

Table 1. Diseases of poultry that can be vectored by darkling beetles

Disease	Disease-causing microorganisms	Reference
Blackhead disease (histomoniasis)	<p><i>Heterakis gallinarum</i> (cecal worm)</p> <p><i>Histomonas meleagridis</i> (histomonad protozoan)</p>	<p>Beckmann, J. F., T. Dormitorio, S. O. Oladipupo, M. T. B. Terra, K. Lawrence, K. S. Macklin, and R. Hauck. 2021. <i>Heterakis gallinarum</i> and <i>Histomonas meleagridis</i> DNA persists in chicken houses years after depopulation. <i>Veterinary Parasitology</i> 298: 109536.</p>
Escherichia coli infection	<p><i>Escherichia coli</i></p>	<p>McAllister, J. C., C. D. Steelman, J. K. skeeles, L. A. Newberry, and E. E. Gbur. 1996. Reservoir competence of <i>Alphitobius diaperinus</i> (Coleoptera: Tenebrionidae) for <i>Escherichia coli</i> (Eubacteriales: Enterobacteriaceae). <i>Journal of Medical Entomology</i> 33:983-987.</p>
Salmonella infection	<p><i>Salmonella enterica</i></p>	<p>A. J. Roche, A. J., N. A. Cox, L. J. Richardson, R. J. Buhr, J. A. Cason, B. D. Fairchild, and N. C. Hinkle. 2009. Transmission of <i>Salmonella</i> to broilers by contaminated larval and adult lesser mealworms, <i>Alphitobius diaperinus</i> (Coleoptera: Tenebrionidae). <i>Poultry Science</i> 88:44-48</p>
Enteritis	<p>Turkey enterovirus and rotavirus</p>	<p>Despins, J. L., R. C. Axtell, D. V. Rives, J. S. Guy, and M. D. Ficken. 1994. Transmission of enteric pathogens of turkeys by darkling beetle larva (<i>Alphitobius diaperinus</i>). <i>Journal of Applied Poultry Research</i> 3:61-65.</p>

Table 2. Empty-barn residual insecticides for darkling beetle control in poultry

Mfr	Brand name	Item #	Unit	Active ingredient	Formulation	Rate
BASF	Alpine® WSG Water Soluble Granule Insecticide	063236	500 gram	dinotefuran (40.0%)	spray (water soluble granules)	10 to 30 grams per 1 gal. per 1,000 ft ²
	Optashield® CS	051787	120 oz.	cyfluthrin (6.0%)	spray (water-based; micro-encapsulated)	2.00 fl. oz. per 1 gal. water per 1,000 ft ²
	Permacap CS®	051794	120 oz.	permethrin (23.0%)	spray (water-based; micro-encapsulated)	2.67 to 5.30 fl. oz. per 1 gal. water per 1,000 ft ²
Blue Ridge Elements	AquaSource Boric Acid	111004	55 lb.	boric acid (100%)	dry granules	2.0 lb. per 100 ft ²
		093688	2200 lb.			
Control Solutions	Bifen I/T	057379	gallon	bifenthrin (7.9%)	spray (water-based)	0.33 to 1.00 fl. oz. per gal. water per 1,000 ft ²
		055175	quart			
	Cyzmic® CS	050610	quart	lambda-cyhalothrin (9.7%)	spray (water-based; micro-encapsulated)	0.80 fl. oz. per 1 gal. water per 1,000 ft ²
	Dominion® 4L	114608	gallon	imidacloprid (42.3%)	spray (water-based)	3.0 fl. oz. per gal. water per 1,000 ft ²
		099871	pallet			
	Martin's® Permethrin SFR	040383	1.25 gal.	permethrin (36.8%)	spray (water-based)	0.32 fl. oz. per gal. water per 1,000 ft ²
	Permethrin CS	054140	120 oz.	permethrin (23.6%)	spray (water-based; micro-encapsulated)	2.67 to 5.30 fl. oz. per 1 gal. water per 1,000 ft ²
Tekko® 10	056686	gallon	novaluron (9.3%)	spray (water-based)	1.5 to 3.0 fl. oz. per gal. water per 1,000 ft ²	
Vector-Ban™ Plus	050619	0.5 gal.	permethrin (10.0%) + PBO (10.0%)	spray (water-based)	6.4 fl. oz. per gal. water per 1,000 ft ²	
Eianco	Agita™ 10 WG	062584	2.2 lb.	thiamethoxam (10%)	spray (water-dispersible granules)	17 oz. per gal. water
	Credo® SC	040748	30 oz.	imidacloprid (42.3%)	spray (water-based)	3.0 fl. oz. per gal. water per 1,000 ft ²
	CyLence Ultra™ Premise Spray	030934	240 ml.	beta-cyfluthrin (11.8%)	spray (water-based)	0.54 fl. oz. per 1 gal. water per 1,000 ft ²
	Elector® PSP	045949	8 oz.	spinosad (44.2%)	spray (water-based)	0.2 to 0.4 fl. oz. per gal. water per 1,000 ft ²
	Ravap EC*	013949	gallon	tetrachlorvinphos (23.0%) + dichlorvos (5.3%)	spray (water-based)	5 to 10 fl. oz. per gal. water per 1,000 ft ²
	Tempo 1% Dust Insecticide	044742	10 lb.	cyfluthrin (1%)	dust	0.5 to 1.0 lb. per 1,000 ft ²

