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Population Dynamics of Filbert aphid, *Myzocallis coryli* (Goetze) on Hazel bushes to an Agroforestry System

Muhammad Naeem and Steve Compton[1]
University of Arid Agriculture, Rawalpindi, Pakistan and [1]Leeds University, Leeds, England

Abstract: The densities of filbert (hazelnut) aphid, *Myzocallis coryli* (Goetze) on the hazel bushes were measured in both 1993 and 1994. The aphids were present on the hazel during from May to September and peaked in July. Significantly greater densities of *M. coryli* were found in block 1 in the tree rows in both years (1993 and 1994). The population densities of aphids on hazel bushes were found to be significantly greater in the forestry plots than in the tree rows. The fewer predators observed provided too small a sample size for any meaningful comparisons of percentage predation to be made.

Key words: Filbert aphid, Hazel bushes, Agroforestry, Production hedge, forestry control

Introduction

In each agroforestry plot at Leeds University form, consisting of four tree rows, each containing, four species of timber tree; sycamore, ash, cherry and walnut. There are also corresponding forestry plots containing the same tree species except the walnut. Hedgerows attracting more abundant and diverse insect fauna than arable crops (Lewis, 1969; Sotherton and Rands, 1987; Morris and Webb, 1987). The tree rows in our agroforestry system are more closely spaced than the conventional hedgerows. However they have a much more open structure due to consist of rows of single trees separated by hazel bushes with a grass understorey (Naeem, 1996). Therefore, they have much less diverse flora as compared to conventional hedges and their open structure should greatly reduce their effects as windbreaks (Lewis and Stephenson, 1966). The growth of the timber trees is recorded as being slower in the rows than the forestry plots (Incoll *et al.*, 1994) and are explaination of this might be due to damaged more by insects than the forestry trees. Other factors especially exposure may be equally or more important of course.

The filbert aphid, *Myzocallis coryli* (Goetze) is a common species on wild and cultivated hazel and a serious pest of commercial hazel nuts in areas such as western Oregon, USA (Messing *et al.*, 1988). It is a monoecious and holocyclic aphid. It attracts a large complex of native natural enemies, including a number of predators, parasites and pathogenic fungi (Messing and AliNiazee, 1986). Populations of this aphid decline during mid-summer (El-Haidari, 1959), resulting from high temperatures or the effects of natural enemies, or both (AliNiazee, 1980).

Therefore the project was conducted to determine whether the responses of aphids to the tree rows and forestry plots varied between the replicate blocks and to determine whether the aphid densities responded differently to th two tree planting regimes and to examine why any difference might occur.

Materials and Methods

The field work was carried out at the Leeds University Farm station at Bramham in northern England. In each agroforestry area there is a series of tree rows (production hedges) which are spaced 14 m apart, each containing four species of timber tree; ash *(Fraxinus excelsior* L.), cherry *(Prunus* sp. L.), sycamore *(Acer pseudoplatanus* L.) and walnut *(Juglens regia* L.) (Fig. 1a). Each tree row include five trees of each species planted at 4 m intervals, giving a total of 20 trees per production hedge. Kentish Cob hazel bushes were planted between each of the timber trees (Fig. 1b), giving a total of 19 bushes per hedge (Naeem, 1996). In the forestry, hazel bushes have been planted at 4 m intervals, giving a total of 30 bushes per section of a forestry plot.

Sampling methods on hazel bushes (1993 and 1994): Hazel bushes were selected haphazardly within the tree rows and forest control plots in 1993 at weekly intervals. In each treatment, 40 leaves were sampled from 4 hazel bushes within each block. In 1994 the sampled were taken from the same marked hazel bushes throughout the season. The bushes were selected from the forest control plots as follows: the first hazel bush in the first row, the 2nd bush in the second row and so on. In each treatment, 36 leaves were recorded for each sample. Leaves were selected haphazardly from the top, middle and lower sections of each hazel plant both for 1993 and 1994. Counting was started at the beginning of aphid immigration (early May) and continued weekly until the collapse of the aphid population at the end of September. Samples were obtained from blocks B1-B3. Alates were not distinguished from apterous adults. Descriptive statistics were calculated using the Minitab package. The block and treatment effects were analysed using a Tukey-HSD test and nested ANOVA Model. The ANOVA models were fitted using the statistical package GLIM 4 (Crawley, 1993).

Results

The filbert aphid, *M. coryli* was present on the hazel during May-October in 1993 and May-August in 1994. The populations were peaked in mid-July of 1993 and at the end of July in 1994 (Fig. 2 and 3).

There were 10581 aphids of this species recorded in the hazel bush samples in 1993. A total of 8421 aphids were found in the forest control plots and 2160 in the tree rows. In 1994, a total of 4454 aphids were counted. There were 2432 aphids in the tree rows and 2022 in the forest control plots.

