

California Pest Rating Proposal for

Lettuce mosaic potyvirus

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Viruses and viroids, Category: Riboviria,
Category: Orthornavirae, Phylum: Pisuviricota,
Class: Stelpaviricetes, Order: Patatavirales,
Family: Potyviridae

Comment Period: 11/16/2023 through 12/31/2023

Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from Lettuce mosaic virus is described herein and a permanent rating is proposed.

History & Status:

Background:

California is the number one producer of lettuce in the nation with 76% of all U.S. receipts. Lettuce is grown on nearly 200,000 acres in California with a 2022 value of \$2B. Production is split between head, leaf, and Romaine lettuce types. Over 50% of California lettuce is produced in Monterey County, mostly in the Salinas Valley. The climate and soils are ideal for growing high-quality lettuce, and it has one of the longest growing seasons, allowing harvesting from April to November. In the winter, production shifts to the desert, mainly in Imperial County. Other important lettuce-producing counties are Santa Barbara, San Benito, and Fresno (Geisseler and Horvath, 2014, updated 2016; CDFA Ag Statistics https://www.cdfa.ca.gov/Statistics/PDFs/2022_Ag_Stats_Review.pdf).

Lettuce mosaic virus (LMV) is in the genus *Potyvirus*, a large and economically important group of plant-infecting viruses in the family Potyviridae. The genus is named after the type species, Potato virus Y. The genome is a monopartite single-stranded positive-sense RNA. The virions are filamentous, flexuous particles and they induce cylindrical pinwheel inclusions in the cytoplasm of plant cells. As is

typical for potyviruses, LMV is transmitted by aphids in a nonpersistent manner (Grogan et al., 1952). It is serologically related to Bean yellow mosaic, Clover yellow vein, Potato virus Y, and Tobacco etch viruses (Brunt et al., 1996).

Lettuce mosaic disease was first described in Florida (Jagger, 1921). It is now distributed worldwide, probably because it is seed-borne, and seeds have been exchanged internationally. Lettuce mosaic virus (LMV) is a major pathogen of lettuce and severe losses are recorded mainly in field crops, but the disease may be significant for lettuce in all stages of growth, including seedlings grown in greenhouses. (Dinant and Lot, 1992).

Hosts: The natural host range of LMV includes at least 26 species in 23 genera from nine families (11 genera of the family Asteraceae). A partial list of potential host reservoirs of Lettuce mosaic virus in California has been compiled. Agronomic Plants: *Carthamus tinctorius* (safflower), *Cicer arietinum* (chickpea, garbanzo bean), *Cichorium endivia* (endive/escarole), *C. intybus* (witloof chicory), *Lactuca sativa* (lettuce), *Pisum sativum* (pea), *Spinacia oleracea* (spinach), *Tetragonia expansa* (New Zealand spinach). Weeds and Other Non-agronomic Plants: *Anagallis arvensis* (scarlet pimpernel), *Capsella bursa-pastoris* (shepherd's-purse), *Carduus broteroi*, *Carduus pycnocephalus* (Italian thistle), *Chenopodium album* (lambs quarters), *C. amaranticolor*, *C. ambrosioides* (Mexican tea), *C. capitatum* (strawberry blite), *C. murale* (nettleleaf goosefoot), *C. quinoa*, *C. urbicum* (city goosefoot), *Cichorium intybus* (chicory), *Cicer yamashitae*, *Cirsium vulgare* (bull thistle), *Erodium cicutarium* (redstem filaree), *Lactuca livida*, *L. saligna* (willowleaf lettuce), *L. serriola* (prickly lettuce), *L. virosa*, *Lamium amplexicaule* (henbit), *Malva parviflora* (little mallow), *Medicago polymorpha* (burclover), *Nicotiana benthamiana*, *N. clevelandii*, *Picris echioides* (bristly oxtongue), *Rumex britannica* (= *R. orbiculatus*), *Senecio vulgaris* (common groundsel), *Silybum marianum* (milkthistle), *Sonchus asper* (spiny sowthistle), *Stellaria media* (common chickweed), *Urospermum picroides*. Ornamental Plants: *Amaranthus caudatus* (love-lies-bleeding), *Aster* spp. (aster), *Callistephus chinensis* (China aster), *Chrysanthemum maximum* (Shasta daisy), *Eustoma grandiflorum* (lisianthus), *Gazania* spp. (gazania), *Gomphrena globosa* (globe amaranth), *Lathyrus odoratus* (sweet pea), *Osteospermum fruticosum* (trailing African daisy), *Senecio cruentus* (cineraria), *Tagetes erecta* (African marigold), *Zinnia elegans* (zinnia) (Koike et al., 2017).

