Korean Journal of Health Education and Promotion
Vol. 1, No. 1, 1999, pp. 1-13

The Public Perception and Attitude on the Medical Insects and Pest Control in Korea

Eun-Soon Lyu* · Hye-Sook Kang** · Dong-Kyu Lee*
*College of Natural Sciences, Kosin University, Pusan, Korea
**Div. of Health Education, Potchefstroom University, South Africa

〈CONTENTS〉

ABSTRACT

A study has been performed on perception of citizens about the medical insects (house flies, mosquitoes, cockroaches) in Chang Won city. A total of 375 subjects (male: 180, female: 195) was surveyed in October 1997. Cockroaches were the most dislike of medical insects to the dwellers. At a residence, cockroaches were the most troubled insects although mosquitoes were the most frequently appeared insects. Also, the most troubled insects were the cockroaches at hospitals, departments, coffee shops, and bars; the mosquitoes at theaters and parks; and the house flies at restaurants in the city. The cockroaches had the highest negative opinion score as a 4.4 point of a 5.0 point. About half of the subjects had extremely suffered from the mosquitoes (52.8%) and cockroaches (51.8%). House residents controlled house flies using fly swatters (50.0%) and insecticide sprayers (38.9%), but apartment residents controlled them using the sprayers (50.8%) and fly swatters (36.5%). The mosquitoes were controlled by using the sprayers (51.6%) and mosquito coils (36.4%). The cockroaches were controlled by using toxic baits (32.9%)

and the sprayers (31.5%). Only 10% of the subjects were satisfied control management against the medical insects. The subjects wanted to more effectively control against cockroaches (39.9%) and mosquitoes (37.9%).

Key Words : mosquito, cockroach, house fly, medical insect, control, perception

I. Introduction

The rapid development of today's industry and science gave a rise to the standard of living, the environment and the ecology. However, the number of pests have also increased due to the development. Medical insects are defined to be insects that give harm to person's health and harm means to disturb health. World Health Organization (WHO) defines health as "mental, physical and social health". Therefore, insects which provide mental pain can also be included in medical insects (Harwood and James 1979). House flies, mosquitoes and cockroaches are not only pathogens transmitting insects, but also strongly disliked pests to people. That is why they are medically important insects in mental hygiene. House flies come into the residential houses, gather near human foods, and give displeasure and dirtiness. Furthermore, they transmit pathogens such as typhoid fever, paratyphus and cerebro-spinal meningitis. Mosquitoes transmit various pathogens such as malaria, encephalitis, filariasis and yellow fever. Japanese B. encephalitis rates 20-30% of lethality (Dept. of Health and Welfare 1985). When people are bitten by mosquitoes, boil and itching disturb their sleep. Cockroaches eat not only food, but also the feces of human and other animals, blood, pus and sputum which held various pathogens. When they walk across food and dishes, they may transmit bacteria of typhoid fever and dysentery to the human digestive organs because of their habit of spiting out their half digested food. Also, cockroaches are not friendly to people because of their shape, smell and behavior. They may bite children while children are asleep (Harwood and James 1979).

Medical insects give intermediary of disease and nuisance to people. Nuisance is defined as indisposition, unclean and hatred with the exception of diseases from

insects (Shin and Lee 1996). Nuisance is not defined perfectly yet, but people in advanced countries have more curiosity in the problems of nuisance than insects that occur diseases. Therefore, people of the tropical countries control mosquitoes to prevent diseases, but in Europe, where there are no disease by mosquitoes, it is just dealt as a simple nuisance (Ree 1999). Also, it is predicted that it takes an increasing interest in nuisance compared to diseases by the insects after the industrial and economical growth in Korea. Several researchers have reported public attitudes toward urban arthropods and their control such as Bennett et al. (1983), Levenson and Frankie (1983), Byrne et al. (1984), Zungoli and Robinson (1984), Hahn and Ascerno (1991) and Potter and Bessin (1998). However, there is little information on the perception of nuisance as well as public attitudes toward medical insects in Korea. The objectives of this study were to assess Korean people's attitudes toward urban medical insects and their perceptions about pesticides and pest control practices. Although the survey population consisted of Changwon citizens, the respondents' opinions likely are representative of opinions of citizens throughout Korea. The results may be useful to establish the basic data to increase welfare and health administration.

