Impact of Bagrada Bug Infestations on Desert Cole Crops

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The Bagrada bug, *Bagrada hilaris,* became a major pest of cole crops in the fall on 2010. Widespread infestations of this invasive stinkbug pest were reported throughout the desert growing areas in September and October of that year where stand losses and yield/quality reductions to broccoli, cauliflower, cabbage and other *Brassica* crops were considered economically significant. In an attempt to document these impacts, we have surveyed produce growers and PCAs from Yuma, Imperial Valley and central Arizona on an annual basis since 2010 to estimate the severity of Bagrada bug infestations on direct-seeded and transplanted cole crops, and the intensity of chemical management.

PCAs and growers were anonymously asked to estimate the fall acreage (August-November) where *Bagrada* populations were present, and of those acres, what percentage required insecticide treatments and how often. In addition, they were asked to estimate, on average, percent stand losses and plant injury caused by *Bagrada* infestations. Finally, PCAs and growers were asked to list the insecticide products they found to be effective in controlling Bagrada adults when applied as either chemigations or foliar sprays. Information was collected separately for direct-seeded and transplanted cole crops. Table 1 shows the number of PCAs who participated in the surveys each year and the acres their estimates represented.

Table 1. Number of Respondents and acreage estimated in Bagrada surveys, 2010-2013

Season	No. PCAs responding	Cole Crop Acres Estimated in Survey		
		Direct-seeded	Transplanted	Total
2010	17	9310	4610	13920
2011	13	6210	3450	9660
2012	19	6290	4595	10885
2013	21	7255	5435	12690

Impact of Bagrada Bug Based on Insecticidal Control

It has been 4 years since the initial outbreaks occurred and the bagrada bug remains an important pest of desert cole crops. Based on seasonal population abundance studies of adults infesting non-treated broccoli plants at the Yuma Ag Center, fall infestations in 2013 were comparable to the outbreaks that we observed in 2010 (Fig 1). With the warmer winter temperatures this year, spring populations occurred earlier and at higher numbers than in the previous 3 years. Based on PCA estimates, bagrada bug infestations have been present on greater than 85% of the direct seeded and transplanted cole crop acreage over the past 4 seasons (Table 2). In direct seeded crops, a greater % of the acreage was treated

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for Bagrada adults than were infested. This is not surprising given the preventative nature of controlling *Bagrada* infestations in order to reduce stand losses and plant injury. This is likely reflected as well by the large number of acres chemigated (>80%) on an average of 1.6 times since the initial outbreaks. However, once sprinkler pipe was removed from the field, the survey reports that management for *Bagrada* remained intensive where about 88% of the reported acres were sprayed an average of 2.4 times in direct seeded-crops and over 83% of transplanted crops were sprayed almost 2 times. Overall, a lower percentage of transplanted cole crops required treatments. When the number of chemigations and foliar sprays are combined over all three years, on average 4 insecticide applications were made to control this pest on direct-seeded crops and 3.2 applications on transplants.

Impact Based of Bagrada Bug Based on Crop Losses

Damage from bagrada bug infestations at stand establishment in both direct-seeded and transplanted crops has decreased by more than 50% from 2010 tom 2012, but increased in 2013 (Table 3). Stand losses in 2013 were greater than what was reported in the previous 2 years and may be due to the extended pressure well into November this past fall (Fig 1). Feeding injury, defined as plants with multiple heads, forked terminals, and/or blind terminals resulting from Bagrada feeding, was also higher in 2013. In fact, plant injury in direct seeded crops was about the same as our 2010 estimates, and in transplanted crops was the highest damage recorded to date. The percent plant damage has typically been lower in transplanted crops and suggests that newly, hardened transplants may withstand feeding injury better during stand establishment, and further suggest that injury occurring in cole crops is most important on very young seedlings (i.e., cotyledon-2 leaf plants). These reported losses are consistent with stand losses and plant injury measured in trials conducted at the Yuma Ag Center over the past four years.

Effective Insecticides:

Over the past 4 years, growers and PCAs reported using pyrethroids almost exclusively to control Bagrada bugs through chemigation (Figure 2). Among the insecticide active ingredients (AI) reported as effective, bifenthrin (Brigade, Sniper, Hero and Discipline) was the most commonly reported, followed by zeta-cypermethrin (Mustang, Hero) and lambda-cyhalothrin (Warrior II, Lambda-Cy). Several other pyrethroids were reported as being effective including esfenvalurate (Asana) and permethrin, but were used by relatively fewer PCAs. One PCA reported using imidacloprid (Alias) in 2010, but since then no use of this AI has been reported. In 2013, 2 PCAs reported using Endigo, an in-can mixture of thiamethoxam and lambda-cyhalothrin. In general, comments provided on the survey suggested that pyrethroid chemigations appeared to provide effective knockdown control of adults, but under heavy Bagrada bug pressure re-application was often necessary after 2-3 days.

