



Deliverable Number D.2.1

D.2.1 Report on the main pests affecting almond orchards

VALMEDALM: Valorization of Mediterranean Almond orchards through the use of intercropping integrated strategies



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Executive Summary

The objective of working package number 2 (WP2) is two-folded. The first objective is to "establish a database of main pests affecting almond orchards in Mediterranean regions". Having the scope of pest challenging the production of almonds within the Mediterranean region, VALDMEDALM is aiming to then construct a network of knowledge transfers to "evaluate the impact of intercropping practices in almond orchards pest and weed management". To cover the first objective, we hereby submit Deliverable 2.1 - an inventory of the main pests affecting almond orchards as reported by the partners of VALMEDALM in Italy (UNIPA), Croatia (UNIST), Morocco (USMS and INRA), Israel (ARO), and Portugal (CNCFS). For each partner, D2.1 hereinafter is listing the main species of pests, their class and order, local or common name, the way of action (*e.g.*, sucking or biting), region of activity, main damage, and agronomic importance.

The list of pests includes 23 species of insects, all of which are considered major pests, but only two of them appear in more than a single participating country: *Capnodis tenebrionis* in Croatia, Morocco, Italy, and Israel, and *Monosteira unicastata* in Italy and Portugal. The next diverse group is Fungi with 16 species, three of which appear in two countries. Arachnida pests in our inventory include two species of mites (acari) - *Panonychus ulmi* (Italy), and *Tetranychus urticae* (Italy, Israel, and Portugal). The list of weeds could not be exhausted, as only several partners were able to mention specific plant species. Almond farmers of course are facing weeds in their orchards, but this challenge is specific to each location, and at the same time – the most common practice is chemical herbicides.

Main Pests in almonds reported by UNIPA, Italy

Pest Spp.	Class	Order	Local name	Way of action	Region of activity	Damage	Agronomic importance
<i>Panonychus ulmi</i>	Arachnida	Tetranychidae	Ragnetto rosso dei fruttiferi	feeding activity on leaves	Worldwide	direct leaf damage	major pest
<i>Tetranychus urticae</i>	Arachnida	Tetranychidae	Ragnetto rosso	feeding activity on leaves	Worldwide	direct leaf damage	major pest
<i>Monosteira unicastata</i>	Insecta	Hemiptera Heteroptera: Tingidae	Cimicetta del mandorlo	feeding activity on leaves	Mediterranean	direct leaf damage	major pest
<i>Brachycaudus helichrysi</i>	Insecta	Hemiptera Heteroptera: Aphididae		feeding activity on buds/flowers	Mediterranean	direct bud/flower damage	major pest
<i>Brachycaudus amygdalinus</i>	Insecta	Hemiptera Heteroptera: Aphididae		feeding activity on buds/flowers	Mediterranean	direct bud/flower damage	major pest
<i>Myzus persicae</i>	Insecta	Hemiptera Heteroptera: Aphididae		feeding activity on buds/flowers	Mediterranean	direct bud/flower damage	minor pest
<i>Hyalopterus pruni</i>	Insecta	Hemiptera Heteroptera: Aphididae		feeding activity on buds/flowers	Mediterranean	direct bud/flower damage	minor pest
<i>Pterochloroides persicae</i>	Insecta	Hemiptera Heteroptera: Aphididae		feeding activity on buds/flowers	Mediterranean	direct bud/flower damage	minor pest
<i>Brachycaudus persicae-niger</i>	Insecta	Hemiptera Heteroptera: Aphididae		feeding activity on buds/flowers	Mediterranean	direct bud/flower damage	minor pest
<i>Capnodis tenebrionis</i>	Insecta	Coleoptera: Buprestidae		larval feeding activity in roots of both sapling and mature trees	Mediterranean	direct root damage, resulting in plant death	occasional pest

