

# MICHIGAN STATE UNIVERSITY

## INSECT MANAGEMENT GUIDE for WINTER CANOLA

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## Calendar of insect pests in winter canola in Michigan

Pests are listed from early to late-season

| Common name                                | Overwintering stage, location                                                                                | April                                  | May                                                                                   | June                                            | Mid summer | September – after planting                                     |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------|------------|----------------------------------------------------------------|
| slugs                                      | Eggs and adults<br>In the soil                                                                               | Feeding on rosette early in the season |                                                                                       |                                                 |            | Feeding in new planting before winter                          |
| flea beetle (several species)              | Adults in leaf litter or protected areas around field                                                        |                                        | Adults feed on leaves then pods                                                       |                                                 |            |                                                                |
| cabbage seedpod weevil                     | Adult beetles in field edges or tree lines                                                                   |                                        | Adults feed early, followed by larvae feeding on seeds in pods                        |                                                 |            |                                                                |
| diamondback moth                           | Larvae may be able to overwinter in southern MI. Otherwise moths move north in the spring from further south |                                        | Larvae feed on buds, flowers, then pods of overwintered stand                         |                                                 |            | Defoliation damage to new plantings prior to dormancy          |
| lygus bug (tarnished plant bug and others) | Adults in leaf litter or protected areas around field                                                        |                                        | Adults (the later nymphs) feed on new growth, flowers, and pods of overwintered stand |                                                 |            | Nymphs and adult feed on new plantings                         |
| aphids                                     | Eggs on crop residue or weeds                                                                                |                                        | Colonies on new growth                                                                |                                                 |            |                                                                |
| swede midge                                | larvae, then pupae, in the soil                                                                              |                                        |                                                                                       | Limited potential for infestation of new tissue |            | Potential for larvae to infest growing points of new plantings |

## Canola, Pollinators, and Pest Management

- Canola is self-pollinated but insect pollination can increase pod number, seed set & weight, and yield by 13% to 30% (depending on the study and variety). Pollination can also end flowering & pod set earlier, leading to a shorter bloom time and more uniform seed maturation.
- Honeybees are key pollinators of many crops. Canola fields near bee hives can have considerable bee activity. Peak forage time is usually 10 AM to noon, coinciding with peak nectar secretion. Canola produces good honey, providing a good opportunity to work with local beekeepers.
- However, winter canola starts to bloom in April. Pollinators which are cold-tolerant and active earlier in the season are often more important in canola than honeybees, which optimally forage at a warmer ~70°F. A survey in Minnesota reported that 90% of the pollinators visiting canola fields during bloom were small native bees, bumble bees, flies, and other insects.
- Standard bee warnings on insecticide labels (“Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area” or “Avoid application when bees are actively foraging by applying during the evening”) may protect non-bee pollinators too.

To protect pollinators in canola, always scout fields and make spray decisions based on IPM guidelines like the ones in this guide. Best option - Avoid spraying insecticides during the bloom stage. This protects pollinators plus beneficial natural enemies that keep pest insects in check. If you must spray, wait until evening (after 8pm) so bees are back in the hive, or at least spray as late in the afternoon as possible when nectar production is lower and the field is less attractive to pollinators. However, natural enemies will still be killed or reduced by most insecticides labeled for canola.

