Technical advice on: Jasmine moth (*Palpita vitrealis*).

Date: 20 December 2024

Summary of advice

***Purpose of the assessment*:** In June 2022, Jasmine moth (*Palpita vitrealis*) was found in a property in Leigh, Auckland. The moth is new-to-New Zealand and from 2022 to 2024, nine other sightings of this moth in Northland, Auckland, and the Waikato were recorded in iNaturalist. This moth is recorded as regulated and unwanted pest in the Official New Zealand Pest Register and is considered a quarantine pest in some countries such as Argentina, Ecuador, Egypt, Peru, and Uruguay. Therefore, **the Incursion Investigation Plant Health (IIPH) Team requested technical advice on the possible entry pathway, establishment potential, and likely impacts of *P. vitrealis* in New Zealand, to help determine if an official pest response is necessary for the incursion.**

Entry pathway: **Jasmine moth is likely to have naturally dispersed into New Zealand via wind currents from Eastern Australia or New Caledonia**. Wind dispersal has been reported for other moth species. The measures on the plant pathways and inanimate pathways are expected to mitigate the risks of the moth's entry into New Zealand, as the moth is likely to be visually detected and managed before or at the border. Some of the known hosts can be imported as whole plant nursery stock and /or cuttings from countries where the moth occurs. But the mandatory post-entry quarantine (PEQ) period of at least three months would have been sufficient to allow detection of the moth due to its short life cycle (typically less than 50 days). However, no record of interception was found.

***Establishment potential*: The environment in the northern parts of New Zealand's North Island is suitable for the establishment of the moth**, known to thrive in environments with mild winters and warm summers. Additionally, availability of hosts in New Zealand are likely to enable the moth's establishment in some parts of the North Island. **The moth's main host plants,** olives (*Olea* europaea) and jasmine (*Jasminum* spp.), **and alternative hosts** (e.g., privets, arrow-leaf sida, and hemp agrimony) **are present in New Zealand**. Most of the known natural enemies of Jasmine moth are not known to occur in New Zealand, thus the moth's **establishment is unlikely to be affected by natural enemies**.

Impact: Overall, **the potential impact of Jasmine moth on New Zealand's economy, way of life, and the environment is estimated to be very low.** However, olive growers could be impacted if the moths reached high population densities. In other olive-producing regions such as the Mediterranean, olive growers are only severely affected in years where the moths become very abundant. But it is not a regular occurrence. Furthermore, the moth has not been recorded as an important pest in other olive-producing countries in the Southern Hemisphere where the moth is known to be present, including Australia and South Africa.

Advice: Multiple findings of adult Jasmine moths across a wide area (i.e. Auckland, Northland, and the Waikato) suggest that moths may have either established populations in New Zealand and are spreading or are being blown in New Zealand by multiple wind events in the last few years. So, **eradication might be challenging**. While the most plausible explanation for the moth's finding in New Zealand is natural dispersal via wind currents, there is some uncertainty surrounding the frequency of its arrival through this pathway, which depends on multiple factors. However, following projections of other wind-mediated incursion events of moths, such as the fall armyworm from Australia, it is expected that at least one event is likely to occur every five years.

Supporting information

Taxonomy

Scientific Name:	*Palpita vitrealis* Rossi 1794
Class: Order: Family	Insecta: Lepidoptera: Crambidae
Synonyms:	*Diaphania unionalis, Margarodes unionalis, Margaronia unionalis, Palpita unionalis, Phakellura unionalis, Phalaena unionalis*.
Common names:	Jasmine moth, Olive leaf moth, Olive moth

Biology

Jasmine moth lays its eggs singly or in groups of 2-5 in the underside the leaf of host plants (Shehata et al 2003; CABI 2019). Eggs are usually tiny ranging from 0.5-1mm in length (see Ghoneim 2015). The incubation period may vary between 3 and 12 days depending on temperature. It takes longer for eggs to hatch at lower temperatures (CABI 2019). In an experimental setting, temperatures of 10°C and below or 35°C and above were found to result in 100% mortality of the eggs (Loi 1990). Mansour (2024) reported that thermal threshold for the eggs was 7.2°C. No evidence indicating that eggs may be laid on inanimate objects was found.