Main Pests in almonds reported by UNIST, Croatia

Pest Spp.	Class	Order	Local name	Way of action	Region of activity	Damage	Agronomic importance
<i>Armillaria melea</i>	Fungi: Agaricomycetes	Agaricales	Root rot	root rot and plant death	widespread in Croatia	roots become infested with micelia, followed by the impermeability of conductive bundles, tree canopy starts to wilt from the periphery and finally finished with plant death	major pest, widespread
<i>Rosellinia necatrix</i> <i>Prilleux</i>	Fungi: subdivision Ascomycotina	Sphaeriales. yn.Xylariales	Root rot of fruit trees and vines	root rot, a progressive weakening of the plant, and plant death	the whole of Croatia	Fungi developing mycelium fans, invading the whole root and causing general rotting	rarely appears
<i>Verticillium dahliae</i> Kleb.	Fungi:Sordariomycetes	Hypocreales	Wilt of almond	the disease affects the root system, young trees lag in development, and leaves wither and dry	Dalmatia	The disease is visible on one part of the tree crown, and a dark brown ring is visible in the cross-section in the part of the conductive bundles	drying of tree
<i>Polystigma fulvum</i>	Fungi:Sordariomycetes	Phyllachorales	Orange spotting of almonds	infestation is caused by ascospores, formation of picking, red-brown spots	Dalmatia	spots on the leaves, cause defoliation	causes defoliation

<i>Taphrina deformans</i>	Fungi:Taphri nomyces	Taphrinales	Almond leaf curl	infestations are caused by ascospores	weakly present in Croatia	leaf curl, necrotized leaves, flowers fall	unequal growth of the tree
<i>Stigma carpophillia</i>	Fungi:Dothi deomycetes	Dothideales	Almond leaf hollownes s	the fungus overwinters in cancer wounds in the form of mycelium	widespread in Croatia	purple spots on young leaves, purple lesions on fruits	defoliation
<i>Tranzschelia pruni spinosae var. discolor</i>	Fungi: Urediniomyc ete	Uredinales	Almond rust	they overwinter in the form of teliospores, basidiospores infect plants	poorly distributed	yellow spots on the leaf that turns black, falling leaves	early defoliation
<i>Venturia carpophilia</i>	Fungi:Dothi deomycetes	Pleosporales	Mottling of fruits and leaves	in spring, pseudothecia discharge ascospores, which constitute the primary inoculum for infections	a very rare disease in Croatia	symptoms are manifested on the fruit, gray spots appear on the fruit	does not cause great damage
<i>Podospaera tridactyla</i>	Fungi: Leotiomycet es	Erysiphales	Powdery mildew of almond	severe infection with mycelium and conidia causes cupping and malformation in the leaves	a very rare disease in Croatia	whitish coating on the leaves, leaf deformatio n	does not cause significant damage
<i>Moniliana laxa</i>	Fungi: Leotiomycet es	Helotiales	Bring the flower and dry the almond shoots	in the spring, the pathogen releases conidia and infects the plant	widespread in Croatia	drying of saplings, wilting flowers, leaves without turgor, necrosis appearance of cancer wounds	flower decay, reduced yield
<i>Fusicoccum amygdal</i>	Fungi: Dothideomy cetes	Botryosphae rales	Drying of almond buds and buds	pickings present on the branches all year round, the mycelium enters the shoot and spreads around the bud	widespread in Croatia	damage in the shoots, rarer branches, drying of shoots, necrosis, formations of black stroma with pickings	the most common disease of almonds, damaged fruits
<i>Anthonomus amygdali</i>	Insecta	Curculionida e	Bajamov cvjetojed almond	larvae eat flower buds	widespread in Croatia	female lay eggs in flower	significant pest, not permanent

			blossom eater			buds, larvae eat the content of flower	
<i>Taeniothrips meridionalis</i>	Insecta	Tysanoptera	Bajamov trips/ pest of flowers	flowers wither become necrotic	widespread in Croatia	symptoms are present during and after flowering	significant pest, not permanent
<i>Epicometis hirta</i>	Insecta	Coleoptera	Dlakavir ružičar/ blossom feeder	flower pest	widespread in Croatia	adults eating flowers contents	significant pest, not permanent
<i>Capnodis tenebrionis</i>	Insecta	Coleoptera	flathead wood borer	pest of roots	widespread in Croatia	larvae burrow roots and lead to the death of plants	major pest, widespread

