

INFESTATIONS OF GERMAN COCKROACH *BLATTELLA GERMANICA* IN MULTI-OCCUPANCY DWELLINGS IN A LONDON BOROUGH – A PRELIMINARY STUDY INTO THE RELATIONSHIP BETWEEN ENVIRONMENT, INFESTATION AND CONTROL SUCCESS

V. SHAH¹, J. LEARMOUNT² & D. PINNIGER²

¹London Borough of Southwark, Municipal offices, Larcom Street, London SE 17 1RY
and ²Central Science Laboratory, London Road, Slough SL3 7HJ

Abstract—Records from a two year period from over 24,000 dwellings in the London Borough of Southwark were examined and infestations of German cockroaches, recorded by inspection and trapping, were analysed. Factors identified as possibly influencing infestation levels were block size and type of heating system, standard of hygiene in dwellings and human density in dwellings. The results indicate that the type of heating system does not have a major influence on cockroach infestation levels in small and medium blocks. However, with large blocks district heating was associated with higher levels of infestation. A relationship between cockroach infestation levels and the standards of hygiene in individual dwellings was established. Heavier levels of infestations were found in dwellings with poor standards of hygiene. Size of multi-occupancy block appeared to have no effect on levels of infestation, although there are implications for the persistence of infestation and difficulties for the implementation of control in very large blocks.

INTRODUCTION

The German cockroach, *Blattella germanica*, requires high temperature and humidity, harbourage and adequate food supply in order to survive and breed in the UK. For this reason it is a pest associated with human beings and their dwellings, which provide the ideal environment for the cockroaches' survival (Cornwell, 1968; Bennett and Owens, 1986). In recent years many local authorities have experienced great problems controlling infestations of German cockroaches, the majority of which were found in multi-occupancy housing blocks (Lea, 1995; Rutter and Tullis, 1992). This type of environment seems particularly well suited to support cockroach infestations. A large turnover of tenants provides ample opportunity for import of cockroaches into the buildings. Poor proofing and ducted services provide ample harbourage for the cockroaches and allow spread of infestations between dwellings (Lea, 1995). Once an infestation is established, many factors may then contribute to the subsequent severity of the problem and the level of success achieved in controlling the infestation. However, it is difficult to find hard evidence to identify key factors relating to cockroach infestation within such complex environments. It was therefore decided to examine the monitoring records of a large number of dwellings in a London borough and to attempt to correlate cockroach infestation levels with specific factors. The factors identified as possibly influencing infestation levels were block size and type of heating system, standard of hygiene in dwellings and absence or presence of children.

The results of this study are discussed in the light of future needs for monitoring infestation, improving the proofing and design of buildings and strategies for control.

MATERIALS AND METHODS

Data was collected from 487 multi-occupancy housing blocks in South East London by companies contracted to carry out pest control by Southwark Council Housing Department. All blocks monitored had reported German cockroach infestations before this survey.

Block size and heating type

Housing blocks were categorised according to their size. Blocks were classified as small when they contained 6–30 dwellings, medium containing 31–80 dwellings and large if they contained 81 or more dwellings

Blocks were then categorised depending on whether or not they had Individual or district heating systems. The tenants in dwellings with local or district heating paid for their heating at a standard rate regardless of how much heat is used. Occupants of such dwellings tend to have their heating at higher levels and for longer periods than those in flats without district heating.

Infestation levels

Levels of infestations were monitored using sticky traps. Visual observations of the dwellings visited were made to detect any signs of cockroaches or cockroach frass. Occupants were also questioned as to whether cockroaches had been sighted between visits. Traps were placed in the kitchen, the bathroom and in the airing cupboard. Where visual observations by occupants and pest controllers showed no evidence of cockroach presence, only 1 trap was placed in each position. Where cockroaches had been sighted, more traps were placed. Traps were collected 3–6 months later. Infestation levels were then categorised based on the following criteria.

1. Were cockroaches present on any of the sticky traps collected?
2. Did visual inspections show any signs of cockroach activity?
3. Did occupants report any sightings of cockroaches?

Dwellings were classed as clear of infestation if the answer to *all* these questions was “no”. They were classed as infested if the answer to *any* of these questions was “yes”. Infested dwellings were then further classified as:

- Light: When no more than 5 cockroaches were caught on all the sticky traps collected.
Medium: When 6–25 cockroaches were caught on all the sticky traps collected.
Heavy: When more than 25 cockroaches were caught on all the sticky traps collected.