Larvae that emerge from hatched eggs of Jasmine moths develop through six instar stages with the first having a very tiny head capsule (0.18 mm long) and the sixth having relatively visually obvious head capsule (1.53 mm long) (see Ghoneim 2015). Early larval stages are about 1.5 mm long while the older instars about 20mm long (CABI 2019). Larval development usually ranges between 14-48 days depending on temperature (Khaghaninia and Pourabad 1999; Ghoneim 2015; Mansour 2024). Larval feeding mostly occurs in shaded areas away from direct sunlight or light (Shehata et al. 2003). The second and third larval instars are more able to overwinter than other forms of the moths (Ghoneim 2015). The thermal threshold for the moth's larvae is the same as for eggs, 7.2°C (Mansour 2024).

The pupa is dark brown, usually about 12-16 mm long and is often found folded in the leaf (see Ghoneim 2015; CABI 2019). Up to 90% of the pupae may emerge into adults (see Ghoneim 2015). At fairly low temperatures such as 17°C, it might take up to 27 days for the pupa to emerge into an adult, whereas at high temperatures such as 30°C, it might take only six days for pupae to develop into an adult, however, the pupa is unlikely to survive at temperatures lower than 11.5°C (Mansour 2024).

Adults begin mating within 24 hours after emergence (CABI 2019) and mating can last between 1-3 hours (Shehata et al. 2003). Males can easily find females because of the pheromones produced by females (Mazomenos et al. 1994). Females begin to lay eggs on the host plants between 2-4 days after emergence from pupae (CABI 2019). Female fecundity is variable depending on regions but generally, the average range of eggs laid by females vary between 185 to 352 and there are reports of up to 800 eggs laid by a female (Ghoneim 2015). Male to female ratio of adults is usually 1:1 but females may be slightly more in some cases (Fodale and Mule 1990; Khaghania and Pourabad 1999). Emerged adults can live for up to 16 days (see Ghoneim 2015).

All stages of the moth can be found all year round and up to 10 generations can be observed in a year (see Ghoneim 2015; CABI 2019). There is still a knowledge gap regarding its overwintering as it is not clear whether occurrence in extremely cold environments is facilitated by dormancy or

migration (Tzanakakis 2003). Although the moth typically takes less than 50 days to complete its life cycle (Shehata et al. 2003), its life cycle can take up to 100 days or more in cold seasons (Tzanakakis 2003; CABI 2019).

Jasmine moth vastly occurs in the Mediterranean region (Fodale and Mule 1990) which has a comparable climate with some parts of New Zealand's North Island. The moth is distributed in many parts of the world which are climatically similar to the Mediterranean region, and this includes some parts of North and South Africa, India, Indonesia as well as Australia (See Tzanakakis 2003; CABI 2019). They are also known to occur around coastal areas (Butterfly Conservation 2024).

The main hosts of Jasmine moths are olives (*Olea* europaea) and jasmine plants (*Jasminum* spp.); the moth is known to feed and lay its eggs on the leaves of these hosts (Fodale and Mule 1990; Ghoneim 2015; CABI 2019; Tahar Chaouche et al. 2019; Mansour 2024). Although many of the alternative hosts share the same family with olive and jasmine plants (i.e. Oleaceae), other hosts such as arbutus (*Arbutus unedo*), arrow-leaf sida (*Sida rhombifolia*) and pala indigo (*Wrightia tinctoria*) come from other plant families (see Appendix 1).

Explored pathways

i. Imported plant material

Apart from the adult stage, the Jasmine moth lives and feeds entirely on its host plants therefore it could arrive in New Zealand on imported plant material. However, current biosecurity measures will likely mitigate the risk of the moth's entry into New Zealand on imported host-plant pathways as the moth will likely be visually detected at the border.

