

On the track of insects responsible for misshaped apples

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Introduction

With the broad use of specific control strategies against primary apple pests, secondary pest species such as fruit piercing insects gained importance. Although some of the species misshaping apples such as the apple fruit weevil (*Tatianaerhynchites aequatus*) or the forest bug (*Pentatomia rufipes*) are well known, we still suspected that a range of other insect species might provoke similar fruit deformations. We tried to unravel this complex by weekly beating samples in conventional orchards and by an enclosure experiment under semi-field conditions.

Materials and methods

Young, mature and old apple orchards were monitored in the spring 2011 and 2012. Fortnightly, around 50 beating samples were taken per orchard. Later in the season, the proportion of punctured apples was estimated and correlated with the number of captured specimens.

Moreover, in the spring 2012, adults of *T. aequatus* as well as adults of the folivorous weevils *Phyllobius betulinus* and *P. oblongus* were each released inside of sleeve cages enwrapping apple inflorescences in order to study insects ability to pierce fruits.



Tatianaerhynchites aequatus ©D.I. Gavryushin



Phyllobius oblongus
© C. Ordonez



Phyllobius betulinus
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Results and discussion

In 2011, 0.45% of inspected apples were punctured and 15-times more deformed apples were counted on untreated cider trees than in conventional orchards. Moreover, the proportion of misshaped fruits was correlated with the number of *T. aequatus* ($R=0.66$, $P=0.001$), *Phyllobius betulinus* ($R=0.42$, $P=0.04$) and *P. oblongus* ($R=0.60$, $P=0.002$). However, the number of phytophagous Heteroptera, which are commonly associated with this type of punctured fruits, was in no direct relationship ($R=0.32$, $P=0.13$). These findings were confirmed in 2012. The 1.25% punctured apples were once again best correlated with the abundance of *T. aequatus* ($R=0.44$, $P=0.01$) and they tended to increase with the presence of *Phyllobius betulinus* ($R=0.34$, $P=0.06$) and *P. oblongus* ($R=0.31$, $P=0.08$). The number of phytophagous bugs was once more unrelated to the proportion of punctured apples ($R=0.08$, $P=0.66$).

The enclosure experiment highlighted that the apple fruit weevil *T. aequatus* was in fact able to misshape apples. However, the two *Phyllobius* species seemed not to feed on apples and their presence within attacked orchards was probably a consequence of moderate pesticide use.

Summary

Over the last years secondary pest species such as fruit piercing insects gained importance in apple production. Here we show that the agents of misshaped fruits are probably not “bugs” as generally assumed, but rather apple fruit weevils that puncture fruits only a single time rather than multiple times. These findings help to unravel the complex of fruit piercing insects and allow to adapt IPM control strategies against these secondary apple pests.

