IWMPRAISE — H2020-SFS-2016-2017/H2020-SFS-2016-2 –Inspiration sheet no. 25 – WP2, WP5
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INTEGRATING WEED BIOLOGICAL CONTROL IN IWM

Biological control of invasive non-native weeds using natural enemies has a long and successful history. Biological control as part of IWM to manage native weeds has also potential, but remains understudied.

DID YOU KNOW?

Insects and pathogens can be successfully used as tools for biological control of weeds.

HISTORY OF WEED BIOLOGICAL CONTROL

More than 200 years ago, a cochineal insect species was used in India to manage invasive cacti, with spectacularly beneficial results. Since then, classical biological control, i.e. the use of specialist natural enemies to manage invasive non-native weeds has been routinely applied in many parts of the world with very high safety standards.

In Europe, however, only a few natural enemies have been released for classical biological control of invasive non-native weeds. One example of such a deliberate introduction of a biological control agent is *Aphalara itadori*, a psyllid which was released against Japanese knotweed, *Fallopia japonica* (Shaw et al. 2018).

Recently, the ragweed leaf beetle *Ophraella communa*, already used as a biological control agent against common ragweed, *Ambrosia artemisiifloia*, in China, has been accidentally introduced in Europe (Figure 1). In Northern Italy, this beetle defoliates ragweed populations (Figure 2) and has led to an 80% reduction of highly allergenic ragweed pollen, which are known to cause rhinitis and asthma (Schaffner et al. 2020).

Figure 1 - Common ragweed (*Ambrosia artemisiifolia*) infestation in sunflower

Figure 2 - Common ragweed plant defoliated by the leaf beetle *Ophraella communa*

WEEDING RUMEX PLANTS WITH NATIVE ROOT-FEEDING MOTHS

In contrast to the classical approach, biological control of native weeds in crops remains a poorly considered tool in IWM. Usually, herbivores of weedy plant species are not very common in the native range, because they are kept in check by their natural enemies, mainly parasitoids or predators.

In the IWMPRAISE project, efforts are underway to develop a biological control product based on native root-boring clearwing moths for augmentative biological control of *Rumex spp.* in European grasslands. Larvae of these moths feed inside *Rumex* taproots, thereby promoting the decay of the storage organ.

In pot experiments, inoculation of *Rumex obtusifolius* plants by larvae of the clearwing moth *Pyropteron chrysidiforme* (Figures 3 and 4) led to 30-

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50% mortality within one year. After initial problems with building up high enough attack rates under field conditions (Hahn et al. 2018), single applications now lead to 80% infestation rates among established *Rumex obtusifolius* plants under real-life conditions. We currently assess the long-term efficacy of biological control on *Rumex obtusifolius* under field conditions.

THE FUTURE OF BIOLOGICAL CONTROL IN IWM

In Europe, the use of classical biological weed control is likely to increase in the near future. Moreover, there are also important but underexplored opportunities to incorporate biological control in the integrated management of native weeds. If the *Rumex-clearwing* moth systems will proof the concept of using native European insects or pathogens to manage native weeds, this will be a major boost of weed biological control in IWM, particularly in single-weed systems.

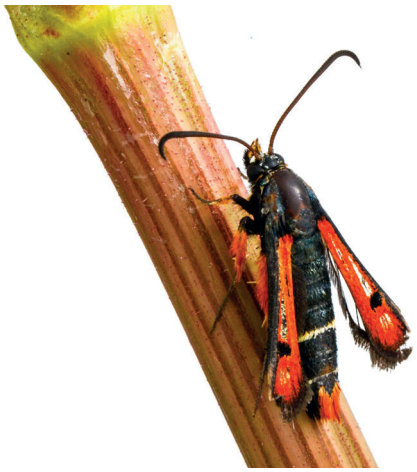

Figure 3 - Adult of the sesiid moth *Pyropteron chrysidiforme*

Figure 4 - Larva of *Pyropteron chrysidiforme* mining in the taproot of *Rumex obtusifolius*

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