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Analysis of Cockroach Fauna and Frequency in Human Residential Habitats of North of Isfahan, Iran

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ABSTRACT

Aims Considering the medical significance of cockroaches as insect vectors of food toxicities, and triggering allergy in respiratory system and skin, this survey was conducted to study the frequency of infestation and their effective factors in Shahin Shahr, Iran.

Materials & Methods This cross-sectional descriptive study was carried out in 2010 in Shahin Shahr, Isfahan, Iran. Data gathering instrument was a researcher-made questionnaire regarding to the research aims. Data were analyzed by SPSS 11.5 software using Chi square and Fisher exact tests.

Findings 675 of 1000 studied houses (67.5%) were infested by all life stages of the cockroaches and 32.5% had no infestation. 46% of infested houses had few, 30% had medium and 24% had high infestation. the bathrooms and toilets were recognized as the most infested places (41%). There were significant relationships between infestation of houses and the age of building ($p<0.001$), the type of building ($p=0.009$) and the education level of the family ($p<0.001$). Significant difference was found between houses equipped their doors and windows by tulles and without tulles ($p=0.03$). Most infection was found in houses sheltering 5 and more people (72.3%). Significant correlation was found between the infection and the number of family members ($p=0.0012$).

Conclusion Infestation rate of cockroaches in Shahin Shahr houses is high and is mostly of P. americana species.

Keywords Cockroaches; Parasitic Diseases; Insect Vectors; Cross-Sectional

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[1] Cockroaches as potential vectors of the pathogenic bacteria found in nosocomial infections [2] Borror and DeLong's Introduction to the study of Insects [3] Medical insects and arachnids (Natural History Museum) [4] Medical entomology (morphology, physiology and medical importance) for students of health and medicine [5] The medical importance of cockroaches [6] Investigation on American cockroaches medically important bacteria in Khorramshahr hospital, Iran [7] Cockroaches, their biology, distribution and control [8] Sensitivity of American cockroach in Kashan hospital to insecticides [9] The first report of drug resistant bacteria isolated from the brown-banded Cockroach, Supella longipalpa, in Ahvaz, South-western Iran [10] Cockroach-associated food-borne bacterial pathogens from some hospitals and restaurants in Addis Ababa, Ethiopia: Distribution and antibiograms [11] Vector Control: Methods for use by individuals and communities [12] The study of Cockroach allergy in Iranian children with asthma [13] Prevalence of aeroallergens in childhood asthma in Mashhad [14] An overview of German Cockroaches, Blattella germanica, Studies Conducted in Iran [15] Identification of bacteria which possible transmitted by Polyphagaaegyptica (Blattodea: Blattidae) in the region of Ahvaz, SW Iran [16] Cockroach surveys in 14 provinces of Thailand [17] Allergen skin test reactivities among asthmatic Thai children [18] Aeroallergen sensitivity of Thai patients with allergic rhinitisy [19] Control cockroaches in Isfahan wastewater network channels [20] Cockroach infestation and factors affecting the estimation of Cockroach population in urban communities [21] Cockroaches as reservoirs and vectors of drug resistant Salmonella spp [22] Factors related to prevalence and density of indoor Cockroaches in Nonthaburi Province [23] The review of pesticide hazards with emphasis on insecticide resistance in arthropods of health risk importance [24] Insecticide resistance profiles and synergism in field populations of the German cockroach (Dictyoptera: Blattellidae) from Singapore

Introduction

Nowadays, cockroaches that are among the oldest insects living on the earth are considered as the major health problem in human communities [1]. These insects spread all over the world, particularly in tropical and subtropical areas. More than 4000 species of them are identified of which some live alongside human beings.

Cockroaches are hemimetamorphosis insects with 3 stages of eggs, nymphs and adults. Nymphs exude 5 to 12 times and become mature [2]. After several days of mating, they release their eggs in the environment at a brown bean-shaped cover or Ootheca capsule [3]. Due to their proper diet and particularly life requirements, cockroaches can be found in most residential areas. These insects feed from all digestible substances found in the environment [4]. Their feeding on human food and feces, regarding to nightly activities, prevent people to identify and understand infested foods. They feed feces and food stuff routinely and excrete feces and leave partly-digestive food on foodstuff habitually [5-8].

