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Shaughnessey No.

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Review No.

EEB BRANCH REVIEW

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TYPE PRODUCT(S): I, D, H, F, N, R, S Insecticide

DATA ACCESSION NO(S)

PRODUCT MANAGER NO. T. Gardner (17)

PRODUCT NAME(S) Cymbush 3E

COMPANY NAME ICI Americas, Inc.

SUBMISSION PURPOSE Registrants's rebuttal to previous EEB review of aquatic field study

SHAUGHNESSEY NO.	CHEMICAL, & FORMULATION	% A.I.
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BACKGROUND

ICI has submitted a document "A Review of the Effects of Pyrethrum and Synthetic Pyrethroids on Non-Target Organisms in Terrestrial and Aquatic Environments." This is a chapter in a book on pyrethroids in general. The editor is J.P. Leahey of ICI. The chapter is intended to be a substitute for a requested aquatic, benthic field study. The basic philosophy of ICI is the synthetic pyrethroids are similar in chemical structure and toxicity, therefore, they can be assessed en block in predicting hazard to non-target organisms. The intent is not to convey that all the pyrethroids are exactly the same, but sufficiently similar that trends and an overall understanding of their affects in the environment can be characterized. This is specifically intended when comparing permethrin and cypermethrin. Both are products of ICI development and chemically very closely related. The major difference is the addition of a cyano group in the cypermethrin molecule. This makes cypermethrin a more biologically active compound and more persistent in the environment. The use of permethrin data to evaluate the affect of cypermethrin is justifiable to a point. Exactly where the delineation should occur is dependent to a degree on interpretation of the available data. Also, the registrant quoted proprietary data that may not have been submitted to the Agency.

It is not the intent to evaluate submission as a whole, but keep the comments within the scope of EEB's concern with pyrethroids in general and specifically address issues concerning cypermethrin.

MAMMALS AND BIRDS

The toxicology data indicates that direct exposure of birds and mammals will not result in direct mortality. The chance of indirect mortality does exist to some degree for waterfowl. All young ducks are insectivorous during the first 10 days to two weeks after hatching. If a pyrethroid is used for grasshopper, black fly, or wheat pest control during the hatching period, fly-overs of the potholes is unavoidable. The aquatic insects could be eliminated, and the young ducklings would be subjected to starvation. However, there is no data available to ascertain the possibility of this occurrence under present conditions.

PLANTS

EEB has no data on the effects pyrethroids have on plants. It is interesting to note that if permethrin is similar to cypermethrin, some inhibition of algae growth could be possible. Cypermethrin is more toxic than permethrin, and the proposed label rates for various registration requests recommend a maximum application of 0.1 lb ai/A. The application rate of permethrin used to inhibit duckweed (Lemma sp.) was 0.025 lb ai/A. Whether cypermethrin has the same biological inhibition to aquatic plants is not known at present.

AQUATIC INVERTEBRATES AND FISH

The laboratory data show that cypermethrin is extremely toxic

to fish. The LC_{50} for rainbow trout range from 0.82 to 0.92 ppb. The 36% weight to volumne formulated product LC_{50} is 4.7 ppb. The bluegill sunfish is more resistant with LC_{50}s ranging from 1.78 ppb to 3.07 ppb with the technical product, and 5.96 ppb with the formulated product. The aquatic invertebrates are much more sensitive. The range is variable depending upon the organism, life cycle stage, and duration of exposure. The trend is quite pronounced. Aquatic invertebrates are extremely sensitive to technical cypermethrin. The LC_{50}s range from 4.75 parts per trillion, to 197 parts per trillion (Refer to the toxicology table). The LC_{50}s listed by the registrant are approximately in the same range. At this point both EEB and the registrant acknowledge the toxicity of the product.

The major questions are whether under normal agricultural practices cypermethrin will reach the aquatic environment; what effects can be anticipated; and what are the recovery times of the organisms. In agriculture, pesticide contamination of aquatic systems occurs mainly by direct field runoff caused by rain fall or irrigation, and spray drift, either by plane or irrigation.

Of the two, spray drift is the easiest to assess because more data is available. The majority of the research has been conducted by the Canadian government and associated universities. The bulk of the material has been with permethrin in New Brunswick forests. The lastest report (Kingsbsury ed. 1983) concentrated on two 600 hectare (1482.6 acres) blocks located on tributaries of the Nashwaak River, B.C. in June, 1980. The application rate was 0.015 lb ai/A (17g ai/ha) by aircraft. One block received a single application, and the other two applications with a 4 day interval between sprays. The discussion of all results exceed the scope of this review, but the pertinent points are of interest. There were no pesticide related mortality of resident and caged fish, though preliminary studies indicated delayed toxic and sublethal effects on caged crayfish. There was a difference in growth between the fish of the single and double application test plots during the summer, but these differences diminished by the end of the study period. The fish initially engorged themselves on the dead insects, and no secondary effects were noted. However, the food supply was depleted. The fish either tolerated the period of starvation or emigrated to other habitats.

Both sigle and double treatments caused severe, adverse effects on the aquatic invertebrate populations. Recovery occurred within a treatment year with the single application. With the double application, substantial reductions occurred in bottom fauna populations. The recovery was considerably slower than the impact caused by the single application.

Similar results have been noted in other studies. A tsetsefly study was well documented (Everts, J. W. et al., 1983). The gallery forest along a river was sprayed five times with deltamethrin at 0.011 lb ai/A (12.5 g ai/ha). The river was exposed to considerable spray drift. The results were similar to the Kingsbury study. The number of fish were basically unchanged. The arthropods, and small shrimp were virtually eliminated, while an economically important shrimp was only stunned. The larvae of some caddisflies, diptera, and mayflies were only temporarily affected. The authors noted that at the time of spraying many species were in diapause or otherwise protected against adverse conditions.

