Olive Diseases and Agri-Chem & IPM Control Options.

Significant fungal diseases of the olive tree canopy

The three most common and potentially destructive fungal diseases found in Australian olive groves are:

Anthracnose *Colletotrichum spp.*

Ref: [1]IPDM Resources (OL17001): Olive Anthracnose Flier by Robert Spooner-Hart et al (2020).

Peacock Spot (Olive Leaf Spot) *Fusicladium oleaginum (Spilocaea oleaginea)*

Ref: [2]IPDM Resources (OL17001): Cercospora Leaf Mould Flier by Robert Spooner-Hart et al (2020).

Cercospora Leaf Mould *Pseudocercospora cladosporioides*

Ref: [3]IPDM Resources (OL17001): Olive Anthracnose Flier by Robert Spooner-Hart et al (2020).

Other less common diseases of olives found in Australia:

Olive Knot *Pseudomonas savastanoi pv. Savastanoi (Pss)*. Less common, this is a bacterial disease, spread by physical injury – hail, pruning, harvest.

Ref: [4]IPDM Resources (OL17001): Field Guide (Second Edition) by Robert Spooner-Hart et al (2020) – pg 50.

Ref: [5]Vigilance required for Olive Knot Disease (*OliveCare®* News – April 2018)

[1] IPDM Resources (OL17001): Olive Anthracnose Flier: https://olivebiz.com.au/wp-content/uploads/2020/08/ANTHRACNOSE.pdf
[2] IPDM Resources (OL17001): Cercospora Leaf Mould: https://olivebiz.com.au/wp-content/uploads/2020/08/PEACOCK-SPOT.pdf
[3] IPDM Resources (OL17001): Olive Anthracnose Flier: https://olivebiz.com.au/wp-content/uploads/2020/08/CERCOSPORA-LEAF-MOULD.pdf
[4] IPDM Resources (OL17001): Field Guide (Second Edition): https://olivebiz.com.au/wp-content/uploads/2020/09/Field-Guide-2nd-edn-revised_2.pdf
[5] Vigilance required for Olive Knot Disease (*OliveCare®* News – April 2018): https://olivebiz.com.au/vigilance-required-for-olive-knot-disease/

Ref: [6]Epidemiology and Management of Olive Knot Caused by *Pseudomonas savastanoi pv. savastanoi* in California Olive Production 2017 Author(s): Nguyen, Kevin, University of California, Riverside.

Ref: [7] Phytophthora Root and Crown Rot, UC IPM Pest Management Guidelines: Olive UC ANR Publication 3452:

Phytophthora Root Rot *Phytophthora spp.* (several species). This is a soil born disease associated with excessively wet and poorly drained soils.

Ref: [8]IPDM Resources (OL17001): Field Guide (Second Edition) by Robert Spooner-Hart et al (2020) – pg 53.

Ref: [9]Phytophthora Root and Crown Rot, UC IPM Pest Management Guidelines: Olive UC ANR Publication 3452.

Exotic diseases of olives not yet established in Australia:

The following 3 are serious exotic diseases not yet established on olives in Australia:

Ref: [10]IPDM Resources (OL17001): Exotic Pests and Diseases Flier by Robert Spooner-Hart et al (2020).

Ref: [11]High Priority Exotic Pests and Diseases of Olives in Australia (*OliveCare®* News).

Verticillium wilt *Verticillium dahliae* (exotic defoliating strains). This is a soil born disease – the causal organism is now present in Australia on cotton, potatoes and related crops, but not yet reported on olives.

Leaf scorch *Xylella fastidiosa subsp. multiplex* (with vectors). This is a bacterial disease spread by insect vectors – not yet detected in Australia.

Olive quick decline *Xylellafastidiosa subsp. pauca* (with vectors). Not yet detected in Australia, this is also a bacterial disease spread by insect vectors.

Olive IPDM Best Practice:

Ref: [12]IPDM Project Resources and how to access them by Robert Spooner-Hart et al (2020).

Ref: [13]Olive IPDM Best Practice Manual - by Robert Spooner-Hart et al (2020).

