FoodBioSystems DTP - PhD Project Advertisement

Project title:

FBS2021-11-Rymer: Controlling feather pecking in laying hens by optimising the use of black soldier fly larvae in hen management

Lead supervisor:

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Project description:

Feather pecking (FP) in egg laying hens has serious economic and welfare implications. At the end of lay, feather loss is seen in >30% of birds in half of UK flocks. However, the motivations for this behaviour are poorly understood. It has been suggested that it is redirected foraging behaviour (but it is still observed in free range hens), or that it is motivated by feather eating to meet a nutritional requirement. There may also be a relationship to gut microbial composition; the microbial composition in the lumen of the gut was more diverse in birds selected for FP activity (HFP) compared with a line selected for low FP activity (LFP), with HFP birds having a higher proportion of *Butyricoccus* and *Faecalibacterium* and a lower proportion of *Lactobacillus* (van der Eijk et al., 2019, Poultry Science, 98:7009). This would suggest that it may be possible to control the drive to feather peck by manipulating the composition of the gut microbiome (perhaps by the supplementation of the diet with targeted prebiotics).

One means of intervening with the birds' environment that has received some attention is by supplying them with black soldier fly larvae (*Hermetia illucens,* BSFL). Hens are insectivores, and the supply of insects may help satisfy an unmet nutritional or behavioural need. The provision of live BSFL to hens encouraged more natural foraging behaviour and was associated with an improvement in feather condition (Star et al., 2020, Animals, 10:216). Optimising the production and provision of BSFL to laying hens may therefore be one means of addressing the challenge of feather pecking. Our industrial partner (ECOInsect) has developed a means of automating BSFL production grown on vegetable waste and evaluating these BSFL on egg production and hen welfare is part of an Innovate UK project. Understanding the mechanism by which BSFL may achieve its effect and optimising its production and use form the basis of this proposed project.

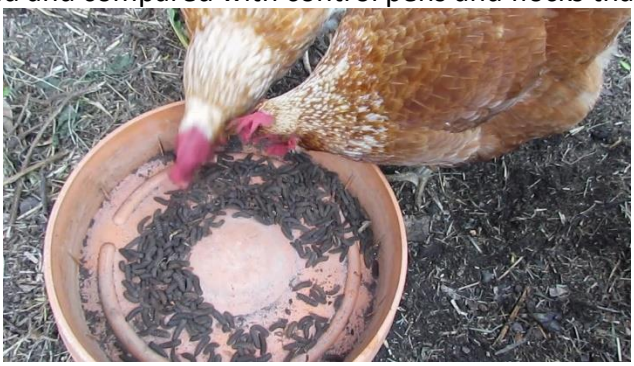
The testable hypothesis is that the provision of live BSFL to laying hens improves hen health and welfare by a combination of a) distraction, to reduce negative behaviours such as feather pecking, b) encouragement of natural behaviours and c) alteration of the caecal microbiome to promote better gut health.

The project has three objectives:

1. *Optimisation of BSF production*. The effect of BSFL on the composition of the caecal microbiome in laying hens will be determined from the analysis of samples taken during the Innovate UK project referred to above. These data will be compared with the observed behaviours by birds in that study to determine what relationship there may be between caecal microbiome composition and FP activity. Other vegetable substrates for BSFL will be investigated in pilot production trials to determine their impact on the BSF production process and on the composition of the caecal microbiome of birds that may consume them. This will be determined *in vitro* by continuous cultures using caecal digesta taken from laying hens as an inoculum. The outcome of this will be a BSF production process that is optimised for bird caecal health.

2. *Optimising the dose and distribution of BSFL to laying hens*. Controlled studies at the University's farm facility will then investigate the effect of offering different doses and distribution methods of BSFL on bird behaviour, health, welfare and performance. Determining whether BSFL act by distracting the birds from negative behaviours and/or by encouraging natural, positive behaviours will be addressed by detailed behavioural observations of the birds. Effects on bird performance (egg yield and mass, measures of egg quality, bird weight change), bird health (including measures of feather cover, gut health and caecal microbiome composition) will also be determined.

3. *Evaluation of BSFL in commercial egg production*. The effect of optimised BSFL production and distribution on laying hen performance and welfare will then be evaluated in a commercial setting. On farm studies will be conducted where BSFL are distributed and the effect on bird health, welfare, behaviour and performance will be assessed and compared with control pens and flocks that do not receive BSFL.



Rob Bob's Aquaponics and Backyard Farm

Training opportunities:

The training opportunities are extensive and will provide a skill set for the next generation of animal scientists with interests in animal behaviour and welfare, gut health, entomology and sustainable production. There will be a placement with the industrial partner (ECOInsect), which will provide training in the automated production of insect larvae, as well as training in adaptive research to optimise the production of the BSFL for both production efficiency and manipulation of the value of the end product. There will also be training in experimental design of applied research, and in the constraints and opportunities afforded by conducting this research at laboratory (*in vitro*), University research facility and farm scale. Detailed training will cover molecular biology, statistical modelling and analysis, behavioural science and assessment of bird welfare. This breadth and depth of experience and training will provide understanding and confidence in a range of applied research methodologies that can be exploited for many goals in your future career.

Training will be provided by:

1. University of Reading: Poultry nutrition, molecular microbiology, *in vitro* and *in vivo* poultry studies.
2. Queen's University, Belfast: Behavioural science and the assessment of animal welfare.
3. ECOInsect: Production process and the commercial drivers behind taking a pilot product through to development and commercialisation.

Student profile:
This project would be suitable for students with a degree in animal science, biology, nutrition, agriculture, food science or a closely related subject. Research skills in animal production, animal welfare or animal nutrition would also be an advantage. A keen interest and understanding of the field of animal welfare and production would be expected, as would an interest in applied microbiology. Strong communication and teamwork skills are necessary, along with capability for data handling and critical analysis. The student should display critical thinking, diligence, independence, problem-solving skills, professionalism, good record keeping and the ability to time-manage effectively (e.g. to meet deadlines).

Funding Note
This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.
The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.
The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply
Please go to FoodBioSystems DTP website for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.