The different spices of cockroaches are capable of transmitting disease-causing factors such as bacteria, molds, protozoa, worms and viruses, because of their proper diet and excessive movement [9].

Also, their medical significance is due to the habit of partly vomiting the food eaten, letting fall excrement, weakly biting and producing bad odor. American cockroaches which are potentially risky for human health carry different diseases such as cholera, leprosy, dysentery, typhoid, food toxicities and Ascariasis. In addition, their secretions, feces and exudation following exodus are known as allergens resulting in dermatitis, itching and numerous acute respiratory diseases in human [10-13].

House cockroaches such as *Blattella germanica*, *Periplaneta americana*, *Blatta orientalis* and *Supella logipalpa* are recorded mostly in Iran, among which *Blattella germanica* is studied more [14, 15]. House living cockroach which consider as the major health problem in Iran is *Polyphaga aegyptica* which is found in old buildings and gardens adjacent to fields and desserts. They have sexual dimorphism, females look like large, rounded scarab beetles and wingless, while males possess long, black wings [15].

Prevalence of cockroaches is common in our country as the other regions of the world. Shahin Shahr is a modern and newly constructed city in Isfahan province which was constructed about 40 years ago and its present population is more than 120,000. Regarding the significance of studying cockroaches' prevalence as a source and vector of diseases and verbal also some records concerning the existence of infestation in the city and lack of documented background studies in this case, this study was conducted to determine the rate of infestation in residential areas of Shahin Shahr.

Materials & Methods

This cross-sectional descriptive study was carried out in 2010 in Shahin Shahr, Isfahan, Iran. One thousand residential buildings were selected by random clustering method. The central limit of Shahin Shahr was divided into four districts; East, West, North and South. Each division was clustered using the map in municipality then by AutoCAD software and in each cluster the streets were selected randomly regarding to population covered. Next, each street was visited and from the beginning of the street by cooperation of family head, different parts of the houses were observed and studied.

The data gathering instrument was a researcher-made questionnaire regarding to the research aims that includes characteristics of the building (apartment or house), number of inhabitants, types of heating and cooling, age of the building, history of methods to fight cockroaches, type and ways of doors and windows, insulation, way of collecting and carrying garbage, level of education of the head of the family etc. The validity of the questionnaire was confirmed by 10 experts and for confirming the reliability, the initial questionnaire was distributed among 20 houses in a pilot study during two weeks and the test-retest correlation was calculated as 0.90.

By obtaining the permission of the owners, the questions were obviously asked from family head. Matures, immature or Nymph and Ootheca of cockroaches were identified in samples collected from the houses and the identified species were recorded by researchers. The rate of adult cockroach

infestation per house was evaluated as 3 categories of few (less than 5), moderate (5 to 15) and high (more than 15) observations of adults trapped cockroaches during the current study in summer 2010.

Data were analyzed by SPSS 11.5 software using Chi square test.

Findings

675 of 1000 studied houses (67.5%) were infested by all life stages of the cockroaches and 32.5% had no infestation. Central regions of Shahin Shahr City was the most infested and the eastern regions was the least. 46% of infested houses had few, 30% had medium and 24% had high infestation. The causes of non-infestation of 325 houses were reconstruction (46%), use of chemical insecticides (42%) and use of non-chemical control methods (13%).

Houses were contaminated in one or several locations, but the bathrooms and toilets were recognized as the most infested places (41% of different inspected places in the houses), followed by kitchen areas (39%), yards and parings (14%), bedrooms (4%) and guest-rooms (2%). Three different species were seen in all collected samples as *P. americana* (45%), *B. germanica* (32%) and *B. orientalis* (23%).

There were significant relationships between infestation of houses and the age of building ($p<0.001$), the type of building ($p=0.009$) and the education level of the family ($p<0.001$; Figure 1).