A study with cypermethrin on cotton indicated similar results. On two occasions Cybister larvae and belostomatids were noted leaving the

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water when exposed to spray drift. The application rate was 0.125 lb ai/A.

To date, ICI has not requested a forest use, but a pecan registration has been submitted. Several other crops immediately come to mind. Any nut crop as pecans, almonds, pistachios, and macadamia nuts would be similar to a forest application. Another crop would be citrus. This crop would be of concern to EEB. Approximately 75% of the citrus is grown in Florida. The orchards abutt on irrigation canals, ponds, rivers, and important commerical estuarine environments. Based on submitted registrations requests, a citrus request would probably have an application rate of 0.5 to 0.1 lb ai/A with recommendations of 5 to 10 applications per growing season. The insecticide would be applied by air, ground equipment, and possibly by spray irrigation. It is reasonable to assume that some waters would receive spray drift on a multiple application basis. Serious adverse, prolonged effects are anticipated. The studies in Canada and Africa used rates 10 times less than the 0.1 lb ai/A that could be requested, and they showed immediate wide spread effects. At rates approaching 0.1 lb ai/A, the initial immpact should be more dramatic and recovery prolonged. Also with the crops mentioned, yearly applications can be anticipated.

The runoff contamination is more difficult to address. ICI has submitted a report that under cotton field conditions, soil-bound cypermethrin entered the aquatic system in amounts that exceeded the LC_{50} of aquatic invertebrates. Normally, cotton is considered an extreme case, and the use of cypermethrin would be less hazardous on other crops. Review of the registration requests indicate that cotton may not be the worst case situation. The appliction for tomato use is a good example. A maximum application rate of 0.1 lb ai/A with 12 applications is recommended. In some areas, mainly South Carolina, tomatoes are grown on soil that is overlayered with plastic covering. The plastic serves to keep down weed growth. The insecticide is applied by ground equipment that causes troughing between the rows. The insecticide would have little chance to soil-bind, and an immediate runoff problems occurs. Cypermethrin is much more stable than permethrin. The runoff will directly enter the aquatic system. This approaches a direct spray application condition. Other speciality crops are grown on a year round basis. The use of cypermethrin would mean a chronic exposure. This as been discussed at greater length in previous reviews. Major crops should not be ignored. A soybean application request rates of 0.1 lb ai/A with four applications. If wheat is requested at a similar rate with two applications, a long term chronic problem could occur. Many farmer double crop a field. As soon as the wheat is harvested, soybeans are planted. The field could received regular applications of cypermethrin.

There are insufficient data to address the sediment problem. Drs. K. Solomon and D. Muir (per. comm.) who are investigating sediment-bound permethrin are concerned that enough permethrin is desorbed at the sediment water interface to be toxic to benthic organisms. Their results are still preliminary. The registrant refers to artifical pond studies conducted in England with permethrin. EEB is not sure if they are gemane to the cypermethrin issue because cypermethrin is more stable in the environment than permethrin.

The submitted document is a very nice piece of scientific work. EEB defers to elaborate on some sections in the text because some of the

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studies referenced have not been reviewed. A cross check is being made with the proprietary permethrin studies referenced and those contained in EEB's file. Any missing studies will be requested.

This is quite important. Independent review is just good science, especially when the registrant is using them to support a registration action. A case in point is the study "Cypermethrin: Aquatic Ecological Effects Under Field Use Conditions in Cotton, Selma, Alabama, 1980, TMUE 0026/B). This report is discussed on pages 77-79 in the text. The text infers that a 42 acre cotton field was used to address spray drift and runoff effects on a 7.4 acre pond. While this is true for spray drift, it is definitely not the case with runoff. Only 7.5 acres of the field drained into the pond (page 2 of the orginal report). Hardly a realistic runoff scenario. This example is not intended to imply that Dr. Hill is not candid in his presentation especially when the opposite is true. It is used as an example why independent review is important.

CONCLUSIONS

1. Spray drift could cause substantial adverse effects to aquatic invertebrates if used in a forest type scenario. This would include crops as pecans, macadamia nuts, apples and pear orchards, and specifically citrus fruits. Approximately 75% of the citrus is grown in Florida, and the orchards abutt on estuaries and other viable waters. If spray drift impacts these sources on a multiple application basis, the benthic fauna may not have the time to recover and immigrants would be killed.

2. Large scale adult fish kills are not anticipated from drift or runoff. In multiple application conditions, there could be a general decline in growth, possibly reproduction, and the eventual elimination of species that cannot shift their diet to other invertebrates.

3. EEB rejects the concept that soil-bound pyrethroids are quickly degraded. Both proprietary and open literature studies show that residues can persist into the next growing season. This applies to sediment-bound products also.

4. EEB does not completely accept the concept that sediment-bound cypermethrin is biologically unavailable. The present data are not conclusive.

Wayne C. Faatz, Ph.D.
Wildlife Biologist
Ecological Effects Branch/HED

Wayne C Faatz 4/24/84

David Coppage
Head, Section #3
Ecological Effects Branch/HED

David Coppage 4/25/84

Clayton Bushong, Chief
Ecological Effects Branch/HED

Clayton Bushong 4/25/84

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Everts, J. W., K. van Frankenhuyzen, B. Roman, and J. H. Koeman. 1983. Side-effects of experimental pyrethroid applications for the control of tsetseflies in a riverine forest habitat (Africa). Arch. Environ. Contam. Toxicol. 12, pp 91-97.

Kingsbury, P.D. (ed.) 1983. Permethrin in New Brunswick salmon nursery streams. Report FPM-X-52. Forest Pest Management Institute, Canada.