The role of native and introduced predatory mites in management of spider mites on raspberry in Finland, Italy and Switzerland

T Tuovinen, I Lindqvist[1], A Grassi, M. Zini[2] and H Höhn, K Schmid[3] S C Gordon, J A T Woodford[4]

[1]Agricultural Research Centre of Finland, FIN-31600 Jokioinen, Finland
[2]Istituto Agrario di S.Michele all'Adige, Via Edmondo Mach 1, 38010 S.Michele a/Adige, (TN) Italy
[3]Eidgenössische Forshungsanstalt für Obst-, Wein- und Gartenbau, Postfach, CH 8820 Wädenswil, Switzerland
[4]Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA, UK

Scottish Crop Research Institute

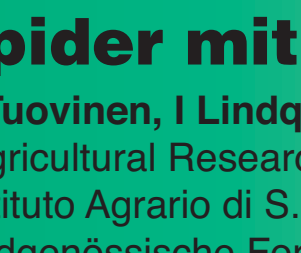
Introduction

Two-spotted spider mite, *Tetranychus urticae* (TSM) is an important pest of raspberry. Control is largely based on acaricides. Alternative biological control methods, using native or introduced phytoseiid mites, formed part of an EU project 'Reduced Application of Chemicals in European Raspberry Production' (RACER). Populations of TSM and natural enemies were monitored in growers' plantations in Finland, Italy and Switzerland in 1998 and 1999, using standard methods.

Symptoms of TSM feeding.

Methods

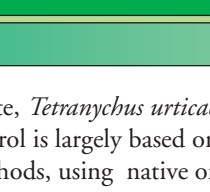
- Open field plantations (Finland and Switzerland) and polythene-covered rows (Italy and Switzerland). Local summer- or autumn-fruiting cultivars.



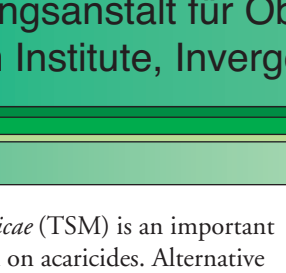
Raspberry plantation in Finland.

Rain coverings are often used in Italy.

- Counts of TSM and phytoseiid mites (mobile stages and eggs) on leaves (fruiting cane and primocane) at 2-4 week intervals.
- Predators released from April to July.



TSM female and egg.

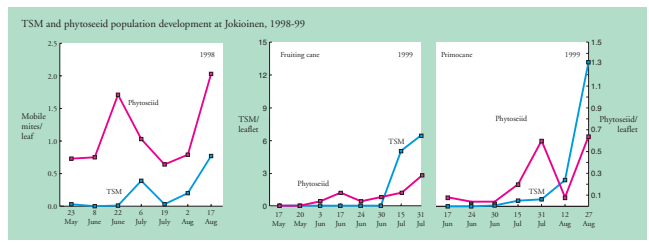


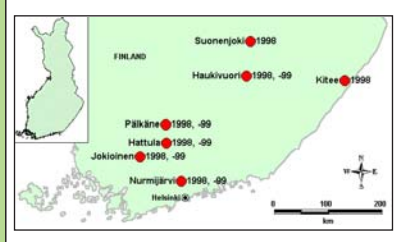
Introduction method of *T. pyri*.

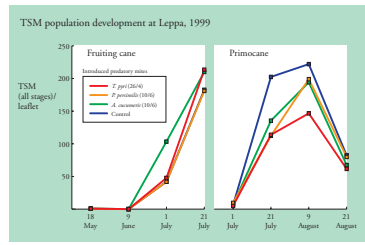
Results

Finland

- 1998 - low numbers of TSM throughout a cool season. Released predators not detected, but 30-70% fewer leaves occupied by TSM than in control plots.
- 1999 - severe winter kill of raspberry canes, low TSM numbers until July.







- 100-200 mobile stages and eggs/leaflet caused severe leaf symptoms; 25-50% control at three sites where *Typhlodromus pyri* was released.
- The specialised predator *Phytoseiulus persimilis* starved without TSM; later, or repeated introductions may be required.

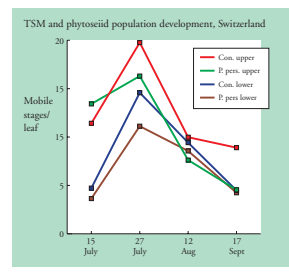
Phytoseius macropilis, a native phytoseiid species, was more abundant than TSM in 1998. Few predators and TSM survived the hard winter in 1999, and spider mite food was not available for overwintered phytoseiids. Birch pollen is an alternative food source for many phytoseiids, and was richly available in 1998, but not in 1999, due to poor flowering.

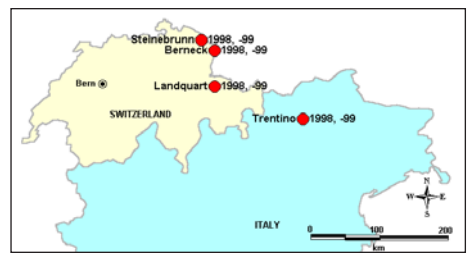
Predatory mite *P. macropilis*.