### Damage checklist to aid in scouting canola in Michigan

| <b>Plant part or timing</b><br>Type of damage or injury | aphids | cabbage seedpod weevil | diamondback moth | flea beetles | lygus bugs | slugs | Swede midge |
|---------------------------------------------------------|--------|------------------------|------------------|--------------|------------|-------|-------------|
| <b>Plant tissue</b>                                     |        |                        |                  |              |            |       |             |
| small holes in leaves                                   |        |                        | x                | x            |            |       |             |
| irregular, ragged leaf feeding                          |        |                        | x                |              |            | x     |             |
| windowpane feeding                                      |        |                        | x                |              |            |       |             |
| leaf yellowing                                          |        |                        |                  |              | x          |       |             |
| leaves or tips cupped or crinkled                       | x      |                        |                  |              | x          |       |             |
| distortions or galls on new growth                      |        |                        |                  |              |            |       | x           |
| bushy plant / extra shoots                              |        |                        |                  |              |            |       | x           |
| growing point killed                                    |        |                        |                  |              |            |       | x           |
| shiny slime trails on plants                            |        |                        |                  |              |            | x     |             |
| sticky plant parts or sooty mold                        | x      |                        |                  |              |            |       |             |
| <b>Buds and Flowers</b>                                 |        |                        |                  |              |            |       |             |
| holes chewed into tissue                                |        | x                      | x                | x            |            |       |             |
| distorted growth, galls                                 |        |                        |                  |              |            |       | x           |
| blasted and shriveled tissue                            |        |                        |                  |              | x          |       | x           |
| <b>Pods</b>                                             |        |                        |                  |              |            |       |             |
| pod surface fed on                                      |        |                        | x                |              |            |       |             |
| scars or small holes                                    |        | x                      |                  |              | x          |       |             |
| distorted pods                                          |        | x                      |                  |              |            |       | x           |
| reduced number of pods                                  |        |                        |                  |              |            |       | x           |
| early shattering                                        |        | x                      | x                |              |            |       |             |
| <b>seeds</b>                                            |        |                        |                  |              |            |       |             |
| developing beans chewed                                 |        | x                      | x                |              |            |       |             |
| developing beans shriveled                              |        |                        |                  |              | x          |       |             |
| mature seed poked or scarred                            |        |                        |                  |              | x          |       |             |
| <b>Other</b>                                            |        |                        |                  |              |            |       |             |
| stand loss                                              |        |                        |                  | x            |            | x     |             |
| uneven crop maturity                                    |        |                        |                  |              |            |       | x           |

## Biology and impact of insect pests of winter canola in Michigan

### *Terms used to describe pest status of each insect*

- **Uncommon pest:** Often present, but below damaging levels
- **Occasional pest:** Often present, sometimes in high numbers
- **Important pest:** Present in most fields, potentially increasing to damaging levels every season. A common target of scouting, management programs, or insecticide use
- **Sporadic pest:** Populations vary from year to year, occurring after a mass movements from south to north during the season or favorable weather patterns (such as drought)
- **Localized pest:** Populations occur in specific locations under specific agronomic conditions, for example in no-till production or in older stands

| Pest (abbreviation)                                                                                     | Life cycle and Number of generations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Impact on the Crop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Conditions which favor infestation or damage                                                                                                                                                                                                                                                                                                                                                                                | Pest Status in Michigan                                                                                                   |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>aphids</b><br><br><i>* often cabbage &amp; turnip aphid, also green peach aphid</i>                  | <p>Both species likely overwinter as eggs on residue. The summer population is all female. Females give birth to multiple live young per day and do not mate to reproduce. At the end of the season, a generation of males and female are produced which mate. Tiny eggs are deposited on crop residue or weeds (depending on the species) for overwintering.</p> <p>Multiple overlapping generations</p>                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Nymphs and adults suck plant sap</li> <li>• Heavier infestation can occur on new growth at the top of the plant, resulting in a curled terminal</li> <li>• Feeding usually has little impact if the infestation occurs during pod fill, or when colonies are limited to the top of the plant where the pods typically won't mature</li> <li>• Cabbage, turnip and green peach aphids transmit turnip mosaic virus, which infects canola as well as sugarbeet</li> </ul>                                                                                                                                         | <ul style="list-style-type: none"> <li>• Dry conditions often exacerbate the feeding of aphids</li> <li>• Canola planted near sugarbeet (</li> </ul>                                                                                                                                                                                                                                                                        | <p>Uncommon</p> <p>Aphids are prey for many other insects and help to develop a natural enemy population in the field</p> |
| <b>cabbage seedpod weevil</b><br><br><i>(on insecticide labels, often called simply seedpod weevil)</i> | <p>From Europe - first found in Canada in 1995. Adults overwinter under litter in sheltered areas like ditch banks, fencerows, or tree lines. Emergence peaks when soil temp is ~60F. They feed on canola and crucifer weeds like wild mustard and can disperse around the landscape by flight. Females lay individual eggs into developing pods. The white legless larvae develop inside the pod, consuming 5-6 seeds as they grow. The last larval stage chews out of the pod and drops to the ground to pupate. First generation adults emerge, feed for a period, then move to overwintering sites.</p> <p>One generation per year</p> | <ul style="list-style-type: none"> <li>• Adult weevils chew into buds and flowers, which can cause them to shrivel and drop. Adult damage only becomes significant if plants cannot form additional buds, for example under dry conditions</li> <li>• Since adults move to new fields in the spring, beetles and damage typically are first found on field edges</li> <li>• Larvae are of greater impact, as they directly consume seeds and tunnel out of pods, leaving an entry point for pathogens</li> <li>• Damaged pods may become distorted when remaining seeds grow larger than normal. Damaged pods can also shatter before harvest</li> </ul> | <ul style="list-style-type: none"> <li>• A mild fall and /or winter can increase beetle survival over the winter</li> <li>• Mild, dry springs are better for weevil dispersal into new fields</li> <li>• Planting new stands near last year's production – the weevils don't have to work hard in the spring to find a host</li> <li>• Earlier-flowering fields attract adult weevils for feeding and egg laying</li> </ul> | <p>Occasional &amp; Localized</p>                                                                                         |

