Press Release – 19 February 2021

# Fresh ammunition in the war on lice !

**Lice are parasitic insects causing a significant public health problem, affecting millions of people every year. While head lice may be the best-known members of this family, their cousins, body lice, are just even more redoubtable. The human lice *Pediculus humanus*, is the causative agent of pediculosis, an infestation characterised by intense itching of the scalp and body. Beyond the social impacts caused by these tenacious parasites, the physical consequences of their presence can be serious as body lice harbour bacteria that can cause severe illness. What is more, they are becoming increasingly resistant to treatment. A novel study led by researchers from INRAE and the University of Tours has revealed the ways in which various insecticides (already in use against other parasites) act on lice. The study, published on 18 February in *PLoS Pathogens*, provides insight into how these insecticides work and opens up new areas for manœuvre in the ongoing fight against lice.**

Human lice, *Pediculus humanus*, are cosmopolitan parasites that mostly attack the scalp and the skin. A significant risk to public health, lice affect millions of people each year and are proving increasingly resistant to treatment. To find a way round this resistance we need to develop new treatments. To this end, researchers from INRAE and the University of Tours have worked together to expand our knowledge of how certain anti-parasitic treatments currently on the market function and to determine which molecules are best-suited to the elimination of lice at each stage of their development.

## From louse breeding to electrophysiology

For their study, the researchers used a laboratory-reared colony of body lice that was susceptible to insecticides. They tested the effectiveness of a number of products (already in use on other insects) on lice and their eggs (nits). Fipronil, ivermectin and lotilaner[1] were high performers and were found to cause death in adult lice but to have no effect on nits. The study is also the first to have demonstrated the efficacy of lotilaner on lice. This product proved to be considerably more effective than the other insecticides tested, achieving a 100% success rate more quickly and at lower concentrations.

Alongside these tests, bioinformatic, molecular and electrophysiological investigations were carried out to identify the receptors for these insecticidal molecules. By cross-referencing their own data with those available for other insects, the researchers discovered two genes encoding the channels, Phh-GluCl and Phh-RDL, which mediate the inhibitory nerve signals in insects. Subsequently, the scientists demonstrated that these receptors were targeted by ivermectin and lotilaner.

The team's results allow a better understanding of how anti-parasitic insecticides work and suggest that the class of compounds to which lotilaner belongs (isoxazolines) could be used as a new treatment against lice. The study opens up fresh strategic avenues in the field of human health, offering a way to work around any resistance to ivermectin in the battle against severe lice infestations.

**A lice farm in the lab ?**

One of the resources available in INRAE's ISP (infectiology and public health) research unit is its precious laboratory-bred louse colony. One of just four in the world, it was established following a donation of body lice from Professor K Y Mumcuoglu's colony at the Hebrew University of Jerusalem. The lice have since been cared for by members of the ISP BioMAP team and the colony produces several thousand lice each year. They are used regularly to test products for over a dozen companies, making it possible to assess a product's effects on both adult lice and nits. These trials are helpful in formulating more general remedies for lice infestations, since treatments that are effective for body lice frequently turn out to work for head lice as well.

[1] A veterinary medicine on the market since 2017 under the name Credelio™ for use against ticks and fleas in dogs and cats.

**Reference:**

Lamassiaude N, Toubate B, Neveu C, Charnet P, Dupuy C, Debierre-Grockiego F, Dimier-Poisson I, Charvet CL. **The molecular targets of ivermectin and lotilaner in the human louse Pediculus humanus humanus: new prospects for the treatment of pediculosis.** PLoS Pathogens, 2021; 17(2): e1008863. https://doi.org/10.1371/journal.ppat.1008863

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