For olive plants which are the main hosts of the moth, entry pathways for nursery stock include cuttings and tissue culture but it requires the plants to be observed for at least 12 months in level 3B post-entry quarantine (PEQ). Nursery stock of some jasmine plants, which are also considered main hosts of the moth, can also be imported as whole plants or tissue culture but requires at least 3 months at Level 2 PEQ, which will allow identification and management of the moth.

Similarly, the nursery stock of alternative hosts such as *Arbutus unedo*, *Daphne gnidium*, *Eupatorium cannabinum, Fragaria* × ananassa, *Fraxinus* sp., *Ligustrum spp. Osmanthus* sp. *Viburnum* spp. can also be imported as whole plant or tissue culture and require at least 3 months observation in Level 2 PEQ. Apart from the hosts mentioned above, there is no entry pathway for nursery stock for other alternative hosts.

Jasmine moth is not specifically mentioned in any of the current Import Health Standards even though it is listed as a regulated and unwanted pest in the Official New Zealand Pest Register. A possible reason for the moth's absence in the current Import Health Standards could be because the moth can easily be visually detected during quarantine since its life cycle is generally completed in less than 50 days (see Shehata et at. 2003).

Based on CABI (2019) eggs are hatched within 3 to 12 days from the time they are laid, and the rapid growth of larvae indicates that the pest is likely to be detected within the 3-month mandatory PEQ period. There is no entry pathway for fresh produce or cut flowers and foliage of the known hosts except for strawberry fresh produce which can be imported from Australia. However, the moth is not known to associate with strawberry fruits. The current measures on the strawberry fresh produce pathway are also sufficient to mitigate risk of entry as it involves chemical treatment and visual inspection. The moth is known to lay eggs on living host leaves hence it is highly unlikely to be associated with dry organic or inorganic substrates.

ii. Wind dispersal

Over the last two decades there has been a steady increase in strong sea surface winds globally (Hu et al. 2020), and this has resulted in an increased natural dispersal of pests and pathogens as

exemplified by the arrival of the fall armyworm moth from Australia (Meurisse et al. 2023). Based on modelling projections, the fall armyworm was predicted to arrive from Australia within five years from 2021 (Biosecurity New Zealand 2021) and it arrived the following year.

While Jasmine moth has been reported to occur in Australia (see CABI 2019; Tzanakakis 2003), molecular studies confirming its presence in Australia are not yet available (Andreas Zwick 2024, Pers. comm). Very little is known about its distribution and abundance in Australia. Although no literature was found on Jasmine moth or other members of its genus being blown into New Zealand, in general, plant pests such as moths may arrive New Zealand from the coasts of either New South Wales or Queensland within two or three days (Biosecurity New Zealand 2021; Close et al. 1978).

Apart from Australia, the moth has been recorded in New Caledonia since 2020 (GBIF.org 2024) and this could potentially be the original source of the Jasmine moths in New Zealand. But details surrounding possible wind dispersal pathways from New Caledonia to New Zealand are lacking.

Potential to establish.

The 10 iNaturalist reports of the moth in New Zealand between 2022 and 2024 occurred in eight different months of the year (Biosecurity New Zealand 2024). This suggests that the populations of the moth are beginning to become established in the northern regions of the North Island. Observations would have likely only been recorded in late autumn and early spring if populations are not being established in New Zealand. Late autumn and early spring are most likely periods of moth arrivals in New Zealand due to the strong winds moving across the Tasman sea around that period (Biosecurity New Zealand 2021).

The Northland region is a suitable environment for the establishment of Jasmine moth because its subtropical climate is characterised by mild winters (12°C to 17°C winter daytime temperature range) and warm summers (Northland Regional Council 2012; NIWA 2024). It is an important olive growing area (Oliveti.co.nz 2024) with a climate similar to the Mediterranean region.

Climatic similarity between New Zealand and other parts of the world can be assessed using the composite match index (Phillips et al. 2018). The CMI values range from 0.1 to 1. If a location has a CMI of ≥ 0.7, its climate is similar to the climate of all of New Zealand and the climate matching tool shows that the climate in New Zealand is very similar to the climate in the Mediterranean region (CMI> 0.7). Noori and Shirazi (2012) showed that Jasmine moths can quickly spread over a large area. It took less than two years (1999-2000) for the moth to rapidly expand its range in Iran.