Hygiene levels

Hygiene levels in each dwelling were also recorded and classified, based on the following criteria:

- Good: When floors and surfaces were clear of food and uncluttered.
Fair: Where there were minor food spillages and pet food and unwashed dishes were left out overnight.
Bad: Where there were heavy deposits of grease and grime in kitchens and ample spilled and open food. Surfaces and floors were cluttered hampering access for inspection and treatment.

An example of the Pro forma report form on which data was recorded is shown in appendix “A”.

Infestations and human density

Data indicating family or single/couple occupancy was collected for the 6 month period commencing April 1995.

Treatment

Blocks were monitored over 6 month periods commencing October 93, April and October 94 and April 95. The mean of data from both periods commencing in 1994 was used, where appropriate. Treatments were carried out by contractors during these periods with Maxforce gel (hydramethylnon) and Protrol (hydroprene) in the main. The change in infestation levels with time were examined to determine the success of these treatments.

RESULTS

Blocks with all dwellings classified as clear of infestation, but with any dwellings not accessed during visits, were not used in the analysis of block results. The non-accessed dwellings may have

been infested. However these blocks were included where results from individual dwellings were analysed.

The numbers of blocks and number of dwellings within blocks monitored are grouped in size categories and shown in Table 1.

Block size and heating type

Blocks grouped into size categories and heating type are shown in Table 2. The distribution of heating systems between block size groups was analysed using chi-square tests. Results were not significant.

Each block size category was then analysed separately. Blocks were grouped according to the number of dwellings they contained with infestations in 1993 and the distribution of heating systems within these groups was analysed. Results for small and medium blocks are shown in Table 3. These results analysed using chi-square tests were not significant. Results for large blocks are shown graphically in Figure 1. These results analysed using chi-square tests were significant ($P>0.5$). Fewer blocks in the 0–25% infested group had district heating compared to those without. In the 26–100% infested group more blocks had district heating compared to those without.

Table 1. Number of blocks and dwellings analysed for German cockroach infestations

Flat size	Small	Medium	Large	Totals
No. of blocks	174	213	74	461
No. of dwellings	3800	10,940	9515	24,255

Table 2. Distribution of heating systems within block size groups

Flat size Heating system	Small	Medium	Large	Totals
District	75	95	31	201
Individual	99	118	43	260

Table 3. Distribution of heating systems within flat size categories

Infestation level	0–25%	26–100%	Totals
Heat system			
Small blocks			
District	57	18	75
Individual	70	29	99
Medium blocks			
District	70	25	95
Individual	84	34	118
Large blocks			
District	17	14	31
Individual	34	9	43

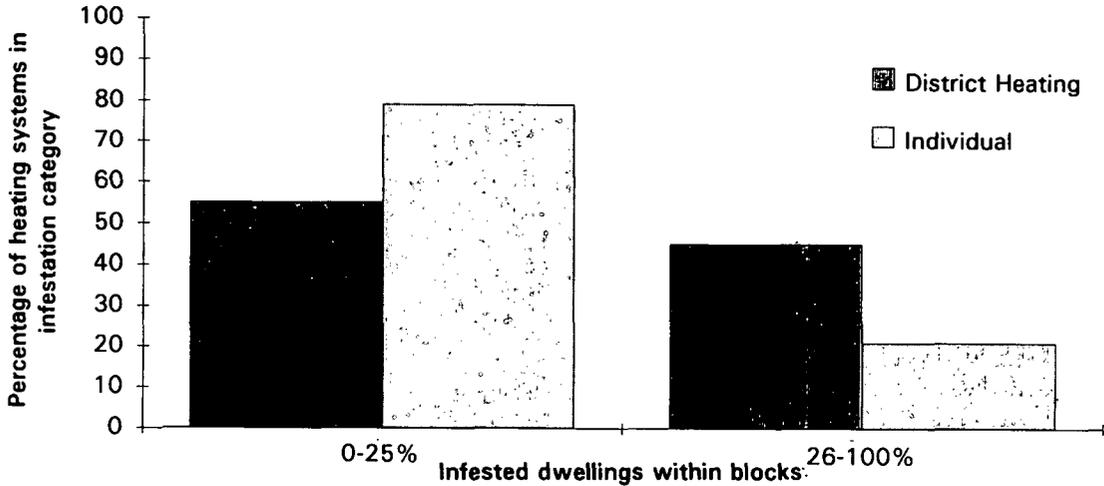


Figure 1. Heating system distribution in large blocks.