| Pest (abbreviation)                                                                   | Life cycle and Number of generations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Impact on the Crop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Conditions which favor infestation or damage                                                                                                                                                                                                                                                                                            | Pest Status in Michigan                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>diamondback moth (DBM)</b><br><br><i>Plutella xylostella</i>                       | <p>DBM recolonizes northward each season from further south, but the line for winter survival is uncertain. The northern limit for larvae to survive the winter has been suggested as the ~43°N latitude, roughly a line from Grand Rapids to Flint, but this has not been confirmed in the field. Under colder winter conditions, it is assumed that DBM must colonize from further south, transported on spring weather fronts. The timing of colonization would determine its impact on the crop, earlier arrival resulting in longer and more feeding.</p> <p>Host plants include many species of mustards (both crops and weeds). Females lay eggs on upper leaf surfaces over a several-week period. Eggs hatch within a week. Larvae (caterpillars) are green to yellowish-green, with a pale tan head and a forked butt-end with two pointy doodads. They feed on leaves and reproductive parts of plants. Larvae wiggle violently when poked or disturbed – they may drop off the plant on a line of silk. Larvae pupate in a white mesh cocoon attached to the plant. The entire life cycle can take 3-7 weeks.</p> <p>Multiple generations in the summer.</p> | <ul style="list-style-type: none"> <li>• Tiny first stage larvae feed within the leaf, creating transparent ‘windowpane’ areas. These are the first signs of infestation</li> <li>• The remaining three larvae stages feed (chew) on leaves and reproductive plant parts. Bud and flower feeding can reduce pod number. Larvae also feed on the surface of pods or chew into them to eat immature seeds. Surface-damaged pods may not fill, or they can shatter and spill seed before harvest</li> </ul> | <ul style="list-style-type: none"> <li>• A warm fall can lead to extended feeding in a new seeding, while earlier arrival of moths in spring means a longer time to attack flowers and pods</li> <li>• Fields with a lot of alternate weed hosts such as wild mustard or pennycress may support higher numbers</li> </ul>               | <p>Occasional &amp; Sporadic</p> <p>Depends on if and where larvae &amp; timing of moths moving from the south</p> |
| <b>flea beetle</b><br><br><i>*several species including crucifer &amp; striped FB</i> | <p>Adults overwinter in leaf litter in protected areas like ditch banks or woods. They emerge in mid to late April and feed on crucifer weeds and canola. Eggs are laid in soil and larvae feed on roots. New adults emerge in mid-summer and feed until early fall</p> <p>1 generation per year</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Adults chew small round holes. In winter canola, adults feed on leaves of overwintering plants, then move up to flowers. Injury is more serious in spring-planted canola where heavy feeding on emerging seedlings can thin the stand</li> </ul>                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>• Hot dry conditions after fall seeding can result in damage</li> <li>• A mild winter can increase winter survival of beetles</li> <li>• Fields with hosts such as wild mustard or pennycress can have more FBs</li> </ul>                                                                       | <p>Uncommon</p>                                                                                                    |
| <b>lygus bug</b><br><br><i>*tarnished plant bug and others</i>                        | <p>Lygus adults overwinter in residue and on field edges. Eggs are laid into stems and leaves of many host plants, including canola. Nymphs and adults pierce and suck plants.</p> <p>Tarnished plant bug has 3-5 generations per summer</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Nymphs and adults pierce and suck new growth and reproductive tissue. In this process they inject saliva which deforms buds, blasts flowers, and shrivels developing seeds.</li> <li>• Feeding on pods creates scars or dimples, potential areas for pathogens to infect</li> <li>• Feeding on seeds can reduce seed quality and increase pick</li> </ul>                                                                                                       | <ul style="list-style-type: none"> <li>• Hot, dry weather is favorable for Lygus</li> <li>• Alfalfa is a common Lygus host. When alfalfa is cut, large numbers of bugs can suddenly move into nearby canola fields</li> <li>• Damage is higher in spring canola (it is vulnerable for a longer period) than in winter canola</li> </ul> | <p>Occasional</p>                                                                                                  |