In contrast, a broader array of AIs were reported for use against *Bagrada* when applied as foliar sprays, with pyrethroids the most commonly reported chemistry used. Bifenthrin was the most commonly used AI, followed by lambda cyhalothin, zeta-cypermethrin, and esfenvaluate. Among the alternative chemistries used, dinotefurnon, methomyl and chlorpyrifos were reported to be effective against Bagrada adults by several PCAs, and a number of neonicotinoids, and pyrethroids were reported less frequently. Reports of neonicotinoid usage for Bagrada control increased in 2013, including the use of Endigo for the first time. These estimates are consistent with results from efficacy trials conducted at Yuma Ag Center where products that have contact activity (i.e., Pyrethroids, OP/Carbamates) have provided the most effective control against Bagrada adults on both direct-seeded and transplanted cole crops.

Acknowledgement

Special thanks go out to all the PCAs and growers who took time away from their busy schedules to participate in these surveys over the past four years. Without you, this data would not exist.

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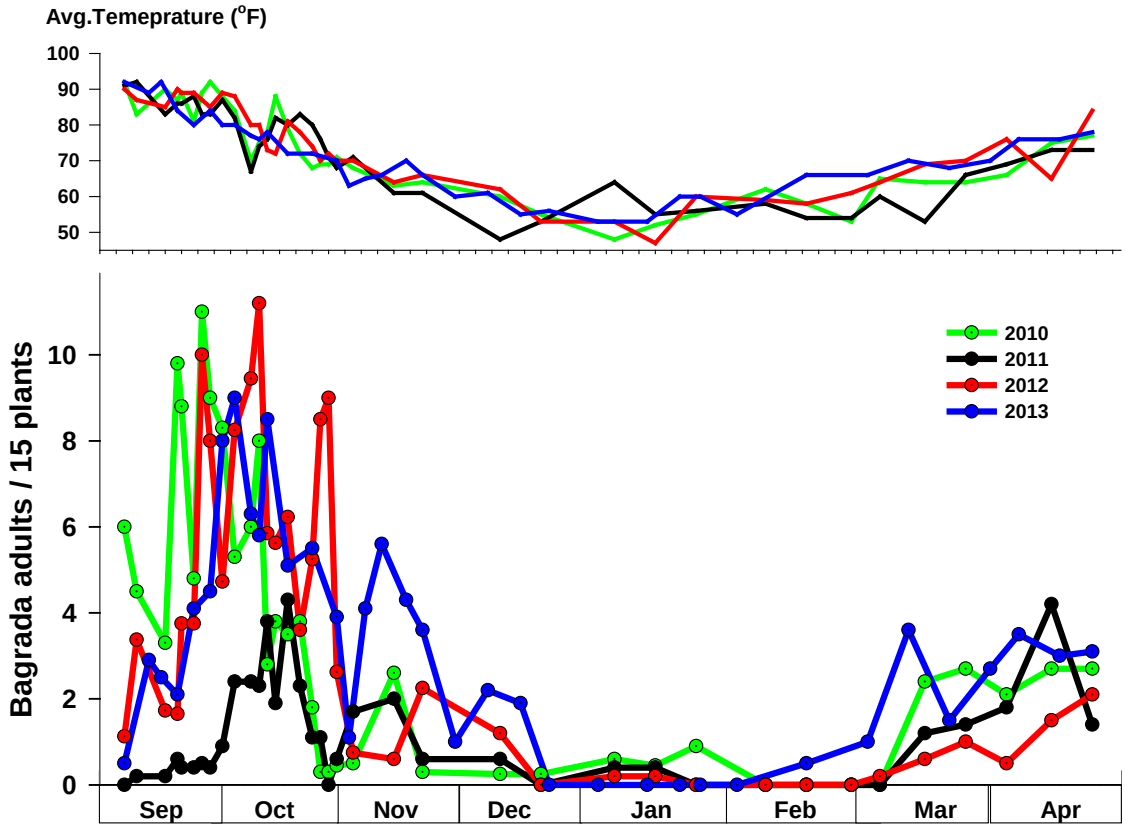

Figure 1. Bagrada bug abundance (adults / 15 plants) in non-treated broccoli plots relative to ambient air temperatures at the Yuma Agricultural Center, from September through April 2010-2013

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Table 2. Impact of Bagrada bug on desert cole crops based on chemical control.

