International Journal of Agricultural Research

ISSN 1816-4897

Academic Journals Inc.

www.academicjournals.com

International Journal of Agricultural Research 2 (8): 741-744, 2007
ISSN 1816-4897

A Preliminary Investigation into Chemical Efficacy Against the Currant-Lettuce Aphid *Nasonovia ribisnigri*

Andrew G.S. Cuthbertson, James J. Mathers and Phil Northing
Central Science Laboratory, Sand Hutton, York YO41 1LZ, UK

Abstract: A preliminary laboratory study was undertaken to investigate the impact of two commonly used chemical pesticides (pirimicarb and pymetrozine) on the currant-lettuce aphid *Nasonovia ribisnigri*. Both chemicals had high efficacy against adult and nymph stages of the aphid. Following direct exposure to pirimicarb 98% mortality of aphid nymphs and 90% mortality of winged adults was observed after 24 h. The systemic pesticide pymetrozine caused 93% mortality of aphid nymphs after 72 h. The potential for development of integrated pest management strategies incorporating chemical pesticides for the control of *N. ribisnigri* is discussed.

Key words: Chemical efficacy, *Nasonovia ribisnigri*, integrated pest management, pesticide resistance

INTRODUCTION

The currant-lettuce aphid, *Nasonovia ribisnigri*, is a frequently occurring pest found on lettuce crops throughout the UK and central Europe (Reinink and Dieleman, 1991; Collier, 1999; Parker *et al*., 2002). Although this species may transmit viruses, most damage is caused by foliage feeding with plants showing deformation and head rot (Rufingier *et al*., 1997). This decreases the percentage of marketable heads and can result in great financial losses for lettuce growers (Aarts *et al*., 1999). The confirmation of seemingly widespread pesticide resistance in UK populations of *N. ribisnigri* (Rufingier *et al*., 1997, 1999; Barber *et al*., 1999; Kift *et al*., 2004) highlights the need for alternative methods of control. The development of effective and rational integrated pest management programmes for the control of a given pest species relies on a thorough understanding of both the biology of the pest and any biocontrol agent to be introduced (Cuthbertson *et al*., 2003) and also the impact of chemical pesticides and fungicides on the given biocontrol agent (Cuthbertson and Murchie, 2003, 2006a, b).

This preliminary study investigates the efficacy of commonly used contact and systemic insecticides against the currant-lettuce aphid, *Nasonovia ribisnigri*.

MATERIALS AND METHODS

Collection of Aphids

Currant-lettuce aphids for the study were obtained from an outbreak situation on an outdoor commercial lettuce farm in England during August 2006. A stock culture of the aphids was maintained in the laboratory within a perspex cage (60×60×80 cm) on lettuce plants (*Lactuca sativa* cv. Atlantis) following the technique of Cuthbertson *et al*. (2005) for the rearing of other invertebrates. The experiment was conducted within the chemical efficacy unit at the Central Science Laboratory, York, UK.

Corresponding Author: Dr. Andrew G.S. Cuthbertson, Central Science Laboratory, Sand Hutton, York YO41 1LZ, UK Tel: +44 (0) 1904 462201 Fax: +44 (0) 1904 462111

Pesticide Treatments

The two chemicals investigated in the study were as follows:

- A contact insecticide, Aphox (Syngenta Crop Protection UK Ltd., active ingredient pirimicarb 50% w/w).
- A systemic insecticide, Plenum WG (Syngenta Crop Protection UK Ltd., active ingredient pymetrozine 50% w/w).

Experiment 1: The Efficacy of the Contact Insecticide Pirimicarb

- Ten nymphs of *N. ribisnigri* were placed onto filter paper within a 90 mm Petri dish and sprayed using a Potter Spraying Tower fitted with a medium atomiser. The formulation was applied at a rate of 500 g 1000 L water. After treatment a lettuce leaf (to act as a food source) was added to the Petri dish which was then sealed with parafilm and allowed to incubate at ambient temperature. Mortality was assessed after 24 h. There were ten replicates of chemical treatment and a similar number of control replicates sprayed only with water.
- Ten individual adult winged aphids were also sprayed with pirimicarb using the same method outlined above and ten with water as control. Again mortality was assessed after 24 h.