| Pest<br>(abbreviation)                                                                                                                                                                                                             | Life cycle<br>and<br>Number of generations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Impact on the Crop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Conditions which<br>favor infestation<br>or damage                                                                                                                                                                                                                                                                                                                                                                               | Pest Status<br>in Michigan                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| <b>slugs</b>                                                                                                                                                                                                                       | Slugs overwinter as eggs and adults, so both small and large ones may be present early in the season. Eggs are deposited in the soil, hatching in about one month. These slugs feed for the summer. Activity is usually at night or on cloudy days.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• The most severe impact occurs when slugs feed underground or on small plants, destroying the growing point. This can reduce stand</li> <li>• On larger plants, slugs chew small holes or larger holes with a tattered appearance</li> <li>• Shiny slime trails on leaves or the soil surface are another sign that slugs are present</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>• No till production, builds residue, food, and shelter for slugs, &amp; is the highest risk</li> <li>• Planting canola after winter wheat may increase risk due to residue left behind</li> <li>• Cool, wet weather is favorable for slug survival, activity, and damage. For winter canola, cool &amp; wet conditions in late summer after seeding could increase stand loss</li> </ul> | <p>Localized</p> <p>Limited to no-till fields with residue</p> |
| <b>swede midge</b><br><br><i>Contarinia nasturtii</i><br><br><i>Note: The assumption is that Swede Midge is gall midge attacking canola in MI. In western Canada, a related species, the canola flower midge, is also present.</i> | <p>A non-native gall midge. Larvae overwinter in the soil and pupate as the temperature increases in early spring. Tiny adults emerge at multiple timings in May into June, triggered by rainfall. Adults live for only a few days, feeding on canola flower nectar. Females lay egg clusters on new growth of numerous brassica &amp; crucifer crops like broccoli, cauliflower, cabbage and canola, plus 20 weed species in the same plant families. Larvae feed for several weeks in galled (distorted) tissue, then drop to the soil to pupate. Swede midge has facultative diapause, meaning that adult emergence is flexible - some emerge in-season while others remain as pupae in the soil for up to 2 years.</p> <p>3-5 generations from May to October</p> | <ul style="list-style-type: none"> <li>• Eggs are laid on new growth, flowers, or in leaf axis, and this is where clusters of small larvae feed surrounded by plant tissue. Their feeding introduces a salivary enzyme. General feeding symptoms include scarring at the point of larval feeding, plus swelling, twisting or galling of tissue in reaction to the saliva</li> <li>• If infestation occurs early in plant development (spring canola) the growing point can be distorted or killed. The main raceme may be stunted and bushy or not develop. Extra secondary shoots may grow.</li> <li>• If infestation occurs later in plant development (winter canola), individual buds may be infested. Some impact to yield, but less than if whole plants are impacted.</li> </ul> | <ul style="list-style-type: none"> <li>• Winter canola is less likely to have significant midge damage than spring canola, since it has bolted and is flowering by the time midges emerge</li> <li>• New seedlings planted in or near canola fields from the past few seasons, as midges emerge from these locations</li> </ul>                                                                                                  | <p>To date, seems uncommon in Michigan</p>                     |

