

USING PLANT PHENOLOGY TO MONITOR INSECT PESTS OF LANDSCAPE PLANTS

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Plant phenology is the relation between climate and specific events in plant development, such as bud break, blooming or dropping of leaves.

This development is dependent on temperature, therefore a plant will bloom earlier in a warm year and later in a cool year. Similarly, insect development is also dependent on temperature. Insect pests are more susceptible to pesticide treatments during their young stages, and less susceptible in the adult and egg stage.

Researchers have correlated the development of certain plants with the appearance of the vulnerable stage of certain insects. This information is helpful to determine which insect pests to monitor at different times of the year. The use of plant phenology for pest management is not exact, and needs to be constantly verified under local conditions.



Above

A brown woody area at the end of the branch is typical damage from Cooley spruce gall adelgids. Plant phenology can help determine when to monitor for this pest, ahead of the damage. For example, when *Magnolia X soulangiana* is in pink bud (early spring), it is an indicator to monitor for the overwintering insects, and treat if found. When *Acer saccharum* is in full leaf colours (during fall season), it is an indicator to monitor for the overwintering nymphs, and treat if found.

I. DEVELOP AN IN-HOUSE CALENDAR

When monitoring, the stage of development of permanent plants in the area should be recorded. Since plant and insect development are both dependent on temperature, it is possible to correlate the development of certain plants with the appearance of the vulnerable stage of specific pests. For example, the egg hatch of eastern tent caterpillars coincides with the blooming period of saucer magnolia. This information can be used to determine the time of year to monitor for a pest, and is more precise than relying on calendar dates.

The use of plant phenology for pest management is not exact, and needs to be constantly verified under local conditions. The pest manager should be aware that the environment is different between the sun exposed site and the north exposed site of a property, or near buildings compared to open fields. The pest manager should take this into account when selecting appropriate indicator plants.

II. INDICATOR PLANTS FOR BRITISH COLUMBIA

A list of indicator plants for insects commonly found on ornamentals in British Columbia is provided in the following tables. When an indicator plant reaches a particular stage of development, it is time to monitor for certain insects.

The information is adapted from the publication *Coincide: The Orton System of Pest Management* (by D.A. Orton and T.L. Green, 1989, Plantsmen's Publications, Illinois). The information in this book is based on twenty years of data from Illinois. Since the development for plants and insects is based on temperature, the same rates of development probably occur in British Columbia, but at different calendar dates.

Another excellent reference is available on the website of the Ohio Agricultural Research and Development Center (look for D.A. Herms, 2000, in Special Circular 173, Ornamental Plants: Annual Reports and Research Reviews 1999"). This report is a field verification and augmentation of the "Orton Book". It presents a sequence of development for 85 plants and 46 insect and mite species in Ohio from 1997 to 1999. There were large weather differences during the three years, but the order of phenological events was generally consistent.

III. TABLES

[Table 1: organized by seasonal pest activity](#)

[Table 2: organized by indicator plant](#)

[Table 3: organized by target pest](#)

I. BY SEASONAL ACTIVITY

Indicator plant and stage	Insect pest and Latin name	Insect and stage To monitor
Syringa vulgaris (green bud)	Pine bark aphid (<i>Pineus strobi</i>)	Overwintering females
Magnolia X soulangiana (pink bud)	Cooley spruce gall adelgid (<i>Adelges cooleyi</i>)	Overwintering insects
Magnolia X soulangiana (pink bud)	European pine shoot moth (<i>Rhyacionia buoliana</i>)	Overwintering larvae
Magnolia X soulangiana (pink bud)	Spruce eriophyid mite (<i>Nalepella halourga</i>)	Newly-hatched immature
Magnolia X soulangiana (pink bud)	Spruce needle miner (<i>Endothenia albolineata</i>)	Young feeding larvae
Magnolia X soulangiana (pink bud)	Spruce spider mite (<i>Oligonychus ununguis</i>)	Newly-hatched nymphs
Magnolia X soulangiana (early bloom)	Eastern tent caterpillar (<i>Malacosoma americana</i>)	Young larvae
Magnolia X soulangiana (blooming)	Fletcher scale (<i>Parthenolecanium fletcheri</i>)	Overwintering females
Magnolia X soulangiana (dropping petals)	European pine sawfly (<i>Neodiprion sertifer</i>)	Newly-hatched larvae
Magnolia X soulangiana (dropping petals)	Spruce budworm (<i>Choristoneura fumiferana</i>)	Young larvae
Magnolia X soulangiana (dropping petals)	Willow aphid (<i>Pterocomma smithae</i>)	Newly-hatched nymphs
Gleditsia triacanthos (bud break)	Honeylocust pod gall midge (<i>Dasineura gleditchiae</i>)	Newly-hatched larvae
Prunus X cistena (blooming)	European elm scale (<i>Gossyparia spuria</i>)	Overwintering nymphs
Aesculus hippocastanum (blooming)	Honeysuckle aphid (<i>Hyadaphus tataricae</i>)	First aphids
Aesculus hippocastanum (blooming)	Pine needle scale (<i>Chionaspis pinifoliae</i>)	First instar nymphs
Syringa vulgaris (late bloom)	Birch leaf miner (<i>Fenusa pusilla</i>)	Young larvae
Syringa vulgaris (late bloom)	Oystershell scale (<i>Lepidosaphes ulmi</i>)	Newly-hatched crawlers

