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Shaug. No.

EEB REVIEW

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TYPE PRODUCT Insecticide/miticide

PRODUCT MANAGER G. LaRocca(15)

PRODUCT NAME Agrimec 0.15 EC (Avermectin)

COMPANY NAME Merck Sharp & Dohme

SUBMISSION PURPOSE Proposed registration of use on Ornamental Plants

SHAUGHNESSEY NO.	CHEMICAL	%AI
122804	Abamectin	

ECOLOGICAL EFFECTS BRANCH REVIEW

Avermectin

100 Submission Purpose and Label Information

100.1 Submission Purpose and Pesticide Use

The registrant, Merck Sharp and Dohme, proposes to register Abamectin for use on Ornamental Plants.

100.2 Formulation Information

Agrimec 0.15 EC is 2 % Avermectin B1, 1 gallon contains 0.15 lb. ai.

100.3 Application Methods, Direction, Rates

Mix with water and apply as a foliar spray. For both spider mites and leafminers, apply when pests first appear and repeat at 7-day intervals or as necessary to maintain control. No minimum interval was specified. Apply 8 to 16 fl. oz (0.01 to 0.02 lb. ai) per acre.

100.4 Target Organism

Leafminer and Spider mites.

100.5 Precautionary Labeling

The following statement is on the label:

"This product is toxic to fish and wildlife. Do not apply directly to water. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not apply when weather conditions favor drift from target area.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow drift to blooming crops or weeds if bees are visiting the treatment area."

101 Hazard Assessment

101.1 Discussion

Maximum application rate is at 0.02 lb. ai/acre. The maximum number of applications were not specified. Many ornamental growing areas (especially flowers) tend to be flat and sandy, making runoff potential negligible.

101.2 Likelihood of Adverse Effects on Nontarget Organisms

The following summarizes the known toxicity information on avermectin.

Acute Tests

Bobwhite quail	LD50>2000 mg/kg
Mallard duck	LD50= 85 mg/kg
Bobwhite quail	LC50=3102 ppm
Mallard duck	LC50= 383 ppm
Mouse	LD50= 13-23 mg/kg
Rat	LD50= 10-11 mg/kg
Nonpolar metabolite / rat	LD50> 48 mg/kg
Polar metabolite / rat	LD50>5000 mg/kg
Bluegill	LC50=9.6 ppb
Rainbow trout	LC50=3.2 ppb
Daphnia magna	LC50 0.22-0.34 ppb
Avermectin B1a	0.42 ppb)
Polar metabolite	4.2 ppb)
Moderately polar metabolite	6.3 ppb) > degradates of abamectin
Nonpolar metabolite	25.4 ppb)
Thin-film polar metabolite	76.7 ppb)
8 a-hydroxy avermectin B1a	25.5 ppb)
Mysid shrimp	LC50= 0.2 ppb
Sheepshead minnow	LC50= 15 ppb
Oyster embryo-larvae	LC50= 430 ppb
Earthworm (Eisenia foetida)	LC50= 18 ppm 28-day
	33 ppm 14-day
	62 ppm 7-day

Chronic Tests

Rat 1-generation reproduction 77-712-0	NOEL=0.1 mg/kg/day (0.5 ppm[1])
	LEL=0.2 mg/kg/day (1 ppm[1])
Rat 1-generation reproduction	NOEL<0.5 mg/kg/day (2.5 ppm[1])

[1] Assuming a small mammal consumes 20% of its body weight per day. Many mammals such as voles, mice, rats and shrews commonly ingest at least 20% of their weight per day. Exposure may also occur through other routes such as grooming and licking fur or feet.

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77-706-0	(decreased pup survival, delay in eye-opening)
Mouse Teratogenic effects test 76-723-3	LEL=0.2-0.4 mg/kg/day (1-2 ppm[3])
10-day oral pregnant mouse test 77-717-1	NOEL=0.05 mg/kg/day (0.25 ppm[3]) LEL=0.075 mg/kg/day (0.375 ppm[3])
Mouse Terat. with photodegradate 84-722-1	NOEL=0.05 mg/kg/day (0.25 ppm[3]) LEL=0.1 mg/kg/day (0.5 ppm[3])
Avian reproduction test	NOEL=12 ppm LEL=64 ppm (reduced egg prod.)
Daphnia magna life-cycle	MATC >0.03<0.09 ppb (all dead by day 5 at 0.09 ppb)
Rainbow trout early life stage	MATC >0.52<0.96 ppb
Mysid Shrimp Life-cycle	MATC >0.0035<0.0093 ppb (unvalidated)

