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OPERATIONAL NOTE

THE USE OF SODIUM HYPOCHLORITE AS OVICIDE AGAINST *AEDES ALBOPICTUS*

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ABSTRACT. We describe the ovicidal action of a 3.75% (w/v) sodium hypochlorite solution on the eggs of *Aedes albopictus* (Skuse). The effectiveness of this ovicide has also been confirmed by a field trial. On the basis of the data collected in the city of Bologna, Italy, we hypothesize a relationship between the numerical increase of the *Ae. albopictus* eggs laid and the reduced daily variation of the relative humidity, facilitating the possibility of planning ovicidal treatments.

KEY WORDS *Aedes albopictus,* sodium hypochlorite, ovicide, chorion, RH

The ability of *Aedes albopictus* (Skuse) to spread in the Italian cities is principally due to the characteristics of its eggs: during favorable periods, the summer eggs can become active even within a few hours after their deposition, while the diapausing eggs are able to survive the winter (Hawley 1988, Hawley et al. 1989, Hanson and Craig 1995). In Italy *Ae. albopictus* is essentially controlled by means of both biological (*Bacillus thuringensis*) and chemical (Temephos) antilarval treatments; however, these actions have not successfully suppressed populations (Romi 1999). To develop novel techniques against *Ae. albopictus,* to destroy both summer and diapausing eggs with the least environmental impact, our attention was focused on the use of sodium hypochlorite, a substance that is already widely used to remove the chorion of many insect eggs in embryological and genetic research (Forbes and Ingham 1993).

Aedes albopictus eggs used were collected in ovitraps placed in Bologna in 2002; the ovitraps consisted of 500-ml black plastic pots with a 12 × 2-cm strip of a wooden pallet attached to the inside of the jar with a paper clip as oviposition substrate. The experiments were carried out both on eggs detached from the substratum (using a small brush) and directly on eggs that had been laid on the wood. The eggs were immersed in aqueous solutions of sodium hypochlorite (15 g of sodium hypochlorite/100 ml) with dilutions varying from 1 to 50% v/v. The eggs were examined with the use of the stereomicroscope to determine the time and the hypochlorite concentration required for chorion removal and the consequent detachment from the substratum. The eggs of *Ae. albopictus* were mounted on stubs previously covered with sticky tape, dried with silica gel, sputter coated with gold, and then examined under a JEOL 5200 scanning electron microscope.

At the end of February 2003 (average temperature of February = 4.5°C), 30 drains localized in an infested area in Bologna were used: 15 were treated with a spray consisting of 20 ml of a 25% dilution of the original 15 g/100 ml sodium hypochlorite solution, and 15 were used as controls. The spraying was carried out with a rucksack-type pump with a nozzle that produced a fan-shaped spray to treat the interior walls of the drains. To avoid the deposition of additional *Ae. albopictus* eggs, mosquito nets were used to cover the drains. The drains were periodically monitored until beginning of the summer (average temperature of May = 20°C).

In the laboratory, the 25% dilution of the sodium hypochlorite mother solution (15 g/100 ml) proved to be the lowest concentration capable of destroying the chorion of the eggs of *Ae. albopictus* in under 1 min (Fig. 1) with the consequent detachment from the substratum. The ovicidal action of the embryo is caused by the loss of the chorion protection (Valencia et al. 1996) and by the detachment of the eggs.

In the field, in the 15 drains treated with the same (25% v/v) dilution, hatching of *Ae. albopictus* did not occur, while 70% of those not treated showed the presence of larvae starting from May 15th, 2003. It should be noted that the quantity of sodium hypochlorite used (20 ml at 25% v/v per drain) is environmentally compatible.

