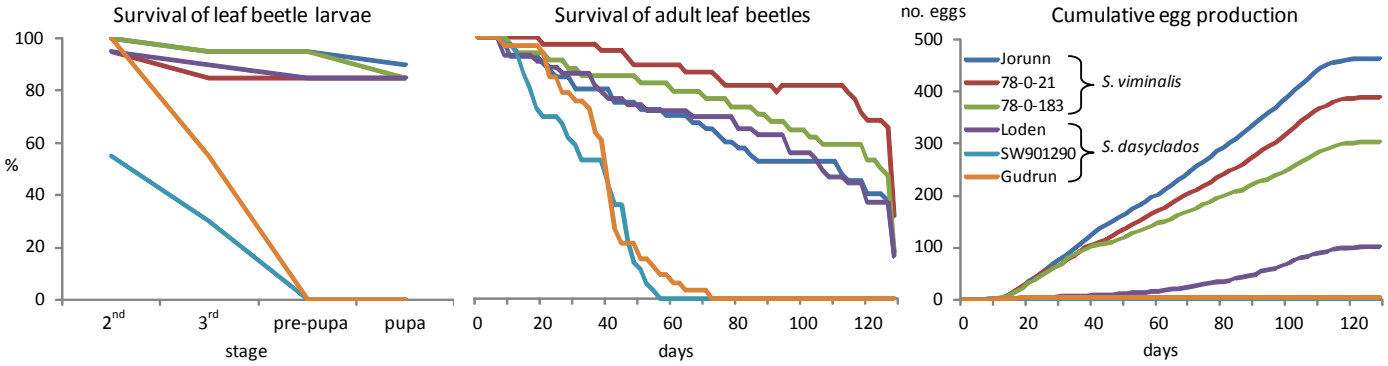
## Leaf beetles on *Salix*

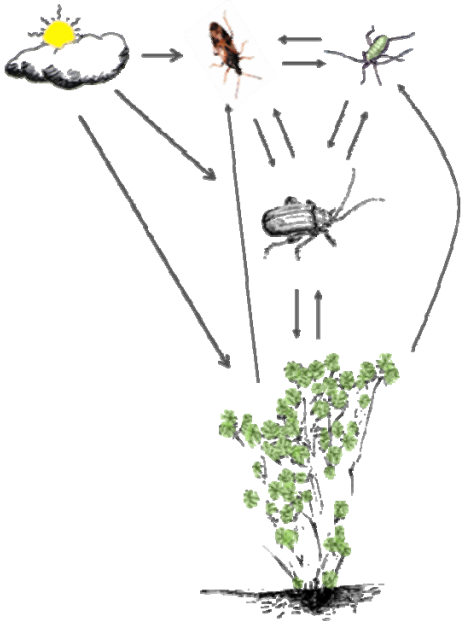

*Phratora vulgatissima*

The long-term goal with our research is to deliver knowledge that can be used to improve the cropping security of *Salix* by minimizing damage caused by leaf beetles, especially the species *Phratora vulgatissima*. Leaf beetles and their larvae, feeding on the leaves, are the pests causing most of the production losses in *Salix* plantations today.

The level of damage depends partly on the defense or resistance of the plant and partly on other factors, such as natural enemies. The plant's defense can be mechanical and/or chemical. The defense can also be constitutive (always 'on') or be triggered when the plant is damaged. To reach the goal we aim at studying both plant defense against the leaf beetle and its natural enemies.

The first step was to develop a simple and reliable method to quantify direct resistance against the leaf beetle. We found, through independent tests involving different *Salix*-species/clones, similar patterns in three studied insect traits; larval and adult survival, and oviposition rate. We came to the conclusion that a two week investigation of oviposition rate is the simplest method to get a reliable estimate of direct resistance against *P. vulgatissima*.



## Natural enemies

Several of the most important natural enemies are omnivores, i.e. they may survive on a pure vegetarian diet (such as *Salix*), but are at the same time predators, feeding on other insects, in this case leaf beetle eggs and larvae. Omnivorous natural enemies are considered to have advantages over other enemies in biological control since they may survive periods with low availability of prey by feeding on the host plant.

