

COCKROACH CONTROL IN THE NETHERLANDS

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Abstract—Cockroach control in the Netherlands is carried out with the use of the synthetic pyrethroids deltamethrin, cyfluthrin or permethrin or of the organophosphate chlorpyrifos. The German cockroach is the species most frequently found in buildings. There are some indications that resistance against insecticides is becoming important. However at the moment in most cases cockroach control can be carried out successfully, especially when there has been great care taken in convincing the occupants or organisations concerned that their co-operation is essential.

INTRODUCTION

The domiciliary species of cockroaches live in buildings, in the direct surroundings of man. Their habit of feeding on both human faeces and human food is a potential health hazard to man. Not only do they carry bacteria but also it was shown in laboratory studies that cockroaches may acquire, maintain, and excrete various viruses. Cockroaches can regurgitate some of their partially digested food and they drop their faeces in human dwellings. Cockroach control is, for these reasons, a necessity. Pest control technicians should try to do their job as good as possible for every cockroach in human dwellings is one to many.

Domiciliary cockroach species in the Netherlands

Surveys on the frequency of infestations of cockroaches in buildings were not carried out in the Netherlands, but roughly it is estimated that we are dealing in more than 80 % of the cases with the German cockroach (*Blattella germanica* (L.)). Other species of cockroaches regularly found in buildings are the Oriental cockroach (*Blatta orientalis* L.), the brown-banded cockroach (*Supella longipalpa* (F.)), the American cockroach (*Periplaneta americana* (L.)), the Australian cockroach (*Periplaneta australasiae* (F.)) and the Surinam cockroach (*Pycnoscelus surinamensis* (L.)). The last two species are mainly found in the soil of greenhouses and feed on parts of plants.

The German cockroach lives in warm situations where a lot of moisture and food is present. Cockroaches are found in houses, especially in kitchens, in restaurants, in food processing plants, in heated apartment complexes, in various trades and industries, health care institutes, on board of ships, etc. Nowadays their presence on dumps is very rarely because of the good maintenance practise on the dumpsites. They can survive remarkably well in all these buildings and under favourable conditions they reproduce very quickly. It is a general feeder and can survive on a wide diversity of organic matter. Because of the fact that people live in well heated, mostly central-heated buildings during the winter period, the cockroaches can reproduce in moderate regions, in spite of their tropical origin. Although it is advisable to keep places as clean as possible, good hygiene will not completely prevent the development of the cockroaches.

Cockroach control

Cockroach control in the Netherlands is carried out with either synthetic pyrethroids or organophosphates. In a house all the possible sites where cockroaches can hide are made accessible. Especially in the kitchen a lot of work has to be done before the pest control technician can apply the insecticide. All the cupboards have to be emptied and food stuffs and kitchenware must be placed in the middle of the room on a table f.i. and protected with a sheet. Normally a crack and crevice treatment is carried out. The insecticide is applied under low pressure so that droplets will be sprayed into the cracks and crevices by touching them with the nozzle while spraying. Complete walls or floors are not treated, only hiding places of the cockroaches. Mostly insecticides on a water basis are used. After the application the water will evaporize and the active ingredient will stay as a

residue on and in the treated cracks and crevices. When the pest control technician is doing his job, the inhabitants are not allowed to stay in the house. Also during the first 2 hours after treatment the inhabitants will have to stay elsewhere. During this time ventilation can take place in order to establish that people coming into the area after that time, will not inhale harmful quantities of the insecticide.

The insecticides

For the control of cockroaches several insecticides are registered according to the Pesticide Act. The most widely used active ingredients are at this moment cyfluthrin, deltamethrin, permethrin and chlorpyrifos. The first three of these active ingredients belong to the group of the synthetic pyrethroids while the latter one is an organophosphate.

Synthetic pyrethroids

Synthetic pyrethroids act as contact and stomach poisons against a wide range of insects. The three active ingredients mentioned here have a residual activity and they all have a very low vapour pressure. As a formulated insecticide, when the concentrate is mixed with water, the toxicity against mammals is low, certainly when it is compared to active ingredients belonging to other toxicological groups. The efficacy of these active ingredients is very good. During the years these insecticides are registered, which is for more than 10 years now, the synthetic pyrethroids were widely used and gave excellent results eradicating crawling insects. In certain buildings cockroach control had to be carried out several times a year with intervals of 4 to 8 weeks and still the results of the pest control actions were satisfactory. Only when the co-operation of the inhabitants was poor there were problems with the results of the action.