Aesculus hippocastanum (late bloom)	Black vine weevil (<i>Otiorhynchus sulcatus</i>)	Overwintering adults
Aesculus hippocastanum (late bloom)	Bronze birch borer (<i>Agrilus anxius</i>)	Newly-hatched larvae
Aesculus hippocastanum (late bloom)	Elm leaf beetle (<i>Xanthogaleruca luteola</i>)	Young larvae
Philadelphus coronaries (blooming)	Peach tree borer (<i>Synanthedon exitiosa</i>)	Start of egg hatch
Crataegus crus-galli (blooming)	Tussock moth (<i>Orgyia leucostigma</i>)	Young immature larvae
Catalpa speciosa (blooming)	Bagworm (<i>Thyridopteryx ephemeraeformis</i>)	Newly-hatched larvae
Catalpa speciosa (blooming)	Black vine weevil (<i>Otiorhynchus suscatus</i>)	New adults
Catalpa speciosa (blooming)	European pine shoot moth (<i>Rhyacionia buoliana</i>)	Newly-hatched larvae
Catalpa speciosa (blooming)	San Jose scale (<i>Aspidiotus perniciosus</i>)	Newly-hatched crawlers
Catalpa speciosa (blooming)	Woolly apple aphid (<i>Eriosoma lanigerum</i>)	When aphids are present
Yucca filamentosa (blooming)	Cottony maple scale (<i>Pulvinaria innumerabilis</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	European elm scale (<i>Gossyparia spuria</i>)	Newly-hatched nymphs
Yucca filamentosa (blooming)	Fletcher scale (<i>Parthenolecanium fletcheri</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	Lecanium scale (<i>Lecanium corni</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	Two-spotted spider mite (<i>Tetranychus urticae</i>)	Immature stages and adults
Sorbus aucuparia (fruit turning orange)	Spruce bud scale (<i>Physokermes piceae</i>)	Newly-hatched crawlers
Sorbus aucuparia (fruit is now orange)	Fall webworm (<i>Hyphantria cunea</i>)	Young larvae
Solidago canadensis (blooming)	Peach tree borer (<i>Synanthedon exitiosa</i>)	End of egg hatch
Solidago canadensis (blooming)	Spruce spider mite (<i>Oligonychus ununuis</i>)	Newly-hatched nymphs
Acer saccharum (leaves in fall colour)	Cooley spruce gall adelgid (<i>Adelges cooleyi</i>)	Overwintering nymphs
Acer saccharinum (leaves have fallen)	Spruce needle miner (<i>Endothenia albolineata</i>)	Young feeding larvae

