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Managing Broad Mite in Commercial Blackberry Production

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Introduction

Broad mite, *Polyphagotarsonemus latus*, is a pest in commercial blackberry production that can be difficult to identify and manage. This microscopic mite species feeds on over more than 60 plant families and it can infest new leaves, flowers and fruit[1]. Broad mites are typically observed infesting crops grown in high tunnels or greenhouses and were first detected on primocane-fruiting blackberries in 2007 on plants grown in a high tunnel in Arkansas. Broad mite infestations have been observed in field production of blackberries in Arkansas almost every year since their initial discovery[2,3].

Signs of broad mite infestation include curled and distorted leaves (Figure 1), bronzing of new leaves (Figure 2) and reduced internode length (Figure 3). Broad mite feeding on blackberries can severely limit growth and yield, especially when considering damage to the developing flowers of primocane-fruiting blackberries. Broad mites can be easily managed if plants are scouted regularly and several miticides are available for control.

Broad Mite Biology

Broad mite is a mite species in the family Tarsonemidae (Figure 4) and is similar in size and impact to other microscopic mite pests such as eriophyid mites. Broad mites survive the winter by sheltering in soil and leaf litter[4]. Female broad mites emerge in the spring and begin infesting plants once temperatures reach 45°F, but population development remains stagnant until temperatures reach 85°F with a relative humidity of 70 to 80 percent[5]. Significant infestations of broad

Figure 1. Blackberry primocane terminal exhibiting distorted/curled leaves and bronzed coloration from broad mite feeding.

Figure 2. Blackberry primocane terminal exhibiting bronzed terminal leaves from broad mite feeding.

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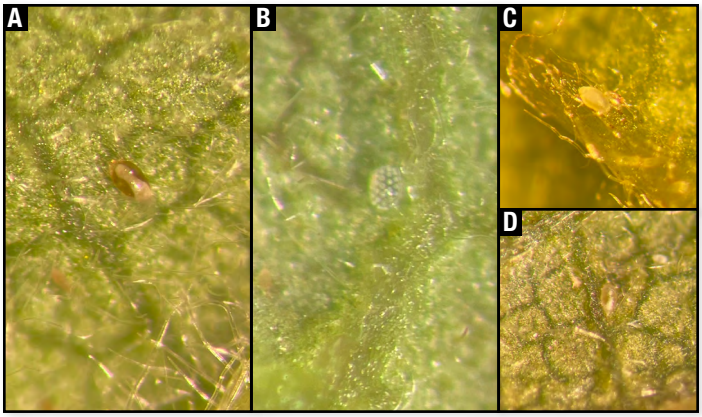
Figure 3. Blackberry floricane exhibiting bud stacking from broad mite feeding during primocane growth in the previous season.

Figure 4. Broad mite life stages observed through a dissecting microscope. (a) broad mite adult, (b) Broad mite egg, (c) Broad mite larvae, (d) broad mite nymph.



mites do not generally occur until late July, where injury may impact post-harvest growth, lead to premature defoliation of large sections of plants and ultimately reduce yield.

Broad mite is especially impactful in primocane fruiting production, as mites directly feed on reproductive plant material and reduce yield. Infestations in both floricane and primocane fruiting cultivars are most pronounced in high tunnels due to higher winter temperatures favoring broad mite survival and higher ambient temperatures during spring and early summer. In field production, broad mite infestations appear to be more severe in years with milder winter conditions.

Broad mites' total maturation takes two to seven days from an egg being laid to the adult life stage, depending on temperature[5]. Broad mites have four life stages: eggs, larvae, nymphs and adults (Figure 4). Broad mite eggs are translucent and densely ornamented with white tubercles and can easily be identified using a dissecting microscope or potentially with a strong hand lens. Broad mite larvae and nymphs can be hard to identify and are often confused with adults. Broad mite adults are ovoid with brown coloration and have a white hourglass-like marking (Figure 4).

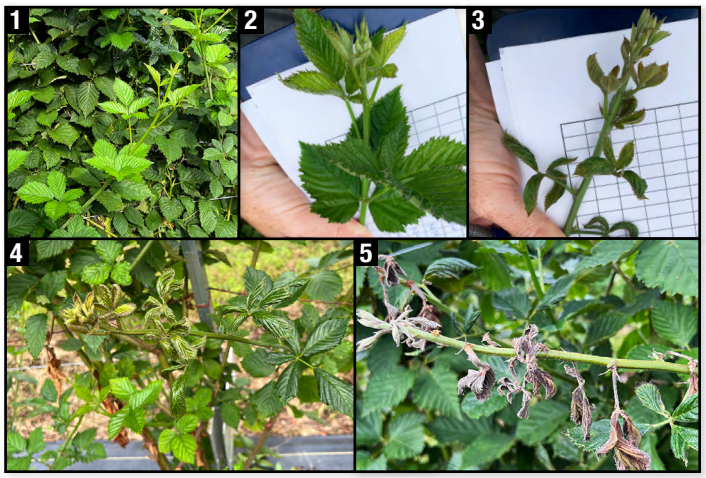
Broad Mite Injury to Blackberry

Symptoms of broad mite feeding can be found on leaves, blossoms and developing fruit of primocanes[2]. Broad mite feeding on new leaves leads to a distorted and rigid appearance with reduced leaf area and ultimately results in upward or downward leaf curling (Figures 1 and 2). Broad mite feeding on blackberry canes can also lead to decreased internode length and growth stoppage[6] (Figure 3). If left completely uncontrolled, broad mite feeding can result in leaf necrosis, terminal shoot dieback and in very severe cases death of the whole blackberry plant[6,7](Figure 5). Feeding on blossoms can result in floral abscission of the primocane crop and ultimately direct yield loss[3].

