

Genus: *Potexvirus*

Distinguishing features

Potexviruses have relatively short virions (<700 nm) and their genomes have only five ORFs. Potexviruses infect herbaceous hosts and have no known vectors.

Virion

Morphology

Virions are flexuous filaments, 470–580 nm in length and 13 nm in diameter, with helical symmetry and a pitch of 3.3–3.7 nm (Figure 1.*Potexvirus*). A central axial canal, about 3 nm in diameter can sometimes be discerned. The number of protein subunits per turn of the primary helix is slightly less than 9.0. The RNA backbone is at a radial position of 3.3 nm ([Atabekov et al., 2007](#)).

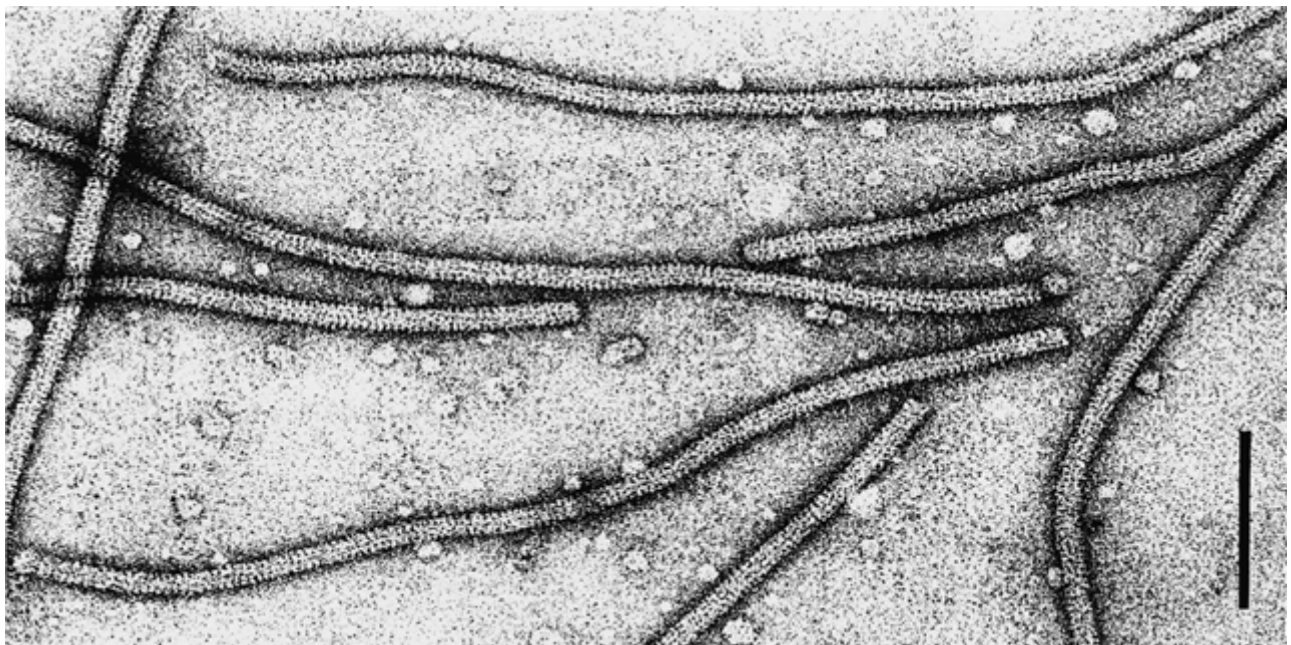


Figure 1.*Potexvirus*. Negative-contrast electron micrograph of particles of an isolate of potato

virus X. The bar represents 100 nm (Courtesy of D.-E. Lesemann).

Physicochemical and physical properties

The potexvirus virion Mr is about. 3.5×10^6 ; $S_{20,w}$ is 115–130S; buoyant density in CsCl is 1.31 g cm^{-3} .

Nucleic acid

Virions of potexviruses contain a single linear molecule of positive-sense RNA of 5.9–7.0 kb, comprising approximately 6% by weight of the virion. The RNA is capped at the 5' -terminus with m^7G and has a polyadenylated tract at the 3'-terminus ([Huisman et al., 1988](#)) (Figure 2.*Potexvirus*).