Table 2. Empty-barn residual insecticides for darkling beetle control in poultry (continued)

Mfr	Brand name	Item #	Unit	Active ingredient	Formulation	Rate
Incidet Technologies	Zone Defense®	116143	50 lb.	boric acid (64.0%)	water-soluble powder	2 lbs. per 100 ft ²
	Grenade® ER Insecticide	013190	8 oz.	lambda-cyhalothrin (9.7%)	spray (water-based; micro-encapsulated)	0.80 fl. oz. per 1 gal. water per 1,000 ft ²
MGK	NyGuard® IGR Concentrate	061004	140 ml.	pyriproxyfen (10%)	spray (water-based)	2.67 to 8.00 fl. oz. per gal. water per 1,000 ft ²
		093669	480 ml.			
	Onslaught® FastCap Spider and Scorpion Insecticide	061570	pint	esfenvalerate (6.4 %) + prallethrin (1.6%) + PBO (8.0%)	spray (water-based; micro-encapsulated)	1.0 fl. oz. per 1 gal. water per 1,000 ft ²
		063695	CS2			
		486918	30 gal.			
	Sector® Misting Concentrate	091755	gallon	permethrin (10.0%) + PBO (10.0%)	spray (water-based)	6.4 fl. oz. per gal. water per 1,000 ft ²
Tobex™ Multi MoA Concentrate	090118	2.5 gal.	lambda-cyhalothrin (4.00%) + prallethrin (0.40%) + pyriproxyfen (1.30%) + PBO (6.00%)	spray (water-based; micro-encapsulated)	1.00 fl. oz. per 1 gal. water per 1,000 ft ²	
	090114	30 gal.				
Neogen	Prozap Gamma-Defense™	117427	quart	gamma-cyhalothrin (5.9%)	spray (water-based microencapsulated)	0.65 fl. oz. per gal. water per 1,000 ft ²
Starbar	Exhalt™ WDG Insect Growth Regulator	116418	5 lb.	novaluron (4.0%)	water-soluble granules	16 oz. dry granules per 1,000 ft ² , or 4 to 8 oz. per gal. water per 1,000 ft ²

Prior to using any product mentioned in this article, carefully read and follow all available instructions, warnings, and safety information made available by the product's manufacturer. *Restricted use insecticide.

Table 3. On-animal insecticides for use against darkling beetle control in poultry with live birds present

Mfr	Brand name	Item #	Unit	Active ingredient	Rate
Control Solutions	Stryker™ Insecticide Concentrate	052465	pint	natural pyrethrins (6.0%) + PBO (60.0%)	2.0 fl. oz. per 1 gal. water
	MGK	EverGreen® Pro 60-6	063831	quart	natural pyrethrins (6.0%) + PBO (60.0%)
062001			gallon		
EverGreen® Pyrethrum Concentrate		059359	gallon	natural pyrethrins (5.0%; organic)	3.0 fl. oz. per 1 gal. water
Riptide® Waterbased Pyrethrin ULV		052706	64 oz.	natural pyrethrins (5.0%) + PBO (25%)	Dilution: 1 part concentrate to 49 parts water
ULD® BP-100		051790	quart	natural pyrethrins (1.0%) + PBO (5.0%)	Use undiluted
		051792	55 gal.		
Starbar	Pyronyl™ Crop Spray	059286	quart	natural pyrethrins (6.0%) + PBO (60.0%)	2.0 fl. oz. per 1 gal. water
		059287	gallon		
	UL-100 EC Insecticidal Spray	480198	55 gal.	natural pyrethrins (0.96%) + PBO (9.60%)	Dilute 1 part concentrate and 9 parts water
Y-TeX	ZetaGard® LBT	054324	pail	zetacypermethrin (0.375%)	25 to 50 lb. per 20,000 ft ²
		064717	25 lb.		

Prior to using any product mentioned in this article, carefully read and follow all available instructions, warnings, and safety information made available by the product's manufacturer.