

Detection of aphid migrations in Finland

I. Markkula¹, M. Leskinen², P. Pylkkö³, J. Koistinen³, S. Ooperi², K. Tiilikkala¹, H. Ojanen¹ & S. Raiskio¹

¹MTT Agrifood Research Finland; e-mail: irmeli.markkula@mtt.fi

²University of Helsinki, Finland

³Finnish Meteorological Institute, Finland

Large numbers of insects migrate to Finland during the growing season. Among these the most numerous are aphids, moths, and butterflies. The most inconvenient of them are pest species which can cause great damage to crops if they are not controlled in time. Masses of bird cherry–oat aphids, *Rhopalosiphum padi* (L.) , have regularly led to serious infestations on crops in Finland, and local populations of overwintering eggs are regularly monitored for predicting outbreaks. However, early infestations, and often the most serious ones, are caused by immigrants from far away populations. *R. padi* is one of the key species in an insect immigration warning system being developed in Finland. This work is a joined effort of MTT Agrifood Research Finland, the Finnish Meteorological Institute, and the University of Helsinki. Earlier experience of long-range migrations and a literature survey were used to develop this warning system. During the newly observed immigration episodes we collected all relevant meteorological data for further analyses and system development.

Our insect immigration warning system was built on the atmospheric dispersion model that has been used in predicting long-range transport of airborne pollen. We observed immigrations with a trap network consisting of rotating tow-nets, yellow sticky traps, and suction traps. A polarimetric weather radar in Helsinki gave us information on insect migrants in the air. This radar can differentiate between rain, migrating birds, and insects. The radar commonly detects insect migrations coming over the Gulf of Finland, and the typical distance that the insects travel above the water is 100-200 km. One of the tow-nets was operated at the radar site on the roof, but generally insect traps were put on the fields less than 60 km away from the radar. Since air currents between south-east and south-west are most likely to carry migrating insects to Finland we selected fields that were open towards the south as monitoring sites.

These traps were monitored during May and June in 2007 and 2008. The field trapping had two modes: continuous catchment and alarm catchment. Rotating tow-nets and sticky papers were used at five standard monitoring sites continuously. Airborne insects were collected at least twice a week using tow-nets and yellow sticky traps. When favourable weather conditions for insect migrations were predicted, an alarm was given by the meteorologists of the research group. During alarm catchment all standard sites were visited and the catching period was changed. In addition, yellow sticky traps were deployed in larger numbers than in continuous catchment.

All the catches were scrutinized rapidly. Most of this work was focused on identification of pest species due to their high importance in crop production and insects were identified to genus. All the sticky papers were also photographed for potential future analyses. The insect monitoring was supplemented with two suction traps, one in Jokioinen (south-western Finland) and the other at Viikki in Helsinki, both belonging to an international network of suction traps.

In 2007 the main immigration of *R. padi* occurred in Finland from May 24th to 28th. Hundreds of aphids were trapped in tow-nets during these few days. At this time the domestic population was still on the overwintering host bird cherry trees (*Prunus padus* L.) and therefore these aphids could only be immigrants. Another invasion of aphids happened just before midsummer in 2008. At this time the domestic population was very small and the invasion was so sudden that the aphids, very likely, had their origin abroad.

Based on our studies the aphids can be detected with radars when they occur in large numbers. Radar surveillance must, however, be combined with a field trap monitoring so that the insects can be identified after their aerial migration has begun. Results of this project led to a novel alarm system prototype which operated via our current web pages to inform farmers if there was an increased need for protection of their crops.

Key words: migration, *Rhopalosiphum padi*, polarimetric weather radar, alarm system