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AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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CONTENTS

Introduction 1

Applicants 1

Project summaries 2

Conclusions 3

Introduction

This project was initiated to provide industry relevant crop protection training in the UK. There is a serious lack of training in the UK for specialists in integrated crop pest and disease management (including weed scientists). The scholarship bursary scheme complements that already in existence for the MSc in Entomology based here at Harper Adams funded by the Royal Entomological Society. Crop protection issues in horticulture are rarely covered at undergraduate level in the UK and when they are, never to any great depth. The UK lacks suitably qualified graduates in this area. Providing funding will stimulate and enable suitably motivated students to acquire specialist post-graduate training in this area.

The continuing production of safe, wholesome food in an environmentally sensitive manner is a major political issue for national governments and internationally within global commodity markets. A report produced by the UK Cabinet Office in 2008 (Food Matters: Towards a Strategy for the 21st Century) predicts that the global population will rise to 9Bn by 2050 rising from a current estimate of nearly 6.8Bn. This increase in population size will substantially increase the demand for food. The global estimates vary in magnitude, but it is thought approximately 25% of crops are lost to pests and diseases, such as insects, fungi and other plant pathogens (FAO Crop Prospects and Food Situation 2009).

The Integrated Crop Pest and Disease Management course offers students training in techniques to facilitate crop food production. The course covers a broad range of topics in applied entomology, plant pathology and nematology and all students receive training in fundamental skills which will enable them to enter either a pest/disease management work environment or a research career in applied entomology, plant pathology or pest management. There is, however, considerable flexibility within the course thus enabling each student to focus on specialist subjects consistent with their interests and future career intentions such as horticulture and related disciplines.

Applicants

Applications for the MSc have been low for some years, hence the request for funding from HDC. Applicants for 2013-14 were up by one on the previous year and for 2014 we saw a further increase to seven, again numbers were small but all of high quality. We already have two first class applicants for the 2015-16 entry, which is unusual this early in the recruitment cycle.

The three Scholars for 2013-2014 were:

Katrina Dainton has a background in preventive conservation and previously worked at the National Trust. Her first degree was in Fine Arts (2i) from Lancaster University. She became interested in integrated pest management through her work at the National Trust where she was in charge of preservation. Despite her non-scientific background she achieved a Pass with Distinction in the MSc. She is currently in Brazil on an entomological expedition. On her return she is hoping to take up a PhD position in the area of pest management.

Alice Gribble came directly from Southampton University with a 2i in Biology. She became interested in entomology and integrated pest management during her final year when she did a module in integrated pest management. She achieved a very good Pass with Merit in the MSc. She is currently seeking work in the horticultural and/or biocontrol sector.

Jordan Ryder came to us from the University of Bath with a 2i in Biology after having a year doing voluntary entomological work. He achieved a very good Pass with Merit in the MSc and is currently registered for a PhD here at Harper Adams University working on the effects of different nutritional regimes on the fitness of solitary bees and bumblebees and their resistance to pesticides.

Project summaries

Katrina Dainton - Feeding preference and response to olfactory cues in the weevil, *Hylobius abietis* (Coleoptera: Curculionidae)

This study investigated the feeding behaviour of *H. abietis* in choice and no choice tests with five tree species commonly grown as Christmas trees. The impact of volatiles released from prior herbivory was also investigated in paired choice tests between artificially girdled and non-girdled twigs of the same tree species. Y-tube and four-choice olfactometer experiments further investigated adult *H. abietis* responses to olfactory cues from food stimuli. Marked host plant preferences were seen. Feeding rates did not differ between males and females, but males were more active in response to olfactory cues than females and showed some aggregation tendencies. A number of adults were parasitised during experiments, which is discussed in terms of potential biological control agents. All results are discussed in relation to Integrated Pest Management strategies.

Alice Gribble - Host cultivar preference of *Rhopalosiphum padi* (L.) as a function of the presence of natural enemies

There are a lack of studies into aphid preference-performance behaviour in response to the presence of natural enemies. This study used on-plant studies and olfactometry to untangle these interactions.

Aphids responded to the presence of conspecifics and natural enemies on potential host plants by altering their host preferences. This opens up the possibility of novel biological approaches in protected cropping by using alarm pheromones and/or volatile extracts derived from natural enemies.

Jordan Ryder - Influence of parasitoid development on host selection

The effect of host plant interactions on parasitoid performance was investigated for two species of Aphidiidae wasps; *Aphidius matricariae* and *Aphidius colemani*.

Laboratory experiments were conducted on the aphid host *Myzus persicae* feeding on Pak choi or Basil host plants. Results for both parasitoids showed greater control on Basil due to *M. persicae* walking off the crop; however more mummies were discovered on Pak choi.

Parasitoid performance was evaluated by recording the following responses; time to first attack, attack rate and consequently mummy production. Parasitoids supplied from Syngenta Bioline showed no significance difference between parasitoid species or host plant values for all performance parameters.

Secondary observational experiments successfully modified parasitoid behaviour with use of host plant cues. Results for both treatments resulted in positive responses to each performance parameter when parasitizing on the host plant to which they had been allowed cue interactions. This included when aphid mummies were exposed to host-plant volatiles.

Overall this study highlights the importance host plant cues may have in relation to pest control in glasshouse systems. In particular such developments may aid in the control of *M. persicae* and other aphid species in a variety of protected systems.

Conclusions

The scheme is definitely having an impact in that we receive more enquiries about the course. Take-up is still relatively low, despite the bursaries and we feel that this is in part,

due to the fact that many new graduates are feeling financially insecure and that the bursaries are limited in number. We are stressing to potential applicants that, due to the demand for IPM graduates, the excellent employment prospects mean that the course is likely to be a good investment, even non-bursary holders.

We also found that the number of projects available from the horticultural industry that were feasible as MSc projects was lower than expected. We plan to start talking to potential industry project suppliers earlier this year but would also welcome suggestions from HDC.