Whiteflies sabotage alarm system of plant in distress

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Whitefly and spider mite on a bean plant. (© Photo: Hans Smid / bugsinthepicture.com)

(PhysOrg.com) -- When spider mites attack a bean plant, the plant responds by producing odours which attract predatory mites. These predatory mites then exterminate the spider mite population, thus acting as a type of 'bodyguard' for the plant. However, if the plant is simultaneously attacked by whiteflies, insects that are related to aphids, the plant becomes less attractive to the predatory mites and therefore more vulnerable to spider mites.

Together with German colleagues, researchers from the Laboratory of Entomology at Wageningen University, The Netherlands, published this discovery in the reputable journal Proceedings of the National Academy of Sciences.

The research team studied the strength of the plant's "cry for help" through a chemical analysis of the plant odour blend and found that one of the odour components (beta-ocimene) is produced in much lower quantities if the plant is not only attacked by spider mites, but also by whiteflies. The production of the odour decreases because of a lower expression rate of the plant gene that codes for a crucial enzyme in the production chain. When the researchers added ocimene to the odour of plants which were attacked by both species, the attraction of predatory mites was restored.

This recent breakthrough demonstrates that there are also herbivores that can interfere with a plant's "cry for help", possibly because the whiteflies attempt to interfere with the plant's defence system. Spider mites also produce more offspring on a plant under attack by whiteflies. For a spider mite, there are therefore two reasons why a bean plant which is being attacked by whiteflies is better than a bean plant that is not being attacked: more offspring and fewer bodyguards. It is therefore no surprise that the researchers found that the spider mite preferred plants infested with whiteflies above plants without them.

The results of this study are significant for integrated crop protection in which a combination of methods can be used to fight various pests infesting a crop. Integrated crop protection offers effective possibilities for environmentally safe pest control, and is based on a solid knowledge of the crop system and its complex of enemies. Once it becomes clear which insects weaken plant defence systems and which strengthen them, more focused research on environmentally-safe pest control will be possible, and people will no longer be caught off guard by unexpected interference from some pest species.

The fact that plants "cry for help" at all was discovered by the Wageningen research group in 1988. Since that time, various laboratories worldwide have continued studying this topic and it is now

known that many - if not all - plants apply this type of defence. The research conducted worldwide has focused primarily on the situation in which plants are only attacked by a single herbivore. In nature, the situation is much more complex, however. Plants are involved in a continuous arms race with herbivorous insects which exploit the plant as food in a variety of ways. Spider mites suck the contents of parenchyma cells. Contrary to what their name suggests, whiteflies are not actually flies at all, but sap-sucking insects related to aphids, which suck from the vascular tissue located deeper in the plant. Some insects reinforce the plant's defence system which protects it from other predators.

Provided by Wageningen University