1. Influence of environmental factors on the response of a natural population of Daphnia magna (Crustacea: Cladocera) to spinosad and Bacillus thuringiensis israelensis in Mediterranean coastal wetlands. Duchet, C.; Caquet, Th.; Franquet, E.; Lagneau, C.; Lagadic, L. Environmental Pollution vol. 158 issue 5 May, 2010. p. 1825-1833

▼

The present study was undertaken to assess the impact of a candidate mosquito larvicide, spinosad (8, 17 and 33 μg L−1) on a field population of Daphnia magna under natural variations of water temperature and salinity, using Bti (0.16 and 0.50 μL L−1) as the reference larvicide. Microcosms (125 L) were placed in a shallow temporary marsh where D. magna was naturally present. The peak of salinity observed during the 21-day observation period may have been partly responsible for the decrease of daphnid population density in all the microcosms. It is also probably responsible for the absence of recovery in the microcosms treated with spinosad which caused a sharp decrease of D. magna abundance within the first two days following treatment whereas Bti had no effect. These results suggest that it may be difficult for a field population of daphnids to cope simultaneously with natural (water salinity and temperature) and anthropogenic (larvicides) stressors.

Keywords: Daphnia; Biopesticide; Salinity; Temperature; Stressor; In situ microcosms

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2. Chitobiase activity as an indicator of altered survival, growth and reproduction in Daphnia pulex and Daphnia magna (Crustacea: Cladocera) exposed to spinosad and diflubenzuron. Duchet, Claire; Mitie Inafuku, Marília; Caquet, Thierry; Larroque, Michel; Franquet, Evelyne; Lagneau, Christophe; Lagadic, Laurent. Ecotoxicology and Environmental Safety vol. 74 issue 4 May, 2011. p. 800-810

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Chitobiase is involved in exoskeleton degradation and recycling during the moulting process in arthropods. In aquatic species, the moulting fluid is released into the aqueous environment, and chitobiase activity present therein can be used to follow the dynamics of arthropod populations. Here, chitobiase activity was used for monitoring the impact of mosquito candidate larvicides on Daphnia pulex and Daphnia magna under laboratory conditions. Both species were exposed to spinosad (2, 4, 8μgL−1) and diflubenzuron (0.2, 0.4, 0.8μgL−1) for 14 days. Bacillus thuringiensis var. israelensis (Bti; 0.25, 0.5, 1μLL−1) was used as the reference larvicide. Chitobiase activity, adult survival, individual growth and fecundity, expressed as the number of neonates produced, were measured every 2 days. Average Exposure Concentrations of spinosad were ten-fold lower than the nominal concentrations, whereas only a slight deviation was observed for diflubenzuron. In contrast to Bti, spinosad and

diflubenzuron significantly affected both species in terms of adult survival, and production of neonates. As compared to D. pulex, D. magna was more severely affected by diflubenzuron, at low and medium concentrations, with reduced adult growth and much lower chitobiase activity. Chitobiase activity was positively correlated with the individual body length, number of neonates produced between two consecutive observation dates, and number of females and neonates. In addition, the significant positive correlations between chitobiase activity measured on the last sampling date before the first emission of neonates and the cumulative number of neonates produced during the whole observation period strongly support the potential of the activity of this chitinolytic enzyme as a proxy for assessing the dynamics of arthropod populations exposed to larvicides used for mosquito control.

Keywords: Daphnia sp.; Neurotoxicant; Insect growth regulator; Bti; Chitobiase; Population dynamics; Bioindicator; Environmental risk assessment

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3. Effects of spinosad and Bacillus thuringiensis israelensis on a natural population of Daphnia pulex in field microcosms. Duchet, C.; Larroque, M.; Caquet, Th.; Franquet, E.; Lagneau, C.; Lagadic, L. Chemosphere vol. 74 issue 1 December, 2008. p. 70-77

► Spinosad, a candidate biological larvicide for mosquito control, was evaluated for its effects… (more)

Keywords: Biopesticide; In situ microcosm; Dissipation kinetics; Mosquito control; Ecological risk assessment

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4. Uptake and loss of Bacillus thuringiensis var. israelensis by Daphnia magna in laboratory exposure. Vaishnav, Dinesh D.; Anderson, Richard L. Environmental Toxicology and Chemistry vol. 14 issue 5 May, 1995. p. 763-766

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We determined the ingestion and loss of the spores of Bacillus thuringiensis var. israelensis (Bti) by a nontarget organismDaphnia magna . Daphnids were either not fed or fed during the exposure to the spores. The results showed that (a) the uptake rates with unfed and fed daphnids were approximately first-order with respect to spore concentration, and the rate constants for unfed and fed daphnids were 5.5×10^{-5} and 1.4×10^{-7} L daphnid^{-1} h^{-1}, respectively, and (b) unfed and fed daphnids rapidly

depurated the majority of the accumulated spores, and the depuration rate constants for unfed and fed daphnids were 0.13 and 0.15 h−1, respectively.

Keywords: Bacillus thuringiensis; Microbial pest control agent; Spore accumulation; Spore depuration; Daphnia

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4. Effects of spinosad and Bacillus thuringiensis israelensis on a natural population of Daphnia pulex in field microcosms. Duchet, C.; Larroque, M.; Caquet, Th.; Franquet, E.; Lagneau, C.; Lagadic, L. Chemosphere vol. 74 issue 1 December, 2008. p. 70-77

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Spinosad, a candidate biological larvicide for mosquito control, was evaluated for its effects on a field population of Daphnia pulex, using Bacillus thuringiensis serovar israelensis (Bti) as a reference larvicide. Microcosms (125L enclosures) were placed in a shallow temporary oligohaline marsh where D. pulex was present. Three concentrations of spinosad (8, 17 and 33µgL−1) and two concentrations of Bti (0.16 and 0.50µLL−1) were applied (5 replicates per concentration, including the controls). Effects of larvicides on D. pulex were evaluated after 2, 4, 7, 14 and 21d of exposure, through measurements of abundance and individual size. Dissipation of spinosad from the water phase was rapid. Four days after treatment, residue concentration represented 11.8%, 3.9% and 12.7% of the initial exposure level for the nominal concentrations of 8, 17 and 33µgL−1, respectively. Spinosyns A and D dissipated at similar rates. Analysis of abundance and size structure of the D. pulex population showed an impact of spinosad. Both survival and size structure were affected. However, at the lowest concentration (8µgL−1), population recovered after the first week. In microcosms treated with Bti, the abundance of D. pulex was not affected but the size structure of the population changed after 21d. As compared to laboratory tests, the use of in situ microcosms improved the environmental risk assessment of larvicides, taking into account the influence of environmental factors (e.g., temperature, light, salinity) and intrinsic capacity of recovery of D. pulex under field conditions.

Keywords: Biopesticide; In situ microcosm; Dissipation kinetics; Mosquito control; Ecological risk assessment

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