Furthermore, during 2003, the trend of *Ae. albopictus* oviposition in relation to the atmospheric conditions was also analyzed on the basis of data obtained from 150 ovitraps in Bologna. The data (Fig. 2) show the existence of a correlation between the quantity of eggs laid and the relative humidity: the most significant increments of the total number of eggs occur near a reduced daily variations of relative humidity ($H_{max} \times H_{min}$), which generally precede a rainfall. These peaks of egg deposition

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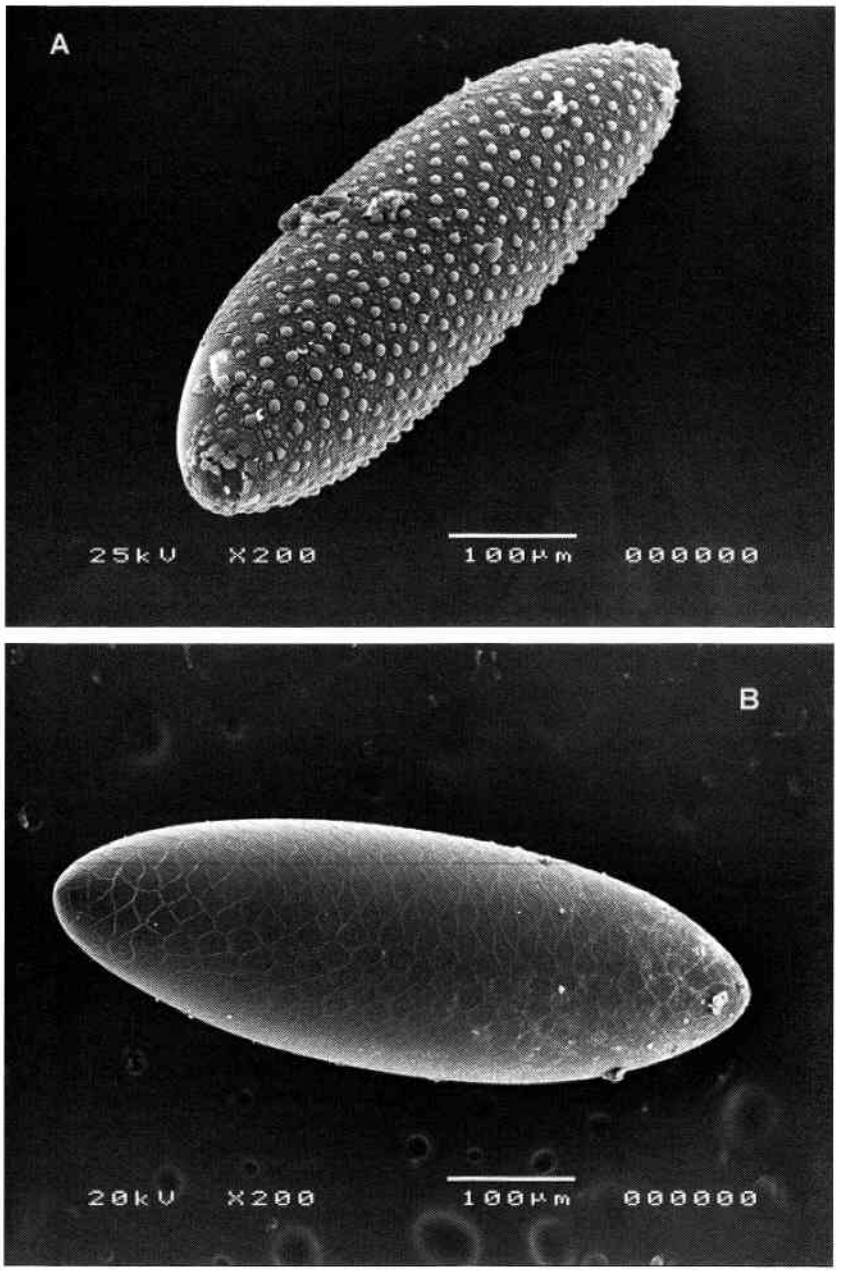

Fig. 1. Morphological appearance of *Ae. albopictus* eggs before treatment (A) and after immersion in a 3.75% (w/v) sodium hypochlorite solution (B). Dechorionation was achieved in 30 s.

seem to be correlated to a greater stimulation to lay eggs, rather than an increased number of adult mosquitoes.