Summary of Environmental Fate Information

(From Draft Pesticide Fact Sheet No. 84 for Avermectin B1)

Solubility:	7.8 ppb	
Octanol/Water Partition Coefficient:	9.9×10^3	
Photolyses:	$t^1/_2$ < 1 day	
Hydrolysis:	minimal	
Soil metabolism:	Aerobic $t^1/_2$ approx. 2 months Anaerobic is slower	
Leaching tendency:	minimal	
Accumulation:	Bluegill	69X whole fish 30X fillet 110X viscera

An aquatic degradation and fate study[2] indicated that once it reaches aquatic habitat, abamectin will bind to sediment and dissipate from the water column generally within two weeks. However, once in sediment, it may persist with an approximate maximum half-life of 52 days.

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[2] Wislocki, Peter. Degradation of Abamectin in a Field Study Simulating Both Drift and Runoff. Report date September 23, 1986; Accession Number 400696-10

Terrestrial Exposure

If abamectin is applied at 0.02 lb. ai/acre, the following residues may occur on terrestrial food items.

	Short Grass	Long Grass	Leafy Crops	Insects Forage	Seed Pods	Fruit
Maximum	4.8	2.2	2.5	1.1	0.2	0.1
Typical	2.5	3.8	0.7	0.6	0.06	0.03

Since multiple applications are permitted on the label chronic exposure is possible. However, rapid degradation in light ($t^1/_2$ < 1 day) should preclude accumulation on food items between treatments.

Birds

These residues do not exceed the lowest avian dietary LC50 of 383 ppm nor the avian reproductive NOEL of 12 ppm. Therefore, no acute or chronic hazard to birds is expected.

Mammals

Using an acute oral LD50 of 10 mg/kg for adult rats the following 1-day adult LC50 values (ppm) were calculated[3] for selected mammals. The weanling 1 day LC50 values were based on a 1.5 mg/kg LD50 for weanling rats. The third column in the table is the extrapolated reproductive LEL's (ppm) based on the rat 1-generation reproductive test[4]. The weight and food consumption data are from Davis and Golly (1963).

Grazing Herbivores	1 day LC50 (ppm) adult	weanling/young	Rep. LEL (ppm)
Meadow vole	16	2.5	0.8
Swamp rabbit	24	3.6	1.6
Deer	412	61.4	25.0
Granivores			
Red squirrel	142	21.3	7.1

[3] LC50 (ppm) = LD50 X wt (g) / consumption in one day (g).

[4] Reproductive NOEL (ppm) = rat NOEL X wt (g) / consumption in one day (g). LEL=0.5 mg/kg/day; decreased pup survival (76% compared to 98% in controls).

Omnivores

Deer mouse	51	7.7	2.5
Marsh rice rat	218	32.6	12.5
Raccoon	470	70.8	25.0

Insectivores

Least shrew	9	1.4	0.45

Carnivore

Least weasel	40	6	0.4

The extrapolated adult LC50's are not exceeded by the estimated residues on terrestrial food items. The estimated residues on short and long grass and leafy crops equal or exceed the LC50 for weanling meadow voles. Therefore acute effects may occur to certain young mammals. Based on the extrapolated reproductive NOEL's, it is likely that when ingesting food items containing typical residues, grazing herbivores, omnivores, and insectivores of small size would receive greater than their reproductive NOEL. Granivores and carnivores would not likely ingest food with residues greater than their reproductive NOEL. Based on this, it is likely that the use of Abamectin at 0.02 lb. ai/A would cause acute effects to young grazers and chronic effects may occur to certain grazing herbivores, omnivores and insectivores. Even though avermectin is relatively short-lived in light, it is likely that small mammals will experience adverse effects because of multiple applications and high toxicity. Further, the photodegradate (delta 8,9-isomer) causes mammalian teratogenic effects at lower levels than the parent. This fact somewhat negates the contention that the lack of persistence of the parent eliminates hazard to mammals, even though this degradate makes up only 10-20% of the combined residues of abamectin and its isomer.

The use of Abamectin on ornamentals is expected to have a moderate impact on exposed mammals, especially young or small ones. However, the ornamental plant use is considered relatively minor resulting in exposure to minimal numbers of nontarget organisms.

