi*	Confirmed	Strawberries, raspberries, blackberries, black currants, cherries, grapes, plums, peaches	DAWR recommends testing	moderate
		TBRV	Cucurbits, tomato, brassicas, alliums, lettuce, bean, beetroot, celery	*Longidorus attenuatus*, *L. elongatus*, soil-borne	confirmed	*Fragaria*, *Ribes*, *Rubus* spp., *Prunus persica*	DAWR recommends not required	Check if imported vegetative material gets tested.
		ToRSV	Cucumber, tomato	*Xiphinema americanum*, *X. rivesi*		Cherries, grapes, black currants, *Rubus laciniatus*, *Gladiolus* spp., *Hydrangea* spp., raspberries, peach, strawberries, *Perlargonium* spp.	DAWR recommends not required	Check if imported vegetative material gets tested. EPPO lists it present in South Australia

	Ophiovirus	LRNV	lettuce	*O. brassicae*				
	Ourimavirus	OuMV	cucurbits				DAWR recommends not required	
	Polerovirus	CABYV	Cucurbits, lettuce	*A. gossypii, M. persicae*			DAWR recommends not required	Probably here, isolates with close identity detected in WA and NT
		CpCSV	Celery, broad bean, pea	*Aphis craccivora*, *A. pisum*			DAWR recommends not required	
	Potyvirus	Multiple species	Cucurbits, Solanaceae, Apiaceae, Brassicaceae	Aphids			DAWR recommends not required	
	Potexvirus	PaV-5	Parsnips, parsley	mechanical			DAWR recommends not required	
		ParV-3	Parsnips	mechanical			DAWR recommends not required	
	Rhabdovirus/ Nucleorhabdovirus	CFRVV	Coriander, parsnip, celery, carrot, fennel, parsley	*Hyadaphis foeniculi*			DAWR recommends not required	
		CtLV	carrot				DAWR recommends not required	
		EMDV	Eggplant, capsicum, potato, tomato, cucumber	*Anaceratogallia laevis, An. ribauti, Agallia vorobjevi*	No evidence		DAWR recommends not required	low
		PaV	Parsley				DAWR recommends not required	
		PYDV	potato	*Agallia* spp.	No evidence			

	Sequivirus	PYFV	Parsnip, celery, carrot, coriander, dill	*Cavariella aegopodii, C. pastinacea* (helper virus AYV),			DAWR recommends not required	
	Sobemovirus	SMAMV	cucurbits	*Aulacophora foveicollis*, mechanical	Confirmed		DAWR recommends not required (low economic impacts)	
		TRoV	brassicas					
	Tobamovirus	CFMMV	cucurbits	Mechanical, soil-borne	Probable[3]		DAWR recommends not required	
		CuMoV	cucurbits	Mechanical, soil-borne	probable		DAWR recommends not required	
		KGMMV	cucurbits	Mechanical, soil-borne	confirmed		DAWR recommends testing	moderate
		PMMoV	capsicum	Mechanical, soil-borne	confirmed		DAWR recommends not required	moderate
		RMV	brassicas, tomato	Mechanical, soil-borne	No evidence		DAWR recommends not required	
		TVCV	Brassicas	Mechanical, soil-borne			DAWR recommends not required	
		ZGMMV	cucurbits	Mechanical, soil-borne	confirmed		DAWR recommends testing	moderate
	Tombusviridae	CBLV	Cucumber, melons				DAWR recommends not required	
		CLSV	Cucumber	Soil-borne, *O. radicale*	confirmed		DAWR recommends not required	

							(low economic impacts)	
		CuNV	cucumber	Soil-borne, *O. cucurbitacearum*	No evidence		DAWR recommends not required	
		MNSV	Cucumber, melon	Soil-borne, *Olpidium bornovanus*,	confirmed		DAWR recommends testing	Restricted to NSW and VIC
	Tospovirus	BeNMV	beans	unknown	very unlikely[2]			
		GBNV	Tomato, potato, onion, melon, cucumber, bean, pea	*F. occidentalis*, *F. fusca, F. schultzei, T. palmi, T. tabaci, S. dorsali*				
		GRSV	Coriander, tomato, capsicum	*F. gemina*, *F. occidentalis*, *F. schultzei*			DAWR recommends not required	
		GYSV		unknown				
		INSV	Wide range, lettuce, capsicum, tomato	*F. occidentalis*				Restricted to NSW
		MYSV	Cucumbers, melons	*T. palmi*			DAWR recommends not required	
		TCSV	Tomato, capsicum, beans, celery	*F. occidentalis*, *F. schultzei*, *F. intonsa*				
		TNSV[1]	Capsicum, tomato					
		TYRV[1]	Tomato, potato					
		TZSV	Tomato, capsicum, chilli, spinach, parsley	*F. occidentalis*				
		WBNV	cucurbits	*T. flavus*			DAWR recommends not required	
		WSMoV	Melons, gourd	*T. palmi*			DAWR recommends not required	

