



MACROJOURNALS

The Journal of **MacroTrends** in **Health and Medicine**

Evaluation of sanitation in an IPM program for cockroach infestation in housing

Gholam Hossein Shahraki

Faculty of Public Health, Yasuj University of Medical Sciences, Iran

Abstract

The German cockroach is the most common indoor species, especially in housing areas of the current study (Shahraki et al., 2010, 2013). A potential mechanical vector of human diseases, many pathogenic organisms have been associated with cockroaches. These include poliomyelitis viruses, bacteria, fungi, protozoa, and helminthes. In addition, cockroaches might cause household allergy and entomophobia. Sarinho (2004) showed that exposure to cockroaches by children can be considered a risk factor for asthma. Cockroaches secrete smelly oils that are offensive and can ruin food. They also impart odors to dishes that look clean (Faith, 1997). In pest management, sanitation reflects the availability of water, food, and harborage in a particular environment. Thus, removing the three resources can regulate cockroach numbers (Bonney, 2008). Water is the most crucial factor determining the survival of the German cockroaches. According to the study by Stephan (1984), harborage removal is the most disruptive. Sanitation was also reported as a major affecting factor determining the bait performance against German cockroaches (Noureddin, 2008). Lee CY and Lee LC (2000) reported that the field performance of insecticidal baits on the American cockroach was improved by a better sanitation. However, they did not show direct relationship between sanitation rate and the level of infestations. The present study dealt with estimating the sanitation rate in an IPM program on the infestation of the German cockroach in Iran.

Keywords: *sanitation, cockroach infestation, housing*

1. Materials and methods

Sticky traps were used as the tools for monitoring cockroach populations in the infested units. The trap catch data was recorded weekly over a seven-day trapping period. One trap per eight square meters of infested areas was set in each sampling units. The numbers of cockroaches per trap was recorded. The units with average of one or more cockroaches per trap per week

were recorded as infested units. The study locations comprised of two student dormitories and a residential building in the southwestern area of Iran. About 25 apartments of the residential building and 125 dormitory units (girls and boys dormitories) were monitored for cockroaches. To evaluate the intensity of infestation (categorized), the cockroach index table was determined for the surveyed residential units, as shown in **Table 1**.

Table 1 Cockroach Index

No. Cockroaches per trap per unit	Cockroach Index (cockroach infestation rate)
$0 \leq x < 1$	Clean (1)
$1 \leq x < 3$	Low (2)
$3 \leq x < 8$	Moderate (3)
$8 \leq x < 26$	High (4)
$26 \leq x < 50$	Very high (5)
$x \geq 50$	Abundant (6)

Questionnaires were distributed among occupants in 88 surveyed units to get information on unsanitary factors and occupants' attitudes towards sanitation in the study locations. To assign rates and to estimate the degree of sanitation of the surveyed units, a sanitation-rating table was designed and modified from Wang and Bennett (2006), as shown in **Table 2**.

Table 2 Scales used to rate the degree of sanitation (Modified from Wang and Bennett 2006)

Rating	General condition	Amount of clutter	Amount of trash on floor	Amount of food on floor and dinner area
1 to 6	Clean=1-2	Few=1	None=0	None=0
	Pretty clean= 3		Some=1	Some=1
	Dirty=4-5	Many=2	Many=2	Many=2
	Severely dirty=6			
Description of module	many =more than one observable clutter	Some = Just observable after looking for Many = visible without any searching	Some =Visible after exact investigation Many = Can see them several points obviously	

After assessing the extent of clutter, food, and debris of these places and assigning a rate for cockroach based on **Table 2**, the sums of these for each corresponding place was recorded as the sanitation rates. A comparison of these sanitation rates and infestation rates at the same places were used to establish the relationship between sanitation and cockroach infestation. Data was analyzed using Spearman's correlation coefficient, with the help of the SPSS15 software.

2. Results and Discussion

Out of 53, 72, and 25 surveyed units of girls and boys dormitories and residential building, 74, 74 and 60% of each units were infested with cockroaches, respectively. The German cockroaches (*Blattella germanica*) were the most abundant (99.2%).

Correlation between unsanitary factors related to food, water, and harborage (for cockroach survival), and cockroach infestation for 88 surveyed units and 19 dormitory kitchens were shown in **Table 4**. The effects of unsanitary factors, associated with food such as food debris (for the kitchens), leftover foods exposed on the table, as well as unwashed dishes left overnight, contributed to the higher infestation rates ($p < 0.05$) in this study as well as in the study by Lee (2000). Moreover, compounding impact (positive impact) of dirtiness and clutter on infestation with cockroaches is pointed in this study and the others (Cochran, 1983; Durbin, 1985; Wright 1979; Sherron, 1982; Schal, 1988). The effect of the other unsanitary factors related to **water** and **harbourage** on cockroach infestation are showed in Table 4.

The correlation coefficient between the sanitation rates and infestation rates showed that there was a significant positive relationship ($n=23$, Spearman correlation coefficient $r_s=0.445$, $p < 0.05$) between sanitation rate and intensity of infestation (according to the cockroach index) at the surveyed units (the girls' dormitory). The same result was achieved for the residential building ($n=11$, $r_s=0.636$, $p < 0.05$). Thus, poor sanitation was associated with the intensity of cockroach infestation at the residential building and girls dormitory.

For the boys' dormitory, the correlation was not significant ($n=19$, $r_s=0.36$, $p > 0.05$). In this dormitory", the bathrooms were located inside the units, while in the "girls dormitory", they were outside the units. This different location might affect the correlation between sanitation and infestation at the girls and boys dormitories.

