

SHORT REPORT

Respiratory symptoms in insect breeders

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Background	A number of specialist food suppliers in the UK breed and distribute insects and insect larvae as food for exotic pets, such as reptiles, amphibians and invertebrates.
Aims	To investigate the extent of work-related (WR) symptoms and workplace-specific serum IgE in workers potentially exposed to a variety of biological contaminants, including insect and insect larvae allergens, endotoxin and cereal allergens at a UK specialist insect breeding facility.
Methods	We undertook a study of respiratory symptoms and exposures at the facility, with subsequent detailed clinical assessment of one worker. All 32 workers were assessed clinically using a respiratory questionnaire and lung function. Eighteen workers consented to provide serum for determination of specific IgE to workplace allergens.
Results	Thirty-four per cent (11/32) of insect workers reported WR respiratory symptoms. Sensitization, as judged by specific IgE, was found in 29% (4/14) of currently exposed workers. Total inhalable dust levels ranged from 1.2 to 17.9 mg/m ³ [mean 4.3 mg/m ³ (SD 4.4 mg/m ³), median 2.0 mg/m ³] and endotoxin levels of up to 29435 EU/m ³ were recorded.
Conclusions	Exposure to organic dusts below the levels for which there are UK workplace exposure limits can result in respiratory symptoms and sensitization. The results should alert those responsible for the health of similarly exposed workers to the potential for respiratory ill-health and the need to provide a suitable health surveillance programme.
Key words	Insect breeders; respiratory symptoms; sensitization.

Introduction

Allergy to insects is relatively common [1–3]. However, there is little information on sensitization and the respiratory health effects associated with specialist live food breeding, specifically as a pet food source. We therefore investigated the presence of work-related (WR) respiratory symptoms and specific IgE in workers from a single such facility.

Methods

In the main study, all 32 workers consented to take part and completed an interviewer-led WR respiratory symptom questionnaire and a reproducible measurement of lung function using a calibrated spirometer (Alpha 2, Vitalograph) [4]. Eighteen workers provided serum for specific IgE determination.

Protein extracts of locusts and mealworms from the worksite and common environmental allergens (atopy) were conjugated to cyanogen bromide-activated discs and analysed for specific IgE [5]. Measurements of per-

sonal dust exposures were made according to MDHS 14/3 [6] and analysed for endotoxin using the Kinetic-QCL automated system (Cambrex Bio Science) and calculated as 8 h time-weighted averages (TWA).

A single worker was subsequently investigated in more detail, and these findings are also presented.

Ethics approval for this study was granted from the Health & Safety Executive (HSE) ethics committee (ref: ETHCOM/REG/01/10).

Results

From observing work activities, workers in the main breeding and dispatch areas (insect facility) were classified as currently exposed ($n = 23$) to potential workplace allergens. The office workers were classified as the comparison group ($n = 9$). The demographics of the workers are listed in Table 1. In total, four workers reported WR upper respiratory symptoms only, five lower respiratory symptoms only and two both upper and lower respiratory WR symptoms.

Table 1. Worker demographics and symptoms data

Characteristics	Office area, <i>n</i> = 9	Insect facility, <i>n</i> = 23	<i>P</i> value
Age (years), mean (SD)	30.7 (11.6)	34.9 (12.0)	NS
Duration of work in industry (months), mean (SD)	45.9 (50.7)	29.7 (31.5)	NS
Gender			
Male (%)	2 (22)	21 (91)	<0.001
Smoking ^a			
Current (%)	3 (33)	18 (78)	<0.05
Ever suffered from asthma			
Yes (%)	3 (33)	5 (22)	NS
Ever suffered from eczema, hay fever or other allergies			
Yes (%)	4 (44)	3 (13)	NS
WR upper respiratory symptoms ^b			
Yes (%)	2 (22)	4 (17)	NS
WR lower respiratory symptoms ^b			
Yes (%)	3 (33)	4 (17)	NS
Any WR respiratory symptoms			
Yes (%)	4 (44)	7 (30)	NS
FVC % predicted			
Mean (SD)	105 (9.0)	105 (12.5)	NS
FEV ₁ % predicted			
Mean (SD)	101 (10.8)	98 (14.5)	NS
Atopy	<i>N</i> = 2	<i>N</i> = 16	
Yes (%)	0 (0)	5 (31)	–
WR sensitization (RAST)			
None (%)	2 (100)	12 (75)	
Locust only (%)		1 (6)	
Mealworm only (%)		2 (13)	
Locust and mealworm (%)		1 (6)	

