

RELEASE AND RECAPTURE OF GERMAN COCKROACHES *BLATTELLA GERMANICA* (L.), IN A VACANT HOUSE

IKUO TANAKA* AND MITUGU MOTOKI**

*Japan Environmental Sanitation Centre, Kawasaki 210, Japan, ** Apex Sangyo Co.

Abstract—The activities of released German cockroaches in a vacant wooden house were investigated. Migrations to rooms away from the release point were infrequent and most cockroaches remained near the release point. Populations of cockroaches which became established in rooms, increased in summer but decreased with the fall in indoor temperature. However, the population which became established around the heating resource did not decrease.

It is suggested that the distribution and population density of German cockroaches in buildings is determined by wandering cockroaches, the existence and numbers of heating resources and the presence of a food supply.

A trial to estimate the population by capturing cockroaches on traps was not successful because of a marking failure.

INTRODUCTION

Increased infestations of the German cockroach, *Blattella germanica*, in buildings, have become more serious with urbanisation and this species has become one of the main control targets for many pest control companies. However, the complexity of building structures and the arrangement of furniture and fittings as well as the development of insecticide resistance make control difficult. Such difficulties in control of the German cockroach depend somewhat on the factors which help determine wandering activity, population growth and choice of harbourage and these factors are not well known.

On the other hand, although it is known that sticky traps can be effectively used for monitoring (Ballard & Gold, 1984), there are a number of unanswered questions, including whether the number of index can reflect the field population correctly. For better planning of the control strategy of the German cockroach, these problems should be clarified.

MATERIALS AND METHODS

A wooden house of two stories was chosen for the study. The house was about two years old, located in a residential area, and in which no inhabitant had lived for the last six months. The house was ca. 65 m² in area with kitchen, living room, dining room, bathroom and toilet on the ground floor and two living rooms and toilet on the first floor.

A stock strain of German cockroach reared in the laboratory was chosen for the test. Two thousand insects (equal numbers of male and female) were released in the kitchen and in the bathroom twice in the years of 1990 and 1991, and their subsequent movements investigated. Cockroach food (laboratory diet) and water were set in bait trays on the floor in several places.

From 2 to 4 weeks after release, trapping was carried out principally once a week. Sticky traps were placed in a corner of every room and changed to new ones after counting the numbers of cockroach trapped. Dead cockroaches on the floor were also recovered.

Throughout the studies, no heating or cooling resources were available for cockroaches except for a refrigerator which was used only in the second year.

Door and windows were kept closed for security except when the investigators visited for observation and so the temperature in the rooms rose as high as 38°C in the summer and fell as low as 13°C at the end of the study.

In the second year, a mass marking method was employed as individual marking took much time. Cockroaches were put in a 2 l beaker and white paint was sprayed over them.

Towards the end of the study, before the insecticide application designed to eradicate the population was carried out, cockroach movement in the kitchen was investigated by setting sticky traps in a grid pattern every 50 cm around the refrigerator area.

TABLE 1 Numbers of adult German cockroach recovered in each room by day 47 after release* in 1991

Floor	Room	Number of Cockroach recovered		
		Total	Trapped	Dead
Ground	Kitchen (1)	685	433	252
	Bathroom (2)	249	168	81
	Entrance Hall	28	5	23
	Toilet	0	0	0
	Dining Room	40	8	32
	Living Room	12	8	4
	Steps	8	8	0
First		5	3	2

*Numbers of cockroach trapped or found dead in each room. Adults at day 50 were considered as released ones (P1).

(1) Release point 1 (1600 adults)

(2) Release point 2 (400 adults)

RESULTS AND DISCUSSION

High early mortality of the released cockroaches (P1) was observed, with approximately 30% mortality within 2 weeks in 1990 and 20% within one month in 1991. Such mortality was attributed to transportation by car and the marking method. Moreover, many cockroaches were trapped on webs which had not been found in the house at the beginning of the study, although they were removed carefully thereafter.

Nymphs hatched soon after the adult release because many females had been carrying oothecae. At the same time, the number of adults decreased initially, but increased again from 50 to 60 days after the start of the trial. However, the reason for this trend was not so clear. Ogata (1976) reported that newly hatched nymphs developed to adult in about 60 days at 25°C and less than 50 days at 27°C. As a result, in this present study, adult cockroaches found by around 50 days were considered to be P1.

On this assumption 8 to 40 P1 adults dispersed to the other rooms by day 47 in 1991 from two release points, including 5 to the first floor (see Table 1). Although more adults were found in these rooms after day 47, it was not clear whether they were P1 females since the paint marking did not last long enough to allow differentiation.

Most of the cockroaches aggregated at the corner of the kitchen and the bathroom where a refrigerator and a medicine cabinet were sited respectively. Runstrom and Bennett (1984) reported that plumbing connections between adjacent apartments enhanced movement of this species in their mark-recapture study of natural populations. Such a movement between the ground and first floor could not be confirmed in this study, but both adults and nymphs were observed to move up the stairs to the first floor.

Increasing populations were confirmed by the increase in numbers of trapped or dead cockroaches recovered in every room, even where a particular hiding place, such as seen in the kitchen or bathroom, did not exist. In such rooms, they aggregated around bait trays or in corners. However, the number in these areas decreased towards the end of the study as the room temperature fell.

When sticky traps were set in a 50 cm grid pattern in the kitchen, only one or two individuals were trapped in traps at some distance from the refrigerator, but large numbers were trapped within 50 cm of the refrigerator. Observation of Owens & Bennett (1981) revealed that adult males were more mobile than females, but in the confined area of our study, females were more mobile than males.

In view of the high population density around the refrigerator in this house, it was considered likely that if some heating sources were present in other places, particularly around the bait, the population in such areas could be as high as in the kitchen.

These results indicate that, with the German cockroach, a few individuals always move around in buildings and settle and breed in areas with food and heating resources. It seems that the majority of the populations of German cockroach move in a comparatively small range around heating resources, particularly in the cold seasons. Jing Zhai (1990) reported that the presence of German and smoky brown cockroaches may be determined by the availability of heat in winter. So, heavy

infestations as seen in many restaurants could be linked to the number of heating sources. Then, if every heating source could be identified, chemical application for the control of this species could be restricted to such areas and might reduce the population without widespread chemical application.

In the marking trial, the paint lasted only for a maximum of one month and marked individuals could not be distinguished from newly emerged adults and thus the trial to assess the relationship between the released population and the number of cockroaches captured, was not successful.

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REFERENCES

- Ballard, J. B. and R. E. Gold (1984). Laboratory and Field Evaluations of German cockroach (Orthoptera: Blattenidae) Traps. *J. Econ. Entomol.* 77: 661-665
- Jing Zhai (1990): Habitat preference of cockroaches in urban environments in Shanghai, China. *Jpn. J. Sanitary Zoology* 41 (40): 353-357.
- Ogata, K. (1976). Studies in the factors affecting infestation of German cockroach. 1. Development of the German cockroach under the various conditions in the laboratory. *Jpn. J. Sanitary Zoology* 27(4): 242-245.
- Owens, J. M. and G. W. Bennett (1982). German Cockroach Movement Within and Between Urban Apartments. *J. Econ. Entomol.* 75: 570-573.
- Runstorm, E. S. and G. W. Bennett (1984). Movement of German cockroaches (Orthoptera: Blatellidae) as influenced by Structural Features of Low Income Apartments. *J. Econ. Entomol.* 77: 407-411.