Organophosphates

Organophosphates belong to the group of the anti-cholin-esterase insecticides. These insecticides came onto the market after the Second World War. The first examples in wide use were dangerously poisonous to higher animals. Especially parathion became wellknown, but fortunately this insecticide was never used inside buildings. Later on safer compounds were found. High insecticidal potency was combined with relatively low mammalian toxicity. In normal nervous activity the chemical acetylcholine is broken down by the enzyme acetyl-cholin-esterase. The organophosphates however, block the activity of this enzyme so that eventually death occurs by paralysis of the muscles. For the control of crawling insects the active ingredients diazinon and chlorpyrifos were used in the Netherlands. The results of the application of these insecticides were good. In most cases the population of the cockroaches could be destroyed completely when two treatments were carried out with an interval of 4 to 6 weeks. A crack and crevice treatment was advised for cockroach control. The only problem was that the active ingredients have a low vapour pressure and that is the reason why in the eighties diazinon was forbidden for use against cockroaches. The residues in foodstuffs were found to be too high to allow the industry to go on with the application of diazinon. Up till now the active ingredient chlorpyrifos is still registered.

Insecticide resistance

The wide use of insecticides, beneficial in many ways, has some undesirable consequences. One of these is the emergence of resistant strains of insects. This emergence is a selection of pre-existing genetic types. The idea that resistance can be developed in individual insects by exposure to sub-lethal doses, is a misconception. Resistance becomes more and more important, especially because of the fact that in most cases the same active ingredients are applied. Insects with a rapid development can achieve resistance against certain insecticides more quickly than others. Cockroaches are controlled on a large scale with time and time again the same active ingredients. In the US the German cockroach is resistant against a wide range of insecticides. A lot of work on this

subject was done by J.M. Grayson and published in *Pest Control*, the magazine of the National Pest Control Association.

For many years it was thought that resistance did not play a role in the pest control activities in the Netherlands. There are not so many places where on a regular basis pest control actions have to be carried out. Probably that is one of the reasons why it took so long before resistance became an issue in our country.

Resistance can only be investigated in the laboratory. First of all the susceptibility level of a normal non-resistant population of the German cockroach must be determined. Most laboratories working in this field have a non-resistant strain at their disposal. An actual test consists of exposing batches of cockroaches to a range of doses and noting their subsequent mortality. Dosage and time of exposure can differ. However very important is to keep the conditions as standard as possible and to use insects of the same age and stage. When the dosage-mortality data of the susceptible and the field strain are available they can be compared to each other. If in a certain field strain several cockroaches are found surviving the chosen 'diagnostic dosage' there is good evidence of the presence of resistant individuals in the field population. With such an observation however a resistance rate is not yet determined. This is only possible by comparing the two dosage-mortality rates to each other.

Inquiry on cockroach resistance in the Netherlands

In the last few years a lot of rumours were spread in the media about the possible existence of resistance in the German cockroach against synthetic pyrethroids and organophosphates. In order to investigate what ideas the pest control industry had on this issue and inquiry was sent to them with some questions about the situation at this moment.

From the inquiry it became clear that only the insecticides deltamethrin, cyfluthrin, permethrin and chlorpyrifos are used. Some firms have the standard procedure that always a second treatment against German cockroaches has to be carried out. Other firms offer only one treatment and wait for callbacks to decide if a second treatment is necessary.

A striking difference between commercial firms and local authorities is that the first indicate that in 50 % of the cases where German cockroaches are treated, it is not possible to eradicate the population completely. Local authorities are much more optimistic in that respect.

Bad organisation of the pest control action is the reason that in 5 to 10 % of the cases the cockroaches are not completely eradicated.

The most important reason however why populations of the German cockroach are not completely destroyed is the fact that in a substantial part of the cases co-operation of the inhabitants of houses is refused. In multi-story buildings in our big cities the presence of the German cockroach has become so normal and pest control activities take place so regularly with so little results that the inhabitants have lost confidence in the pest control industry.

The commercial pest control firms and the local authorities have the opinion that in only a very small number of houses resistance is the reason that the population is not eradicated completely. The highest percentage mentioned in this respect is 5 %. Of course it must be investigated further, especially in the laboratories, but it is good to know that resistance is only a small part of the problems of the pest control industry in our country.

DISCUSSION

Resistance in the German cockroach in the Netherlands is still a minor problem. Most of the treatments against this pest can be successful if the organisation of the action is good and if the co-operation with the inhabitants is 100 %. If in multi-story buildings in the big cities of the Netherlands the German cockroach cannot be eradicated, this is mostly due to the fact that a lot of tenants refuse to let the pest control technicians enter their home. The synthetic pyrethroids and the organophosphates are efficacious in most of the circumstances in practice.