II. BY INDICATOR PLANT

Indicator plant and stage	Insect pest and Latin name	Insect and stage To monitor
Acer saccharum (leaves in full colour)	Cooley spruce gall adelgid (<i>Adelges cooleyi</i>)	Overwintering nymphs
Acer saccharinum (defoliated)	Spruce needle miner (<i>Endothenia albolineata</i>)	Young feeding larvae
Aesculus hippocastanum (blooming)	Honeysuckle aphid (<i>Hyadaphus tataricae</i>)	First aphids
Aesculus hippocastanum (blooming)	Pine needle scale (<i>Chionaspis pinifoliae</i>)	First instar nymphs
Aesculus hippocastanum (late bloom)	Black vine weevil (<i>Otiorhynchus sulcatus</i>)	Overwintering adults
Aesculus hippocastanum (late bloom)	Bronze birch borer (<i>Agrilus anxius</i>)	Newly-hatched larvae
Aesculus hippocastanum (late bloom)	Elm leaf beetle (<i>Xanthogaleruca luteola</i>)	Young larvae
Catalpa speciosa (blooming)	Bagworm (<i>Thyridopteryx ephemeraeformis</i>)	Newly-hatched larvae
Catalpa speciosa (blooming)	Black vine weevil (<i>Otiorhynchus suscatus</i>)	New adults
Catalpa speciosa (blooming)	European pine shoot moth (<i>Rhyacionia buoliana</i>)	Newly-hatched larvae
Catalpa speciosa (blooming)	San Jose scale (<i>Aspidiotus perniciosus</i>)	Newly-hatched crawlers
Catalpa speciosa (blooming)	Woolly apple aphid (<i>Eriosoma lanigerum</i>)	When aphids are present
Crataegus crus-galli (blooming)	Tussock moth (<i>Orgyia leucostigma</i>)	Young immature larvae
Gleditsia triacanthos (bud break)	Honeylocust pod gall midge (<i>Dasineura gleditchiae</i>)	Newly-hatched larvae
Philadelphus coronaries (blooming)	Peach tree borer (<i>Synanthedon exitiosa</i>)	Start of egg hatch
Prunus X cistena (blooming)	European elm scale (<i>Gossyparia spuria</i>)	Overwintering nymphs

Magnolia X soulangiana (pink bud)	Cooley spruce gall adelgid (<i>Adelges cooleyi</i>)	Overwintering insects
Magnolia X soulangiana (pink bud)	European pine shoot moth (<i>Rhyacionia buoliana</i>)	Overwintering larvae
Magnolia X soulangiana (pink bud)	Spruce eriophyid mite (<i>Nalepella halourga</i>)	Newly-hatched immature
Magnolia X soulangiana (pink bud)	Spruce needle miner (<i>Endothenia albolineata</i>)	Young feeding larvae
Magnolia X soulangiana (pink bud)	Spruce spider mite (<i>Oligonychus ununguis</i>)	Newly-hatched nymphs
Magnolia X soulangiana (blooming)	Fletcher scale (<i>Parthenolecanium fletcheri</i>)	Overwintering females
Magnolia X soulangiana (dropping petals)	European pine sawfly (<i>Neodiprion sertifer</i>)	Newly-hatched larvae
Magnolia X soulangiana (dropping petals)	Spruce budworm (<i>Choristoneura fumiferana</i>)	Young larvae
Magnolia X soulangiana (dropping petals)	Willow aphid (<i>Pterocomma smithae</i>)	Newly-hatched nymphs
Solidago canadensis (blooming)	Peach tree borer (<i>Synanthedon exitiosa</i>)	End of egg hatch
Solidago canadensis (blooming)	Spruce spider mite (<i>Oligonychus ununuis</i>)	Newly-hatched nymphs
Sorbus aucuparia (fruit turning orange)	Spruce bud scale (<i>Physokermes piceae</i>)	Newly-hatched crawlers
Sorbus aucuparia (fruit is now orange)	Fall webworm (<i>Hyphantria cunea</i>)	Young larvae
Syringa vulgaris (green bud)	Pine bark aphid (<i>Pineus strobi</i>)	Overwintering females
Syringa vulgaris (late bloom)	Birch leaf miner (<i>Fenusa pusilla</i>)	Young larvae
Syringa vulgaris (late bloom)	Oystershell scale (<i>Lepidosaphes ulmi</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	Cottony maple scale (<i>Pulvinaria innumerabilis</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	European elm scale (<i>Gossyparia spuria</i>)	Newly-hatched nymphs
Yucca filamentosa (blooming)	Fletcher scale (<i>Parthenolecanium fletcheri</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	Lecanium scale (<i>Lecanium corni</i>)	Newly-hatched crawlers
Yucca filamentosa (blooming)	Two-spotted spider mite (<i>Tetranychus urticae</i>)	Immature stages and adults