Ⅱ. Materials and Method

1. Respondents and Method

The survey was conducted by questionnaires in 3 apartment areas and 8 food service operations in Changwon city, Kyungsangnam-do. Changwon is a new planned city for a purpose of better social welfare and the buildings are almost new in the different districts by the city plan. The 150 questionnaires were directly distributed for apartment areas by investigators. The 350 questionnaires were distributed by dieticians to customers in food service operations. Survey respondents had to be at least 17 years old. The questionnaires were took back after record by the respondents. The survey was conducted 11-30 October, 1997. A total of 375 papers were completed with 75% of total response throughout city.

2. Details of the research

To minimize bias, the questionnaire was corrected and re-edited after conduction of

pre-survey before the survey was initiated. We used a 38-item questionnaire of which 4 general questions such as gender, age, residential types and address; 12 questions involved pests in various sites; 4 questions pertained to pest control and 18 questions pertained to attitudes against medical insects such as house flies, mosquitoes and cockroaches. The questionnaire was included the level of physical and mental pains by pests, their control methods in homes, the satisfaction of the city's insect control, and the pests which need more control. The recognition of medical insects was made up 6 objects including displeasure, fear and dirtiness. Likert's 5 point scales were used for the recognition which were from 1 point as 'never' to 5 points as 'very much' as described in Kim and Lee (1997).

3. Statistical Analysis

The strength of selected associations among demographics variables and attitudes toward pests and pest control practices was tested with a Pearson chi-square (χ^2) test of homogeneity, t-test and ANOVA. Also, the differences among groups were tested for significance using a Scheffe-test. The statistical analysis was used a SPSS/PC$^+$ program (Hur 1994).

Ⅲ. Result and Discussion

1. Respondents

Demographics of the 375 survey respondents are listed in Table 1. There were 180 (48.0%) males and 195 (52.0%) females. In addition, 128 (34.5%) respondents were the age of the 20's, 126 (34.0%) were in the 30's, 74 (19.9%) were in the 40's and 43 (11.6%) were in the 10's who were usually 17-19 years old. There were 250 (67.8%) respondents living in apartments, 91 (24.7%) in individual houses and 28 (7.6%) others in dormitories.

〈Table 1〉 General characteristics of subjects.

	N(%)
Sex	
Male	180 (48.0)
Female	195 (52.0)
Age	
10's	43 (11.6)
20's	128 (34.5)
30's	126 (34.0)
>40's	74 (19.9)
Type of residence	
House	91 (24.7)
Apartment	250 (67.8)
Others	28 (7.6)

2. Opinions toward medical insects

(1) Medical insects in houses: The rating of medical insects was put following people's negative feelings shown in Table 2. The tolerance level for any type of pests found inside houses was low, no matter how insignificant the risk to health or property. The respondents disliked cockroaches showing the most rating 73.1%, and people who disliked mosquitoes also rated 22.7%. Similar negative feelings toward indoor arthropods were reported among people in other country (Byrne et al. 1984; Hahn and Acerno 1991; Potter and Bessin 1998), indicated they disliked or were afraid of indoor arthropods. As shown in Table 3, there were the medical insects that made the most problems in different houses. Most householders were unwilling to tolerate medical insects. The most problem insects at home were cockroaches composing 45.8%, followed by mosquitoes (36.9%) and house flies (7.3%). In resident types, cockroaches (48.4%), mosquitoes (35.2%) and house flies (11.0%) were the most problems in houses, and they were rated

〈Table 2〉 Ranking of the most dislike of medical insects. N(%)

	First	Second	Third
House flies	35 (10.7)	86 (26.3)	206 (63.0)
Mosquitoes	77 (22.7)	193 (56.9)	69 (20.4)
Cockroaches	261 (73.1)	47 (13.2)	49 (13.7)

〈Table 3〉 The most troubled and frequently appeared medical insects to residence. N(%)