A total of six coccinellids were collected on hazel bushes. There were five coccinellids in the forest control plots and one in the tree rows. Significantly mean densities of *M. coryli* were recorded in the tree rows only (Table 1). There were greater numbers found in block 1 in the tree rows both in 1993 and 1994. The numbers in this block were significantly greater than in blocks 2 and 3 in both 1993 and 1994 (Tukey's test). Significant differences in density of *M. coryli* were found between the treatments in 1993, but not in 1994 (Fig. 4 and Table 2).

Discussion

The numbers of aphids and their natural enemies on the hazel bushes in the agroforestry system were measured weekly between May and October 1993 and 1994. The hazel aphid responded in their own way to the different microclimates offered by the trees growing in the forestry plots and in the tree rows.

Table 1: The numbers of hazel aphid, *M. coryli* (Mean/sample ± 1 standard error) recorded on the hazel bushes in the tree rows (TR) and forest control plots (FC) of the three replicate blocks (B1, B2, B3). N = 84 and 396 samples in each block × treatment in 1993 and 1994, respectively

Treatments	B1	B2	B3	F	P
1993					
Tree rows	15.57 ± 3.7	5.34 ± 1.27	4.79 ± 1.11	6.61	0.002**
Forest plots	29.69 ± 5.4	28.04 ± 4.91	42.51 ± 7.15	1.79	0.170 NS
1994					
Tree rows	2.87 ± 0.30	1.29 ± 0.18	1.97 ± 0.22	10.73	0.001***
Forest plots	1.32 ± 0.16	1.95 ± 0.23	1.83 ± 0.19	2.72	0.067 NS

Table 2: Anova's comparing the numbers of *M. coryli* classified by the agroforestry treatments (TR, tree rows and FC, forest control plots), and treatment effects are nested within three replicate blocks (B1, B2, B3)

Source of variation	df	SS	MS	F	P
1993					
Treatment	1	77778	77778	45.50	0.001***
Treatment within blocks	4	16723	4181	2.45	0.046*
Error	498	851310	1709		
Total	503	945811			
1994					
Treatment	1	69.03	69.03	3.48	0.063 NS
Treatment within blocks	4	588.43	147.11	7.41	0.001***
Error	2370	47060.91	19.86		
Total	2375	47718.37			

*Significant ($p<0.05$) *** Significant ($p<0.001$)

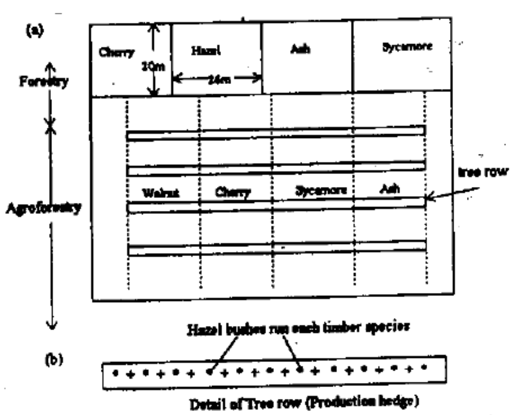

Fig. 1: Layout of the experimental site of a typical replicate at the Leeds University Farm, Bramham, England

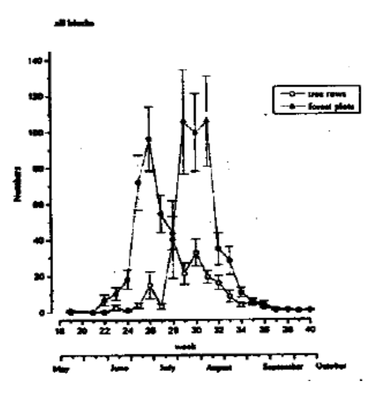

Fig. 2: Total numbers of *M. coryli* (Mean/sample ± 1 standard error) in tree rows and forest control plots, based on leaf surveys in 1993

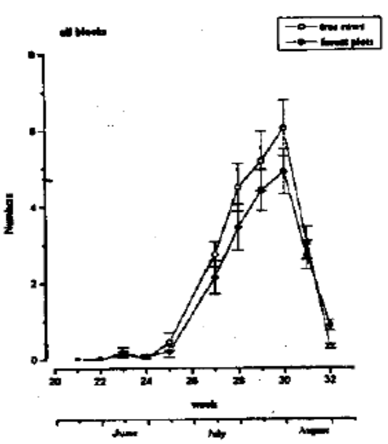

Fig. 3: Total numbers of *M. coryli* (Mean ± 1 standard error) in tree rows and forest control plots, based on leaf surveys in 1994