Experiment 2: The Efficacy of the Systemic Insecticide Pymetrozine

Ten lettuce plants were sprayed with pymetrozine (Plenum WG at 0.397 kg ha^{-1} applied in 400 L water ha^{-1}) using a Booth Sprayer fitted with Teejet UB85015 nozzles. Ten *N. ribisnigri* were then added to the plants. The plants were then placed inside ventilated bags to prevent the nymphs from escaping. Mortality of nymphs was assessed after 72 h. An equal number of control replicates, sprayed with water at the same application rate, were also infested with aphid nymphs. Data from both experiments underwent ANOVA where appropriate.

RESULTS

For all experiments mortality assessments were made using the following criteria:

- Dead - no movement following mechanical stimulation with a fine camel hair brush
- Alive-obviously alive or moving following mechanical stimulation with a fine camel hair brush

Experiment 1: The Efficacy of the Contact Insecticide Pirimicarb

After 24 h 98% mortality of treated nymphs was observed (Table 1). This was significantly different from the control treatment ($p<0.001$).

Ninety percent mortality of winged adults treated with chemical was recorded after 24 h (Table 1). Note the one adult remaining alive only moved slightly when stimulated with the brush.

Experiment 2: The Efficacy of the Systemic Insecticide Pymetrozine

After 72 h 93% mortality of nymphs on treated lettuce was recorded (Table 1). Total mortality of nymphs was obtained after a further 72 h.

Table 1: Percentage mortality of the currant-lettuce aphid *Nasonovia ribisnigri* following treatment with the pesticides pirimicarb and pymetrozine. Mortality assessed after 24 h following direct application of pirimicarb and after 72 h following application of the systemic pesticide pymetrozine. Control aphids treated with water

	Treatment		
Aphid life stage	Pirimicarb	Pymetrozine	Water control
Nymphs	98	93	10
Winged adults	90	Not tested	0

DISCUSSION

The control of currant-lettuce aphid is a major problem for UK lettuce growers (Collier, 1999). The most common method of control is by the use of chemical insecticides (Rufingier *et al*., 1997; Aarts *et al*., 1999). However, due to increasing public awareness regarding both environmental issues and the presence of potential chemical residues there is a need for lettuce growers to be continually aware of other means of invertebrate pest control. In the current study both chemicals investigated caused high mortality of both winged adult and nymphal stages of *N. ribisnigri*. The results from this study also indicate that there is no insecticide resistance within the aphid population tested, a scenario which is a continually increasing problem with *N. ribisnigri* (Rufingier *et al*., 1997; Barber *et al*., 1999; Kift *et al*., 2004).

Factors other than the application of chemical insecticides are also known to affect aphid population survival. The presence of natural predators such as carabid beetles, lycosid spiders and anystid mites (Kielty *et al*., 1999; Cuthbertson *et al*., 2003; Lang, 2003; Snyder and Ives, 2003; Cuthbertson and Murchie, 2004) can all impact negatively on aphid population growth. Rainfall has also been reported to affect aphid survival (Dean and Wilding, 1971; Araya and Fereres, 1991) although the effects are not conclusive and vary between species, probably as a result of preferred feeding sites providing different degrees of shelter (Vickerman and Wratten, 1979). Further work is now required to investigate the impact of the chemicals used in this trial on beneficial species. The information gained from such studies will then be used in the development of effective integrated past management schemes for the control of *N. ribisnigri*.

ACKNOWLEDGMENTS

The authors thank Mr. Phil Mason and Mr. Alan Acaster (CSL) for valuable assistance and expertise in carrying out the study and also Mr Richard Natt and the CSL Horticulture team for the provision of lettuce plants.

REFERENCES

Aarts, R., J.W. Schut, R. Driessen and K. Reinink, 1999. Integrated control of aphids on lettuce varieties resistant to *Nasonovia ribisnigri*. Mededelingen Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent, 64: 11-15.

Araya, J.E. and A. Fereres, 1991. Cereal aphid survival under flooding conditions. Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz, 98: 168-173.

Barber, M.D., G.D. Moores, G.M. Tatchell, W.E. Vice and I. Denholm, 1999. Insecticide resistance on the currant-lettuce aphid, *Nasonovia ribisnigri* (Hemiptera: Aphididae) in the UK. Bull. Entomol. Res., 89: 17-23.