Monitoring for Broad Mite

Successful management of broad mite requires a diligent monitoring program to indicate when broad mite infest blackberry fields. Research has shown that the visual injury present in plants is a good indicator of broad mite density (Figure 5). When bronzed terminals and small amounts of leaf curling are easily observed, broad mites are likely averaging about one to five mites per leaflet, which is our economic threshold. Although visual scouting is a great indicator of broad mite density, visual scouting alone

Figure 5. Visual injury scale (1-5 scale) used to monitor broad mite population density in commercial blackberry fields. This method of scouting involves visually rating terminal portions of primocanes on a scale of 1 to 5 with 1 being no damage, 2 being reduced leaflet size and beginning of leaf curling, 3 being excessive leaf curling and reduced internode lengths, 4 being leaf bronzing and beginning of leaf necrosis and 5 being complete leaf necrosis and shoot dieback.



cannot be used in primocane-fruiting cultivars. Broad mite that infest fields during primocane flowering will feed on developing reproductive material and terminal growth. This means that significant yield loss could be incurred before visual scouting, indicating the need for miticide applications.

Floricane Fruiting Cultivars

Floricane fruiting cultivars should be scouted by making observations of visual injury to blackberry canes. Scout at least 10 different locations throughout each blackberry field[8]. At each location, observe 10 blackberry primocanes and note the level of broad mite injury observed using the one-to-five scale explained in Figure 5. A miticide application for broad mite in floricane fruiting blackberries is warranted when bronzed terminals and small amounts of leaf curling are commonly observed (injury rating of 2 or higher) (Figure 5). Miticides are especially warranted when canes exhibit excessive leaf curling and any level of necrosis (rating of 3-4). Leaflet samples (described below in Primocane Fruiting Cultivars) can still be used to confirm that the present injury is from broad mite, and miticide applications are warranted if one to five broad mites are observed per leaflet.

Primocane Fruiting Cultivars

To avoid direct yield loss in primocane fruiting cultivars, blackberry leaflets should be sampled to estimate broad mite density. Leaflet sampling should begin as primocane fruiting buds emerge and should continue weekly through fruiting. Blackberry leaflets should be sampled three to four nodes below the terminal-most primocane leaflets (Figure 6). To take a leaflet sample, pull 15 total leaflets from an area within a field and place them in a plastic zip-top bag, making sure the leaflets come from different plants. Leaflet samples should be taken in 11 different locations for each blackberry field being scouted (totaling 165 primocane leaflets per field)[8]. Each leaflet should be observed using a dissecting microscope, and the average number of broad mites should be estimated across all leaflets sampled in a field. Consider a miticide application when broad mite density averages one to five mites per leaflet. Visual sampling can still be used in primocane fruiting cultivars prior to primocane fruit bud emergence, although feeding before this stage could delay or affect fruit production if infestations are not caught early.

Figure 6. Blackberry primocane leaflet being sampled to quantify broad mite populations.

Cultural Control

Very few cultural control options for the management of broad mite exist. Research suggests that cultivar and trellis selection appear to impact broad mite development, although data are limited. Broad mites have been found to favor T-trellis systems earlier in the season compared to RCA (rotating cross arm) trellis systems[9]. However, there is little difference in these trellis systems after initial colonization[9]. Cultivars with higher trichome density have been found to limit broad mite population growth[2]. Leaf trichomes may act to physically exclude broad mites from the surface of the leaf, which could limit feeding. An example of a high trichome density cultivar would be 'Ouachita'. Low trichome density cultivars include 'Ponca' and 'Von,' while 'Osage' has been reported to have almost no trichomes[10, 11, 12, 13].

Chemical Control

Management of broad mite in blackberry is currently only achievable using miticides, and very few are labeled in blackberry that effectively reduce broad mite populations (Table 1). Several oil-based miticides may reduce broad mite infestations, but often can't be used in the hot summer when broad mite infestations are common[14,15]. Abamectin and fenazaquin are most effective in managing broad mite with at least seven to 14 days of residual control. However, abamectin and fenazaquin have a seven-day preharvest interval (PHI), making these products most favorable outside of harvest. Fenpyroximate and tolfenpyrad can knock down broad mite populations, potentially providing up to seven days of residual control and have a 1-day PHI, which allows for use during harvest. Abamectin is the cheapest and most effective option and should be applied once broad mite is detected in blackberries when thresholds are reached unless harvest is ongoing. If broad mite persists, a follow-up application of a miticide with a different IRAC group should be applied to ensure rotation of mode of action and reduce risk of resistance, which may be difficult if issues persist during harvest.

Table 1. Miticide options for managing broad mite on blackberry.

Active Ingredient	Trade Name	Mode of Action	Rate (per acre)	REI	PHI	Applications per Year
Abamectin	Agri-Mek® SC	IRAC Group 6	3.5 fl oz	12 hours	7-day	2
Fenazaquin	Magister® SC	IRAC Group 21A	32–36 fl oz	12 hours	7-day	1
Fenpyroximate	Portal®	IRAC Group 21A	32 fl oz	12 hours	1-day	2*
Tolfenpyrad	Apta®	IRAC Group 21A	27 fl oz	12 hours	1-day	2

*Allow 14 days between applications of Portal®.

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