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[6] Epidemiology and Management of Olive Knot Caused by *Pseudomonas savastanoi pv. savastanoi* in California Olive Production, Author(s): Nguyen, Kevin, University of California, Riverside 2017: https://escholarship.org/uc/item/8g25c868

[7] Phytophthora Root and Crown Rot, UC IPM Pest Management Guidelines: Olive UC ANR Publication 3452: https://www2.ipm.ucanr.edu/agriculture/olive/Olive-knot/

[8] IPDM Resources (OL17001): Field Guide (Second Edition): https://olivebiz.com.au/wp-content/uploads/2020/09/Field-Guide-2nd-edn-revised_2.pdf

[9] Phytophthora Root and Crown Rot, UC IPM Pest Management Guidelines: Olive UC ANR Publication 3452: https://www2.ipm.ucanr.edu/agriculture/olive/Phytophthora-root-and-Crown-rot/

[10] IPDM Resources (OL17001): Exotic pests and diseases Flier: https://olivebiz.com.au/wp-content/uploads/2020/08/EXOTIC-PESTS-AND-DISEASES.pdf

[11] High Priority Exotic Pests and Diseases of Olives in Australia (*OliveCare®* News): https://australianolives.com.au/high-priority-exotic-pests-and-diseases-of-olives-in-australia/

[12] IPDM Project Resources and how to access them: https://olivebiz.com.au/webinar-ipdm-project-resources/

Ref: [14]*OliveCare®* Best Practice Checklists: Integrated Pest and Disease Management (IPDM).

The recommended approach to pest and disease management for olives is integrated pest and disease management (IPDM). Based on ecological principles, it encourages reduced reliance on pesticides through the use of a number of control strategies in a harmonious way to keep pests and diseases below the level causing economic injury. It came out of the realisation that too heavy reliance on pesticides (particularly those with broad-spectrum activity) can cause major problems, notably:

- effects on human health and safety
- environmental contamination
- pesticide resistance in target and non-target organisms
- resurgence of secondary pests
- plant damage or yield loss (phytotoxicity)
- residues on fruit and products, with national and international consequences.

There is also general community concern about the use of pesticides, particularly on foods, especially those, such as olive products, reported to provide health benefits. The major components of IPDM systems are:

- Identification of pests, diseases and natural enemies
- Monitoring of pests, diseases, damage and natural enemies
- Selection of one or more management options on the basis of monitoring results and action thresholds, from a wide range of pesticide and non-pesticide options
- Use of selective pesticides targeted at the pest or disease—for instance, pesticides that will interfere least with natural enemies, targeted only at infested trees or parts of trees.
- Continuous review of management success, and incorporation of new information and techniques.

IPDM programs commonly utilise or support biological control provided by natural enemies such as predators, parasites, insect diseases and non-pathogenic antagonistic or competitive microorganisms. These natural enemies may be encouraged or introduced onto groves.

Programs invariably involve cultural control strategies to minimise pest and disease entry and their spread in space and time. Cultural controls include protocols of entry to and movement around farms; sanitation (practices to prevent the spread of pests and diseases by removing diseased/infested plant material and by decontaminating equipment); manipulation of the field environment to discourage pests and diseases, such as maintaining optimum plant health, opening tree canopies to increase air movement and reduce humidity; eliminating of alternative hosts for pests; or growing nectar- and pollen-producing plants within the grove or surrounding areas to encourage natural enemies. IPDM may also

[13] Olive IPDM Best Practice Manual: https://olivebiz.com.au/wp-content/uploads/2020/11/Best-Practice-Manual-REVISED.pdf

[14] *OliveCare®* Best Practice Checklists: Integrated Pest and Disease Management (IPDM): https://australianolives.com.au/olivecare-best-practice-checklists/

involve the use of tolerant or resistant plant varieties, where available. Chemical pesticides, whether conventional or organically acceptable, are used judiciously and thus play a supportive role.

Anthracnose Management: Understanding IPM Principles

According to Dr Vera Sergeeva[15], *successful management of anthracnose relies on understanding the conditions that promote disease development and the control measures taken to obtain olive oil of good quality.*

Integrated pest management (IPM) Integrated pest management (IPM) of anthracnose in olives involves managing yield and creating an environment less appealing to disease. The disease epidemiology and disease cycle play an important role in working out strategies for effective and timely management of anthracnose and in reducing the number of unnecessary fungicides applications.

Anthracnose is difficult to control after the symptoms appear, particularly when environmental conditions are favourable for infection. Environmental factors play an important role in managing diseases. Weather is a crucial in the development of anthracnose throughout the year, especially at flowering and prior to harvest. Optimum conditions for disease development depend on temperature, wetness, relative humidity and rain period. If these weather conditions prevail during flowering they cause severe flower infection and consequently, reduce fruit set. Latent infection of developing fruit in spring may permit survival of the pathogen in the following summer even under hot conditions (Moral et al., 2008). Epidemics occur when olive varieties susceptible to the anthracnose pathogens grow under warm and humid conditions. Infection can be controlled in a number of ways (Sergeeva, 2011a; 2011b). Effective disease control is obtained through a combination of methods, including prevention, observation and intervention.