III. BY TARGET PEST

Indicator plant and stage	Insect pest and Latin name	Insect and stage To monitor
Catalpa speciosa (blooming)	Bagworm (<i>Thyridopteryx ephemeraeformis</i>)	Newly-hatched larvae
Aesculus hippocastanum (late bloom)	Black vine weevil (<i>Otiorhynchus sulcatus</i>)	Overwintering adults
Catalpa speciosa (blooming)	Black vine weevil (<i>Otiorhynchus suscatus</i>)	New adults
Syringa vulgaris (late bloom)	Birch leaf miner (<i>Fenusa pusilla</i>)	Young larvae
Aesculus hippocastanum (late bloom)	Bronze birch borer (<i>Agrilus anxius</i>)	Newly-hatched larvae
Magnolia X soulangiana (pink bud)	Cooley spruce gall adelgid (<i>Adelges cooleyi</i>)	Overwintering insects
Acer saccharum (leaves in fall colour)	Cooley spruce gall adelgid (<i>Adelges cooleyi</i>)	Overwintering nymphs
Yucca filamentosa (blooming)	Cottony maple scale (<i>Pulvinaria innumerabilis</i>)	Newly-hatched crawlers
Magnolia X soulangiana (early bloom)	Eastern tent caterpillar (<i>Malacosoma americana</i>)	Young larvae
Aesculus hippocastanum (late bloom)	Elm leaf beetle (<i>Xanthogaleruca luteola</i>)	Young larvae
Prunus X cistena (blooming)	European elm scale (<i>Gossyparia spuria</i>)	Overwintering nymphs
Yucca filamentosa (blooming)	European elm scale (<i>Gossyparia spuria</i>)	Newly-hatched nymphs
Magnolia X soulangiana (dropping petals)	European pine sawfly (<i>Neodiprion sertifer</i>)	Newly-hatched larvae
Magnolia X soulangiana (pink bud)	European pine shoot moth (<i>Rhyacionia buoliana</i>)	Overwintering larvae
Catalpa speciosa (blooming)	European pine shoot moth (<i>Rhyacionia buoliana</i>)	Newly-hatched larvae
Sorbus aucuparia (fruit is now orange)	Fall webworm (<i>Hyphantria cunea</i>)	Young larvae
Magnolia X soulangiana (blooming)	Fletcher scale (<i>Parthenolecanium fletcheri</i>)	Overwintering females
Yucca filamentosa (blooming)	Fletcher scale (<i>Parthenolecanium fletcheri</i>)	Newly-hatched crawlers

Gleditsia triacanthos (bud break)	Honeylocust pod gall midge (<i>Dasineura gleditchiae</i>)	Newly-hatched larvae
Aesculus hippocastanum (blooming)	Honeysuckle aphid (<i>Hyadaphus tataricae</i>)	First aphids
Yucca filamentosa (blooming)	Lecanium scale (<i>Lecanium corni</i>)	Newly-hatched crawlers
Syringa vulgaris (late bloom)	Oystershell scale (<i>Lepidosaphes ulmi</i>)	Newly-hatched crawlers
Syringa vulgaris (green bud)	Pine bark aphid (<i>Pineus strobi</i>)	Overwintering females
Aesculus hippocastanum (blooming)	Pine needle scale (<i>Chionaspis pinifoliae</i>)	First instar nymphs
Philadelphus coronaries (blooming)	Peach tree borer (<i>Synanthedon exitiosa</i>)	Start of egg hatch
Solidago canadensis (blooming)	Peach tree borer (<i>Synanthedon exitiosa</i>)	End of egg hatch
Catalpa speciosa (blooming)	San Jose scale (<i>Aspidiotus perniciosus</i>)	Newly-hatched crawlers
Sorbus aucuparia (fruit turning orange)	Spruce bud scale (<i>Physokermes piceae</i>)	Newly-hatched crawlers
Magnolia X soulangiana (dropping petals)	Spruce budworm (<i>Choristoneura fumiferana</i>)	Young larvae
Magnolia X soulangiana (pink bud)	Spruce eriophyid mite (<i>Nalepella halourga</i>)	Newly-hatched immature
Magnolia X soulangiana (pink bud)	Spruce needle miner (<i>Endothenia albolineata</i>)	Young feeding larvae
Acer saccharinum (leaves have fallen)	Spruce needle miner (<i>Endothenia albolineata</i>)	Young feeding larvae
Magnolia X soulangiana (pink bud)	Spruce spider mite (<i>Oligonychus ununguis</i>)	Newly-hatched nymphs
Solidago canadensis (blooming)	Spruce spider mite (<i>Oligonychus ununuis</i>)	Newly-hatched nymphs
Crataegus crus-galli (blooming)	Tussock moth (<i>Orgyia leucostigma</i>)	Young immature larvae
Yucca filamentosa (blooming)	Two-spotted spider mite (<i>Tetranychus urticae</i>)	Immature stages and adults
Magnolia X soulangiana (dropping petals)	Willow aphid (<i>Pterocomma smithae</i>)	Newly-hatched nymphs
Catalpa speciosa (blooming)	Woolly apple aphid (<i>Eriosoma lanigerum</i>)	When aphids are present