NS, not significant.

^aThere were no self-reported ex-smokers.^bSymptoms of WR cough, shortness of breath, phlegm, chest tightness or wheeze were categorized as lower respiratory symptoms, while WR nasal or ocular irritation were categorized as upper respiratory symptoms. Two workers reported both WR upper and lower respiratory symptoms.

Of the 18 workers providing serum, 4 (all of whom were in the currently exposed group) were found to have specific IgE to at least one workplace allergen. Of these, three also reported WR respiratory symptoms.

Mean percentage lung function measurements demonstrated no significant differences between the office workers and insect facility workers.

Twenty-one personal inhalable dust samples were taken across the worksite. Mean dust levels in the insect facility (range 1.2–17.9 mg/m³, mean 4.3 mg/m³, SD 4.4 mg/m³) were significantly higher than those in the office area (range 0.1–0.9 mg/m³, mean 0.5 mg/m³, SD 0.3 mg/m³) (*P* < 0.05). Thirteen personal samples were taken for endotoxin analysis (only 1 sample was available in the office area). Only six of these were above the lower limit of detection for the assay (1 EU/m³), with the maximum value being 29 435 EU/m³.

A 41-year-old male cricket breeder subsequently underwent a more detailed clinical assessment. He gave a history of asthma diagnosed 15 years previously with increased sickness absence attributed to WR respiratory problems over the preceding 2 years. Clinical examination revealed an expiratory wheeze and reduced lung

function measurements compared to those taken during the main study 2 years prior to the clinical assessment, with an forced vital capacity (FVC) of 3.92 L (predicted 4.98), forced expiratory volume in 1 s (FEV₁) of 2.48 L (predicted 4.09) and a FEV₁/FVC ratio of 63%, the latter indicating airways obstruction. Serial peak flow measurements (Figure 1), plotted and analysed using OASYS 2 software [7], confirmed a significant WR pattern with a work effect index of 3. Serum analysis detected specific IgE to atopy, bran, locust and cricket. He was subsequently moved to the dispatch area of the facility, with no direct exposure to insects. On review 5 months later, the WR symptoms had resolved and further serial peak flow recordings (data not shown) confirmed that the previously documented WR variation had been abolished, without change in his inhaled asthma treatment.

Discussion

This study identified high levels of reported WR respiratory symptoms in workers currently exposed to a variety of insect-related allergens. Sensitization, as judged by specific IgE to insects, was only found in those workers

