

The **colony collapse disorder** (CCD) of bees in recent years is a growing worldwide problem, causing many of the concerns and questions about the future of agriculture and fruit farming. Colony collapse disorder causes significant economic losses because many agricultural crops (although no staple foods) worldwide are pollinated by honey bees (*Apis mellifera*). It is estimated that bees are responsible for pollinating 70 of the 100 crop species, contributing to the production of 90% of the food. Alarming trends on the decreasing number of bees colonies, and economic losses in the production of oilseeds, fruits and vegetables and negative environmental aspect, (significant role of bees in pollination of wild plants) have forced scientists and governments to address the causes of this phenomenon. Extensive studies carried out by scientists from various research centers in Europe, Canada and the United States have shown that one of the major reasons of CCD phenomenon is. using of pesticides, especially fungicides and insecticides.,

On the other hand, the ever growing demand for food is a major pushing factor for **increasing the efficiency of methods of crops cultivation**. However, modern intensified cultivation methods often lead to problems related with exposure of plants to factors that drastically reduce the crops yields. Such factors are for example: pathogens, insects or other pests, and atmospheric factors, hence increasingly scale of using pesticides, especially fungicides. hence used increasingly common scale pesticides, especially fungicides. It is estimated that the fungicides in Plant Protection Products market takes 49%. According to the report Greenpeace in the pollen of plants in Europe can be found fungicides such as boscalid, dimetmorf, fenhexamid, trifloxystrobin, azoxystrobin, and dodine.

Fungicides are divided into three basic groups because of the way they work against pathogen: (i) contact - remaining on the plant surface at the point of application, (ii) translaminar- the active substance moves between cells from one side to the other leaf, and (iii) systemic - penetrating into the tissues of plants and spreading in plant. Systemic fungicides must both have good solubility in fat (allowing penetrating of the active substance through the wax on the leaf surface to the interior of the plant) and water (transport in the interior of the plant. Reducing solubility of fungicides which act both translaminar and systemically leads to a lower penetration of the active substance to the plant and thus reduces the occurrence in pollen, thus reducing the CCD phenomenon.



Dead bees on honeycomb. One of the causes of death of bees are fungicides
Greenpeace/Bas Beentjes "Trudny los pszczół"

For this purpose, the European Union, by the directives imposes limitations in the use of the most hazardous pesticides, while promoting the searching for new, safer for the environment and consumer health solutions. One of them may be the use a new generation of fungicides in the form of a dual functional organic salts based on currently used fungicides agents (contact or translaminar) in which the counterion is transmitting into molecule an additional function such as modifying the solubility in water or fat, dissolution rate, volatility, surface tension, reduced or increased phytotoxicity and antifungal activity. The main goal is to **design and synthesis new bifunctional salts** based on fungicidal ion (contact or translaminar) to modify physicochemical properties in order to have significant impact on **the occurrence of these substances in the pollen and leaves in plant** and thereby indirectly **reducing the harmful effect to the bees**. Research hypothesis assumes that the modification of the fungicide to the form of a salt with the counterion with modified physicochemical properties (solubility in water and fat, surface tension, dissolution rate, thermal stability, volatility) will (i) **limit its incidence in the leaves and pollen**, which bees are fed on (ii) **increase the antifungal activity** by providing longer retention time of the active substance on the surface of the plant.