	Most troubled insects			Total	Most frequently appeared insects			Total
	House	Apartment	Others		House	Apartment	Others	
House flies	10(11.0)	15(6.0)	2(7.1)	27(7.3)	10(11.0)	15(6.0)	2(7.1)	49(13.3)
Mosquitoes	32(35.2)	88(35.2)	16(57.1)	136(36.9)	32(35.2)	88(35.2)	16(57.1)	154(41.7)
Cockroaches	44(48.4)	120(48.0)	5(17.9)	169(45.8)	44(48.4)	120(48.0)	5(17.9)	141(38.2)
Others	2(2.2)	3(1.2)	1(3.6)	6(1.6)	2(2.2)	3(1.2)	1(3.6)	10(2.7)
Nothing	3(3.3)	24(9.6)	4(14.3)	31(8.4)	3(3.3)	24(9.6)	4(14.3)	15(4.1)
	χ^2 =16.33888*	df=8		369(100.0)	χ^2 =17.40769*	df=8		369(100.0)

* $p<0.05$

at 48.0%, 35.2% and 6.0% in apartments with dormitories, respectively. The most abundant medical insects in the residence were the mosquitoes (41.7%), followed by cockroaches (38.2%) and house flies (13.3%). In resident types, cockroaches (42.9%), mosquitoes (35.2%) and house flies (18.0%) were the most abundant insects in houses. In apartments and dormitories, however, mosquitoes (41.6%), followed by cockroaches (39.2%) and house flies (11.2%) showed the most appearance. The abundance of the insects was significantly different among resident types ($p<0.05$).

The frequency and the places of appearance of medical insects were shown in Table 4. The respondents marked 'very much appearance and much appearance' rated 71.4% at house flies, 64.8% at mosquitoes, and 49.7% at cockroaches which were significantly different among them ($p<0.05$). For the place of occurrence, house flies appeared 25.6% in home, followed by 20.5% in streams and 16.7% in garbage places. In the case of mosquitoes, 30.7% and 19.7% of the respondents took home and streams as the place of occurrence, respectively. Cockroaches were chosen as 22.5% in home, 22.5% in garbage places and 14.5% in streams. This means that the insect ecological knowledge

Table 4. Frequency and a place on appearance of medical insects to residence. N (%)

Appearance	House flies	Mosquitoes	Cockroaches	Total
Very often	12(24.5)	42(27.5)	19(13.4)	73(21.2)
Often	23(46.9)	57(37.3)	45(31.7)	125(36.3)
Sometimes	14(28.6)	49(32.0)	71(50.0)	134(39.0)
Seldom	0(0.0)	5(3.5)	7(4.9)	12(3.5)
		χ^2 =19.81888* df=6	344(100.0)	
Inside of residence	20 (25.6)	39 (30.7)	31 (22.5)	90 (27.8)
Garbage places	13 (16.7)	16 (12.6)	31 (22.5)	60 (18.6)
Dumping ground	2 (2.6)	6 (4.7)	10 (7.2)	19 (5.9)
Sewers	16 (20.5)	25 (19.7)	20 (14.5)	61 (18.9)
Mountains	9 (11.5)	11 (8.7)	11 (8.0)	31 (9.6)
Unknown	15 (19.2)	21 (16.5)	26 (18.8)	62 (19.2)
		NS	323(100.0)	

NS: Not significant * $p<0.05$

of citizens was not enough.

As a result of the survey, the medical insects that people dislike the most were cockroaches. Cockroaches were making more trouble in residents' lives although the appearance of them was less than mosquitoes and flies. It is suggested that health centers should increase control activity against mosquitoes because they were practical problems in daily life and also had a high rate of appearance.

(2) Medical Insects in Public: The results of the most troubled medical insects in public places were shown in Table 5. In hospitals, cockroaches (25.8%), house flies (22.0%) and mosquitoes (17.6%) were thought as the problems. Mosquitoes and cockroaches rated 32.1% and 30.9% in theaters, respectively, and mosquitoes rated 60.8% in parks. The respondents of 47.2% said there were no troubled pests in department stores but 25.0% of them thought cockroaches as the pests in the same places. In restaurants, house flies and cockroaches rated 56.2% and 33.4% whereas they were 19.9% and 39.8% in coffee shops, respectively. Also, a high rate of the respondents (51.0%) indicated cockroaches in bars. It means that there were lots of problems in food service industries because the growth of Korea's economics gave an increase of food service industries. They need the education concerning on medical insects as well as sanitation because the state of public health was poor and especially the workers in food related places did not have much knowledges of public health and medical insects (Cho 1986; Lyu and Lee 1995).