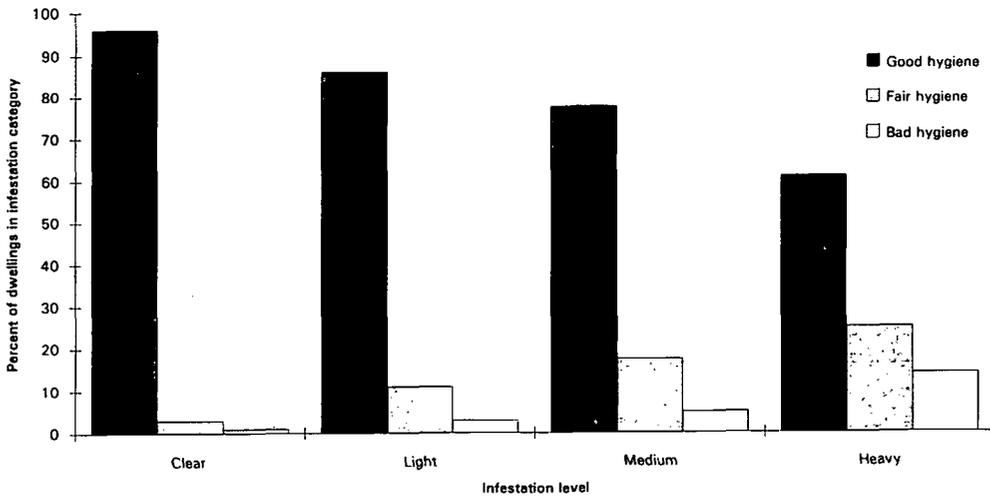


Figure 2. Infestation level and hygiene.

Infestation and hygiene levels

Data for infestation level and hygiene within individual dwellings from the 10 most heavily infested blocks in 1993 are shown in Figure 2. These results analysed using chi-square tests were significant ($P > 0.001$). There was more likelihood of infestations in dwellings with bad hygiene.

Infestations and human density

Data showing the distribution and frequency of infestations with or without family occupancy are shown in Table 4. These results analysed using chi-square tests were significant ($P > 0.001$).

Treatments

Data for infestation level within blocks in 1993, 1994 and 1995 are shown in Figure 3. Results analysed using chi-square tests were significant ($P > 0.001$). The number of dwellings clear of infestations increased with time while the number infested, whether light, medium or heavy decreased.

Table 4. Number of dwellings with or without infestations and families

	Infested	Clear
Families	704	5999
Singles/couples	850	17,629

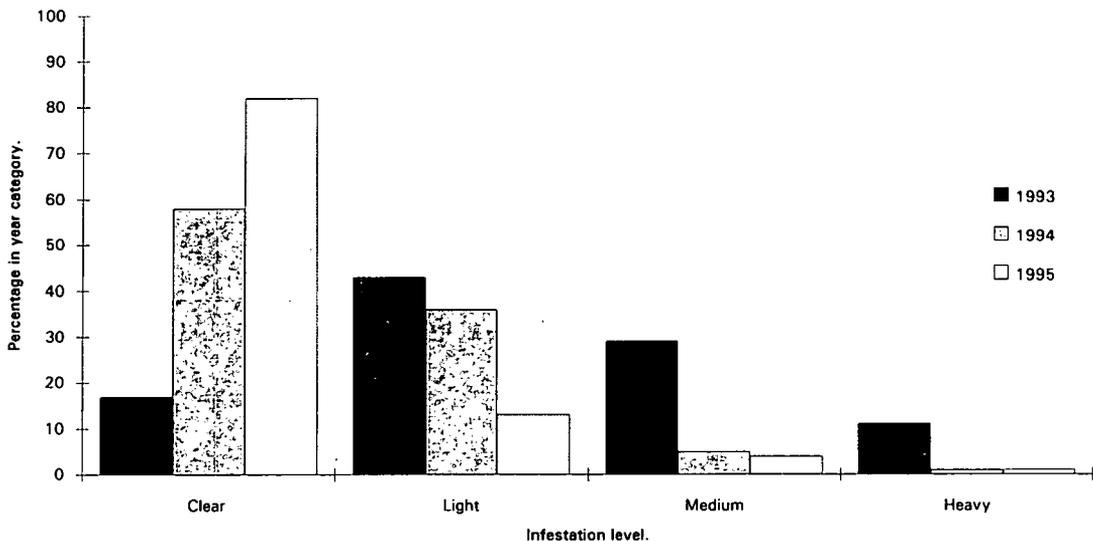


Figure 3. Infestation level and time.