While sporadic frost events in the North Island may potentially impede population establishment of the moth, gravid adult females may likely be naturally wind dispersed into New Zealand again given that adult females usually have their eggs fertilised within the first two days of emergence from pupa. It is important to note that the Jasmine moth specimen collected from Auckland was an adult female (PHEL Surveillance report 2024). This suggests that some of the moths present in New Zealand may be females which are already carrying or laying eggs.

Most of the known natural enemies are not present in New Zealand (Appendix 2) so it is not clear whether Jasmine moth populations can be negatively affected by natural enemies in New Zealand. However, some known natural enemies mentioned in Appendix 2 such as the *Apanteles* spp., *Brachymeria* spp. and *Dolichogenidea laevigata* have some representative members of their genus in New Zealand, which could potentially act as natural enemies of Jasmine moth.

Potential Impacts

The overall potential impact of Jasmine moth on New Zealand's economy, way of life and the environment is estimated to be very low. But the impact might be reasonably high for olive growers in years where the moths are remarkably abundant. Impacts of Jasmine moths on host plants often depend on the population density of host plants, the type of host plants and interannual variation in abundance of the moth (Gohneim 2015; Tahar Chaouche et al. 2019). Consequently, the impacts of the moths are variable for different countries. Some countries (e.g. Egypt, Turkey, Syria and Spain) consider it as a significant pest (Tahar Chaouche et al. 2019) while it is considered an insignificant pest in countries such as South Africa (see Gohneim 2015).

The moth damages olive and jasmine leaves by feeding on them (Fodale and Mule 1990; CABI 2019; Mansour 2024). The moth is known to be a serious pest of *Jasminum* sp. and *Ligustrum* sp. in Greece (see Gohneim 2015). Damage to olives usually involves young plants and, in some countries, can be very serious as the moth has been recorded to feed on entire shoots of olives even up to 15 cm tall (Gohneim 2015). Damage on hosts is usually not limited to leaves but includes leaf buds, flowers, and fruits of hosts (CABI 2019; Tahar Chaouche et al. 2019). High larval infestation may reduce olive fruit yield by up to 30% and attacks on fruits may make them unsuitable for marketing (see Gohneim 2015; CABI 2019).

Jasmine moth has been recorded in Australia (see CABI 2019; Tzanakakis 2003; iNaturalist 2024) and olives are commercially grown in many areas of the country such as Queensland, New South Wales, Victoria, and Tasmania (Australian Olive Association 2018). However, the moth has not been listed among the significant pests of the olives (Fruit tree lane 2017; DPIRD 2023). Additionally, no evidence was found to indicate that Jasmine moths are considered as significant pests of other host species in Australia. One caveat to note is that molecular confirmation of the moth's presence in Australia has not yet been determined (Andreas Zwick 2024, Pers. comm).

While it is likely the Jasmine moths can establish in New Zealand and potentially find new hosts, the likelihood of it becoming a significant pest in New Zealand is very low. Although the moths have been recorded in some parts of New Zealand, it is not clear whether they can become significant pests if exposed to olive orchards or hedges of jasmine plants and privets. It is important to note that not all olive trees are preferred by Jasmine moths as pointed out by Ghoneim (2015) hence it not clear whether, the environment and host abundance in New Zealand will create a suitable situation for a significant defoliation of olive orchards.

In New Zealand, Jasmine moth may potentially infest on some socio-culturally significant or native plant species in the family Oleaceae given that most of the moth's hosts have been recorded from that plant family. These hosts include native maire species such as *Nestegis apetala*, *N. cunninghamii*, *N. lanceolata*, *N. montana* (see NZPCN 2024) and the canary island olive tree (Picconia excelsa) which is an endangered species (see Beddie 2021). Their impact on such hosts may be crucial because one of them (*Nestegis apetala*) is naturally uncommon. However, no evidence has been found to indicate that any member of the genus *Nestegis* has been recorded as a host of the moth.