## Management of insect pests of winter canola in Michigan

A 15-inch sweep net is useful to monitor insects in the crop. A supplier for nets in the region is Great Lakes IPM in Vestaburg MI, <https://www.greatlakesipm.com/>

| Pest (abbreviation)                                                                            | Management options and notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Scouting recommendation                                                                                                                                                                                                                                                                                                                                         | Threshold                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>aphids</b><br><br><i>* often cabbage &amp; turnip aphid, also green peach aphid</i>         | <ul style="list-style-type: none"> <li>Biological: Aphids in general are kept in check by numerous predators (ladybugs, lacewings, syrphid fly larvae) and specialized parasitoids. Under humid conditions, beneficial entomopathogenic fungi also infect and kill aphids. Keep this biocontrol in the system (for aphids as well as other insects like diamondback moth) by avoiding insurance sprays</li> <li>Environmental: Adequate moisture (rainfall or irrigation) reduces feeding stress and increases humidity for infection by fungal pathogens</li> </ul>                                                                                                                                                                                                                                                                                                                                                             | Nothing specific                                                                                                                                                                                                                                                                                                                                                | A guideline from North Dakota:<br><br><u>Late flower-early pod</u><br>20% of stems with an aphid colony                                                                                                                            |
| <b>cabbage seedpod weevil</b><br><br><i>(on many labels, often called just seedpod weevil)</i> | <ul style="list-style-type: none"> <li>Biological: At least 15 native parasitoids attack weevil in western Canada, but parasitism is far below levels found in its original range in Europe. The impact of biocontrol in Michigan, if any, is unknown</li> <li>Agronomic: Control of volunteer canola and brassica &amp; crucifer weeds in and around field reduces alternate hosts</li> <li>Agronomic: Since adults are attracted to early-flowering fields, a trap strip of an early flowering variety (say, in a headland) can be used to concentrate beetles for a limited border spray (as below)</li> <li>Insecticide: Since adults move into fields from edges, border spraying may be possible if populations are found early enough (or in a trap crop, as above)</li> <li>Insecticide: In a one-spray system for a whole field, optimal spray timing is at mid-flower, 7-10 days after first flowers appear</li> </ul> | Sample in mid-day, during bud & flowering:<br>Take sets of 10 sweeps from 4 locations in the field. Total the number of weevils collected in the 40 sweeps                                                                                                                                                                                                      | A threshold used in Canada:<br>2 to 4 weevils per sweep in the early flowering stage<br><br>Use the higher threshold (delay spraying) if natural enemies are present                                                               |
| <b>diamondback moth</b>                                                                        | <ul style="list-style-type: none"> <li>Biological: Biocontrol usually keeps the population in check. Many generalist predators likely feed on DBM caterpillars and multiple parasitoids attack them. Under humid conditions, larvae can be infected and killed by beneficial fungal pathogens. Keep biocontrol in the system by avoiding unnecessary sprays</li> <li>Environmental: Heavy rainfall (~minimum ½ inch in a short period) can reduce infestations by knocking larvae off plants</li> <li>Agronomic: Proper fertilization and good root development may help plants compensate for DB defoliation or set new buds</li> <li>Insecticides: DBM is a pest in many vegetable crops where it is frequently sprayed; <i>resistance to pyrethroids is common</i></li> </ul>                                                                                                                                                 | Cut off plants in a 1ft x 1ft square and shake them over a flat cloth or into a bucket (green larvae show up well against orange or white). Count the number of larvae. Take samples at multiple locations in the field.<br><br>Note: Pheromone traps can detect moth arrival in Michigan. DB moth trap kits are available thru Great Lakes IPM in Vestaburg MI | A guideline used in Canada:<br><u>Plants in the fall</u><br>3 larvae per ft <sup>2</sup><br><br><u>Veg-early flowering</u><br>15 larvae per ft <sup>2</sup><br><br><u>Flowering to podding</u><br>20-30 larvae per ft <sup>2</sup> |
| <b>flea beetle</b><br><i>*several species including crucifer &amp; striped FB</i>              | <ul style="list-style-type: none"> <li>Agronomic: Control of volunteer canola and brassica &amp; crucifer weeds in and around field reduces alternate hosts</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nothing specific<br><br>Examine plants for small holes created by adults                                                                                                                                                                                                                                                                                        | Nothing specific                                                                                                                                                                                                                   |
| <b>lygus bugs</b><br><br><i>*tarnished plant bug and others</i>                                | <ul style="list-style-type: none"> <li>Biological: Small bugs are vulnerable to predation by natural enemies</li> <li>Agronomic: If possible, do not plant canola next to alfalfa. When alfalfa is cut, adult plant bugs move in large numbers into adjacent fields.</li> <li>Environmental: Small Lygus nymphs, ones that do not yet have wing pads, are susceptible to heavy rainfall</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Take sets of 10 sweeps from 10 different locations in the field, counting the number of <u>large nymphs</u> (those with wing pads) plus <u>adults</u> . Total the number of bugs collected in the 100 sweeps                                                                                                                                                    | A guideline:<br><u>Bud to bloom stage</u><br>150 or more bugs total or 1.5 per sweep<br><br><u>After bloom</u><br>200 or more bugs total, or 2 per sweep                                                                           |