Proteins

The only structural protein is the 21–27 kDa capsid protein (CP).

Carbohydrates

The capsid protein of some strains of the species *Potato virus X* are reported to be glycosylated ([Baratova et al., 2004](#)).

Genome organization and replication

The genomic RNA of potexviruses, as exemplified by potato virus X (PVX), typically has five ORFs (Figure 2.*Potexvirus*). ORF1, at the 5'-terminus, encodes the replication-associated protein (Rep) and ORF5, located at the 3'-terminus, is the CP gene. Between ORF1 and ORF5 is the triple gene block (TGB) of three overlapping ORFs, the products of which (25, 12 and 8 kDa) are involved in cell-to-cell movement. The 25 kDa protein contains an NTPase-helicase domain, but is not involved in RNA replication. It has been shown to have RNA silencing suppressor activity which is necessary for virus movement. The 12 and 8 kDa proteins contain large blocks of uncharged amino acids and are associated with membrane vesicles derived from the endoplasmic reticulum. The third TGB protein of *Alternanthera mosaic virus* (AltMV) (but not that of PVX) is targeted to the chloroplast and is required for movement from the epidermis to the mesophyll layer. The CP is also involved in cell-to-cell movement. ORFs 2 to 5 are expressed via the production (and subsequent translation) of subgenomic RNAs (sgRNAs). Two or three 3'-co-terminal sgRNAs can be isolated from plants infected with potexviruses (ca. 2.1, 1.2 and 1.0 kb); the double-stranded counterparts of these sgRNAs have also been detected. The medium-sized sgRNA (1.2 kb) is probably functionally bicistronic, its translation yielding the 12 and 8 kDa proteins.

Virions of PVX contain only genomic RNA, but some other potexviruses also encapsidate the sgRNA for the CP. Genomic RNA is translated as a functionally monocistronic message; only the 5'-proximal Rep gene is translated directly by ribosomes, producing the Rep protein (150–181 kDa). The 5'-UTR leader sequence of PVX RNA consists of 83 nt (excluding the cap-structure) and enhances translation.

