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THE IMPORTANCE OF ARTHROPOD PESTS IN BELGIAN POME FRUIT ORCHARDS

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SUMMARY

Located in temperate, maritime climate with frequent rainfall, crop protection in Belgian orchards is dominated by fungicides. Though, the importance of arthropod pests should not be underestimated. Pcfruit, the former Research station of Gorsem, has been maintaining a warning system for fruit pests in Belgium since 1944. Therefore, various pests and beneficials and their life cycle stages have been monitored in Gorsem and in different observation posts across Belgium, being part of a monitoring network. Although up to 3000 arthropod species are present in pome fruit orchards, about 25 % can be considered as harmful and another 25 % as beneficial. Out of those species, around 100 harmful and 50 beneficial organisms are omnipresent. The list of monitored species is extended yearly for upcoming or difficult to control organisms. Integrated pest management was introduced in the eighties, with the accent on using selective pesticides and saving beneficial organisms. A shift in pesticide use affected the importance of secondary pests, together with recent exceptional climatic conditions. Following many years of monitoring insects and mites and editing warning bulletins in our station, a ranking of the economical importance of different pest species is presented.

Key words: pest monitoring, pest warning, Integrated Pest Management, IPM

INTRODUCTION

Pome fruit plantations are home to a tremendous diversity of arthropods, of which about 46% are phytophagous, 32% are detritivorous and 23% are parasitoids or predators (Simon 2003). Nearly 100 pome fruit pests were described for temperate regions by Frankenhuyzen (1988). However, regional and local differences in pest prevalence and densities are expected due to variability in both the environment and agricultural practices (Jenser et al. 2006; Simone et al. 2007). Furthermore, changes in pesticide use, from fairly broad-spectra insecticides to highly selective products, may lead to a shift in the pest community. Integrated pest management (IPM) has gained tremendous importance in pome fruit production. Belgian legislation chose to strictly adhere to IPM guidelines since the early nineties, resulting in an effective shift towards registration of more selective insecticides.

Successful implementation of IPM requires good knowledge of the prevailing pests and their life cycles. For growers, it is indeed crucial to know which pests are most threatening to their local production, and when previously unimportant pest could become important. Such knowledge can only be derived from exhaustive and long-term pest monitoring. The research station of Gorsem (now pcfruit) has a 60-year long tradition in monitoring fruit pests, and since the nineties has adopted a systematic methodology to warn growers of pest dangers. This warning system builds on frequent observations from pcfruit and a network of farms throughout the country.

To estimate the risk a certain pest poses, the classical approach is to first look at the pests' life history to determine when and how long the fruit crop is at risk and subsequently correlate this on observations of abundance. This is useful for local purposes, but time-consuming if one wants to estimate economic pest importance on a regional or national scale. In this paper, we build on the metadata inherent to an extensive warning system and use the frequency with which a pest is warned against as an indication to its relative importance. The goal of this analysis is twofold: first we want to build a ranking of the most important pome fruit pests in Belgium, and second we want to observe if certain pests have recently changed status. We discuss whether our method of analysis gives a realistic picture on pest prevalence in Belgium.

MATERIALS AND METHODS

Pcfruit operates a warning service for fruit pests and diseases, that includes information on all aspects of fruit growing such as planting, frost, pruning,... For insect pest warnings, these IPM bulletins are based on frequent (3-7 times a week) observations of the phenology of about 50 pests and beneficial arthropods. In addition to this, first hand information on pest pressure from a number of growers is obtained through the extension services. This knowledge is combined into a number of warning messages send out to the grower community.

We analyzed the warning bulletins from 1998-2007 for the occurrence of major and minor pome fruit pests. In this period, IPM warning bulletins were send out at a frequency of 18 to 25 per year. We used the number of times that a specific pest was mentioned in the warning bulletins as a discriminator. The pests for which was warned in more than 10 % of the bulletins were classified as major pests. Pests that were mentioned in 5 to 10% of the bulletins were classified as medium pests. Pests that were mentioned less than 5% were classified as minor pests. For this last category we also noted if these were recorded only recently. For each category, we rank the pests according to the frequency with which they occur in the bulletins.

RESULTS AND DISCUSSION

For the past 10 years, 12 pests had a warning frequency of more than 10% in all warning bulletins (Table 1). *Cacopsylla pyri* received most attention, as this is the supreme pest in the important Belgian pear production. The multiple generations usually require active control measures at three time points-(1) before flowering, (2) after flowering and (3) in fall, while use of selective products ensure an adequate predatory bug (*Anthocoris nemoralis*) population to suppress this pest in summer (Gobin et al. 2005; Eelen et al. 2006). In recent years, the number of warnings has even increased (figure 1).