Main Pests in almonds reported by USMS, Morocco

Pest Spp.	Class	Order	Local name	Way of action	Region of activity	Damage	Agronomic importance
<i>Hordeum murinum</i>	Weed	Poaceous	L'orge des rats	Competition for water and nutrients	Mediterranean	Weakening of almond trees and attraction of insect pests.	Low importance
<i>Calendula arvensis</i>	Weed	Astéraceous	Soucis des champs	Competition for water and nutrients	Mediterranean		Low importance
<i>Raphanus raphanistrum</i>	Weed	Brassicaceous	La Ravenelle	Competition for water and nutrients	Mediterranean		Low importance
<i>Sinapis arvensis</i>	Weed	Brassicaceous	Moutarde des champs	Competition for water and nutrients	Mediterranean		Low importance
<i>Capsella bursa-pastoris</i>	Weed	Brassicaceous	Bourse à berger	Competition on water and nutrients	Mediterranean		Low importance
<i>Scolytus amygdali</i>	Insect	Coleoptera	Scolyte	Females drill under tree bark in an egg-laying gallery, issued larvae drill for feed and give adult insects to attack other trees	Mediterranean	Attacking almond barks (galleries on branches)	Alarming mortality factor
<i>Calliphora vomitoria</i>	Insect	Diptera	Mouche bleue	Females blue bottle fly lays eggs in decaying vegetable matter	Mediterranean	Attacking almond leaves (wounds and discolored spots that became increasingly necrotic)	A fundamental role in investigations on biodiversity

Main Pests in almonds reported by INRA, Morocco

Pest Spp.	Class	Order	Local name	Way of action	Region of activity	Damage	Agronomic importance
<i>Cetonia aurata</i>	Insecta	Coleoptera	La cétoine	Adult attack on flowers	Azilal mountains and Mesknès	flowers damage/ Low fruit set	Major pest
<i>Scolytus amygdali</i>	Insecta	Coleoptera	Scolyte/N khar khchb (in arabic)	Larva attack on weed/Xylofagus	Azilal mountains and Mesknès	Attacking almond barks (galleries on branches)	Major pest
<i>Aphids</i>	Insecta	Hemiptera	Lmen (in arabic)	Adultes et larves sur feuilles	Azilal mountains and Mesknès	Leaf's wrap/ honeydew and sooty mold	Major pest
<i>Capnodis tenebrionis</i>	Insecta	Coleoptera	Le capnode	Larva attack on roots/ Adult attack on leaves	Azilal mountains and Mesknès	Root attack by larvae	Moderate pest