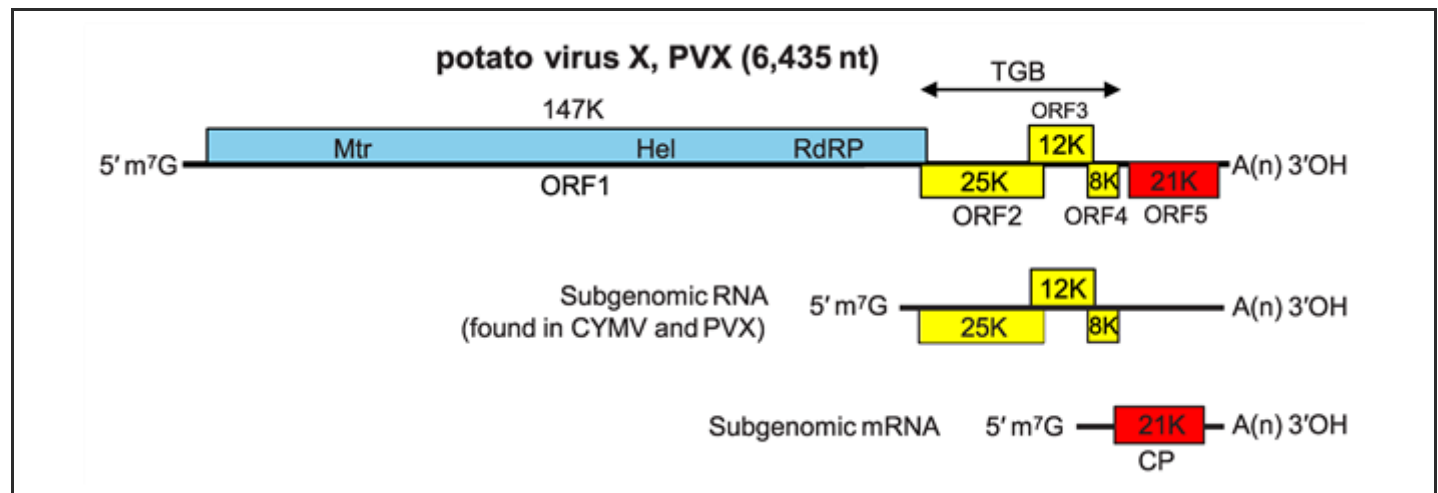


Figure 2. Potexvirus. Potato virus X genome organization and expression. Mtr, methyltransferase; Hel, helicase; RdRP, RNA-directed RNA polymerase; TGB, triple gene block; CP, capsid protein;

Biology

Host range

Some potexviruses are moderately pathogenic, causing mosaic or ringspot symptoms in a wide range of mono- and dicotyledonous plant species, but others cause little damage to infected plants. The host range of individual members is usually limited, although AltMV and Plantago asiatica mosaic virus (PIAMV) infect a number of taxonomically diverse crops.

Transmission

Potexviruses are transmitted in nature by mechanical contact. Potato aucuba mosaic virus (PAMV) can be transmitted by aphids when assisted by a potyvirus that provides a helper protein.

Geographical distribution

As a group, potexviruses occur world-wide. The distribution of some species is very wide but others are apparently more geographically restricted.

Cytopathic effects

The cytoplasm of infected cells contains fibrous, banded or irregular aggregates of virus particles, and often membrane accumulation. There is no cytopathology specific to potexviruses, although some viruses induce unique structures such as the beaded sheets found in cells infected by PVX.

Antigenicity

Virions are highly immunogenic; members of some species are antigenically related, but others are serologically distinct.

Derivation of names

Potex: from *Potato virus X*, the type species of the genus.

Species demarcation criteria

Species are demarcated by:

- Host range: the natural host range is usually particular to different species.
- Members of distinct species fail to cross-protect in infected plants.
- Serology: members of different species (and strains of some members) are readily distinguishable in differential reactions with monoclonal antibodies.
- Sequence: isolates of different species have less than 72% nt identity (or 80% aa identity) between their CP or Rep genes.

Member species

★ Exemplar isolate of the species

Species	Virus name	Isolate	Accession number	RefSeq number	Available sequence	Virus Abbrev.
★ <i>Actinidia virus X</i>	Actinidia virus X	RV-3124	KR872420	NC_028649	Complete genome	AVX
★ <i>Allium virus X</i>	allium virus X	Netherlands	FJ670570	NC_012211	Complete genome	AVX
★ <i>Alstroemeria virus X</i>	alstroemeria virus X	Japan	AB206396	NC_007408	Complete genome	AlsVX
★ <i>Alternanthera mosaic virus</i>	alternanthera mosaic virus	Pennsylvania	AY863024	NC_007731	Complete genome	AltMV
★ <i>Asparagus virus 3</i>	asparagus virus 3	J	AB304848	NC_010416	Complete genome	AV3