Aquatic

Abamectin has low solubility (7.8 ppb), and high octanol water partition coefficient (9.9×10^3). Therefore, runoff is not expected to occur at greater than 0.1% of the applied. The following scenario assumes a small treated area flows into a similarly small body of water. The ratio of treated area to waterbody is 10 to 1.

0.02 lb. ai/acre
X 10
0.2 lb.
X 0.001 (0.1% runoff)
0.0002 lbs ai loading into water

X 61 ppb in 6 feet	X 122 ppb in 3 feet of water
0.0122 ppb	0.0244 ppb

These values are both less than the mysid shrimp and Daphnia magna LC50's (0.2 and 0.22 ppb, respectively). However, they do exceed the mysid shrimp life cycle NOEL and LEL of 0.0035 and 0.0093 ppb, respectively ~~and~~ but not the Daphnia magna life cycle NOEL and LEL of ~~0.003~~ 0.03 and ~~0.009~~ 0.09 ppb, respectively. RE. 2-17-89

Exposure to aquatic and estuarine organisms is possible through drift. The application rate is 0.02 lb. ai per acre. It is assumed that 5% of the sprayed pesticide would transport via this route.

0.02 lb. ai/A X 0.05 (%) = 0.001 lb. ai/A drifts

water depth	concentration (ppb)
6'	0.061
3'	0.122
1'	0.368
6"	0.734

These levels are greater than the aquatic invertebrate chronic NOEL of 0.03 ppb. The concentrations in shallow water (up to 1 foot) would exceed the Daphnia magna and shrimp LC50's (0.22-0.34 and 0.2 ppb, respectively). They also approach or, in shallow water, exceed the rainbow trout chronic NOEL. These concentrations do not exceed the fish or oyster acute effect levels.

Rainbow trout LC50=3.2 ppb
Rainbow trout early life stage NOEL=0.52 ppb

Summary

Nonendangered birds will experience minimal acute and chronic effects. Neither acute nor chronic risk to large mammals or granivores and carnivores is expected. However, where exposure occurs, young mammals (meadow voles) may experience acute and chronic effects, and grazing herbivores, omnivores and insectivores of small size would receive greater than their reproductive NOEL. This use of abamectin on ornamentals is not expected to result in risks to large numbers of these mammals because of the limited acreage involved.

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Aquatic or estuarine invertebrates adjacent to treated areas are expected to experience severe acute and chronic effects. Acute risk to fish are expected to be minimal, however chronic effects are likely where drift occurs. Due to the relatively limited acreage involved with ornamental use, impact to aquatic organisms is not expected to be extensive.

101.3 Endangered Species Considerations

Adverse effects to endangered organisms are not expected because of the limited exposure potential with the ornamental use.

101.4 Adequacy of Data

The available data were adequate to complete a risk assessment for this ornamental use. However, before EEB can complete risk assessments for major uses including citrus or cotton, additional testing is required. This includes a fish full life cycle test. This test is required since Avermectin is applied repeatedly and is likely to drift into water at levels exceeding 0.1 the fish early life stage NOEL. Furthermore, it will persist for several months in sediment (t1/2=52 days), and it has teratogenic effects on mammals at low level. The effects to mammals suggest avermectin may affect reproduction of other organisms. Finally, aquatic field testing is required to determine effects to fish and invertebrates and if the sensitivity potentially demonstrated by shrimp is shared by other estuarine or freshwater species. This should include both mesocosm testing and estuarine studies.

Field testing is required to either quantify the affects of Avermectin on wild mammals, or to show that effects observed in the laboratory tests do not occur in the field.

101.5 Adequacy of Labeling

Minor changes in the labeling are required. It should read:

"This pesticide is toxic to fish and wildlife. Do not apply directly to water or wetlands (swamps, bogs, marshes and potholes). Do not contaminate water when disposing of equipment wash water or rinsate.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow drift to blooming crops or weeds if bees are visiting the treatment area."

103 Conclusions

The EEB has reviewed the proposed use of Avermectin on Ornamental Plants. Based on available information, EEB concludes that this use is likely to result in acute and chronic adverse

effects to mammals and aquatic invertebrates in localized areas near where it is applied. These affects are not expected to be extensive, since relatively small acreage is involved. Adverse effects to endangered species are not anticipated.

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