# MOSQUITO (DIPTERA: CULICIDAE) CONTROL IN AGRICULTURAL AREAS IN PIEDMONT, ITALY

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In Piedmont, water used in agriculture is one of the most important source of mosquitoes. For this reason more resources are used for the mosquito control. In particular in grazing meadows and rice field, genus *Aedes* mosquitoes can be controlled using B.t.i.. In rice field genus *Culex* and *Anopheles* can be controlled with mosquito fish (*Gambusia holbrooki*).

In some areas of the Piedmont in Italy agriculture causes great number of mosquito problems, primarily because of the large amount of standing water. For these reasons, in 1995 the Piedmont region introduced a law to promote initiatives for the biological control of mosquitoes. In light of the law, some municipalities agreed to participate in a joint program. These territories are mainly agricultural with many large cities and towns. However, thousands of hectares are dedicated to agricultural production. In the biologically unbalanced situations of the fields there are large concentration of mosquito larvae. Absence of predators, competitors, and the abundance of food lead to serious infestations during the hot periods.

There are three main problems: 1) Infestation of flooded fields. The poor soil of some area limits cultivation to only grazing meadows. In order to increase productivity, in the warm season the fields are flooded. The water is left for several days in the fields, nonetheless the puddles formed last for a sufficient period for the complete life cycle of two species of mosquitoes which lay their eggs in the earth and hatch after the prolonged flooding: *Aedes caspius* (Pallas) and *Aedes vexans* (Meigen). 2) Infestation of rice-fields. Generally Piedmont rice-fields are flooded three times between April and the beginning of June. *Ae. caspius* eggs hatch after every flooding; larvae are gathered especially on the edge of the fields, because young rice plants gives them no shade. Conditions permit development of a number of adults only after second flooding. 3) Over-infestation of rice-field. The over-infestation of fields by *Culex modestus* (Ficalbi), *Culex pipiens* (L.), and *Anopheles maculipennis s.l.* Meigen, during the latest flooding is usual, and increases with temperature until the end of August, when water is finally removed. The objectives of this study were to investigate the biological control of mosquitoes in these agricultural areas.

To control mosquito larvae development in flooded fields, we used a liquid formulation of 15% *B.t.i.* H 14 - 1500 UI/mg preparations sprayed by hand application and truck mounted blower application. Applications were made within 24 hours after flooding. Larval control in rice fields is still experimental. We propose to employ the same B.t.i. preparation, spraying it on one meter of the field's perimeter, just after the 2nd flooding. The treatments are done up to a 10 kilometres distance from inhabited centres, because *Ae. caspius* is able to cover those distances.

For fields over-infested with *Culex* and *Anopheles* the most common method is the release of mosquito fish into the water up to 1-2 kilometers distance from inhabited centers, because these mosquitoes do not fly as far as *Ae. caspius*. To verify the method, we prepared two identical flooded fields. In one we released 2,000 mosquito fish (*Gambusia holbrooki*) per hectare. On each chambers where settled nine points to sample and count larvae every week. Along the field internal perimeters a ditch was dug to preserve fish when water is lacking and to aid fish preying.



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Wm H. Robinson, F. Rettich and G.W. Rambo (editors). 1999.