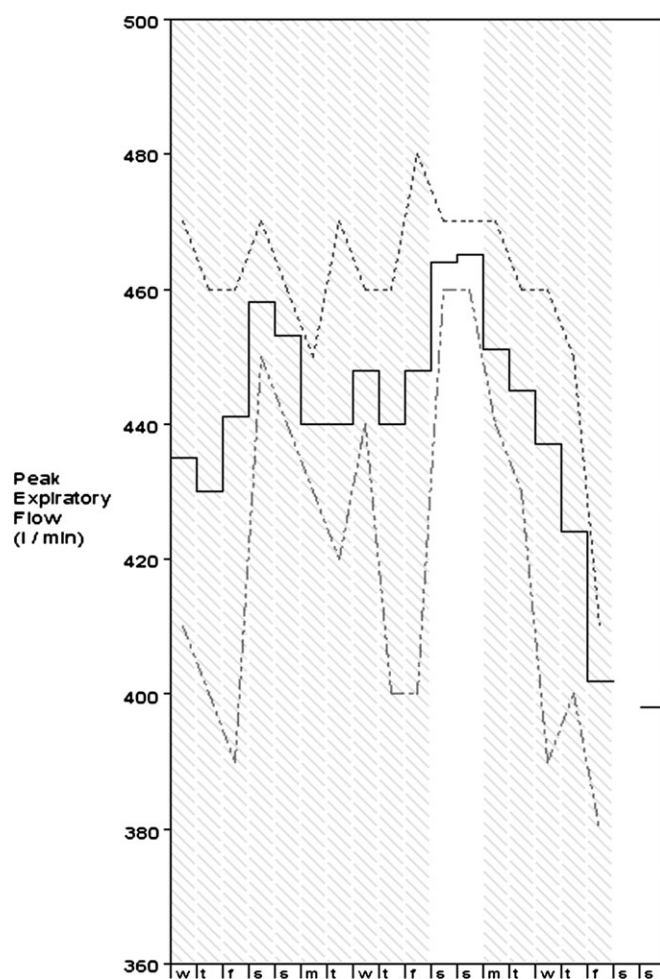


Figure 1. Serial peak flow recordings plotted using OASYS 2 software, work effect index calculated as 3.0. Time (days, with work days shaded). Note: the subject usually had work exposure each weekend but arrangements were made to have a break.

currently exposed in the main breeding and dispatch areas, although symptoms without evidence of sensitization were identified in the lesser exposed office areas. The reasons for this finding are unclear but may represent a combination of the healthy worker effect, with in-house movement of staff from the insect facility to the office environment, if they developed WR symptoms. Additionally, those exposed workers with symptoms may have under-reported symptoms due to concerns about job losses, introducing the potential for reporting bias.

These limited data demonstrate the potential for these allergens to cause sensitization in this context, with WR respiratory symptoms present in the majority of those with serological evidence of sensitization. The index clinical case is highly likely to have had occupational asthma, given an appropriate history, latency and a positive OASYS serial PEF chart (which has high sensitivity for a diagnosis of occupational asthma [8]), with subsequent improvement following reduced exposures.

The majority of workers reporting WR respiratory symptoms did not, however, demonstrate sensitization to locust or mealworm. While it is possible that some of these symptoms may relate to sensitization to other workplace allergens not measured, it is also possible that symptoms are due to a combination of allergic, direct irritant or other (for example endotoxin-related) effects.

Given the probable presence of occupational asthma in at least one worker, it is notable that measured total inhalable dust levels were generally below the current HSE workplace exposure limit [9] of 10 mg/m³ (8 h TWA), although dust levels were significantly higher in the insect facility compared to the office area. Endotoxin levels measured were in some cases high relative to the postulated European exposure limit [10] of 50 EU/m³, raising the possibility that this may be a specific cause of some of the reported WR symptoms, although no suspected cases of organic dust toxic syndrome were clearly identified.

This study indicates that insect breeders are at risk of WR respiratory complaints, probably including occupational asthma, the latter being associated with sensitization to workplace allergens. General and specific feedback to the workplace resulted in a plan of action to assist future risk reduction. Despite this, a more detailed understanding of the cause of reported symptoms in this group is needed, as high-quality health surveillance programmes designed to protect workers can only be formulated once the risk to workers is fully understood.

Key points

- Workers employed in breeding insects are at risk of work-related respiratory problems and the development of sensitization to workplace allergens.
- The high levels of endotoxin in a number of personal exposure samples in the insect breeding facility raise the possibility that some of the work-related respiratory symptoms may relate directly to this exposure.
- Employers need to be made aware of the high-sensitizing potential of various biological materials, should consider how to avoid or reduce risk associated with such exposures through a comprehensive risk assessment and offer appropriate occupational health surveillance where justified.

Funding

Health & Safety Executive (HSE).

Acknowledgements

Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

Conflicts of interest

None declared.

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