	Direct-seeded				Transplanted			
Chemical Control for Bagrada	***2010***	***2011***	***2012***	***2013***	***2010***	***2011***	***2012***	***2013***
% acres where Bagrada present	95.8	87.6	87.2	89.1	94.4	87.0	86.7	73.2
% acres treated with insecticide	95.8	91.3	87.4	92.4	88.3	84.3	84.4	74.1
% acres chemigated	73.8	75.2	85.5	87.1	60.6	72.0	65.1	67.4
Avg. no. of chemigations applied	1.6	1.6	1.6	1.5	1.4	1.3	1.1	1.3
% acres sprayed with insecticide	90.0	87.0	86.8	88.5	85.6	80.8	82.8	67.9
Avg. no. of sprays applied	2.7	1.8	2.5	2.5	2.1	1.8	1.8	1.9
Total avg. no. applications	4.3	3.4	4.1	4.0	3.5	3.1	2.9	3.2

Table 3. Impact of Bagrada bug infestations on desert cole crops based on feeding injury.

	Direct-seeded				Transplanted			
Impact of Bagrada on Crops	***2010***	***2011***	***2012***	***2013***	***2010***	***2011***	***2012***	***2013***
Avg. % stand loss	6.3	2.5	2.8	3.9	3.1	1.5	1.4	1.7
Worst case (% stand loss)	18.7	17.4	10.0	8.8	6.8	6.3	2.6	3.2
Avg. % plant injury	8.0	4.2	3.2	7.9	4.6	3.9	2.1	5.8
Worst case (% plant injury)	18.1	11.1	7.2	12.6	9.8	11.0	3.6	7.1

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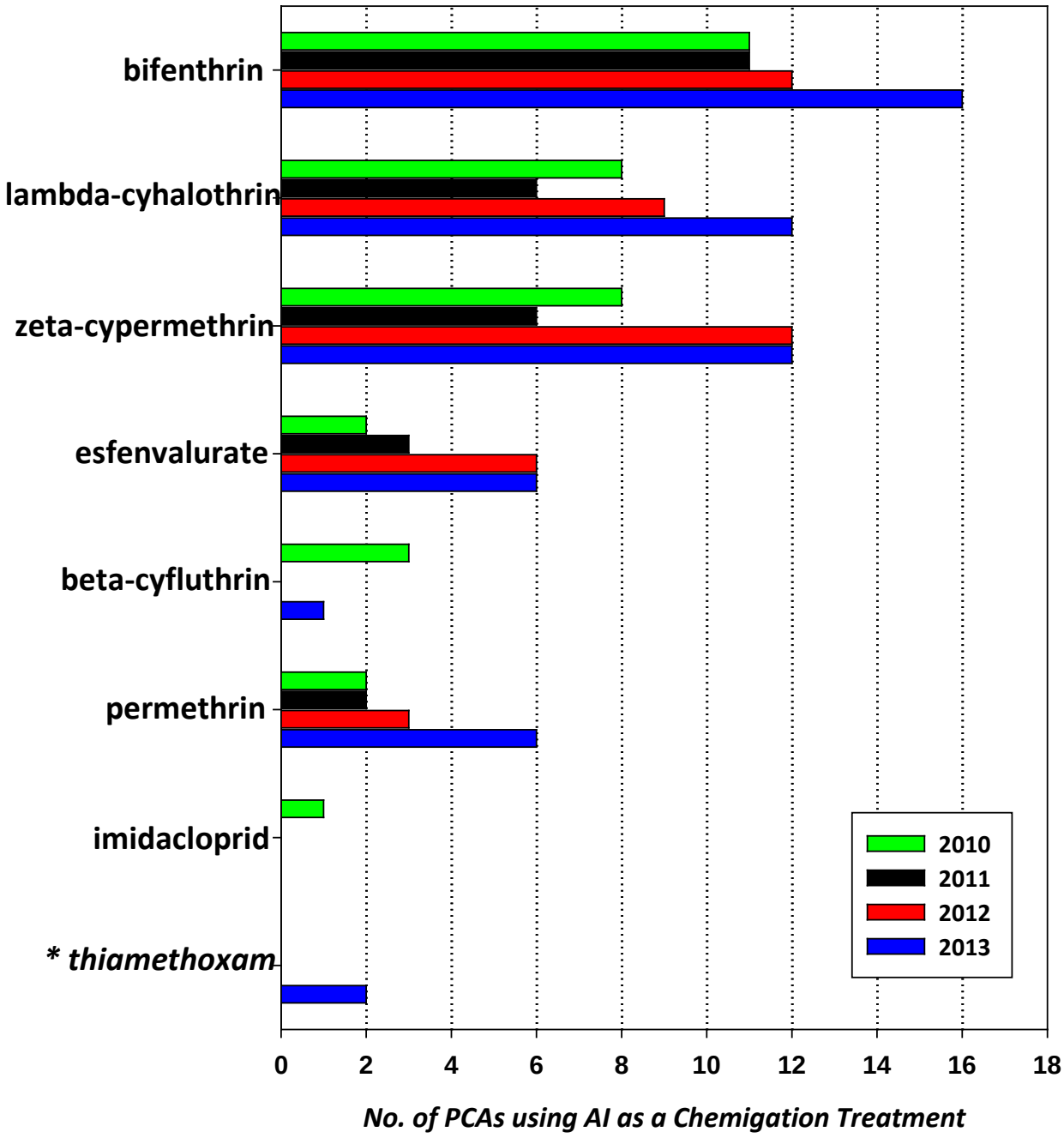

Figure 2. Insecticide AIs reported as effective against bagrada bug adult infestations when applied as chemigation treatments during stand establishment on cole crops in Yuma and Imperial Valley in 2010-2013. * represents Endigo, a mixture of lambda cyhalothrin and thiamethoxam.