For further information on anthracnose and management options please refer to the following reports / bulletins / presentations:

- [16]Olive IPDM Best Practice Manual - by Robert Spooner-Hart et al (2020).
- [17]Olive Pests & Diseases (*OliveCare®* News – June 2020) - by Robert Spooner-Hart et al (2020)
- [18]Anthracnose in Olives Article - Symptoms, Disease Cycles & Management by Dr Vera Sergeeva
- [19]Anthracnose management factors influencing yield and quality of olives by Dr Vera Sergeeva (AOA 2014 Conference)

[15] Olivera: http://olivediseases.com/
[16] Olive IPDM Best Practice Manual: https://olivebiz.com.au/wp-content/uploads/2020/11/Best-Practice-Manual-REVISED.pdf
[17] Olive Pests & Diseases (*OliveCare®* News – June 2020): https://australianolives.com.au/olive-pests-and-diseases-2/?utm_source=rss&utm_medium=rss&utm_campaign=olive-pests-and-diseases-2
[18] Anthracnose in Olives Article - Symptoms, Disease Cycles & Management by Dr Vera Sergeeva: https://olivediseases.com/wp-content/uploads/2012/02/Anthracnose-in-Olives-symptoms-disease-cycle-and-management-Vol-I-pp-269-274.pdf

- [20]Achieving effective control of Anthracnose (*Colletotrichum spp*) – edited by Peter McFarlane 2015
- [21]Olive Anthracnose Journal of Plant Pathology (2012), 94 (1), 29-44, by Cacciola et al

Pest & Disease Control Options:

Remember that 'happy trees are healthy trees' - pests and disease outbreaks may indicate your olive grove is under stress – humid weather, water stress, soil nutrient deficiencies, tree canopy out of control, natural beneficial organisms present in low numbers, etc.

Spray carefully, if you must spray:

- Understand pest and disease life-cycles:
  - Spray if really necessary? Healthy trees, few problems?
  - One Spray enough? Can you limit to spot-sprays?
  - Catch early – sprays will be more effective
- Understand the Spray and its effect:
  - Is it legal in your state?
  - Does it kill beneficials – even if it is organic?
  - When do you spray again – do observe critical life cycle times and resistance management strategies.

A reminder that an open tree canopy is important for improved ventilation and good spray coverage.

Fungal Disease Control Program

Always use chemical control options in accordance with permit / label conditions:

Ref: https://australianolives.com.au/chemical-permits/

Always regularly monitor weather conditions and groves for fungal disease symptoms.

If a fungal disease is present or high risk weather conditions exist:

- At flowering – apply **AERO** (Group 11 and M3 dual action fungicide) followed by a second spray in 2 weeks. (An alternative is to use Azoxystrobin (Amistar) Group 11 fungicide).

  View the Aero Permit details **here.**

  View the Amistar Label details **here.**

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[19] Anthracnose management factors influencing yield and quality of olives by Dr Vera Sergeeva (AOA 2014 Conference): https://australianolives.com.au/wp-content/uploads/2019/05/Vera_Sergeeva_-_Diseases_and_Pests_olives_AOA_19_Sep_2014.pdf

[20] Achieving effective control of Anthracnose, edited by Peter McFarlane 2015: http://www.australianolives.com.au/article-detail/managing-anthracnose-in-olives?allowed_user=true

[21] Olive Anthracnose Journal of Plant Pathology (2012), 94 (1), 29-44, Cacciola et al: http://sipav.org/main/jpp/index.php/jpp/article/viewFile/2438/1115

- At fruit set apply **Mancozeb** (Group M3 fungicide) and again 2 weeks later

  View the Mancozeb permit details **here.**
- After harvest apply 1 application of **Copper Tri-base Blue-190** (Group M1 fungicide) or alternative

  View the copper permit details **here.**

  View the copper oxychloride Label details **here.**

- After pruning repeat the copper spray.

Then monitor the grove for any signs of fungal infection through to flowering in each year.

Rotate available chemical control options as part of a resistance management strategy:

Fungicide Options & Resistance Management:

If the same or similar fungicides are regularly used on a crop there is a risk that the fungal pathogens will become resistant to these chemicals, as a consequence their efficacy declines.

A resistance management strategy involves the rotation of use of approved fungicides from difference chemical groups – hence the need to have approved alternative control options available.

Ref: [22]CROPLIFE AUSTRALIA FUNGICIDE RESISTANCE MANAGEMENT REVIEW GROUP Fungicide Activity Group Table (Valid as at 10 June 2020).

Note: Currently only the following **Group M1** copper based formulations are approved for use on olives for the control of Cescospora (*Pseudocercospora cladosporioides*) and Peacock Spot (*Fusicladium oleagineum*).