| Pest<br>(abbreviation) | Management options and notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Scouting<br>recommendation                                                                                                                                                                                                                                           | Threshold        |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>slugs</b>           | <ul style="list-style-type: none"> <li>• Biological: some ground beetle species specialize in eating slugs (see insecticide note below)</li> <li>• Agronomic: tillage can reduce residue (slug habitat).</li> <li>• Agronomic: avoid planting in wet conditions that leave an open furrow that allows slugs to access germinating seeds before plants can emerge</li> <li>• Insecticides: Neonicotinoid seed treatments (NSTs) do not kill slugs, so they can eat treated plants. In fact, NSTs can increase a slug issue in the long term because beneficial ground beetles eat 'toxic' slug prey and die</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Nothing specific</p> <p>Scout new seedlings at emergence and determine if slugs are the cause of plant damage and stand loss. Slugs will be under residue and lower leaves. If possible, scout in the morning.</p>                                                | None             |
| <b>swede midge</b>     | <ul style="list-style-type: none"> <li>• Biological: At least one swede midge parasitoid from Europe has already established in Canada. The distribution of this species in Michigan is unknown</li> <li>• Agronomic: Locate new canola seedlings a mile or more away from production fields from the last two seasons.</li> <li>• Agronomic: Crop rotation is key. Rotate out of canola for at least 3 years, since a portion of adults may diapause in the soil for several years. Adults that emerge into another crop do not live very long and are weak fliers (note, crop rotation also reduces disease pressure)</li> <li>• Agronomic: Tillage after harvest can reduce the population emerging the following spring</li> <li>• Agronomic: Control of volunteer canola and brassica &amp; crucifer weeds in and around field reduces alternate hosts</li> <li>• Cultural: For fields that are known to be infested, harvest them last and clean equipment (including tires) after harvest</li> <li>• Insecticides: To my knowledge, no US labels list swede midge as a specific pest target in canola. However, some pyrethroids, chlorantraniliprole (Coragen), and cyantraniliprole (Exirel) - labeled for other pests on canola - are recommended for swede midge control in certain vegetable crops.</li> </ul> | <p>Nothing specific</p> <p>Swede midge damage can resemble other problems like herbicide injury. Distorted tissue at the growing point can be checked for larvae. They may have dropped to the ground to pupate, but brown feeding scars should still be visible</p> | Nothing specific |