The confirmation of these results could open new approaches for the development of ovicide treatments: in fact, it would be possible to plan operations against the eggs of *Ae. albopictus* after a considerable increase in egg deposition has been noted on the data obtained from the ovitrapping survey. This ovicidal treatments on the drains should also be efficient on the eggs of *Culex pipiens*; in fact, treatment with sodium hypochlorite could also destroy their floating egg rafts.

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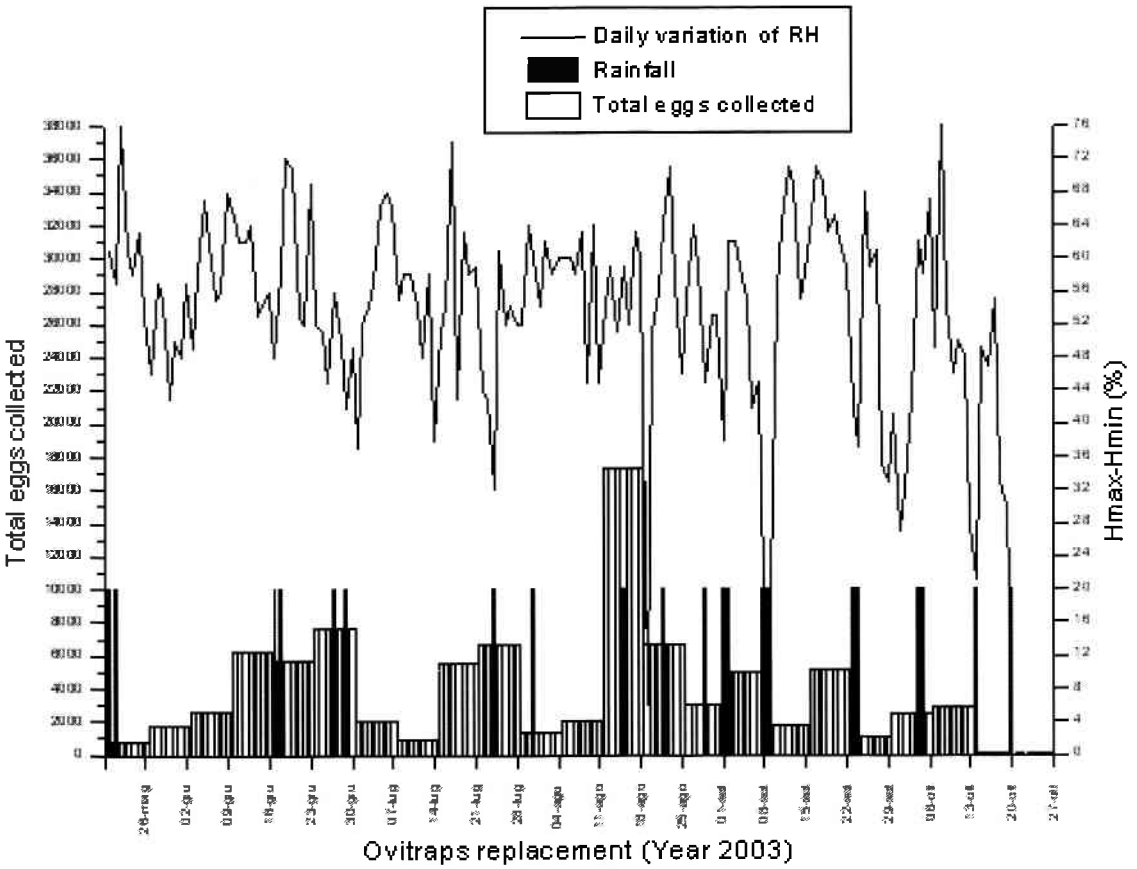

Fig. 2. Trend of *Ae. albopictus* oviposition in relation to the daily variation of relative humidity. Note the correlation between the quantity of eggs laid and the relative humidity variation ($H_{max} \times H_{min}$) just before a rainfall.

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