		ZLCV	Cucumber, zucchini, gourd, gherkin	*F. zucchini*			DAWR recommends not required	
	Tymovirus	MRMV	Cucurbits		confirmed		DAWR recommends not required (low economic impacts)	
	Unassigned	BrCV-1	brassicas		confirmed		DAWR recommends not required (low economic impacts)	
		PaLV	Parsley, spinach	mechanical	confirmed		DAWR recommends not required (low economic impacts)	
		Parsnip leafcurl virus	parsnip				DAWR recommends not required	
		PMV	Parsnip, celery	*C. pastinacae*			DAWR recommends not required	
		RsV-1	radish		confirmed		DAWR recommends not required (low economic impacts)	
		RsV-2	radish					
		RsV-3	radish					
		SaCV-1	White mustard		confirmed		DAWR recommends not required (low	What is the host range in cover

							economic impacts)	crop mustards?

[1]tentative species [2] Viruses in this genus are thought not to be seed-borne, [3] Viruses in this genus are known to be seed-borne, [4]ArMV = Arabis mosaic virus, AYRSV = artichoke yellow ringspot virus, AYV = Anthriscus yellows virus, BBWV = broad bean wilt virus, BCTV = beet curly top virus, BeNMV = bean necrotic mosaic virus, BnYDV = bean yellow disorder virus, BrCV-1 = brassica rapa cryptic virus 1, CABYV = cucurbit aphid-borne yellows virus, CBLV = cucumber bulgarian latent virus, CCYV = cucurbit chlorotic yellows virus, CeYSV = celery yellow spot virus CFMMV = cucumber fruit mottle mosaic virus, CFRVV = coriander feathery red vein virus, CLSV = cucumber leaf spot virus, CoLV = cole latent virus, CtLV = carrot latent virus, CuMoV = cucumber mottle virus, ChYMV = chicory yellow mottle virus, CuNV = cucumber necrosis virus, CVYV = cucumber vein-yellowing virus, CYLV = carrot yellow leaf virus, CYSDV = cucurbit yellow stunting disorder virus, EMDV = eggplant mottled dwarf virus, GBNV = groundnut bud necrosis virus, GCMV = grapevine chrome mosaic virus, GRSV = groundnut ringspot virus, GYSV = groundnut yellow spot virus, INSV = Impatiens necrotic spot virus, KGMMV = kyuri green mottle mosaic virus, LCV = lettuce chlorosis virus, LIYV = lettuce infectious yellows virus, LRNV = lettuce ring necrosis virus, MMMV = melon mild mottle virus, MNSV = melon necrotic spot virus, MRMV = melon rugose mosaic virus, MuVNV = muskmelon vein necrosis virus, MYaV = melon yellowing-associated virus, MYSV = melon yellow spot virus, MWMV = Moroccan watermelon mosaic virus, OuMV = Ourmia melon virus, PaLV = parsley latent virus, Par-3V = parsnip 3 virus, PaV = parsley virus, PaV-5 = parsley virus 5, PMMoV = pepper mild mottle virus, PYDV = potato yellow dwarf virus, PYFV = parsnip yellow fleck virus, PYVV = potato yellow vein virus, PZSP = Pelargonium zonate spot anulavirus, PMV = parsnip mottle virus, PSV = peanut stunt virus, RaMV = radish mosaic virus, RMV = ribgrass mosaic virus, RsV-1, -2 and -3 = Raphanus sativa virus -1, -2 and -3, SaCV-1 = Sinapis alba cryptic virus 1, SMAMV = Snake melon asteroid mosaic virus, SLRSV = Strawberry latent ringspot virus, SPCSV = sweet potato chlorotic stunt virus, TBRV = tomato black ring virus, TCSV = tomato chlorotic spot virus, TCV = turnip crinkle virus, TICV = tomato infectious chlorosis virus, ToRSV = tomato ringspot virus, TNSV = tomato necrotic ringspot virus, TNV = tobacco necrosis virus, ToCV = tomato chlorosis virus, TRoV = turnip rosette virus, TVCV = turnip-vein clearing virus, TYRV = tomato yellow ring virus, TZSV = tomato zonate spot virus, WBNV = watermelon bud necrosis virus, WSMoV = watermelon silver mottle virus ZGMMV = zucchini green mottle mosaic virus, ZLCV = zucchini lethal chlorosis virus, ZYFV = zucchini yellow fleck virus