(3) The amount of pain by medical insects: Cockroaches were the most painful to dwellers among medical insects as a 4.4 point of a 5.0 negative point, which was the highest negative opinion score, followed by mosquitoes (4.0) and house flies (3.7) shown as Table 6. In these same surveys,

〈Table 5〉 The most troubled medical insects at public places N(%)

Places	House flies	Mosquitoes	Cockroaches	Others	Nothing	Total
Hospital	75 (22.0)	60 (17.6)	88 (25.8)	9 (2.6)	109 (32.0)	341(100.0)
Theater	48 (14.4)	107 (32.1)	103 (30.9)	14 (4.2)	61 (18.3)	333(100.0)
Park	91 (25.9)	214 (60.8)	24 (6.8)	4 (1.1)	19 (5.4)	352(100.0)
Department	51 (15.7)	23 (7.1)	81 (25.0)	16 (4.9)	153 (47.2)	324(100.0)
Restaurant	129 (56.2)	13 (3.6)	126 (33.4)	4 (1.1)	17 (4.5)	365(100.0)
Coffee shop	67 (19.9)	23 (6.8)	134 (39.8)	8 (2.4)	105 (31.2)	337(100.0)
Bar	85 (24.8)	31 (9.0)	175 (51.0)	12 (3.5)	40 (11.7)	343(100.0)

〈Table 6〉 Negative opinions* about the medical insect. Mean±SD

Pests	Sex			Age				F-value	Total
	Male	Female	t-value	10's	20's	30's	> 40's		
H. fly	3.6±0.84	3.7±0.95	2.34	3.9±0.71$^{(a)}$	3.5±0.82$^{(b)}$	3.6±0.82$^{(ab)}$	3.9±0.72$^{(a)}$	6.76**	3.7±0.81
Mosq.	3.9±0.73	4.1±0.74	9.16***	4.1±0.68	3.9±0.95	4.0±0.68	4.1±0.71	2.42	4.0±0.74
Cockr.	4.2±0.62	4.5±0.61	17.39***	4.7±0.52$^{(a)}$	4.3±0.63$^{(b)}$	4.3±0.61$^{(b)}$	4.4±0.59$^{(ab)}$	5.28***	4.4±0.64

* The maximum point of negative opinion is 5.0.
** $p<0.05$ *** $p<0.01$

females had more negative feelings toward indoor pests than did males. The negative opinions by cockroaches were a 4.2 point for males and a 4.5 point for females. In the case of mosquitoes, they were a 3.9 point for males and a 4.1 point for females. The females had significantly more pain than males from medical insects ($p<0.05$). This was the same as the result of Potter and Bessin (1998). The dwellers aged 10's and above 40's had significantly more dislike to house flies than those of the 20's ($p<0.05$). Otherwise, the 10's took a stronger dislike to cockroaches than the 20's and the 30's ($p<0.01$). Roth and Willis (1967) reported that cockroaches gave displeasure and fear to people as like this result. Moreover, American cockroaches (Periplaneta americana) and Smocky brown cockroaches (P. fuliginosa), which are comparatively bigger cockroaches, gave more discomfort. This result was the same as that cockroaches were important nuisance insects (Ebeling 1978).

The amount of mental and physical pains by medical insects was shown in Table 7. Twenty-four percent of respondents felt mental and physical pains from house flies, and 53% and 52% of them did from mosquitoes and cockroaches, respectively. Cockroaches may give allergy to people's respiratory organs (Roth et al.. 1956; Bernton and Brown 1964, 1970a, b). The pain for males by house flies was only 16% of respondents, but for females, it rated 30.9% being almost twice as males. Mosquitoes gave pain to 45.7% of males and 59.0% of females, and cockroaches gave pain to 41.3% of males and 61.2% of females. These data were significantly different between females and males ($p<0.05$). Again, the fact that males had more pain from mosquitoes and females did from cockroaches, was similar to the result of Lyu and Lee (1995). The public heath authorities and the workers in food services should be

〈Table 7〉 Mental and physical suffering from medical insects. N(%)