Panonychus ulmi, the red spider mite, sat at a second place, which is quite surprising with a well established nationwide IPM system. Frequent spider mite warnings –especially around eclosion of winter eggs- are however very useful for recently planted apple orchards, prior to the introduction of predatory mites (*Typhlodromus pyri*). Once predatory mites have established, spider mites are no longer a problem. Therefore, it received too much weight in our analysis and should be considered a medium pest rather than a major pest.

In general, the codling moth *Cydia pomonella* is highly important in pome fruit due to its long generation. This requires repetitive control applications during a period of 7-12 weeks, even longer if a partial second generation occurs. Although a number of products for codling moth are registered in Belgium, there is still need for additional products of different resistance groups and long efficacy period. Although more common in apple, codling moth can be locally extremely damaging in pear. The woolly apple aphid is another major pest in apple, with population pressure increasing from colonies surviving on the branches due to mild winters. Colonies migrate to new shoots in late spring and early summer and damage trees if no corrective spray is applied. In summer, natural enemies such as the parasitoid wasp *Aphelinus mali* (Evenhuis 1958) and the common earwig *Forficula auricularia* (Gobin et al. 2006, 2008) give complete control. In some years, an important explosion of woolly apple aphid can occur in fall once these natural enemies start hibernation.

The summer fruit tortrix *Adoxophyes orana* used to be an important pest in apple, but has recently become less important, as is reflected in lower warnings in recent years (figure 1). This is likely due to very good control of the first generation in a post blossom leaf roller application. The same is true for the Eulia tortrix *Argyrotaenia pulchellana*. So although these pests are considered less of a problem now, this is likely due to the efficiency of the warning system aimed to control them. Without this control, we suspect a quick rebound of the pressure of these pests.

Table 1. The pest species of major importance in Belgium, in a descending order of importance as counted by their appearance in warning messages:

Importance	Latin name	Common name	comments
1	<i>Cacopsylla spp.</i>	pear sucker	Pear, the most important pest. 1 st , 2 nd and last generation damaging
2	<i>Panonychus ulmi</i>	red spider mite	Apple, high importance in new orchards (<2years old), redundant in older orchards with established predatory mite population
3	<i>Cydia pomonella</i>	codling moth	Apple and pear, most important pest in apple, long flight requires repetitive control
4	<i>Eriosoma lanigerum</i>	woolly aphid	Apple, can be important in older orchards, thrives especially June-July and September
5	<i>Adoxophyes orana</i>	summer fruit tortrix	Apple and pear, in recent years considerably less important due to good control
6	<i>Aculus schlechtendali</i>	apple rust mite	Apple, local outbreaks due to absence of spider mite control
7	<i>Epitrimerus pyri</i>	pear rust mite	Pear, usually secondarily controlled by <i>Psylla</i> control, but problem if <i>Psylla</i> is early or absent
8	<i>Dysaphis plantaginea</i>	rosy apple aphid	Apple important due to high damage which requires zero tolerance
9	<i>Anthonomus pomorum</i>	apple blossom weevil	Apple can be highly damaging but good control measures exist
10	<i>Anthonomus pyri</i>	pear blossom weevils	Pear can be highly damaging but currently not controllable
11	<i>Argyrotaenia pulchellana</i>	Eulia tortrix moth	Apple and pear, widespread occurrence, usually controlled with leaf-roller and codling moth sprays.
12	<i>Aphis pomi</i>	green apple aphid	Apple

The rust mites in apple and pear are important, but vary in their need for control. The lack of necessity for spider mite control in mature apple orchards makes this pest a potential risk, as only few other control measures (i.e. codling moth) have an acaricidal effect. In pear, a number of products commonly used in pear sucker control adequately control rust mite. However, seasonal particularities can move *Psylla* control to an inopportune moment for adequate rust mite control.

The most important aphid in apple is the rosy apple aphid, *Dysaphis plantaginea*, as even the smallest population can be highly damaging to yield and trees (Peusens et al. 2006). The green apple aphid, *Aphis pomi*, is a bit later in the season and generally somewhat less damaging. Both aphids can be controlled with a number of insecticides of various classes.

The blossom weevils (*Anthonomus spp*) can be quite destructive to flowers, and populations have a tendency to build up unnoticed until it is too late. In apple, we have sufficient products to control the population, whereas it is more difficult to use IPM compatible control in pear.