Symptoms: According to the host genotype, infection stage, and environmental factors (German-Retana et al., 2008), the severity of symptoms brought on by LMV isolates varies greatly. In lettuce seedlings, a slight inward rolling of the leaves along the long axis is the initial symptom, and the first true leaf is frequently atypically shaped and somewhat lobed. Seedlings with seed-borne virus have misshapen cotyledons, the first true leaf is misshapen and has a dark green mottling appearance. A pale green to yellow spotting appears after or alongside these symptoms. Towards the end of the juvenile rosette stage, the mottled leaves may begin to display vein clearing and very faint bronzing. Plants can suffer severe stunting. The plants hardly ever reach their full size; early infected head lettuce doesn't produce heads.

If infected later in the growth cycle, there is a different set of symptoms. Although these plants may grow to their full size, the older outer leaves will be twisted, yellow, and in other ways malformed. The wrapper leaves on the head lettuce frequently curl back and away from the head. Deformed

developing heads are possible. On the wrapper leaves, brown, necrotic specks occasionally appear (Koike et al., 2017). Reduced seed production results from Lettuce mosaic virus (LMV) infection of lettuce (Zink et al., 1956)

Leaves often show an uneven form, rolling, and mottling. The entire plant can have a dull green to slightly yellow discoloration. Although the leaves may be turgid, the tips of the outer leaves are rolled inward giving the plants a wilted appearance. Close to the leaf margins, there can be spotting. Most mosaic-infected plants are severely stunted and unable to grow properly, especially those that were infected early. These stunted plants have aberrant midrib protrusions on the underside of the leaf blades, giving the underside of the heads a ribby appearance (Grogan et al., 1952).

Transmission: This virus is seed-borne in lettuce, and infected seed is a primary way of introducing lettuce mosaic to new areas. To prevent the introduction of Lettuce mosaic virus, it is recommended to plant lettuce seed that has been tested for the virus using immunological techniques such as enzyme-linked immunosorbent assay (Falk and Purcifull, 1983). It is recommended that seed lots contain no infected seeds per 30,000 seeds tested (Grogan, 1980; Koike et al., 2017).

Secondary spread of Lettuce mosaic virus is by several species of aphids, in a nonpersistent manner, including *Acyrtosiphon pisum* (pea aphid), *Aphis gossypii* (cotton aphid), *Macrosiphum euphorbiae* (potato aphid), and *Myzus persicae* (green peach aphid). All four of these aphid species are C-rated in California. Aphids can spread the virus within a lettuce field and introduce it into lettuce fields from infected weeds and crops in proximity to the field. Monterey County has a mandated lettuce-free period for the second two weeks of December of every year. Deprived of infected lettuce plants to feed on, the virus titer in the aphids drops and this reduces the inoculum for lettuce planted after December 21. Lettuce mosaic virus has a wide host range and these other hosts, (other crops, weeds, and ornamentals) are a source of the virus when fed upon by aphids.

Damage Potential: Lettuce mosaic virus is an economically damaging virus of lettuce and endive. The virus has been spread worldwide due to the movement of seeds. A very high proportion of infected plants may result from a low level of infected seed, because of very efficient transmission by several common aphid species (Dinant and Lot, 1992).

Worldwide Distribution: Africa: *Egypt, Ghana, Malawi, Mauritius, Morocco, Sierra Leone, South Africa, Tanzania, Tunisia, Zambia, Zimbabwe.* America: *Argentina, Brazil, Canada, Chile, Ecuador, Jamaica, Mexico, Trinidad and Tobago, United States of America (California, Colorado, Florida, Idaho, New York, Ohio, Oregon, Pennsylvania, South Carolina, Wisconsin), Uruguay.* Asia: *China, India, Iran, Iraq, Israel, Japan, Jordan, Lebanon, Malaysia, Syria, Taiwan, and Yemen.* Europe: *Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Türkiye, and the United Kingdom.* Oceania: *Australia, New Zealand.*

Official Control: Lettuce mosaic virus is on the EPPO's A2 List for Bahrain and Jordan, it is a quarantine pest for Mexico, and it is a regulated non-quarantine pest for Egypt. Lettuce mosaic virus is on the USDA PCIT's harmful organisms list for Bangladesh, Colombia, Ecuador, Egypt, French Polynesia,

Georgia, Guatemala, Honduras, Israel, Japan, Madagascar, Mexico, Morocco, Namibia, Nepal, New Caledonia, Nicaragua, Panama, South Africa, Sri Lanka, Syrian Arab Republic, Taiwan, and Uruguay.

CDFA maintains a State Miscellaneous Ruling: 3611. LETTUCE MOSAIC HOST-FREE DISTRICT AND PERIOD It includes lettuce and endive or escarole and sets the boundaries of a host-free district that is the entire County of Monterey. The host-free period is from December 7 to December 21 of each year. During this time, no host plants, including greenhouse seed crop plants or transplants or part thereof, except seed, shall be planted or maintained in any state of cultivation or growth during the host-free period unless authorized under a permit issued by the Secretary or agricultural commissioner. During the host-free period, any host plant or part thereof, except seed, which is planted, growing, or being cultivated or maintained within a host-free district, is a public nuisance and subject to all the laws which relate to the abatement of such nuisance.