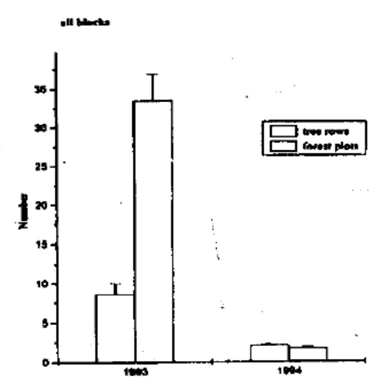

Fig. 4: Numbers of *M. coryli* (Mean/sample ± 1 standard error) in tree rows and forest control plots, based on leaf surveys

The population densities of *M. coryli* on hakel bushes were found to be significantly greater in the tree rows than in the forestry plots. Greater densities were also recorded significantly in the first replicate block in the tree rows in both years (1093 and 1994). It was observed that the hazel bushes appeared to be in better condition under the tree rows in block 1 than in other blocks (personal observation). The greater abundance of these aphids in block 1 might therefore be due to there more healthy hazel bushes providing better resouces for the aphids. The population growth rate of the sycamore aphid is influenced by host-plant quality (Naeem, 1996). The dispersion of aphids could also be influenced by the differences between tree rows and forestry controls. In the forestry controls, aphids can dispersed easily within the trees as the closed canopy will reduce disturbance. In contrast, aphids in the single trees rows are likely to be dispersed on to the crops in the arable alleys as well as on the grasses in the ground flora.

Significantly more numbers were found in the forestry controls than in the tree rows in 1993. This might be due to hazel bushes appeared to be in better condition under forestry control plots being less sheltered than the single tree rows. The lower numbers in the tree rows of the hazel aphids could be due to shelter effect and interrupted by different tree species and arable alleys. The white or reflected surface areas close to growing plants are not attractive to aphid densities (Minks and Harrewijn, 1989). The interrupted area in the tree rows could reduce the attraction to the hazel aphids in the production hedges. The aphid numbers could be affected by weather conditions (especially wind) more in the single tree rows compared to the forestry plots. Small insects, such as aphids, are particularly affected by wind (Strong, 1984). High wind speeds could affect aphid density by mechanically dislodging aphids and dispersing alates flying from within the canopy. The increased canopy density in forestry area could *reduce* wind intensity and thereby influence aphid dispersal. Bimodality in the forest plots could be influeced by rainfall (>5 mm). No, significant differences were observed in 1994.

References

AliNiazee, M.T., 1980. Filbert insect and mite pests. Oregon State University, Agricultural Experiment Station Bulletin, pp: 643.

Crawley, M.J., 1993. Glim for Ecologists. Blackwell Scientific Publications, Oxford, Pages: 398.

El-Haidari, H., 1959. The biology of the filbert aphid, *Myzocallis coryli* (Goetze), in the central Willamette valley. Ph.D. Thesis, Oregon State University, Corvallis.

Incoll, L.D., D.T. Corry, C. Wright, D. Hardy and S.G. Compton *et al.*, 1994. Silvoarable experiment with quality timber production hedges. Agrofor. Forum, 5: 22-23.

Lewis, T. and J.W. Stephenson, 1966. The permeability of artificial windbreaks and the distribution of flying insects in the leeward sheltered zone. Ann. Applied Biol., 58: 355-363.

Lewis, T., 1969. Factors affecting primary patterns of infestation. Ann. Applied Biol., 63: 315-317.

Messing, R.H. and M.T. AliNiazee, 1986. Impact of predaceous insects on filbert aphid, *Myzocallis coryli* (Homoptera: Aphididae). Environ. Entomol., 15: 1037-1041.

Messing, R.H., M.T. AliNiazee and J. Calkin, 1988. Indirect effects of carbaryl on populations of the filbert aphid, *Myzocallis coryli* (Goeze)(Hom., Aphididae). J. Applied Entomol., 106: 72-78.

Minks, A.K. and P. Harrewijn, 1989. World Crop Pests, 2C, Aphids their Biology. In: Natural Enemies and Control, Sabelis, M.W. (Ed.). Elsevier Science Publishers, The Netherland, pp: 312.

Morris, M.G. and N.R. Webb, 1987. The Importance of Field Margins for the Conservation of Insects: Field Margins. Lavenham Press Limited, Suffolk, UK.

Naeem, M., 1996. Responses of aphids and their natural enemies to a Silvoarable Agro-Forestry envirnoment. Ph.D. Thesis, Leeds University, Leeds, England.

Sotherton, N.W. and M.R.W. Rands, 1987. The Environment Interest of Field Margins to Game and other Wild Life. In: A Game Conservancy View: Field Margins, Way, J.M. and P.W. Greig-Smith (Eds.). Lavenham Press Limited, Suffolk, UK.

Strong, D.R., 1984. Density-Vague Ecology and Liberal Population Regulation in Insect. In: A New Ecology: Novel Approaches to Interactive System, Price, P.W., C.N. Slobodchikoff and W.S. Gaud (Eds.). Wiley, New York, pp: 313-327.