## Foliar Insecticides to manage insect pests of winter canola in Michigan

- On pesticide labels, canola may be standalone or listed under 'Oil Seed Crops' (EPA crop group 20)
- Active ingredient(s) are listed alphabetically, allowing for easier comparison of insecticides with the same chemistry
- Application rates are listed for pests which appear on the manufacturer label. If a column is blank, the pest is not on the label. The letters in the pest columns refer to the label use rate from column two

| Active ingredient<br>Trade Names                                                                                                                                                      | Labelled rate<br>per acre                                                                                                              | aphids | diamondback moth | flea beetle | lygus (plant) bug | seedpod weevil | PHI<br>in<br>days | Precautions and Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------|------------------|-------------|-------------------|----------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bacillus thuringiensis (Bt)</b><br>Deliver<br><br>Dipel DF or Xentari<br><br>Javelin WG                                                                                            | (a) 0.25 - 1.5 oz<br><br>(a) 0.5 - 2.0 lb<br><br>(a) 0.12 - 1.5 lb                                                                     |        | a                |             |                   |                | 0                 | <ul style="list-style-type: none"> <li>Bts are biological insecticides that must be eaten to kill, so coverage is important</li> <li>Applications must be made when larvae are small and pest pressure is low</li> <li>Deliver, Dipel, &amp; Javelin are Bt kurstaki / Xentari is Bt aizawai</li> <li>Xentari does not list diamondback moth for canola, but DBM is listed for other crops</li> <li>See the active ingredient GS-omega below, which can be mixed with Bt</li> <li>Bee toxicity rating: low, highly safe</li> </ul> |
| <b>Bifenthrin</b> (many generics)<br>Bifen2AgGold Bifenture EC<br>Brigade 2EC Discipline 2EC<br>Fanfare EC Tundra EC<br>Sniper Sniper Helios<br><br>Bifender FC<br><br>Bifenture 10DF | (a) 2.1 - 2.6 oz<br><br><br><br><br><br><br>(a) 2.4 - 2.9 oz<br><br>(a) 5.3 - 6.4 lb                                                   | a      | a                | a           | a                 | a              | 35                | <ul style="list-style-type: none"> <li>Coverage is important. Use a minimum of 10 gal/ acre for ground application, 2 gal/ acre by air</li> <li>See label for instructions for using emulsified oil in place of water in aerial spraying</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                          |
| <b>bifenthrin + sulfoxaflor</b><br>Ridgeback                                                                                                                                          | (a) 4.5 - 5.5 oz                                                                                                                       | a      | a                | a           | a                 | a              | 35                | <ul style="list-style-type: none"> <li>Similar precautions as bifenthrin alone</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>bifenthrin + cypermethrin</b><br><br>Hero<br><br><br>Hero EW<br><br><br>Steed                                                                                                      | (a) 4.0 - 5.5 oz<br>(b) 2.6 - 5.5 oz<br><br><br>(a) 4.5 - 5.95 oz<br>(b) 2.8 - 5.95 oz<br><br><br>(a) 3.5 - 4.7 oz<br>(b) 2.5 - 3.5 oz | a      | a                | b           |                   | a              | 35                | <ul style="list-style-type: none"> <li>Similar precautions as bifenthrin alone</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>chlorantraniliprole</b><br>Coragen<br>Shenzi 400SC<br>Vantacor                                                                                                                     | (a) 3.5 - 7.5 oz<br>(a) 1.7 - 3.8 oz<br>(a) 1.2 - 2.5 oz                                                                               |        | a                |             |                   |                | 1                 | <ul style="list-style-type: none"> <li>Has some contact activity, but better if ingested. Insects feed, become paralyzed, and die in a few days. Newly hatched larvae are most susceptible</li> <li>Bee toxicity rating from label: Relatively non-toxic</li> </ul>                                                                                                                                                                                                                                                                |