There are currently no approved chemical control options for Olive Knot or Verticillium Wilt.

However under Victorian control of agri-chemical use legislation, Victorian olive growers have broader use options.

M1. Copper formulations (Group M1 fungicides):

Low risk of fungicide resistance developing

There are five types of copper compounds available in Australia: copper oxychloride (Oxydul-520, Coppox-500) copper hydroxide (Kocide WP-500, Kocide Blue-350, Kocide Blue Liquid-360, Blue Shield-500), tribasic copper sulphate (green and blue coppers such as Cuprofix-200, Tri-base Blue-190), copper ammonium complexes and cuprous oxide (red copper). Products are formulated as wettable powders, wettable granules, liquid flowable suspensions or aqueous liquids. Copper products may also contain small amounts of impurities (lead cadmium etc.). Those permitted for use on olives are:

[22] Fungicide Activity Group Table (Valid as at 10 June 2020): https://www.croplife.org.au/wp-content/uploads/2020/05/2020-Fungicide-Activity-Group-Table.pdf

- **PER11360 Copper** (Copper present as Cupric Hydroxide, Cuprous Oxide, or Tri-basic Copper Sulphate) Permit to 30 November 2021: systemic **Group M1 fungicide**, withholding Period: 1 day
- **Copper oxychloride** Label Registration: systemic **Group M1 fungicide**, withholding Period: 1 day

Note: The following **Group M3, Group 3, Group 7** and **Group 11** chemicals are also likely to have efficacy to the Cescospora (*Pseudocercospora cladosporioides*) and Peacock Spot (*Fusicladium oleagineum*) NOT APPROVED, as well as to the Anthracnose (*Colletotrichum* spp.)

In addition to the above Group M1 copper formulations, the following fungicides are APPROVED for use on olives (or approval pending) for the control of **Anthracnose** (*Colletotrichum spp*):

Qols (Strobilurin) fungicides (Group 11):

High risk of fungicide resistance developing

Strobilurins are part of the larger group of QoI inhibitors.

The group includes: azoxystrobin, kresoxim-methyl, picoxystrobin, fluoxastrobin, oryzastrobin, dimoxystrobin, pyraclostrobin and trifloxystrobin.

Strobilurins represented a major development in fungus-based fungicides. They were extracted from the fungus *Strobilurus tenacellus*. Strobilurins are mostly contact fungicides with a long half time as they are absorbed into the cuticle and not transported any further. Those permitted for use on olives are:

- **PER14908 Pyraclostrobin + Metiram (Aero**) / Olives / Anthracnose, permit to 31 March 2020: systemic Group 11 and M3 **dual action** fungicide, withholding Period: 21 days
- **Azoxystrobin (Amistar)** Label Registration / Olives / Anthracnose: systemic Group 11 fungicide, withholding Period: 21 days
- **Pending: Bayer Luna Range: 'Sensation' – Fluopyram + Trifloxystrobin (Group 7+11)** for the control of anthracnose in olives – trial work contracted by Hort innovation Feb 2017, due for completion June 2021.

Dithiocarbamate fungicides (Group M3):

Low risk of fungicide resistance developing

Note: Thise group includes: (Mancozeb, Methan, Metiram, Propineb, Thriram, Zineb and Ziram).

- **PER14908 Pyraclostrobin + Metiram (Aero**) Label Registration /Olives/Anthracnose. Systemic Group 11 and protectant M3 dual action fungicide, withholding period 56 days;

- **New Permit: PER88358 Mancozeb**/Olives/Anthracnose, permit to 31 July 2023. Group M3 protectant fungicide, withholding period 14 days.

DMI fungicides (Group 3):

Medium risk of fungicide resistance developing

DMI = demethylation inhibitors, also called sterol biosynthesis inhibitors.

These include: tebuconazole, difenconazole, propiconazole, epoxiconazole, tetraconazole

- **Pending: Bayer Luna Range: 'Experience' – Fluopyram+Tebuconazole (Group 7+3)** for the control of anthracnose in olives – trial work contracted by Hort innovation Feb 2017, due for completion June 2021.

SDHI fungicides (group 7):

High risk of fungicide resistance developing

Fluopyram is a broad - spectrum fungicide of the pyridinyl – ethyl – benzamides ('pyramide') group with preventative, systemic and curative properties for the control of certain crop diseases. For crop protection purposes Luna Privilege Fungicide is best suited for use in a preventative treatment program.