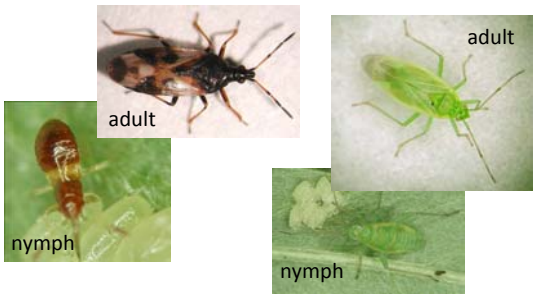
It is primarily two natural enemies that are of importance for the control of *P. vulgatissima*; the mirid *Orthotylus marginalis* and the anthocorid *Anthocoris nemorum*. Both species are even more dependent of the host plant than many other omnivores since they also oviposit in the leaves, stems or buds of the host plant. This causes problems with present management regimes because the mirids overwinter as eggs and thereby are removed from the plantations at harvest.

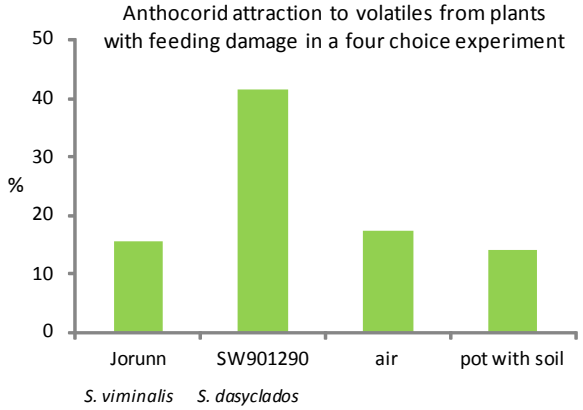
We have built a laboratory where we can study the attraction of insects to different scents (e.g. *Salix* clones) and collect and identify the different compounds that the insects respond to.

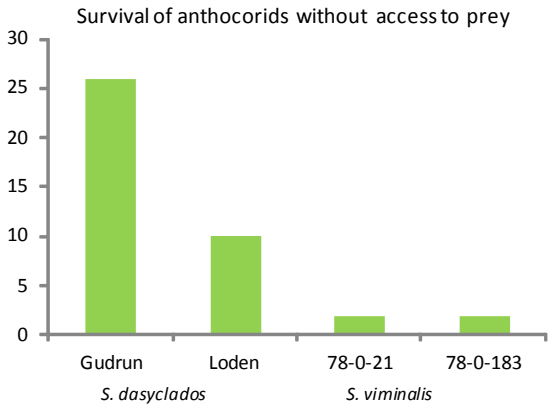
We have tested the preference of the mirid and the anthocorid for different *Salix* clones and measured their performance on the plants without any prey available.

The results are preliminary but show that clones, having negative effects on the leaf beetles, seem to be preferred by the natural enemies. The natural enemies also seem to perform better on the clones resistant to the leaf beetles. These results indicate that *Salix* clones with a strong direct defense against the leaf beetle also have an indirect defense, functioning by attracting and supporting the natural enemies of the pest.

The anthocorid & the mirid feeding on leaf beetle eggs




## Future

In future experiments we will among other things study the attraction of the mirid to different *Salix* clones and try to identify the stimuli that they respond to. In addition, we will estimate the importance of two newly discovered parasitoid species in the biological control of the leaf beetle.

The ambition in the SAMBA-project has been to identify genetic markers for resistance against leaf beetles. However, so far we have not been able to fulfill this ambition because the *Salix* genotypes showing the strongest resistance (*S. dasyclados*), either through direct negative effect on the leaf beetles or indirectly by promoting the natural enemies, are polyploids (i.e. every chromosome occur in more than two copies). Today's molecular tools are developed for diploid organisms (i.e. every chromosome occurs twice).

Our expectation is to instead identify chemical markers. Some *Salix* species contain high levels of certain phenolics, salicylates that presumably affect the leaf beetle *P. vulgatissima* negatively. At present, we are trying to find a correlation between resistance against the leaf beetle and the concentration of salicylates, which then could serve as a basis for quantifying the resistance in the breeding material.

In a longer perspective our goal is to develop links between cropping security and ecological knowledge to form comprehensive solutions together with scientists from other disciplines and stakeholders. We aim at testing our ideas in controlled field experiments in parallel with gaining more knowledge about the insects on *Salix*. The ongoing climate change may lead to the establishment of new insect species in Sweden – both herbivores and predators. Evaluation of the roles of new insect species in the *Salix* system will be an important challenge.

We are the people working in the project: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