Most pests of medium importance (Table 2) are typically locally important, or have outbreaks under extreme climatic conditions. A number of these pests (such as *Contarinia*, *Dasineura*, *Lepidosaphis*,...) have profited from the use of more selective products. They typically used to be controlled by broad spectrum pesticides and currently a number of these pests- (i.e. *Contarinia* and *Dasineura*- quite important problems in 2007 and 2008) lack registered products for control.

Table 2. Pests of medium importance are presented in a descending order of importance for pome fruit.

Importance	Latin name	Common name	comments
13	<i>Quadraspidiotus ostreae-formis</i>	oystershell scale	Apple and pear, locally abundant
14	<i>Dasineura pyri</i> / <i>Dasineura mali</i>	pear and apple leaf midge.	<i>D. mali</i> is similar but less important on apple
15	<i>Rhopalosiphum insertum</i>	apple-grass aphid	Apple, usually little damage, some years (ie. 2008) very damaging
16	<i>Lepidosaphes ulmi</i>	apple mussel scale	Apple and pear, locally abundant
17	<i>Lygocoris pabulinus</i>	mirids	Less important in Belgium
18	<i>Operophtera brumata</i>	winter moth	Locally abundant
19	<i>Phyllobius sp.</i>	leaf weevils	Fairly abundant, but leaf damage is often considered acceptable
20	<i>Orthosia sp.</i>	noctuids	Can be of local importance
21	<i>Phytoptus/Eriophyes pyri</i>	pear leaf blister mite	Locally abundant
22	<i>Contarinia pyrivora</i>	pear midge	Increasing pest problem in recent years
23	<i>Hoplocampa testudinea</i>	apple sawfly	Can be of local importance

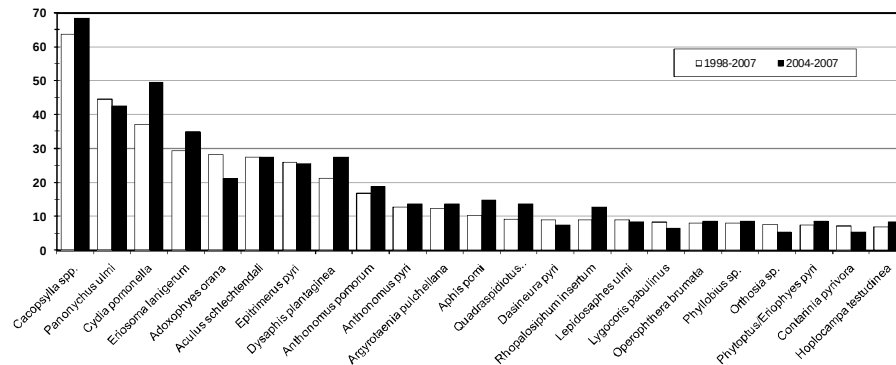


Figure 1: The percentage of occurrence of pest species in warning messages per year throughout the 10 year analysis period (white bars) and for the past 4 years (black bars).

Finally, a number of pest species were mentioned only few times throughout the years. These were the pear bedstraw aphid *Dysaphis pyri*, two-spotted spider mite *Tetranychus urticae*, pear sawfly *Hoplocampa brevis*, Hawthorn Jewel Beetle *Agilus sinuatus*, Rosy leaf curl aphid *Dysaphis devector*, apple clearwing moth *Synanthedon myopaeformis*, Dock sawfly *Taxonus glabratus*, broad-leaved pinhole borer *Xyleborus dispar*, leopard moth *Zeuzera pyrina*, Raspberry weevil *Otiorhynchus singularis*, Stem sawfly *Janus compressus*, pear-coltsfoot aphid *Anuraphis farfarae*, and two recent additions: the Mullein leaf bug *Campylomma verbasci*, and the apple bud moth *Spilonota ocellana*.

CONCLUSION

The meta analysis of data from the warning system gives a good indication of the most important pest species. For one species, the red spider mite, it attributed a too high importance, while this is perhaps also the case for the rust mites. Two other species of tortrix moths are currently less of a problem due to the efficacy of the warning system. We do have to bear in mind that this type of meta-analysis gives increased weight to (1) pest with multiple or long generations –rightly so as often all generations or the full period are damaging; and (2) tends to overestimate pests with multiple control options. The strongest example is that of the red spider mite, for which different products target either eggs, both eggs and mobile stages and only mobile stages. Therefore the whole hatching period of winter eggs is provided in detail in warning bulletins. As the error of our analysis lies in overestimating the importance of a few pests, but without missing any, it can be used as a global indicator of pest importance. We foresee that it can be used to detect shifts in pest pressure in the future.

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