Figure 1) Frequency of infestation of residential houses of Shahin Shahr in 2010 according to the age of building, type of building and education level

Parameter	Infested	Clean	p Value
Age of the Building (years)			
Less than 10	197 (55%)	161 (45%)	
10-20	308 (70.2%)	131 (29.8%)	<0.001
More than 20	170 (83.7%)	33 (16.3%)	
Type of Building			
Villa	547 (69.5%)	240 (30.5%)	0.009
Apartment	128 (60.1%)	85 (39.9%)	
Education Level			
Diploma and Under	454(72.3%)	174(27.7%)	<0.001
Above Diploma	221(59.4%)	151(40.6%)	

Significant difference was found between houses equipped their doors and windows by tulles and without tulles ($p=0.03$). Most infection was found in houses sheltering 5 and more people (72.3%). Significant correlation was found between the infection and the number of family members ($p=0.0012$).

Discussion

The aim of this study was to determine the rate of infestation in residential areas of Shahin Shahr City. Nowadays, Cockroaches are considered as the most significant and common pest at houses, public places, hospitals, and restaurants. Results of the current study revealed a high infestation to cockroaches in Shahin Shahr, Iran central region. The high infestation to cockroaches has been reported from Thailand and Malaysia [16] in the similar studies. These facts show that infestation to cockroaches is a pest problem around the world and that cockroaches are cosmopolitan insects which can easily move to different places [16]. Although different species have been recorded in the different studies of different countries, the American cockroaches are dominant species in the present study. Kongpanichkul *et al.* have reported *P. americana* as the most abundant cockroaches in Thailand. It was also found to be an important source of allergy among the asthmatic Thai children and patients with allergic rhinitis [17, 18].

In Hamdi *et al.*, American cockroaches were introduced as the prevalent species in modern sewage system of Isfahan that is consistent with our study [19]. In Shahraki *et al.*, 39% of sampling units have been reported as infested by cockroaches in urban communities [20]. According to Motevali *et al.*, German cockroaches had the most frequency in Isfahan houses and hospitals [21] which is not in line with our results.

Most infestations were observed in old constructions that could be due to the type of used materials and lack of reconstruction. Villas had more infestation than apartments, that was likely due to the age of building, type of used materials, the passages of cockroaches such as yard, flowerbed and so on. There was a direct relationship between the level of education and infestation. Seemingly, the more educated the head of the family was the less infestation was observed.

Based on the obtained results of the present study, more crowded family conditions lead to more cockroach infestation in the premises. This is due to economic problems, which force

them to select cheaper resident houses with less sanitation conditions. Thus, by increasing the awareness of citizens to observe sanitary principles and identify the center of their growth and reproduction inside houses cesspools, hosepipes, sink, bathroom, waste piles, kitchen cabinets, infestations resulting from their beings can be reduced largely [5, 22].

There was no significant correlation between installing tulle on doors and windows with infestation of houses to cockroaches. It can be concluded that these insects due to their elliptical shapes usually penetrate houses through opens and doors and walls, and around water and gas pipes more likely due to their limited powers for flying [5, 6].

One way to fight against cockroaches is to use insecticides which cause a major challenge due to resistance of these pests. Cockroaches' resistance to insecticides has been studied more than other pests [23], because they have more resistance to different insecticides, so, fighting them deserves most attention. The oldest record pertaining their resistance concerns the German spices resistance to Carbamate, Propoxur, Malathion and Bendiocarb insecticides [23, 24].

Of limitation of the study was that family heads did not let careful inspection for different parts of the house.

Considering the widespread and background of cockroaches resistance to different types of insecticides while fighting them chemically, effectiveness of insecticides along with determination of sensitivities in each area should be assured to prevent overuse of them. Having migrants and marginal settlers are among the causing factors and stability of infection in Shahin Shahr which can be reduced by teaching the citizens and establishing containers with doors in which alley having standard distance for collecting wastes decrease infesting environment to them. Efficient management of building and simultaneous fighting in apartments' complex can have an effective result on reducing and eliminating infestation in the apartments. Also, not having suitable coverage for entrances of city sewage system causes entering of cockroaches to an environment adequate for growth and replication. This can be best controlled by fixing suitable tulles and bungs on manhole channels. Paying attention to the type and amount of suitable insecticide for timely spraying brings about reduction of resistance in cockroaches which consequently puts the environment less in danger by cockroaches

Conclusion

The cockroaches' infestation is a common problem in Shahin Shahr city and more than 67% of residential areas of this region are infested by cockroaches.

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