FLOATING ARTICLE FOR IMPROVED CONTROL OF AQUATIC INSECTS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 347,310, filed Feb. 9, 1982 now abandoned, and entitled "Internal Flotation-System For Carrier of Larvicidal Micro-Organism For Insect Control", the disclosure of which is incorporated herein in its entirety by reference.

FIELD OF THE INVENTION

This invention relates to a floating article for improved control of aquatic insects, and more particularly, to a floating article containing a larvicidal microorganism for the destruction of the mosquito larvae, black fly larvae, and the like.

BACKGROUND OF THE INVENTION

Mankind has for many years struggled against various insects, such as the mosquito and the black fly. These types of insects breed in various bodies of water, such as marshes, stagnant water, catch basins, ponds, woodland pools, abandoned pools and the like. Each adult female mosquito is capable of depositing hundreds of eggs, each of which experiences a complete metamorphosis. The egg hatches into a larva, and after a period of time, the larva enters into a pupa stage. The pupa stage is also spent in the water, and within a few days the adult mosquito emerges.

With respect to the commercial practices used in the field of mosquito control, and especially those intended for use primarily by governmental agencies and by large-scale industrial users, three "generations" of insecticides have been developed over the years. The first are various chemicals which are dispensed by foggers or sprayers, both on the ground and through the air. These chemicals may be classified as either adulticides or larvicides and are intended to attack and kill the adult mosquito or its larva, respectively. These chemicals usually have an inherent toxicity, which is potentially injurious to the environment, to marine life and wildlife, and ultimately to humans. As a result, these chemical insecticides have been viewed with disfavor in recent years.

One such product was "DURSBAN 10CR" produced by Dow Chemical Company around 1975. It was molded into the matrix of a polyethylene pellet, and the pellets were simply thrown into the water. Although the pellets sank to the bottom, the chemical larvicide was intended for a controlled release over a substantial duration. However, there were two problems with this product. First, it had an inherent toxicity problem which was potentially harmful to the environment. Second, and because of the long-term long-lasting effects of this product, the larvae could develop a resistance; and ultimately, the mosquitos could develop an immunity to adulticides of the same chemical family. This situation is referred to as "cross resistance" and illustrates that under adverse conditions, insects may tend to adapt. This ability to adapt, often within a few generations, can be somewhat exasperating for researchers engaged in the field of mosquito control.

As a departure from the chemical adulticides and larvicides, a second generation was developed. This second generation is known as insect growth regulators. Their purpose is to prevent the embryo from developing into an adult. The larva enters into its pupa stage but never develops into an adult. These products have very low toxicity, or practically no toxicity, and hence are not detrimental to marine life.

One such product is "ALTOSID" which is manufactured by Zoecon Corporation of Palo Alto, Calif. This product is available in two forms, one a liquid called "ALTOSID" SR-10, and the other a solid block called "ALTOSID" briquets. The active ingredient is methoprene. The methoprene is impregnated into a truncated cone-shaped charcoal briquet, and the briquets are sold as a package and are removed singly for individual use. The briquet is thrown into the water and sinks to the bottom. It decomposes slowly and is intended to have a sustained release over a period of about thirty days. During this time period, the briquets release the methoprene to prevent the mosquito larvae in the water from developing into adults. Because of the charcoal form of the briquet, it is messy and somewhat inconvenient to handle.

For about the past fifteen years, a third generation has been developed. Basically, these are bacteriological methods for spreading disease among insect populations. One of the most successful disease agents is *Bacillus thuringiensis* Berliner var. *kurstaki*, a bacterium which infects the larvae of Lepidoptera (moths) that are to be destroyed. More recently, a new variety has been uncovered for use against mosquito larvae and black fly larvae. This is *Bacillus thuringiensis* Berliner var. *israelensis* and its accompanying proteinaceous parasporal particles which contain protoxin. This bacillus is an aerobic spore-forming rod and is presently formulated into either a flowable liquid concentrate or a wettable powder, the latter being available commercially from Biochem Products under the trademark "BACTIMOS". The liquid concentrate or wettable powder is mixed with water and suspended, and the suspended particles are sufficiently fine to be sprayed homogeneously. Alternately, the *Bacillus thuringiensis* Berliner var. *israelensis* may be carried by granules of clay, sand, or other suitable granular material having a 20 to 40 mesh.

When these granules are used as a larvicidal carrier for either a chemical insecticide, an insect growth regulator, or a larvicidal micro-organism—a major problem is encountered. These granules have a specific gravity which is greater than water and thus sink towards the bottom of the water. Since the larvae breed at or near the surface of the water, much of the active larvicide is thus wasted. As a result, either the concentration of larvicide in the water is insufficient to destroy the mosquito larvae completely, or else a greater quantity of larvicide must be used to achieve the desired objective.

Moreover, when a larvicidal micro-organism of the bacillus type is used, and is sprayed on the water in the form of a liquid produced by diluting the wettable powder or liquid concentrate with water, a similar problem is encountered. The bacillus spores and protoxin particles are themselves heavier than water and sink towards the bottom. Additionally, the application of the bacillus does not have a sustained release—it is essentially "one shot"—and hence re-applications are often necessary to insure an effective mosquito control program. This is time consuming and expensive.

Besides these existing commercial practices, the prior art has disclosed various devices and methods for the