DISCUSSION

Studies of cockroach infestation are particularly difficult to undertake in multi-occupancy blocks due to the complexity of the environment in which they are found. It is possible that cockroaches may be transported into dwelling within the blocks in bulk food supplies, furniture and personal effects where turnover of tenants is high. Once established, infestations can easily spread between dwellings for example, via ventilation shafts, hot water pipes, gaps between electrical cable and conduit and communal rubbish chutes. It is difficult, therefore, to establish why an infestation exists and its origin. The results of this study, do, however suggest that, once a population is established, infestation levels can be linked to certain environmental factors.

There was a link between cleanliness and levels of infestation in individual dwellings. This might be expected as a heavy cockroach infestation would be more easily supported if there are adequate food resources within a dwelling. Also, the cleanliness categories took account of the amount of clutter in the dwellings. Cluttered dwellings are more difficult to treat with insecticides and provide harbourage for cockroaches which can then disperse more easily throughout the dwelling. Results linking higher infestation levels with greater human density also further reinforce the idea that cluttered flats may encourage infestations. It is also possible that children are more likely to visit other dwellings with children and further spread infestations via clothes or toys. Similar results linking cleanliness and human density/clutter in flats with infestation levels have been found in council blocks in France (Rivault and Cloarec, 1995). However, it has also been shown that once established, eradication of cockroach populations is extremely difficult even if hygiene is improved (Bennett and Owens, 1986).

It has also been assumed that the type of heating system present in blocks may contribute to the level of infestation. The ducting associated with district heating systems provides an ideal environment for cockroaches to harbour in (BRE information paper, 1992). Also blocks with district heating tend to have higher and more constant temperatures and this could provide more suitable conditions for cockroaches. Other workers have found that higher population densities of German cockroaches are found in buildings having warmer conditions, particularly bakeries

(Stejskel and Verner, 1996). However the results of this study suggest that heating system type may not have a major influence on infestation levels. Heating systems were evenly distributed between light and heavily infested small and medium blocks, although in large blocks more blocks with district heating systems fell into the heavily infested category. It is possible, therefore, that the heating system is more important in the spread of cockroaches over greater distances provided by larger blocks.

During this study a number of different control treatments were used. However, increasingly used by contractors were the insecticide bait, Maxforce (hydramethylnon) and the Insect Growth Regulator (IGR) Protrol (hydroprene). These insecticides were recently released onto the UK market and have been of particular value to pest controllers due to widespread resistance to pyrethroid insecticides particularly in the London Boroughs (Chapman *et al*, 1993). Additionally, conventional insecticides formulated as sprays and dusts are difficult to use effectively in multi occupancy blocks as cockroaches in harbourages may avoid treatments and occupants may find treatments disruptive. Maxforce is formulated as a bait and is, therefore, easily placed and is more acceptable to tenants. Also there is, as yet, no reported resistance to hydramethylnon in the UK. Protrol is an IGR which disrupts growth and reproduction of the cockroaches. Although this product does not offer rapid control of the insects, when it is coupled with a treatment such as Maxforce it should produce a more long term solution to cockroach problems. The results of this study indicate that the treatments have improved the level of control achieved in the blocks sampled. The number of clear dwellings increased in both '94 and '95 and those infested with light medium or heavy infestations decreased.

For the purposes of this paper, analysis has concentrated on the 1993 results, as this was when infestation levels were at their worst. However, a great deal more data has been generated and it may be useful to examine this in more detail in the future. For example, it may be interesting to examine the link between hygiene and infestations over the 3 year period as treatments began to take effect, to see whether the more persistent infestations were concentrated in those dwelling with poor hygiene.

This study reinforces the experience of pest control operators that environmental factors within dwellings in council blocks contribute to problems controlling German cockroach infestations. The results from monitoring treatments and infestations suggest that the increasing use of Maxforce and Protrol have improved the infestation problems in this London Borough. However, some infestations do still exist in many blocks even after three years following this treatment regime. The study underlines the difficulty of controlling infestations in such complex environments even with effective insecticide products available.

ACKNOWLEDGEMENTS

London Borough of Southwark for permission to use its records and its support in the submission of this paper.

Mr G. C. Bowyer-Tagg for investing in the setting up of the first data-base program to record data of all visits.

Alex Santoni for long hours of work to test the current data-base program.

Roberta Harrill for carefully converting all 50Mb of data into summary tables.

Ambit Pest Control Ltd, Cannon Hygiene Ltd, National Bitannia Ltd, Peter Cox Environment Services for carefully inputting all data.

Richard Westley for supporting in every way possible to enable this volume of work to be done.

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