- **Pending: Bayer Luna Range: 'Sensation' – Fluopyram + Trifloxystrobin (Group 7+11)** and **'Experience' – Fluopyram+Tebuconazole (Group 7+3)** for the control of anthracnose in olives – trial work contracted by Hort innovation Feb 2017, due for completion June 2021.

Organic and other 'soft' Control Options:

- Recent research in Europe found the biocontrol bacterium Bacillus subtilis was effective against Cercospora Leaf Mould *Pseudocercospora cladosporioides* (various strains of this and similar bacteria were sprayed on trees at regular intervals through the year).

A new fungal disease found on olives in Australia:

***Neofabraea vagabunda (*Neofabraea blight, leprosy of olive)**

Hosts include Olive, Apple, Pear, Quince and Ash trees.

Whilst this disease has previously been reported in Australia on Apples and Pears, the first report of this disease in Australia on olive (*Olea europaea*) occurred in June 2020 in an olive grove in Central Victoria exhibiting the following symptoms on fruits:

Note: The disease also affects leaves and twigs (cankers).

Background:

Neofabraea vagabunda 'first appeared in Sonoma County California and was reported by Farm Advisor Paul Vossen in 2005. It has now appeared in San Joaquin County in 2015-2016 as reported by Brenna Aegerter and Joe Grant.In Sonoma County it appeared mostly on fruit in cool wet conditions causing sunken spots on the varieties Coratina and Picholine. In San Joaquin County, trees show leaf spots, twig dieback and severe defoliation. So far we have found it mostly in cv. Arbosana in 3 orchards. The disease has been an increasing concern in olive in the last decade in Italy, Spain and Portugal and could potentially become a substantial problem for our CA olive industry. The pathogen, *Neofabraea vagabunda*,is also known to cause the Bull's eye rot in pear and apple, as well as cankers in ash tree and apple'.

Ref: http://cesonoma.ucanr.edu/files/240843.pdf

Ref: http://apsjournals.apsnet.org/doi/abs/10.1094/PDIS-04-13-0394-PDN

Note: Grove Best Practice disease control for Anthracnose can be expected to also control *Neofabraea vagabunda.*

Also keep a lookout for: Cytospora Canker *Cytospora sorbicola*

Cytospora canker was detected in samples taken from two plum trees (Var. Primetime) exhibiting dieback during a routine industry survey of stone fruit orchards around Nannup, Western Australia in November 2019.

This is believed to be a first record of *Cytospora sorbicola* in Australia, noting the *Cytospora* genus has recently been revised in 2017–18 with several new species described.

Common name	Scientific name	Image	EPPRD category
Canker/ Dieback	*Cytospora sorbicola* Is reported to occur on olive in the Rostov region in Russia and in the California central valley. **Note**: Now reported on plum in Western Australia, but not yet seen on olives	 *Cytospora* associated cankers in olive twigs.	Not yet categorised as an EPP

About the pathogen

- *Cytospora* species are plant pathogens which cause dieback and canker diseases on a wide range of hosts including fruit and nut trees and plantation timbers.
- *Cytospora* species have traditionally been considered as secondary pathogens, invading stressed and wounded trees. Canker diseases in general can cause death of young trees, but canker diseases increase in prevalence as orchards get older which can impact on yield, the life span of trees and production costs.
- Fruit is not considered a pathway for *Cytospora* canker based on its primary association with trunk and stem diseases.
- The Olive Biosecurity Plan (OBP) V2: 2016, currently lists only *Cytospora oleina* as causing canker in olive trees (*Olea europaea)*.
- In California, three *Cytospora* species (*C. oleicola, C. plurivora, and C. sorbicola*) are associated with Cytospora canker and dieback of olives.
- *Cytospora oleina* was isolated from dead twigs of olive associated with old cankers in the Mount Pelion region of central Greece (2007).

Biosecurity and reporting:

On-farm biosecurity best practices play a pivotal role in maintaining Australia's reputation for producing high quality products. Olive growers should have in place on-farm biosecurity action plan outlining critical measures to protect their crops from pests and diseases.

Ref: [23]Biosecurity risk management, AOA 2019

AOA requests olive growers to regularly monitor their groves for the above exotic disease symptoms in the coming fruit season, and report any findings to the usual biosecurity agency in your state or via the Exotic Plant Pest Hotline: 1800 084 881. This will put you in contact with your state or territory department of agriculture or primary industries**,** who will ask some questions to help understand the situation, such as:

- what was seen (describe the pest or send a photo) and when was it first noticed
- where it was found and what it was on
- how many pests are present/how infected is the crop
- how widely distributed it is.

Every report will be taken seriously, checked out and treated confidentially.

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END

[23] Biosecurity risk management, AOA 2019: https://australianolives.com.au/bio-security-plan/