	Sex		Year				Total
	Male	Female	10's	20's	30's	>40's	
House flies							
Very weakness	44(25.2)	29(15.2)	1(2.3)	26(20.8)	25(20.1)	21(28.4)	73(19.9)
Weakness	28(16.0)	24(12.6)	4(9.3)	14(11.2)	26(21.0)	8(10.8)	52(14.2)
Medium	75(42.9)	79(41.4)	24(55.8)	58(46.4)	44(35.5)	28(37.8)	154(42.1)
Extreme	28(16.0)	59(30.9)	14(32.6)	27(21.6)	29(23.4)	17(23.0)	87(23.8)
	χ^2=14.52799* df=5			NS			366(100.0)
Mosquitoes							
Very weakness	18(10.1)	11(5.7)	0(0.0)	13(10.2)	7(5.6)	9(11.8)	29(7.8)
Weakness	22(12.4)	12(6.2)	1(2.3)	13(10.1)	11(8.9)	9(11.8)	34(9.2)
Medium	56(31.6)	56(29.0)	15(34.9)	32(25.2)	42(33.9)	23(30.3)	112(30.3)
Extreme	81(45.7)	114(59.0)	27(62.8)	69(54.3)	64(51.7)	35(46.0)	195(52.8)
	χ^2=12.26934* df=5			NS			370(100.0)
Cockroaches							
Very weakness	32(18.6)	18(9.3)	3(7.0)	20(16.6)	12(10.0)	14(18.4)	50(13.7)
Weakness	19(11.0)	8(4.1)	2(4.7)	8(6.3)	12(10.0)	5(6.6)	27(7.4)
Medium	50(29.1)	49(25.4)	7(16.3)	33(26.2)	34(28.3)	25(32.9)	99(27.1)
Extreme	71(41.3)	118(61.2)	31(72.1)	64(50.8)	62(51.7)	32(42.1)	189(51.8)
	χ^2=20.19999** df=5			NS			365(100.0)

NS: Not significant * $p<0.05$ ** $p<0.01$

educated for control strategy and control against cockroaches because they are mentally and physically important pests as shown in Tables 6 and 7.

3. Control Methods of Medical Insects

Respondents preferred to use insecticide sprayers to control pests such as house flies, mosquitoes and cockroaches in their homes (Table 8). Most dwellers controlled house flies using insecticide sprayers (48.2%) and fly swatters (38.8%). At residence types, house residents controlled house flies using fly swatters (50.0%) and insecticide sprayers (38.9%) but apartment residents controlled them using the sprayers (50.8%) and fly swatters (36.5%). It was significantly different between the types of house and apartment ($p<0.05$). The mosquitoes were controlled by using insecticide sprayers (51.6%) and mosquito coils (36.4%). At residence types, house residents controlled mosquitoes using the sprayers (61.8%), the coils (31.5%) and fly swatters (4.5%) but apartment residents used in the ratio of 47.0%, 39.8% and 10.8%, respectively. It

was significantly different between the types of house and apartment ($p<0.05$). In addition, cockroaches were controlled using toxic baits (32.9%), aerosol (31.5%), hands (16.3%) and sticky traps (14.4%). It was not significantly different methods between the types of house and apartment.

4. Opinions of Pest Control

The last questions about professional pest control focused upon application of pesticides around the outside of a person's home (Table 9). These so-called perimeter treatments are used widely today by health centers controlling mosquitoes and house flies. The respondents said they would be somewhat (42.0%), ignorant (26.6%) or unsatisfactory (21.4%), and only 9.9% were satisfied concerned on the pest

〈Table 8〉 Medical insect control methods by type of residence N(%)

