Appendix 1. Insecticides for BTM control

The products listed below are for the treatment of boxwood plants for BTM. Use of a suitable adjuvant is required for boxwoods to get sufficient coverage, wetting, and penetration of the chemical treatment of the waxy foliage of these plants (Table 3). Spray products to wet the plants and use spray cards to ensure good coverage.

Listed in Table 1 are the products that can be used to treat boxwood for BTM before shipping from establishments under a compliance agreement. Abide by all applicable State and Federal laws.

A high labeled rate of a diamide (IRAC[1] chemical class 28) or a long-lasting formulation of one of the following synthetic pyrethroids (IRAC chemical class 3) will effectively control BTM larvae that may be present on plants. Plants must be treated within 14 days of plant shipment.

Table 1. Products for use as the pre-shipment treatment. Specific products listed are those that were tested in 2023 and 2024, but use of products with the same active ingredient and percent active ingredient and rate are also acceptable if allowed by the label.

Active ingredient	Commercial name	EPA Reg. #	REI	IRAC[1] Chemical Class	Rates	Remarks
bifenthrin	Talstar S (7.9% active ingredient)	279-3155	12 hrs	3	21.7 oz/100 gal	Tested by FPML[2], 100% mortality for eggs, 1st to 3rd instar; complete control of 2nd instars when exposed to foliage treated 4 and 7 days prior (2023). Mortality 98% in NY field test mixed populations of small and large larvae (Sept. 2023) at 21.7 oz/100 gal. Mortality 100% for 3rd instar when exposed for 7 days to foliage treated up to 2 weeks prior at 10.8 oz/100 gal (2024).
chlorantraniliprole	Acelepryn (18.4% active ingredient)	100-1489	4 hrs	28	16 oz/100 gal	Tested by FPML, 100% mortality for eggs, 1st to 3rd instar; complete control of 2nd instars when exposed to foliage treated 4 and 7 days prior (2023). Mortality 97%-99% in NY field mixed populations of small and large larvae test (July & Sept. 2023). Mortality 100% for 3rd instar when exposed for 7 days to foliage treated up to 3 weeks prior (2024).

cyantraniliprole	Mainspring GNL (18.66% active ingredient)	100-1543	4 hrs	28	8 oz/100 gal	Tested by FPML, 100% mortality for 3rd instar when exposed for 7 days to foliage treated up to 3 weeks prior (2024).
lambda-cyhalothrin	Scimitar GC (9.7% active ingredient) Restricted use.	100-1088	24 hrs	3	5 oz/100 gal	Tested by FPML, 100% mortality for eggs, 1st to 3rd instar; complete control of 2nd instars when exposed to foliage treated 4 and 7 days prior (2023). Mortality 95% in NY field test (Sept. 2023). Mortality 100% for 3rd instar when exposed for 7 days to foliage treated up to 3 weeks prior (2024).
permethrin	Perm-Up 3.2 EC (36.8% active ingredient)	70506-9	12 hrs	3	8 oz/100 gal	Tested by FPML, 100% mortality for 3rd instar when exposed for 7 days to foliage treated up to 3 weeks prior (2024).

[1] IRAC or Insecticide Resistance Action Committee has developed a numbering system for each mode of action to select the most appropriate rotation alternatives by assigning a unique group number. (https://irac-online.org)
[2] USDA-PPQ-Science and Technologies' Forest Pest Methods Laboratory (FPML)

In addition to the products in Table 1, the products listed in Table 2 may be considered for managing BTM in the production system. But should not be used as a treatment for boxwood plants before shipment. All active ingredients target larvae.

A list of additional products for managing caterpillars in commercial landscape and nursery use is available at https://ir4.cals.ncsu.edu/EHC/InvasiveSpecies/BTM_FactSheet_VisualGuide.pdf. These products may be considered for managing BTM in the production system. Consult with your local Extension office to determine if an active ingredient is registered for use in your state or county.

Table 2. Recommended products to treat boxwood for BTM in the production system.

Active ingredient	Commercial name	EPA Reg. #	REI	IRAC Chemical Class	Rates	Remarks
Bacillus thuringiensis, kurstaki	Javelin WG (85% active ingredient)	70051-66	4 hr.	biological	1.0 lb./100 gal	Highly effective when early larval stages are targeted. Used in Europe[3] and Canada to control BTM. Applied in NY pilot project, in urban gardens area-wide control experiment with high degree of control achieved. Two applications timed 7-10 days apart achieve good control. Sprays should target young larvae for best results. No residual efficacy.

spinosad	Conserve SC T&O (11.6% active ingredient)	62719-291	4 hr.	5	6 oz/100 gal	Tested by FPML, 100% mortality for eggs, 1st to 3rd instar. Mortality 98-100% in NY field test (July & Sept. 2023). This product is short lived. Should not be used when residual control efficacy is needed.
methoxy fenozide	Intrepid 2F (22.6% active ingredient)	62719-442	4 hr.	18	8 oz/100 gal	Tested by FPML, 100% mortality for eggs, 1st to 3rd instar; complete control of 2nd instars when exposed to foliage treated 4 and 7 days prior, once molting occurred (2023). Mortality in NY field test (July 2023) was 98-99%. Mortality 100% for 3rd instar when exposed for 7 days to foliage treated up to 3 weeks prior, at 16 oz/100 gal (2024). User may see active caterpillars after application. Product prevents molting, and caterpillars do not die until they try to molt.

[3] Barbero, F., C. Pogolotti, S. Bonelli, C. Ferracini. 2024. Is microbiological control of the box tree moth feasible? Effectiveness and impact on non-target diurnal Lepidoptera. Biological Control, 188:105427.

Table 3. Recommended adjuvant products[4] to include with insecticides[5] when treating boxwood for BTM.

Commercial name	**Active ingredient(s)**	**Rates**
Pentra-Bark	Alkylphenol ethoxylate, polysiloxane polyether copolymer, propylene glycol	6 fl. oz./100 gal.
Stik-Kote	Polyether modified heptamethyltrisloxane	12.75 fl. oz./100 gal.
CapSil	Blend of polyether-polymethylsiloxane-copolymer and nonionic surfactant	6 fl. oz./100 gal.
Induce	Alky aryl polyoxylkane ethers, alkanolamides, dimethyl siloxane, and free fatty acids	16 fl. oz./100 gal.
Polymer Taxi	Acrylic polymer sodium	128 fl. oz./100 gal.
Aero Dyne-Amic	Methyl esters of fatty acids, alcohol ethoxylate phosphate ester, alkyl phenol ethoxylate	64 fl. oz./100 gal.
Nu Film P	Pinene (polyterpenes) polymers, petrolatum, alkyl amine ethoxylate	16 fl. oz./100 gal.

[4] Tested by Cornell Cooperative Extension Suffolk County. Based upon ratings immediately after application, on two cultivars (*Buxus* x 'Green Mountain' and *B. microphylla* 'Winter Gem') Pentra-bark and Stik-Kote had the highest ratings for wetting and spreading of spray material on both new and old foliage. Most other adjuvants also provided at least moderate wetting and spreading on old and new foliage, similar in most cases to the water-based controls. Ratings after dark under UV light showed very good coverage on new foliage among all adjuvants and the dye control treatments, and on old foliage in nearly all adjuvant treatments. Coverage with Nu Film P was somewhat less, though not always significantly, on old foliage compared with other adjuvants tested. Nu Film P may still be an option to consider for organic production situations.

[5] Choice of material might depend upon insecticide and adjuvant modes of action, label recommendations and whether tank is mixed with other products.