Native *P. macropilis* and alternative food for phytoseiids may prevent harmful increase of TSM on unsprayed raspberry. Introduced foreign phytoseiids may not be effective enough in unprotected, open raspberry plantations.

Switzerland

- TSM numbers in open organic plantations were too low to cause severe damage (max. 9-11 mites/leaf in late summer).
- Native phytoseiids prevented TSM populations increasing to harmful levels.
- *Euseius finlandicus* and *A. andersoni* were more abundant on summer-fruiting cv. Nootka (max. 1/leaf) than on cv. Autumn Bliss (max. 0.2/leaf).





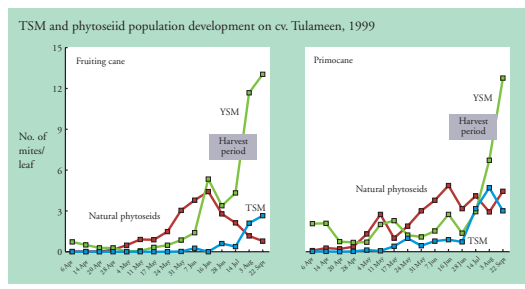
- TSM numbers were higher at intensively fertilised and irrigated covered plantations (max. 70 mites/leaf), and not controlled by *A. andersoni* (max. 2/leaf).

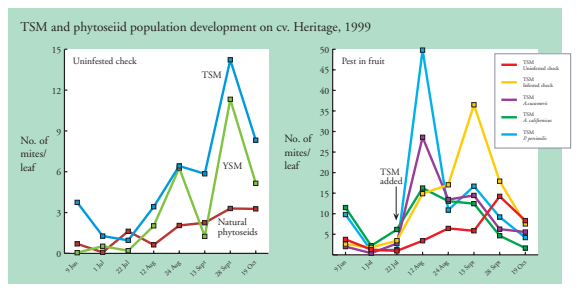
In 1999, *P. persimilis*, released on cv. Autumn Bliss, decreased TSM infestations by 16% (upper leaves) to 36 % (lower leaves; higher, more favourable humidity). Only low numbers of *P. persimilis* and *A. cucumeris* were found after release on cv. Glen Ample. Better control was achieved with *P. persimilis* (67 %) than with *A. cucumeris* (31 %).

Italy

- Mixed populations of TSM and yellow mite *Eotetranychus carpini* (YSM), a less damaging species on raspberry.
- On the summer-fruiting cultivar Tulameen, YSM and the native phytoseiid *Amblyseius andersoni* colonised fruiting cane leaves soon after bud burst in April.
- Phytoseiids started to reproduce before TSM females colonised leaves.
- The prey/predator ratio was < 1; no damage at low mite densities.
- More TSM and *A. andersoni* on primocanes; higher prey/predator ratios, but predation suppressed spider mites.
- TSM infested the autumn-fruiting cultivar Heritage soon after planting. *A. andersoni* and predatory insects suppressed TSM and YSM populations.

Predatory mite *A. andersoni*.





Predators were introduced when TSM infested 70-90 % of sampled leaves. Numbers of the generalist predator *Amblyseius cucumeris* increased more than those of *A. californicus* and *P. persimilis*. All three introduced species are useful for augmentative release strategies, but the release must be timed accurately to coincide with spider mite increase.
Numbers of natural phytoseiid mites fell in the middle of the season, probably due to the effect of high temperature and low humidity. Thrips (*Scolothrips* sp), midge larvae (*Feltiella* sp.), bugs (*Orius* sp.), beetles (*Stethorus* sp.) and lacewing larvae (*Chrysoperla carnea*) were important predators at the end of the season.

Feltiella sp.

Orius sp.

Stethorus sp.

Chryoperla carnea.

Conclusions

- The population dynamics of TSM and phytoseiids, and the species composition of naturally occurring phytoseiids, differed between the geographic areas.
- Natural phytoseiid populations were the key factors in spider mite management in all areas.
- Several species can be utilized as natural, native plant protection resources.
- Their impact on TSM can be strengthened by releases of commercially available phytoseiids.

More information is needed on the effect of different phytoseiid species, prey preferences and interspecific competition, the necessity for releases, their timing and amounts, and on methods to enhance natural predators in open and covered raspberry plantations.

T Tuovinen, I Lindqvist
Agricultural Research Centre of Finland, FIN-31600 Jokioinen, Finland
A Grassi, M Zini
Istituto Agrario di S.Michele all'Adige, Via Edmondo Mach 1, 38010 S.Michele a/Adige, (TN) Italy
H Höhn, K Schmid
Eidgenössische Forshungsanstalt für Obst-, Wein- und Gartenbau, Postfach, CH 8820 Wädenswil, Switzerland
S C Gordon, J A T Woodford
Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA, UK

RACER

'Reduced Application of Chemicals in European Raspberry Production' (RACER) was a project involving raspberry producers in six European countries who joined with scientists to develop IPM methods for the major pests and diseases of this crop.

Acknowledgements

We thank the SME's and growers who provided sites for these studies, and Mr. J W McNicol (Biomathematics and Statistics Scotland) for statistical advice. The RACER project was funded by the European Commission (FAIR FA-S2-CT97-9038) and Bundesamt für Bildung und Wissenschaft in Switzerland.