	House	Apartment	Others	Total
House flies				
Sprays	35(38.9)	128(50.8)	15(2.3)	178(48.2)
Fly swatters	45(50.0)	92(36.5)	6(22.2)	143(38.8)
Traps	3(3.3)	14(5.6)	1(3.7)	18(4.9)
Neglect	7(7.8)	14(5.6)	2(7.4)	23(6.2)
Others	0(0.0)	4(1.6)	3(11.1)	7(1.9)
		χ^2=22.70293* df=8		369(100.0)
Mosquitoes				
Sprays	55(61.8)	118(47.0)	17(60.7)	190(51.6)
Fly swatters	4(4.5)	27(10.8)	2(7.1)	33(9.0)
Mosquito coils	28(31.5)	100(39.8)	6(21.4)	134(36.4)
Neglect	1(1.1)	3(1.2)	0(0.0)	4(1.1)
Others	1(1.1)	3(1.2)	3(10.7)	7(1.9)
		χ^2=22.09459** df=8		368(100.0)
Cockroaches				
Sticky traps	12(13.3)	39(15.9)	1(3.8)	52(14.4)
Toxic baits	30(33.3)	81(32.9)	8(3.8)	119(32.9)
Sprays	27(30.0)	75(30.5)	12(46.2)	114(31.5)
Hands	14(15.6)	41(16.7)	4(15.4)	59(16.3)
Neglect	4(4.4)	7(2.8)	1(3.8)	12(3.3)
Others	3(3.3)	3(1.2)	0(0.0)	6(1.7)
		NS		362(100.0)

NS: Not significant * $p<0.05$ ** $p<0.01$

control management. Thirty percent of males and 23.3% of females said they did not know about it. Also, 24.0% of males and 19.0% of females were unsatisfied. The 32.6% of the 10's, 34.4% of the 20's, 22.1% of the 30's and 17.6% of the over 40's responded with ignorance to the pest control management. Also, 27.0% of the 30's and 23.0% of the over 40's were unsatisfied to the management. As a reason of the problems of the control method, the respondents said a shortage of control activities (35.6%), a shortage of control method (30.1%), careless of management (18.5%) and a shortage of publicity (13.4%). These data were significantly different between females and males ($p<0.05$) (Table 9). The subjects wanted to more effectively

〈Table 9〉 Opinions about medical insect control management N(%)

	Sex		Year				Total
	Male	Femle	10's	20's	30's	>40's	
Control management							
Unknown	53(30.3)	44(23.3)	14(32.6)	43(34.4)	27(22.1)	13(17.6)	97(26.6)
Satisfy	16(9.1)	20(10.6)	3(7.0)	13(10.4)	11(9.0)	9(12.2)	36(9.9)
Common	64(36.6)	89(47.1)	20(46.5)	47(37.6)	51(41.8)	35(47.3)	153(42.0)
Unsatisfy	42(24.0)	36(19.0)	6(14.0)	22(17.6)	33(27.0)	17(23.0)	78(21.4)
	NS		NS			364(100.0)	
Problems of control method							
Shortage of control activities	35(37.6)	42(34.1)	11(44.0)	22(32.8)	26(34.2)	18(37.5)	77(35.6)
Shortage of control method	35(37.6)	30(24.4)	5(20.0)	20(29.9)	26(34.2)	14(29.2)	65(30.1)
Shortage of publicity	8(8.6)	21(17.1)	4(16.0)	15(22.4)	7(9.2)	3(6.3)	29(13.4)
Careless of management	12(12.9)	28(22.8)	4(16.0)	8(11.9)	17(22.4)	11(22.9)	40(18.5)
Others	3(3.2)	2(1.6)	1(4.0)	2(3.0)	0(0.0)	2(4.2)	5(2.3)
	χ^2= 9.46447* df=4		NS			216(100.0)	
Necessary to more control activity							
House flies	28(20.1)	20(13.0)	3(9.1)	20(19.8)	17(16.3)	8(14.5)	48(16.4)
Mosquitoes	56(40.3)	55(35.7)	10(30.3)	39(38.6)	37(35.6)	25(45.5)	111(37.9)
Cockroaches	49(35.3)	68(44.2)	17(51.5)	37(36.6)	43(41.3)	20(36.4)	117(39.9)
Others	3(2.2)	8(5.2)	2(6.1)	2(2.0)	6(5.8)	1(1.8)	11(3.8)
Nothing	3(2.2)	3(1.9)	1(3.0)	3(3.0)	1(1.0)	1(1.8)	6(2.0)
	NS		NS			293(100.0)	

NS: Not significant * $p<0.05$

control against cockroaches (39.9%) followed by mosquitoes (37.9%) and house flies (16.4%). The females wanted more for control cockroaches (44.2%) and mosquitoes (35.7%). Comparing by age, the 20's (38.6%) wanted mosquitoes to be controlled. Also, the 10's (51.5%) and the 30's (41.3%) wanted cockroaches to be exterminated whereas the over 40's wanted more to control mosquitoes.