| Active ingredient<br>Trade Names                                                                                                                                                                                                                                                                                               | Labelled rate<br>per acre                                                                                           | aphids | diamondback moth | flea beetle | lygus (plant) bug | seedpod weevil | PHI<br>in<br>days | Precautions and Remarks                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------|------------------|-------------|-------------------|----------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>chlorantraniliprole +<br/>lambda cyhalothrin</b> Besiege                                                                                                                                                                                                                                                                    | (a) 5 - 10 oz<br>(b) 10 oz                                                                                          | b      | a                | a           | a                 | a              | 21                | <ul style="list-style-type: none"> <li>Minimum of 10 gal/ acre for ground application, 5 gal/ acre by air</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                  |
| <b>cyantraniliprole</b><br>Exirel with Cyazypyr<br>Kraden with Cyazypyr                                                                                                                                                                                                                                                        | (a) 7.0 - 13.5 oz<br>(b) 7.0 - 17 oz                                                                                |        | a                | b           |                   |                | 7                 | <ul style="list-style-type: none"> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                                                                                              |
| <b>cypermethrin (zeta)</b><br>Mustang Maxx                                                                                                                                                                                                                                                                                     | (a) 4.0 oz                                                                                                          | a      | a                | a           | a                 | a              | 7                 | <ul style="list-style-type: none"> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                                                                                              |
| <b>deltamethrin</b><br>Delta Gold                                                                                                                                                                                                                                                                                              | 0.8 oz                                                                                                              |        | a                | a           | a                 | a              | 7                 | <ul style="list-style-type: none"> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                                                                                              |
| <b>flonicamid</b><br>BeLeaf 50SG<br>Bestero 50WG<br>Carbine 50WG                                                                                                                                                                                                                                                               | (a) 2.8 oz                                                                                                          | a      |                  |             | a                 |                | 7                 | <ul style="list-style-type: none"> <li>Narrow mode of action targets sucking insects. Apply before pest numbers build. Insects stop feeding quickly but may take several days to die</li> <li>Thorough coverage needed for control. Minimum 10 gal / per acre by ground, 3 gal / acre by air. Do not mix with a fertilizer application</li> <li>Bee toxicity rating from label: moderately toxic</li> </ul> |
| <b>gamma cyhalothrin</b> Declare                                                                                                                                                                                                                                                                                               | (a) 0.77 - 1.54 oz<br>(b) 1.54 oz                                                                                   | b      | a                | a           | a                 | a              | 7                 | <ul style="list-style-type: none"> <li>Declare is a microencapsulated insecticide</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                                          |
| <b>GS-omega/kappa-Hxtx-Hv1a</b><br>Spear-Lep                                                                                                                                                                                                                                                                                   | (a) 1 - 2 pts                                                                                                       |        | a                |             |                   |                | 0                 | <ul style="list-style-type: none"> <li>Novel mode of action may be useful on resistant Leps. Must be applied with Bt insecticide, which damaged the caterpillar gut &amp; allows Spear-Lep to enter the body. See label for details</li> </ul>                                                                                                                                                              |
| <b>lambda cyhalothrin</b><br>Grizzly Too CS Grizzly Too LC<br><br>Warrior II w/Zeon Technology<br>Grizzly Too Kendo 22.8CS<br>Lamcap II Province II Ravage II<br><br>Kendo LambdaCy LambdaCyAg<br>Lambda Cyhalothrin 1EC<br>LambdaStar LambdaT Lamcap<br>Paradigm VC Ravage<br>Silencer Silencer VXN<br>Willowood Lambda-Cy1EC | (a) 0.96 - 1.84 oz<br>(b) 1.84 oz<br><br>(a) 0.96 - 1.92 oz<br>(b) 1.92 oz<br><br>(a) 1.92 - 3.84 oz<br>(b) 3.84 oz | b      | a                | a           | a                 | a              | 7                 | <ul style="list-style-type: none"> <li>See label for mandatory info on spray drift management, buffer strips, and protecting aquatic habitats</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                              |
| <b>sulfoxafloor</b><br>Transform WG                                                                                                                                                                                                                                                                                            | (a) 0.5- 0.75 oz                                                                                                    | a      |                  |             |                   |                | 14                | <ul style="list-style-type: none"> <li>Do not apply from 3 days before bloom to after petal fall</li> <li>Bee toxicity rating from label: highly toxic</li> </ul>                                                                                                                                                                                                                                           |