<https://pi.cdfa.ca.gov/pqm/manual/pdf/453.pdf>

There are also county restrictions for lettuce mosaic disease. Imperial, Monterey, and Riverside counties have county ordinances that require testing of lettuce seed, and freedom from lettuce mosaic virus, before sale. "Mosaic-tested seed" means the seeds of all species and varieties of lettuce that have been tested at a qualified seed-testing facility approved by the County agricultural commissioner or designee and which have been found to contain zero LMV positive seeds in thirty thousand (30,000) seeds tested. <https://pi.cdfa.ca.gov/pqm/manual/pdf/511.pdf>

California Distribution: This disease appears sporadically in lettuce-growing areas. Imperial, Monterey, and Riverside counties mandate (via ordinance) that only tested, disease-free seeds can be planted in those counties.

California Interceptions: none

The risk that Lettuce mosaic virus would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** This virus is likely to be found wherever its hosts can grow.

Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: 3

- Low (1) Not likely to establish in California; or likely to establish in very limited areas.
- Medium (2) may be able to be established in a larger but limited part of California.
- **High (3) likely to establish a widespread distribution in California.**

- 2) Known Pest Host Range:** The host range is very broad including agronomic hosts, ornamentals, and weeds.
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Evaluate the host range of the pest.

Score: 3

- Low (1) has a very limited host range.
- Medium (2) has a moderate host range.
- **High (3) has a wide host range.**

- 3) Pest Reproductive Potential:** This virus replicates inside its hosts, can be seed-borne, and spread by a flying vector.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 3

- Low (1) does not have high reproductive or dispersal potential.
- Medium (2) has either high reproductive or dispersal potential.
- **High (3) has both high reproduction and dispersal potential.**

- 4) Economic Impact:** There is a direct cost from lost yield due to this disease. In addition, there is also a cost to having a host-free period in Monterey County, a cost for vector control and alternate host eradication, and a cost to performing seed testing. It is a pest of concern or a quarantine pest for multiple countries.

Evaluate the economic impact of the pest on California using the criteria below.

Economic Impact: A, C, D, E

- A. The pest could lower crop yield.**
- B. The pest could lower crop value (including increasing crop production costs).
- C. The pest could trigger the loss of markets (including quarantines).**
- D. The pest could negatively change normal cultural practices.**
- E. The pest can vector, or is vectored, by another pestiferous organism.**
- F. The organism is injurious or poisonous to agriculturally important animals.
- G. The organism can interfere with the delivery or supply of water for agricultural uses.

Economic Impact Score: 3

- Low (1) causes 0 or 1 of these impacts.
- Medium (2) causes 2 of these impacts.
- **High (3) causes 3 or more of these impacts.**

- 5) Environmental Impact:** None have been reported but it can affect ornamental hosts negatively.

Evaluate the environmental impact of the pest on California using the criteria below.

Environmental Impact: E

- A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.
- B. The pest could directly affect threatened or endangered species.
- C. The pest could impact threatened or endangered species by disrupting critical habitats.
- D. The pest could trigger additional official or private treatment programs.
- E. The pest significantly impacts cultural practices, home/urban gardening, or ornamental plantings.**

Environmental Impact Score: 2

- Low (1) causes none of the above to occur.
- **Medium (2) causes one of the above to occur.**
- High (3) causes two or more of the above to occur.

Consequences of Introduction to California for Lettuce mosaic virus: High

Add up the total score and include it here. **14**

- Low = 5-8 points
- Medium = 9-12 points
- High = 13-15 points**

- 6) Post-Entry Distribution and Survey Information:** Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication, or have been delimited with no further detections should not be included.

This disease has been found in California for more than 75 years. Outbreaks have occurred in coastal counties and the desert.

Evaluation is 'high'.

Score: -3

- Not established (0) Pest never detected in California or known only from incursions.
- Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).
- Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.
- High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.**

- 7) The final score is the consequences of the introduction score minus the post-entry distribution and survey information score: (Score)**
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Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 11*

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for **Lettuce mosaic virus is C.**

References:

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Responsible Party:

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***Comment Period: 11/16/2023 through 12/31/2023**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at [permits\[@\]cdfa.ca.gov](mailto:permits[@]cdfa.ca.gov).

Comment Format:

- ❖ Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

Example Comment:

Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to “Climate/Host Interaction” here.]

- ❖ Posted comments will not be able to be viewed immediately.
- ❖ Comments may not be posted if they:

Contain inappropriate language which is not germane to the pest rating proposal;

Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

Violates agency regulations prohibiting workplace violence, including threats.

- ❖ Comments may be edited prior to posting to ensure they are entirely germane.
 - ❖ Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.
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Proposed Pest Rating: C