To conclude, the satisfaction of controlling medical insects was low, and the problems were the poor control and an inappropriate method against pests. Previous investigators also cited a need for more public education about urban pests so that citizens might make more informed pest management decisions (Byrne and Carpenter 1986; Hahn and Ascerno 1991) Therefore, the heath authorities should look over the pest control plan and have a better program developed.

REFERENCES

1. Bennett, G. W., E. S. Runstrom and F. A. Wieland. 1983. Pesticide use in homes. *Bull. Entomol. Soc. Am.* 29:31-38.
2. Bernton, H. S. and H. Brown, 1964. Insect allergy: Preliminary studies of the cockroach. *J. of Allergy*, 35:506-513.
3. Bernton, H. S. and H. Brown 1970a. Cockroach allergy: Age of onset of skin reactivity. *Ann. of Allergy*, 28:420-422.
4. Bernton, H. S. and H. Brown 1970b. Insect allergy: The allergenicity of the excrement of the cockroach *Blattella germanica. Ann. of Allergy* 28:543-547.
5. Byrne, D. N. and E. H. Carpenter 1986. Attitudes and actions of urbanities in managing household arthropods, pp. 13-24. In G. W. Bennett and J. M. Owens: *Advances in Urban Pest Management.* Van Nostrand Reinhold, New York.
6. Byrne, D. N., E. H. Carpenter, E. H. Thoms and S. T. Cotty 1984. Public attitudes toward urban arthropods. *Bull. Entomol. Soc. Am.* 30:40-44.
7. Cho, Hye Yeong 1986. *A study on employers' and employees' attitudes for sanitation in some Korean style restaurants.* Graduate School of Public Health, Seoul National University (in Korean).
8. Dept. of Health and Welfare 1985. *Control methods of medical insects and rodents,* Department of Health and Welfare, Korea, (in Korean).
9. Ebeling, W. 1978. *Urban Entomology.*

Univ. of Calif., Berkeley

10. Hahn, J. D. and M. E. Ascerno 1991. Public attitudes toward urban arthropods in Minnesota. *Am. Entomol.* 37:179-184.
11. Harwood, R. F. and M. T. James 1979. *Entomology in Human and Aanimal Health.* 7th ed. Macmillan, New York,
12. Hur, M. Y. 1994. *SPSS and Statistical Analysis,* Kyohaksa, (in Korean).
13. Kim, K. D. and O. J. Lee 1997. *Social Research Survey Method,* Parkyoungsa (in Korean).
14. Levenson, H. and G. W. Frankie 1983. A study of homeowner attitudes and practices toward arthropod pests and pesticides in three U. S. metropolitan areas, pp. 67-106. In G. W. Frankie and C. S. Koehler, *Urban Entomology: Interdisciplinary Perspectives.* Praeger, New York,
15. Lyu, Eun-Soon and Dong-Kyu Lee 1995. A survey on Knowledge, perception and the control management on cockroaches in food-service institutions. *Korean J. Dietary Culture,* 10(1):45-56 (in Korean).
16. Potter, M. F. and R. T. Bessin 1998. Pest control, pesticides, and the public: Attitudes and implications. *Amer. Entomol.* 44(3):142-147.
17. Ree, Han Il: 1999. *Medical Entomology,* Ko-Moon Sa (in Korean).
18. Roth, L. M., W. D. Hiegisch and W. H. Stahl 1956. Occurrence of 2-heavenal in the cockroach, *Eurycotis Floridana. Science,* 123:670-678.
19. Roth, L. M. and E. R. Willis 1967. *The Medical and Veterinary Importance of Cockroaches.* Smithsonian Institute, Washington D. C.,
20. Shin, Yoo Hang and Dong-Kyu Lee 1996. *Cockroaches and Their Control,* Academy Books (in Korean).
21. Zungoli, P. A. and W. H. Robinson 1984. Feasibility of establishing an aesthetic injury level for german cockroach pest management programs. *Environ. Entomol.* 13:145-148.