

## **Mythic SC : a valuable tool for the control of crawling insects**

Dr Romain Lasseur, Izipest, France

Insects are by far the terrestrial living beings represented by the greatest number of species. With nearly 1.3 million species described, insects account for more than two-thirds of all living organisms. Within these species, some of them come into direct contact with humans. This is the case in particular for some crawling and flying insect species living in our environment. These insects then become invasive and disruptive to the extent that they consume our food, and grow thanks to our waste or to the meals of blood that they obtain directly from us (cockroaches, bed bugs, mosquitoes for example). Focusing on invasive crawling insects, they grow mostly by eating our food (1).

This is the case for the various species of cockroaches, including the German cockroach, the Oriental cockroach, the American cockroach and the Brown-banded cockroach (2). Cockroaches are omnivorous, show gregarious behaviour and are able to live in many environments provided the food supply is abundant. It has been shown that their presence, including their ability to multiply fast, has a proven impact on human health. Cockroaches can transmit infectious agents (3). Even if transmission does not occur from insect bites, the cockroaches carry pathogens on the outside of their bodies; the texture of their cuticle is ideal for the binding of germs and these pathogens are also present in their intestines. Cockroaches can also cause allergies, especially in the case of heavy infestation.

Ants (4) are also insects that can become invasive and problematic in the human environment. There are 4 to 5 ant species in Europe that can cause problems in adjoining dwellings and gardens, including the Argentine ant, the Pharaoh ant, the Carpenter ant and the Red ant. Indeed, these ants can move into dwellings to access food or to settle themselves in colonies in the structure of buildings. In terms of health, ants have an impact mainly on the structures by settling in the houses but can also cause hypersensitivity reactions in people being bitten. Ants as a gregarious species have colonies that can range from 5000 to 10 000 individuals.

Bed bugs (5) constitute the third main family of invasive crawling insects. This species has been spreading internationally for about 20 years as a consequence of the ban of powerful non-selective insecticides. Bed bugs live in harbourages within dwellings in numbers of up to a few hundred insects and are in direct contact with the hosts, feeding regularly on the blood which enables them to complete their life cycle. The host can be a domestic animal but bed bugs will preferentially bite humans when they are sleeping at night. It is for this reason that in houses the harbourages of bedbugs, including the adults, eggs and larvae, are found in the occupied bedrooms. In large numbers, bedbugs become a real scourge that is difficult to control and can have a very strong impact on the physical and mental health of people. Indeed, the physical impairment results in blistering of the punctures which can be very numerous, but also by a hypersensitivity reaction sometimes requiring hospitalization. The attack is also psychological to the extent that people affected by this insect develop a feeling of shame, insecurity, or extreme phobia.

It is therefore necessary to be able to quickly control these 3 families of crawling insects that have a significant health impact on humans. There are different methods of controlling these insects. The most effective are the use of synthetic insecticides in their living environment to quickly achieve high control efficiencies. For cockroaches, gel baits are very effective on small

colonies but it is preferable to spray to control other crawling insects as well as large colonies of cockroaches. In fact, spraying (depending on the active ingredients used) allows a very rapid effect of the treatment and a drastic reduction in the number of insects if all the potential harbourages are treated. On contact with the insect, the sprayed insecticide will penetrate into the insect systemically (through the cuticle) and act quickly on the insect. It is therefore necessary for the insect to passively receive the product or to move onto a surface that has been treated where the active substance still remains. Therefore, spraying is the preferred application method for the rapid control of large colonies of crawling insects and for obtaining a residual treatment on the surface.

There are to date several families of active ingredients used in the control of crawling insects, including cockroaches, ants and bed bugs:

- Family of pyrethroids: natural pyrethrum and all its synthetic derivatives (permethrin, etofenprox for example) are highly used active substances acting on the nervous system of the insect by blocking sodium channels
- Family of carbamates: bendiocarb is found in this family, which also acts by blocking the nerve impulses in the insect
- Family of neonicotinoids: imidacloprid, acetamiprid and clothianidin, which act by blocking the nerve impulse in the insect

There are also 2 active insect growth inhibiting ingredients: S-methoprene and diflubenzuron. These active ingredients are recommended for the treatment of insects whose larvae grow by successive moults. Because of their action centered on larvae (no action on adults), the use of these active ingredients remains limited.

The majority of the active ingredients used in the control of invasive crawling insects act on the nervous system of the insect, have a controlling impact and a repellent effect. The modes of action are very similar. Nevertheless, many studies report the adaptation of crawling insects to the use of these active ingredients and in particular the development of colonies of resistant insects. This is the case for example, with the development of colonies of bed bugs resistant to certain pyrethroids (6). There has also been evidence of a decrease in the effectiveness for some cockroach species and the emergence of resistance in the field (7).

It is therefore important to have new modes of action in controlling populations of crawling insect pests to prevent this phenomenon of loss of efficacy. It is in this sense important that an additional family of active substances is available, the family of pyrroles, in particular the active substance chlorfenapyr (8). This active substance acts on the energy metabolism of the insect so does not directly affect the nervous system or growth like all other active ingredients currently used to control crawling insects. The action of this active substance is slower, which makes it possible to achieve a high level of effectiveness and in a sustainable manner thanks to the residuality of the active substance. Used as a spray (Mythic SC, BASF), this active ingredient does not have a rapid or repellent effect, which ensures that as many insects as possible stay at the treatment site and are killed. Thus, with the aim of long-term management of the populations of bedbugs, ants and cockroaches, it is very important to maintain an active substance such as chlorfenapyr into the rotation of the active substances in order to prevent the adaptation phenomena of these insects.

## Bibliography :

- (1) Xavier Bonnefoy; Helge Kampen; Kevin Sweeney (2008). Public Health Significance of Urban Pests. World Health Organization. pp. 35
- (2) Bell, W. J. Roth, L. M., and Napela C. A., Cockroaches: Ecology, Behavior and Natural History, Baltimore, The Johns Hopkins University Press, 2007.
- (3) Tatfeng YM et al. (2005) Mechanical transmission of pathogenic organisms: the role of cockroaches. J Vect Borne Dis. 42: 129–134
- (4) Giraud, Tatiana, Jes S. Pedersen, et Laurent Kelle, « Evolution of supercolonies: The Argentine ants of southern Europe », National Academy of Sciences, vol. 99, no 9, 200
- (5) Arnaud Cannet, Mohammad Akhoundi, Jean-Michel Berenger, Gregory Michel, Pierre Marty et Pascal Delaunay, « A review of data on laboratory colonies of bed bugs (Cimicidae), an insect of emerging medical relevance », Parasite, vol. 22, 2015, p.21
- (6) J Econ Entomol. 2016 Mar 27. pii: tow041. [Epub ahead of print]  
Evidence for Metabolic Pyrethroid Resistance in the Common Bed Bug (Hemiptera: Cimicidae).  
Lilly DG1, Dang K1, Webb CE1, Doggett SL2.
- (7) Wu X, Appel AG. Insecticide Resistance of Several Field-Collected German Cockroach (Dictyoptera: Blattellidae) Strains J Econ Entomol. 2017 Mar 8
- (8) Fardisi M, Gondhalekar AD, Scharf ME. (2017) Development of Diagnostic Insecticide Concentrations and Assessment of Insecticide Susceptibility in German Cockroach (Dictyoptera: Blattellidae) Field Strains Collected From Public Housing  
J Econ Entomol. 2017 Mar 20.