The presence of Jasmine moth in New Zealand may slightly impact international plant trade as the moth is regarded as a quarantine pest in Argentina, Ecuador, Egypt, Peru, and Uruguay. However, basic pre-export and post-entry biosecurity measures will likely mitigate the risks of spreading through plant trade hence the impact on plant trade is estimated to be negligible.

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Appendix 1:

Appendix 1: Table showing list of known plant hosts of Jasmine moth (*Palpita vitrealis*). The superscript numbers and asterisks (*) represent the sources ([1.]CABI CPC, [2.] Ghoneim 2015, [3.] Khaghaninia and Pourabad 1999, [4.] GLOBI 2024, [5.] African Moths 2013, [*]Commonly recorded as a host many sources).

Hosts	Family	Host status	Presence in New Zealand
Arbutus unedo (arbutus)[1]	Ericaceae	alternative	present
Centranthus ruber[4]	Caprifoliaceae	alternative	present
Daphne gnidium[4]	Thymelaeaceae	alternative	no record
Eupatorium cannabinum (hemp agrimony)[4]	Compositae	alternative	present
Fragaria x ananassa (strawberry)[3]	Rosaceae	alternative	present
Fraxinus spp. (ash)[2]	Oleaceae	alternative	some species are present
Grewia sp.[5]	Malvaceae	alternative	some species are present
Helicteres isora[5]	Malvaceae	alternative	no record
Jasminum spp. (jasmine)*	Oleaceae	main	Some species are present
Jasminum officinale (common jasmine)[4]	Oleaceae	main	present
Jasminum sambac[4]	Oleaceae	main	no record
Ligustrum spp. (privet)[1]	Oleaceae	alternative	some species are present
Olea europaea subsp. *europaea (*European olive)*	Oleaceae	main	present
Osmanthus sp.[1]	Oleaceae	alternative	Some species are present
Phillyrea spp.[2]	Oleaceae	alternative	no record
Porterandia scortechinii[5]	Rubiaceae	alternative	no record
Schima noronhae[5]	Theaceae	alternative	no record
Sida rhombifolia (arrow-leaf sida)[5]	Malvaceae	alternative	present
Viburnum spp.[3]	Adoxaceae	alternative	some species are present
Wrightia tinctoria (pala indigo)[1]	Apocynaceae	other	no record

Appendix 2: Table showing natural enemies of Jasmine moth (*Palpita vitrealis*). All the records are found in CABI CPC except for the ones with asterisks (*) which were recorded in GLOBI 2024.

Organism	Order	Organism type	Presence in New Zealand
Apanteles syleptae	Hymenoptera	insect (parasitoid)	no record
Apanteles taragamae	Hymenoptera	insect (parasitoid)	no record
Apanteles xanthostigma	Hymenoptera	insect (parasitoid)	no record
Bacillus thuringiensis	Bacillales	bacteria (pathogen)	present
Brachymeria aegyptiaca	Hymenoptera	insect (parasitoid)	no record
Brachymeria euploeae	Hymenoptera	insect (parasitoid)	no record
Chelonus tabonus	Hymenoptera	insect (parasitoid)	no record
Dolichogenidea laevigata	Hymenoptera	insect (parasitoid)	no record
Eupeodes corollae	Diptera	insect (predator)	no record
Nemorilla floralis	Diptera	insect (parasitoid)	no record
Nemorilla maculosa	Diptera	insect (parasitoid)	no record
Nemorilla notabilis	Diptera	insect (parasitoid)	no record
Pales pavida	Diptera	insect (parasitoid)	no record
Pseudoperichaeta nigrolineata	Diptera	insect (parasitoid)	no record
*Menemerus semilimbatus**	Araneae	spider (predator)	no record
*Miniopterus schreibersii**	chiroptera	bat (predator)	no record
Trichogramma sp.	Hymenoptera	insect (parasitoid)	some species are present
*Trichogramma oleae**	Hymenoptera	insect (parasitoid)	no record
Xanthopimpla punctata	Hymenoptera	insect (parasitoid)	no record