Main Pests in almonds reported by ARO, Israel

Pest Spp.	Class	Order	Local name	Way of action	Region of activity	Damage	Agronomic importance
<i>Eurytoma amygdali</i>	Insect	Hymenoptera	צרעה השקד, almond seed wasp	Eggs are hatched in fruits	Mediterranean	Direct fruit damage, a risk to next year's yield	Major pest
<i>Tetranychus urticae</i>	Arachnida	Trombidiformes	אקרית אדומה/צהובה מצויה	sucking cell contents from the leaves	Cosmopolitan	reduce the photosynthetic capability	Major pest
<i>Anarsia lineatella</i>	Insecta	Lepidoptera	עשבחנין / המשמש / עש המשמש / אנרסיה	larva feed on young meristems and fruits	Cosmopolitan	Direct fruit damage	Major pest
<i>Jacobiasca lybica (and 2 more cicadellidae)</i>	Insecta	Cicadellidae	ציקדיה ירוקה, משפחת הציקדיים (ציקדות)	Pierces cells and sucks their contents	Mediterranean basin, Arabia, India, East, South and North Africa.	Damage to shoot	Major pest in several crops
<i>Aphis gossypii</i>	Insecta	Hemiptera	אפיד הכותנה (כנימת הדלועיים)	Sucking sap exudates is hosting damaging fungi	Cosmopolitan	Damage to leaves	Major pest
<i>Capnodis tenebrionis</i>	Insecta	Coleoptera	קפנודיס	Larva is feeding on roots and damage tree structure	Overlaps the natural distribution of almond	attack and kill apparently healthy trees	Major pest
<i>Ruguloscolytus amygdalis</i>	Insecta	Coleoptera	קמבית השקד (ח). קליפת השקד	Dig, feed and mate in young shoots	Mediterranean region, Southern Europe, India	Damage to branches	Major pest
<i>Ectomyelois ceratoniae</i>	Insecta	Lepidoptera	עשנור החרוב (עש החרוב)	larva feed on fruits	Mediterranean basin to Iran, South Africa, Australia, America.	Polyphagous, infests almonds in storage	Major pest
<i>dux Cerambyx</i>	Insecta	Coleoptera	יקרונית השקד	Larva is feeding on roots and damage tree structure	France, Italy, the Balkan, the Near East, Iran	Attacking sapwood, heartwood	Major pest
<i>Puccinia</i>	Fungi: Pucciniomycetes	Pucciniales	חילדון			Stem rust	Major pest
<i>Monilinia laxa</i>	Fungi: Leotiomycetes	Helotiales	מוניליה (ריקבון חום)	Causes disease on fruits, twigs, and blossoms	fruit rotting	Damaging blooming branches	Major pest

<i>Alternaria alternata</i>	Fungi: Dothideomycetes	Pleosporales	כתמי חלפת	moist warm environment		leaf spots, rots, and blights	Major pest
<i>Colletotrichum gloeosporioides</i>	Fungi: Leotiomyces	Helotiales	אנטרקנו השקד (גחלון)	Infect leaves, fruits	Common fungal plant pathogen	Direct damage to fruits	Major pest
<i>Tranzschelia discolor</i>	Fungi: Urediniomycetes	Uredinales	חילדון הגלעיניים	Angular, yellow spots on leaves			Major pest
<i>Taphrina deformans</i>	Fungi: Taphrinomycetes	Taphrinales	סלסול עלים	Leaf curl		Damage to leaves	Major pest
<i>Polystigma fulvum</i>	Fungi: Sordariomycetes	Phyllachorales	פוליסטיגמה			leaf blotch	Major pest
<i>Venturia pyrina</i>	Fungi: Dothideomycetes	Pleosporales	גרב הגרעיניים		Widespread distribution in temperate and subtropical regions	Black spots on fruits	Major pest
<i>Stigmina carpophila</i>	Fungi: Ascomycota	Dothideales	חורי ירי			Shot hole disease	Major pest

Main Pests in almonds reported by CNCFS, Portugal

Pest Spp.	Class	Order	Local name	Way of action	Region of activity	Damage	Agronomic importance
<i>Monosteira unicostata</i>	Insecta	Hemiptera	monosteira	Insect biting/sucking activity	Mediterranean	Chlorotic spots in the area where they are bitten; Dryness and premature fall - which can cause complete defoliation ; Fruit abortion – production breaks; Excretion of honeydew – hinders photosynthesis and gives rise to the installation of sooty mold.	Major pest
<i>Tetranychus urticae</i>	Arachnida	Trombidiformes	two-spotted spider mite	Insect biting/sucking activity	Global	Reduce the photosynthetic capability of plants and they do damage to the spongy mesophyll, palisade parenchyma, and chloroplasts.	Major pest
<i>Panonychus ulmi</i>	Arachnida	Trombidiformes	European red mite	Insect biting/sucking activity	Global		Major pest