In conclusion Sanitation Rate Table could be applied to evaluate sanitation in an IPM program on cockroach infestation. This substantiated by survey on unsanitary factors associated with to food, water and harborage.

Table 4. Percentage frequency of sanitary and unsanitary factors at cockroach infested units (\geq low level) and clean level units for 88 units and 19 kitchens of dormitories

Factors (related to food, water and harborage)	Percentage frequency of factors		Correlation*
	Infested units (%)	Clean level units (%)	
Left foods, which were not eaten and exposed on the table before retiring at night	18	3	$r_s = -0.237, P < 0.05$
Food debris on the floor (for kitchens)	80	25	$r_s = -0.482, P < 0.05$
Unwashed dishes left overnight	88	47	at the girls' dormitory, $r_s = -0.433, P < 0.01$
Leaking for water pipe in the kitchens	53	25	$r_s = 0.231, p > 0.05$
Accumulated water on the floor of the kitchens	27	0	$r_s = 0.267, p > 0.05$
Dirty and cluttered	23	10	at the girls' dormitory, $r_s = 0.315, P < 0.05$
Clutter with boxes, papers, books and wetly clout	48	41	$r_s = 0.067, p > 0.05$
Musty wooden equipment	46	31	$r_s = 0.151, p > 0.05$
Do not clean the spaces under Sedentary furniture	79	68	$r_s = -0.124, p > 0.05$
Do not vacuum at all	74	69	$r_s = 0.041, p > 0.05$
Using plastic bag linings for trash containers	74	75	$r_s = -0.011, p > 0.05$
Tie-up the plastic bags before dumping them	65	72	$r_s = -0.078, p > 0.05$
Empty trash containers immediately	34	43	$r_s = -0.093, p > 0.05$
Empty trash containers occasionally	10	5	$r_s = 0.112, p > 0.05$
Trash containers without lids (for kitchens)	80	75	$r_s = -0.05, p > 0.05$

* Spearman's correlation coefficient (employing crosstab, SPSS);

References

- Bonnefoy, X., Kampen, H., and K. Sweeney. 2008. Public health significance of urban Pest. Copenhagen:WHO Europe, p. 569
- Cochran, D. G. 1983. Food and water consumption during the reproductive cycle of female German cockroaches. *Entomologia Experimentalis et Applicata* 34: 51-57.
- Durbin, E. J., and D. G. Cochran. 1985. Food and water deprivation effects on reproduction in female *Blattella germanica*. *Entomologia Experimentalis et Applicata* 6: 27-54.
- Erik Stephan, R. 1984. Factors Influencing the Movement German Cockroaches, pp. 85, Entomology. Purdue University, Purdue
- Faith, M. O., G. A. Arthur, and P. B. Eric. 1997. IPM Tactics for Cockroach Control, USA.
- Lee, C. Y., and L. C. Lee. 2000a. Diversity of cockroach species and effect of sanitation on level of cockroach infestation in residential premises. *Tropical Biomedicine* 17: 39-43.
- Lee, C. Y., and C. Y. Heng. 2000. Effects of food and water deprivation on nymphal development, adult fecundity and insecticide susceptibility in German cockroaches, *Blattella germanica* (L.). *Tropical Biomedicine* 17.
- Lee, C. Y., and L. C. Lee. 2000b. Influence of sanitary conditions on the field performance of chlorpyrifos-based baits against American cockroaches, *Periplaneta americana* (L.) (Dictyoptera: Blattellidae). *Journal of Vector Ecology* 25: 218-221.
- Noureldin, E. M., and H. A. Farrag. 2008. The role of sanitation in the control of German cockroach (*blattella germanica* L.). *Biosciences Biotechnology Research Asia* 5: 525-536.
- Schal, C. 1988. Relation among efficacy of insecticides, resistance levels, and sanitation in the control of the German cockroach (Dictyoptera: Blattellidae). *Journal of Economic Entomology* 81: 536-544.
- Shahraki, G.H., Parhizkar, S., and A.R. Shirazi Nejad. 2013. Cockroach Infestation and Factors Affecting the Estimation of Cockroach Population in Urban Communities. *International Journal of Zoology*, 2013(ID649089):6pages.
- Shahraki, G.H., Ibrahim, Y.B., Hafedzi, M.N., Rafinejad, J., and M.S. Khadri. 2010. Biorational control programme for the German cockroach (Blattaria: Blattellidae) in selected urban communities. *Tropical Biomedicine*, 27(2): 226-235.
- Sherron, D. A., C. G. Wright, M. H. Ross, and M. H. Farrier. 1982. Density, fecundity, homogeneity and embryonic development of *German cockroach* (*Blattella germanica* L.) populations in kitchens of varying degrees of sanitation (Dictyoptera: Blattellidae). *Proceedings of the Entomological Society of Washington* 84: 376-390.
- SPSS 2006. Correlation and Difference between mean computer program, version 15.0.1. By SPSS, Chicago, IL.
- Stephan, R. E. 1984. Factors influencing the movement German cockroaches, pp. 85, Entomology. Purdue University, Purdue
- Wang, C., and G. W. Bennett. 2006. Comparative study of Integrated Pest Management and baiting for German cockroach management in public housing. *Journal of Economic Entomology* 99: 879-885.
- Wright, C. G. 1979. Survey confirms correlation between sanitation and cockroach populations. *Pest Control* 47: 28.