



ICTV Virus Taxonomy Profile: *Avsunviroidae*

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Abstract

Members of the family *Avsunviroidae* have a single-stranded circular RNA genome that adopts a rod-like or branched conformation and can form, in the strands of either polarity, hammerhead ribozymes involved in their replication in plastids through a symmetrical RNA–RNA rolling-circle mechanism. These viroids lack the central conserved region typical of members of the family *Pospiviroidae*. The family *Avsunviroidae* includes three genera, *Avsunviroid*, *Pelamoviroid* and *Elaviroid*, with a total of four species. This is a summary of the ICTV Report on the taxonomy of the family *Avsunviroidae*, which is available at <http://www.ictv.global/report/avsunviroidae>.

Table 1. Characteristics of the family *Avsunviroidae*

Typical member:	avocado sunblotch viroid (J02020), species <i>Avocado sunblotch viroid</i> , genus <i>Avsunviroid</i>
Genome	Single-stranded circular RNA of 246–401 nt that can form hammerhead ribozymes in the strands of either polarity
Replication	A nuclear-encoded plastid RNA polymerase generates complementary oligomeric RNAs that are co-transcriptionally self-cleaved by the hammerhead ribozymes. The resulting monomeric RNAs are circularized by a tRNA ligase
Host range	Plants (dicots)
Taxonomy	Three genera, collectively containing four species

GENOME

Members of the family *Avsunviroidae* have a circular single-stranded RNA genome of 246 to 401 nt, which may assume rod-like, quasi-rod-like or branched conformations *in silico* or *in vitro*, with indirect or direct evidence supporting similar conformations *in vivo* (Table 1, Fig. 1). Viroid G+C content is >50% except for avocado sunblotch viroid (38%). RNAs of (+, arbitrarily the most abundant strand *in vivo*) and (–) polarity can form active hammerhead ribozymes (Fig. 2) that are involved in replication [1, 2].

REPLICATION

Replication takes place in plastids, mostly chloroplasts, through a symmetrical rolling-circle mechanism. A nuclear-

encoded plastid RNA polymerase, conscripted to transcribe RNA templates instead of its physiological DNA template, synthesizes oligomeric viroid RNAs of both polarities. These oligomers are self-cleaved co-transcriptionally by the embedded hammerhead ribozymes, thereby generating linear monomeric RNAs that are subsequently circularized by a tRNA ligase. This enzyme, like the nuclear-encoded plastid RNA polymerase, is encoded in the nucleus and translocated into plastids.

TAXONOMY

The type of hammerhead structure, the genome G+C content and its solubility in 2 M LiCl, together with clustering in phylogenetic trees derived from whole genome sequences, are used as genus demarcation criteria.

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Keywords: *Avsunviroidae*; ICTV; taxonomy; viroid; avocado sunblotch viroid; peach latent mosaic viroid; eggplant latent viroid.

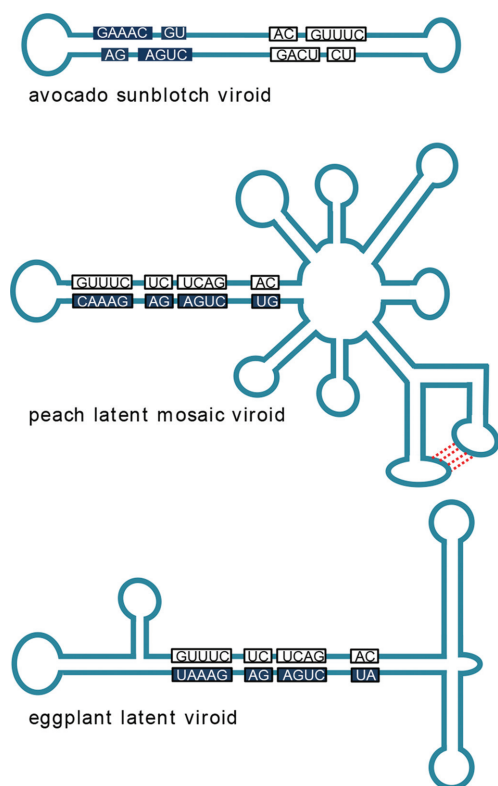


Fig. 1. Proposed secondary structures of representative members of the family *Avsunviroidae*. Conserved nucleotides in the hammerhead catalytic core are boxed with filled and open shadings referring to ribozymes formed in the viroid (+) and (-) strand, respectively.

Avsunviroid

Members of the single species in the genus, *Avocado sunblotch viroid*, have a genome that adopts a rod-like conformation, has G+C content of 38 %, and is soluble in 2 M LiCl (Fig. 1). Hammerhead structures formed by either strand are thermodynamically unstable with a short helix III (Fig. 2); thus double-hammerhead structures may be involved in self-cleavage. Avocado is the only known natural host [3].

Pelamoviroid

Members of the two species included in this genus (*Peach latent mosaic viroid* and *Chrysanthemum chlorotic mottle viroid*) have circular RNA genomes that are insoluble in 2 M LiCl and assume branched conformations stabilized by a kissing-loop interaction in the (+) strand (Fig. 1). Stable single-hammerhead structures (Fig. 2) mediate replication [4, 5]. Host range is restricted to the original hosts and some closely related species.

Elaviroid

Members of the single species in this genus, *Eggplant latent viroid*, have a genome that assumes a quasi rod-like conformation (Fig. 1) and is soluble in 2 M LiCl. Both strands

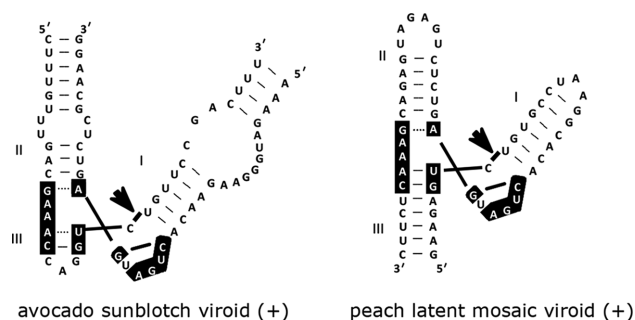


Fig. 2. Hammerhead structures formed by the (+) strand of two viroids. Catalytic cores (black boxes), self-cleavage sites (arrows) and helices (I, II, III) are indicated. Figure modified from [7].

form stable single-hammerhead structures involved in replication. Host range is restricted to several eggplant cultivars [6].

RESOURCES

Full ICTV Online (10th) Report:
www.ictv.global/report/avsunviroidae.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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