	<i>Asparagus virus 3</i>	scallion virus X		AJ316085		Complete genome	SVX
★	<i>Bamboo mosaic virus</i>	bamboo mosaic virus	O	D26017	NC_001642	Complete genome	BaMV
★	<i>Cactus virus X</i>	cactus virus X	Taiwan	AF308158	NC_002815	Complete genome	CVX
★	<i>Cassava common mosaic virus</i>	cassava common mosaic virus	Brazilian	U23414	NC_001658	Complete genome	CsCMV
★	<i>Cassava virus X</i>	cassava virus X	Ven164	KY288487	NC_034375	Complete genome	CsVX
★	<i>Clover yellow mosaic virus</i>	clover yellow mosaic virus	Sit	D29630	NC_001753	Complete genome	CIYMV
★	<i>Cymbidium mosaic virus</i>	cymbidium mosaic virus	Singapore	U62963	NC_001812	Complete genome	CymMV
★	<i>Foxtail mosaic virus</i>	foxtail mosaic virus	Bancroft	M62730	NC_001483	Complete genome	FoMV
★	<i>Hosta virus X</i>	hosta virus X	Kr	AJ620114	NC_011544	Complete genome	HVX
★	<i>Hydrangea ringspot virus</i>	hydrangea ringspot virus	PD 109	AY707100	NC_006943	Complete genome	HdRSV
★	<i>Lagenaria mild mosaic virus</i>	lagenaria mild mosaic virus		AB546335	NC_043079	Partial genome	LMMV
★	<i>Lettuce virus X</i>	lettuce virus X	Karaj	AM745758	NC_010832	Complete genome	LeVX
★	<i>Lily virus X</i>	lily virus X	Netherlands	AJ633822	NC_007192	Complete genome	LVX
★	<i>Malva mosaic virus</i>	malva mosaic virus	Cote	DQ660333	NC_008251	Complete genome	MalMV
★	<i>Mint virus X</i>	mint virus X	NCGR MEN 454	AY789138	NC_006948	Complete genome	MVX
★	<i>Narcissus mosaic virus</i>	narcissus mosaic virus	Zuidema	D13747	NC_001441	Complete genome	NMV
★	<i>Nerine virus X</i>	nerine virus X	J	AB219105	NC_007679	Complete genome	NVX
★	<i>Opuntia virus X</i>	opuntia virus X	CC10	AY366209	NC_006060	Complete genome	OpVX
★	<i>Papaya mosaic virus</i>	papaya mosaic virus	Sit	D13957	NC_001748	Complete genome	PapMV
★	<i>Pepino mosaic virus</i>	pepino mosaic virus	Sp-13	AF484251	NC_004067	Complete genome	PepMV
★	<i>Phaius virus X</i>	phaius virus X	Japan	AB353071	NC_010295	Complete genome	PhVX
★	<i>Pitaya virus X</i>	Pitaya virus X	P37	JF930327	NC_024458	Complete genome	PiVX

★	<i>Plantago asiatica mosaic virus</i>	plantago asiatica mosaic virus	Solovyev	Z21647	NC_003849	Complete genome	PIAMV
★	<i>Plantain virus X</i>	plantain virus X				No entry in Genbank	PIVX
★	<i>Potato aucuba mosaic virus</i>	potato aucuba mosaic virus	Xu	S73580	NC_003632	Complete genome	PAMV
★	<i>Potato virus X</i>	potato virus X	X3	D00344	NC_011620	Complete genome	PVX
★	<i>Schlumbergera virus X</i>	schlumbergera virus X	K11	AY366207	NC_011659	Complete genome	SchVX
★	<i>Strawberry mild yellow edge virus</i>	strawberry mild yellow edge virus	MY-18	D12517	NC_003794	Complete genome	SMYEV
★	<i>Tamus red mosaic virus</i>	tamus red mosaic virus	IT	JN389521	NC_016003	Complete genome	TRMV
★	<i>Tulip virus X</i>	tulip virus X	J	AB066288	NC_004322	Complete genome	TVX
★	<i>Vanilla virus X</i>	Vanilla virus X	CRV2148P OT	MF150240	NC_035205	Complete genome	VaVX
★	<i>White clover mosaic virus</i>	white clover mosaic virus	Forster	X06728	NC_003820	Complete genome	WCIMV
★	<i>Yam virus X</i>	yam virus X	T551	KJ711908	NC_025252	Complete genome	YVX
★	<i>Zygocactus virus X</i>	zygocactus virus X	B1	AY366208	NC_006059	Complete genome	ZyVX

Virus names, the choice of exemplar isolates, and virus abbreviations, are not official ICTV designations.

Related, unclassified viruses

Virus name	Accession number	Virus abbreviation
Babaco mosaic virus	MF978248	
Caladium virus X	AY727533	
Cnidium virus X	LC460456	
Euonymus yellow vein virus	MF078061	
Paris polyphylla virus X	DQ530433	
potexvirus 1 LSD-2014	KJ729597	
potexvirus Opuntia	MH579716	

potexvirus ST4	EU676007	
potexvirus ST5	EU676008	
Senna mosaic virus	KX196173	SenMV
turtle grass virus X	MH077559	
yam potexvirus 1	KJ815100	
yam potexvirus 2	KJ815103	

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