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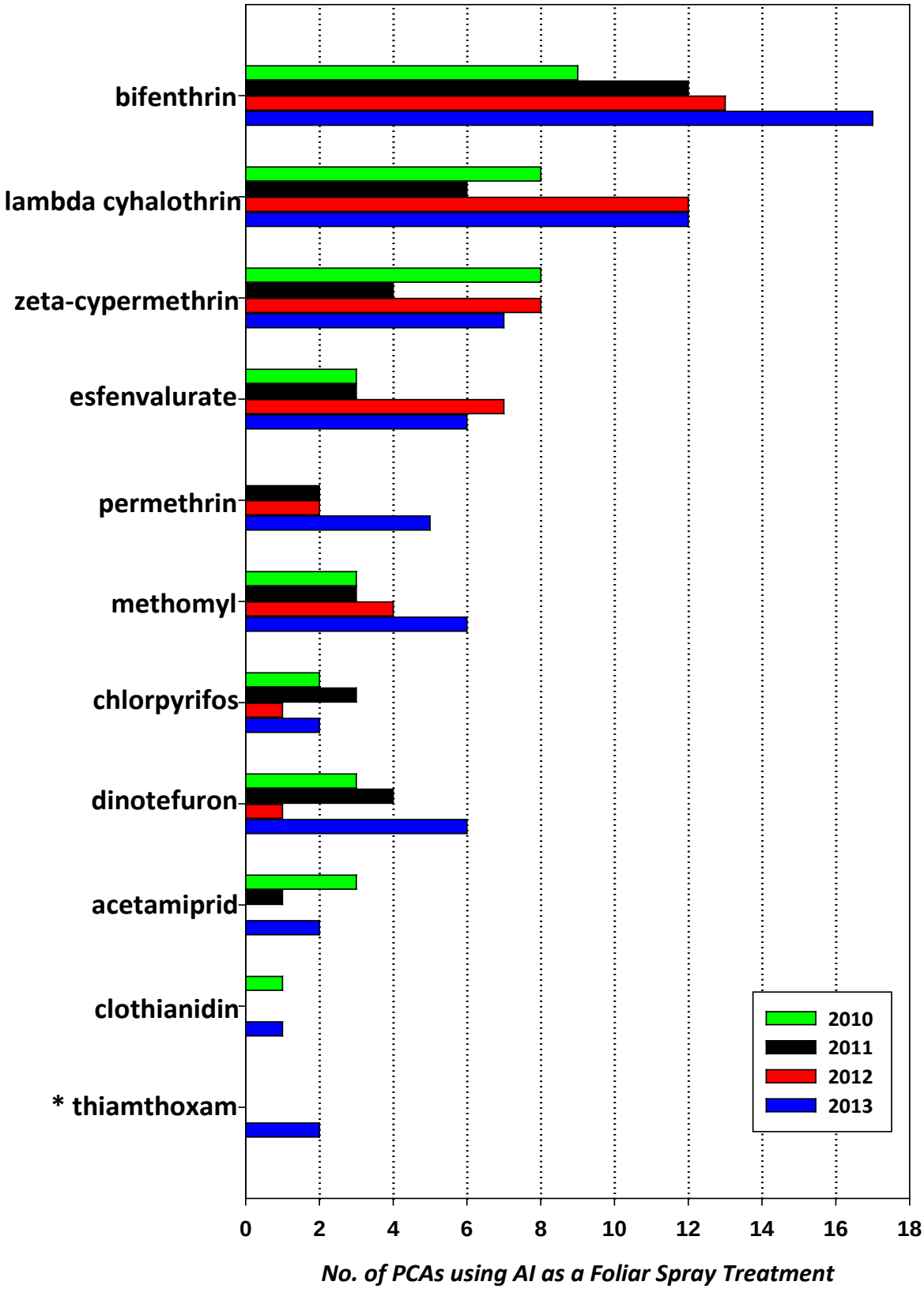

Figure 3. Insecticide AI s reported as effective against bagrada bug adult infestations when applied as foliar spray treatments on cole crops in Yuma and Imperial Valley in 2010-2013. * represents Endigo, a mixture of lambda cyhalothrin and thiamethoxam.

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