



BOOK OF ABSTRACTS

Viroids and Viroid-like RNAs
Bari, 22-24 September 2025

Investigating seed and pollen transmission of hop latent viroid in hops

M. Luigi¹, A. Taglienti¹, T. Ganino², M. Rodolfi², T. Lino², K. Carbone³, F. Faggioli¹, L. Ferretti¹

¹CREA Centro di Ricerca Difesa e Certificazione (CREA-DC), Via C. G. Bertero 22, 00156 Roma, Italy;

²Università di Parma, Dipartimento di Scienze degli Alimenti e del Farmaco, Parco Area delle Scienze 11/A, 43124 Parma, Italy; ³CREA Centro di Ricerca Olivicoltura, Frutticoltura e Agrumicoltura (CREA-OFA), Via di Fioranello 52, 00134 Roma, Italy.

E-mail: marta.luigi@crea.gov.it

Rates of vertical transmission of viroids have always been a controversial topic over the years. Pollen transmission has been described for viroids belonging both to the *Avsuvviroidae* and *Pospiviroidae* family, whereas seeds transmission seems to be strictly linked to the host/viroid combination (Hadidi *et al.*, 2022). Hop latent viroid (HLVd - *Cocadviroid latenshumuli*; genus *Cocadviroid* family *Pospiviroidae*) is a pathogen that mainly infects hop (*Humulus lupulus*) but also hemp plants (*Cannabis sativa*) often without causing visible symptoms — hence the term *latent*. However, it can impact yield and quality, especially in commercial hop production with potential transmission routes that include vegetative propagation, pollen, and possibly seeds. In hemp, female parental plants pollinated with pollen obtained from HLVd-infected male parents were found infected, along with 58% of obtained seedlings, confirming a potential role of pollen in vertical transmission (Atallah *et al.*, 2023). Similar tests on hemp were conducted by Punja *et al.* (2025), showing a transmission rate of 100% either by pollen or seeds. Regarding hops, the study by Matoušek *et al.* (2000) reports a very low or negligible seed transmission rate, to the extent that seed propagation is recommended as a method for 'cleaning up' hop germplasm, given the widespread presence of HLVd in hop orchards. In Italy, the presence of HLVd was ascertained in almost all the cultivated hop plants tested (Gargani *et al.*, 2018) confirming the widespread presence of the viroid. To further investigate the potential seed and pollen transmission of HLVd in hops, female parental plants and pollen used in a controlled crossbreeding program, were molecularly investigated. Specifically, pollen from cv. Chinook was collected, separated from anthers and total RNA (TRNA) was extracted from 200 mg fresh weight. Leaves from female recipient plants cv. Chinook and Comet were collected and analyzed as well. The TRNA from both pollen and leaf tissue was analyzed by a HLVd-specific RT-PCR-based test, which assessed the presence of HLVd in the pollen and in both the female parent plants. Then, 420 F1 hybrid seedlings generated from the female parental plant were sampled, pooled in groups of ten and analyzed. None of the pools tested positive for the presence of HLVd. According to these preliminary results, the transmission of HLVd in hop seems to involve at least only pollen and not seeds. Specific transmission trials involving healthy female plants and HLVd-infected male plants acting as pollen donors, performed under controlled growing conditions, are ongoing in order to better evaluate the role played by pollen in the transmission of HLVd and in its widespread presence in most of the commercial hop orchards in Italy.

This study was carried out in the frame of the project “Luppolo, Orzo, Birra: biodiversità Italiana da valorizzare - LOB.IT” financed by the Italian Ministry of Agriculture (Masaf, D.M. n. 667550, 30.12.2022).

Atallah OO, Yassin SM, Verchot J. New Insights into Hop Latent Viroid Detection, Infectivity, Host Range, and Transmission. *Viruses*. 2023 Dec 23;16(1):30. doi: 10.3390/v16010030. PMID: 38257731; PMCID: PMC10819085.

Gargani, E., Ferretti, L., Faggioli, F., Haegi, A., Luigi, M., Landi, S., Simoni, S., Benvenuti, C., Guidi, S., Simoncini, S., D'Errico, G., Amoriello, T., Ciccoritti, R., Roversi, P.F. and Carbone, K. (2017) 'A survey on pests and diseases of Italian Hop crops', *Italus Hortus*, 24(2), pp. 1-17. doi: 10.26353/j.itahort/2017.2.117.

Hadidi, A., Sun, L., Randles, J.W. 2022. Modes of Viroid Transmission. *Cells* 2022, 11, 719. <https://doi.org/10.3390/cells1104071>

Punja, Z.K.; Scott, C.; Tso, H.H.; Munz, J.; Buirs, L. Transmission, Spread, Longevity and Management of Hop Latent Viroid, a Widespread and Destructive Pathogen Affecting Cannabis (*Cannabis sativa* L.) Plants in North America. *Plants* 2025, 14, 830. <https://doi.org/10.3390/plants14050830>.