Collier, R., 1999. Integrated control of aphid pests of lettuce and brassica crops in the UK. Mededelingen Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent, 64: 3-9.

Cuthbertson, A.G.S. and A.K. Murchie, 2003. The impact of fungicides to control apple scab (*Venturia inaequalis*) on the predatory mite *Anystis baccarum* and its prey *Aculus schlechtendali* (apple rust mite) in Northern Ireland Bramley orchards. Crop Prot., 22: 1125-1130.

Cuthbertson, A.G.S., C.C. Fleming and A.K. Murchie, 2003. Detection of *Rhopalosiphum insertum* (apple-grass aphid) predation by the predatory mite *Anystis baccarum* using molecular gut analysis. Agric. For. Entomol., 5: 219-225.

Cuthbertson, A.G.S. and A.K. Murchie, 2004. The phenology, oviposition and feeding rate of *Anystis baccarum*, a predatory mite in Bramley apple orchards in Northern Ireland. Exp. Applied Acarol., 34: 367-373.

Cuthbertson, A.G.S., K.F.A. Walters and C. Deppe, 2005. Compatibility of the entomopathogenic fungus *Lecanicillium muscarium* and insecticides for eradication of sweet potato whitefly, *Bemisia tabaci*. Mycopathologia, 160: 35-41.

Cuthbertson, A.G.S. and A.K. Murchie, 2006a. A preliminary study into the direct effect of chemical pesticides on the predatory mite *Anystis baccarum*. J. Ultra. Sci. Phys. Sci., 18: 177-180.

Cuthbertson, A.G.S. and A.K. Murchie, 2006b. Environmental impact of an orchard winter wash and early season pesticide applications on both a beneficial and a pest mite species in Bramley apple orchards. Int. J. Environ. Sci. Tech., 3: 333-339.

Dean, G.J.W. and N. Wilding, 1971. *Entomophthora* infecting the cereal aphids *Metopolophium dirhodium* and *Sitobion avenae*. J. Invert. Pathol., 18: 169-176.

Kielty, J.P., L.J. Allen-Williams and N. Underwood, 1999. Prey preferences of six species of Carabidae (Coleoptera) and one Lycosidae (Araneae) commonly found in UK arable crop fields. J. Applied Entomol., 123: 193-200.

Kift, N.B., A. Mead, K. Reynolds, S. Sime, M.D. Barber, I. Denholm and G.M. Tatchell, 2004. The impact of insecticide resistance in the currant-lettuce aphid, *Nasonovia ribisnigri*, on pest management in lettuce. Agric. For. Entomol., 6: 295-309.

Lang, A., 2003. Intraguild interference and biocontrol effects of generalist predators in a winter wheat field. Oecologia, 134: 144-153.

Parker, W.E., R.H. Collier, P.R. Ellis, A. Mead, D. Chandler, J.A.B. Smyth and G.M. Tatchell, 2002. Matching control options to a pest complex: The integrated pest management of aphids in sequentially-planted crops of outdoor lettuce. Crop Prot., 21: 235-248.

Reinink, K. and F.L. Dieleman, 1991. Survey of aphid species on lettuce. Bulletin OILB SROP, 16: 56-68.

Rufingier, C., L. Schoen, C. Martin and N. Pasteur, 1997. Resistance of *Nasonovia ribisnigri* (Homoptera: Aphididae) to five insecticides. J. Econ. Entomol., 90: 1445-1449.

Rufingier, C., N. Pasteur, J. Lagnel, C. Martin and M. Navajas, 1999. Mechanisms of insecticide resistance in the aphid *Nasonovia ribisnigri* (Mosley) (Homoptera: Aphididae) from France. Insect Biochem. Molec., 29: 385-391.

Snyder, W.E. and A.R. Ives, 2003. Interactions between specialist and generalist natural enemies: Parasitoids, predators and pea aphid biocontrol. Ecology, 84: 91-107.

Vickerman, G.P. and S.D. Wratten, 1979. The biology and pest status of cereal aphids (Hemiptera: Aphididae) in Europe: A review. Bull. Entomol. Res., 69: 1-32.